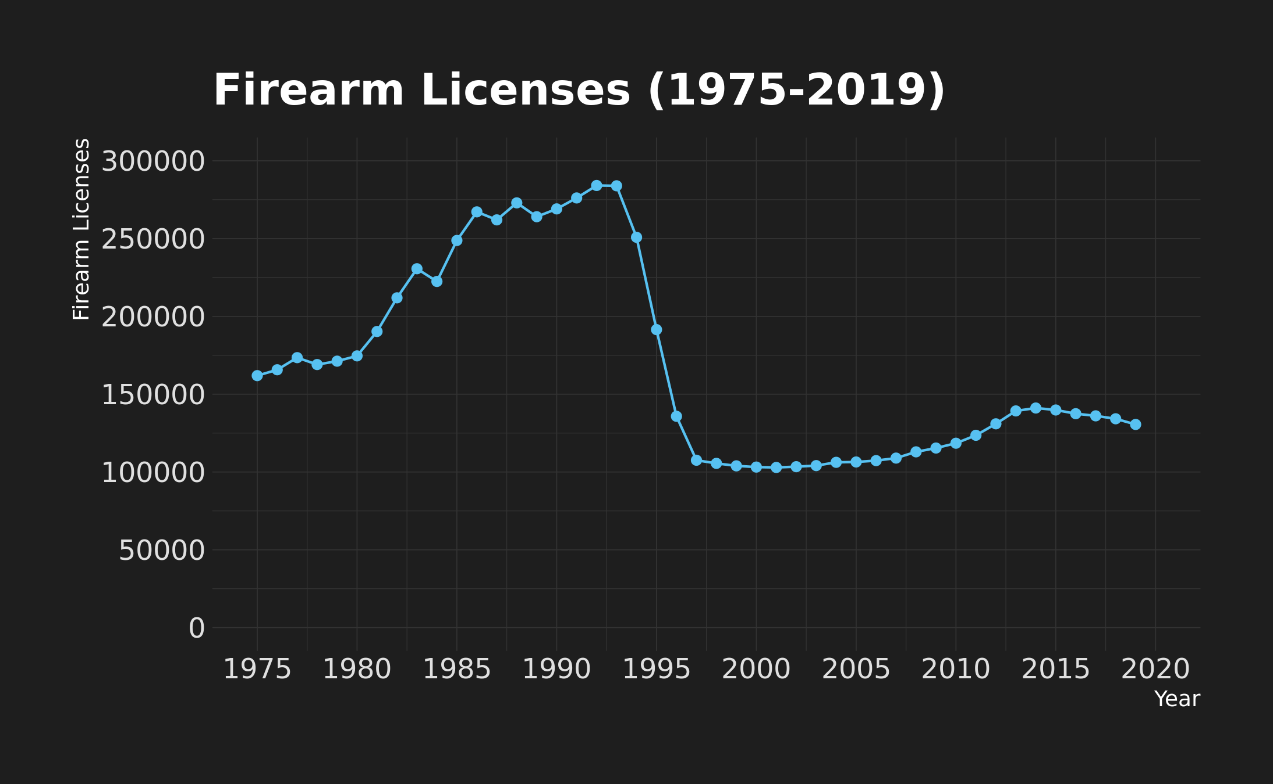
**Correlation Between Federal Firearm Licenses & Firearm Related Homicides**

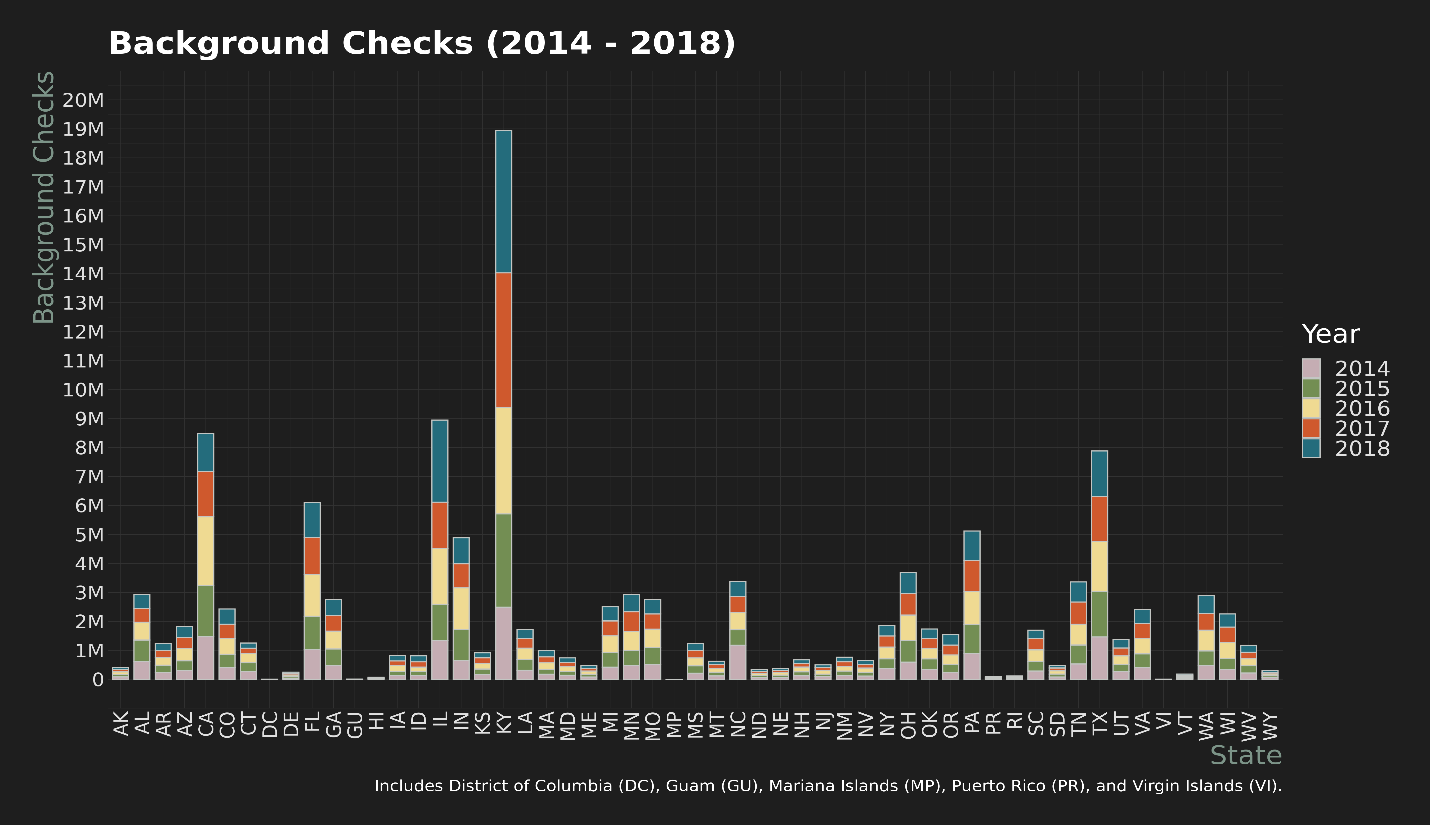
The Second Amendment protects Americans' right to bear arms for their own defense, and it is under attack more so now than ever. For this social justice data exploration project, I planned to explore the year-after-year debate on firearm related deaths in America. The original question that was purposed was “how many deaths in America are related to funs, and is there a correlation between those deaths and firearm sales each year?” Unfortunately finding legitimate sales data for firearms proved to be a daunting task that was not fruitful, so I must pivot. We will be comparing firearm related homicides to federal firearm licenses in America to see if there is a correlation between the two. As a strong believer and supporter of The Second Amendment personally, during this project it was important to continually remind myself to be unbiased doing this research. It is also just as important that we ensure the data we use is correct and unbiased.

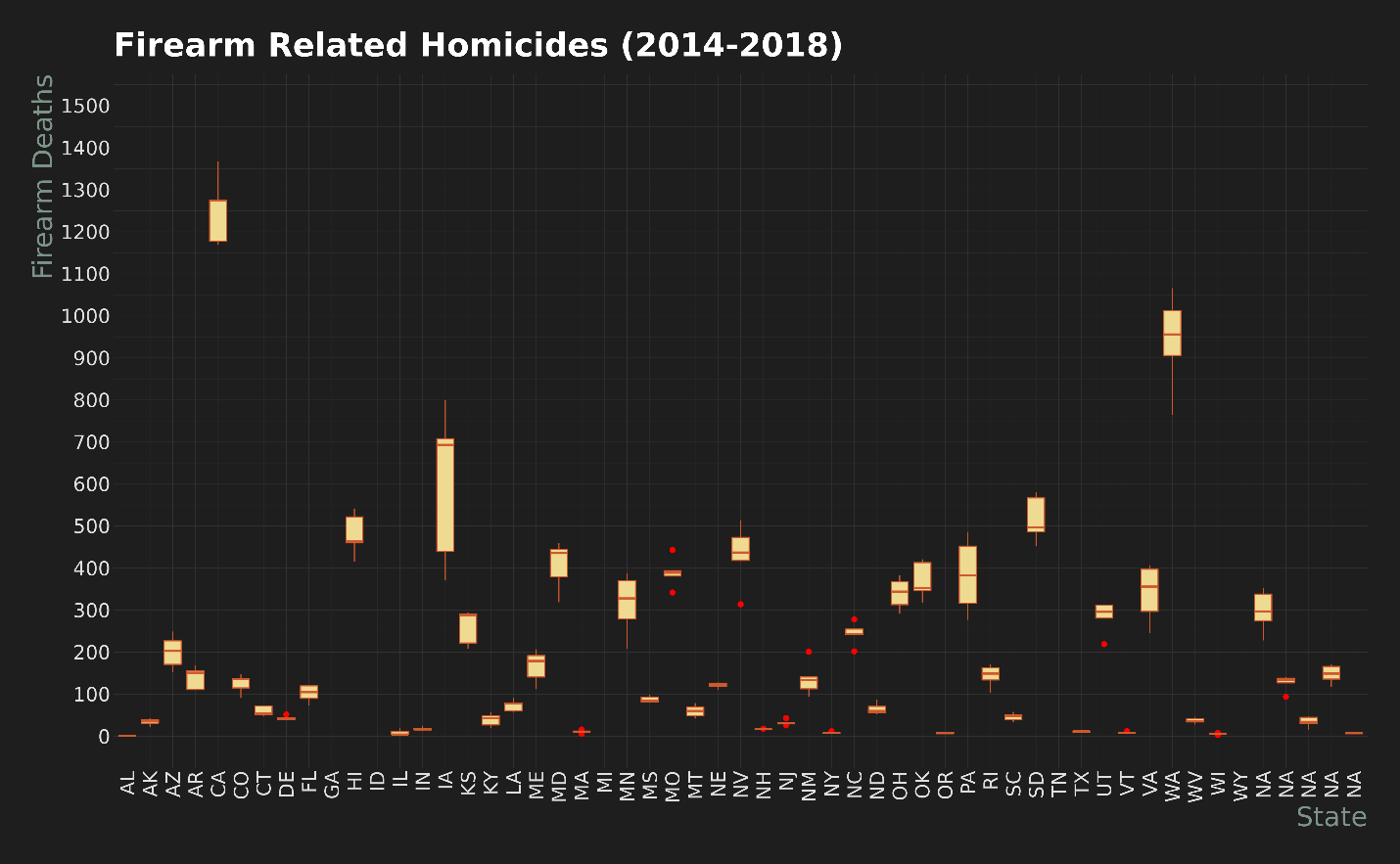
Year after year the mainstream media pushes their agenda that guns are the cause of so many deaths in America, and that we should confiscate guns from owners; ultimately attempting to push an agenda to abolish The Second Amendment. I personally have never investigated the data behind the claims, but instead I have relied on other researchers that make statements against the mainstream medias’ agenda. I think it is about time that I get my hands dirty and investigate the data myself, this way I can answer questions as a little bit more of a subject matter expert. The specific question I want to attempt to answer is, how many deaths in America are related to guns, and is there a correlation between those deaths and successfully awarded firearms licenses each year. I think this is a great question that is part of the debate for social justice in which I should be able to get more clarity on; and it is also a hot debate every year among Americans that deserves to be investigated. As a supporter of The Second Amendment, I believe the only way for me to be completely fair is to ask this question and do the research myself.

The proper sources for data to be used in this research are government databases that most likely have not been altered by an external entity. I think data from the government will prove to be fruitful, as I know that all different agencies use it year after year in assessments. Some of the issues I encountered was that the data that was publicly available was in PDF files rather than CSVs or databases. This made it difficult to extract the data but, in the end, I was able to get them into CSV formats so I could read the data a bit easier. Unfortunately, at the end of the assignment I had a brilliant idea, that I could have requested the information I was seeking by submitting a Freedom of Information Act, or Public Information Act request to the FBI. I found an article that led me to this eureka moment but unfortunately this is a slow process, and I would not have heard back in time forcing me to pivot to the question I am examining now. Thankfully, it was relatively simple to import the CSVs that I generated to analyze, and I only had to clean up the data a few times. All the data is publicly available in my GitHub repository at <https://github.com/danner26/Stockton-DSSA/tree/main/R/Data%20Exploration%20Project/data>.

Using R, I was able to find many different matrices that allows us to analyze and form some ideas about what the data may tell us. The first thing we analyzed was how many federal firearm licenses have been awarded in the United States. Using the NICS (National Instant Criminal Background Check System) data provided by the FBI we were able to pull this data. Between the years of 1975 to 2019 there have been a total of 7,596,985 awarded federal firearm licenses. I find this interesting that there have only been 7.5 million licenses awarded within those 44 years as I expected this number to be a lot higher. In this data project we will be exploring the data from 2014 to 2018 as those are the years of homicide data that were easily accessible from the UCR (Uniform Crime Reporting) and background check program run by the FBI.

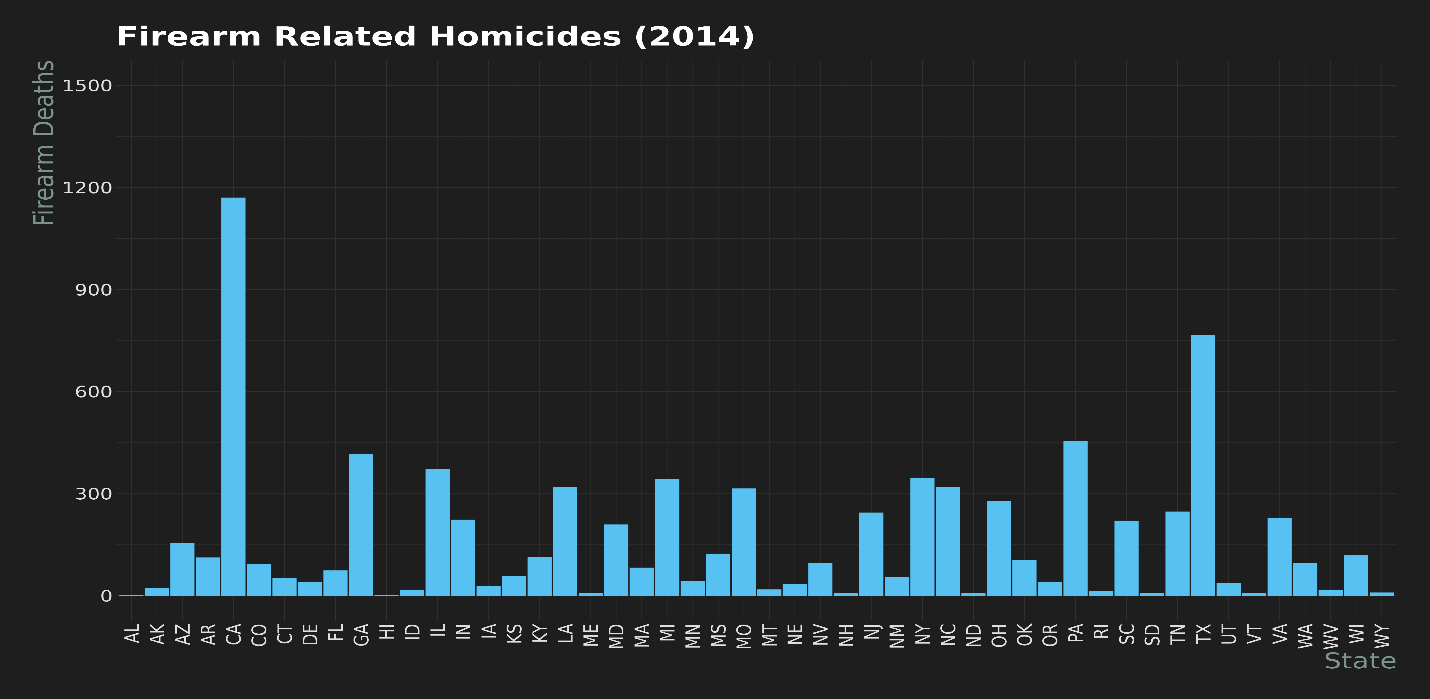


The next bit of data that I wanted to investegate was background checks. Background checks are a big part of the screening process for federally awared federal firearm licenses. From the following stacked bar chart you will be able to see that Kentucky is the leader in baackground checks flowing through the NICS system for federal firearm licenses year over year. The next 3 highest states have almost 10 million less firearm related background checks in only a 5 year timespan. Since background checks are a large part of the data that we have to analyze it is important to see it in a good view. Remember that Kentucky has the most background checks for firearms when comparing the homicide data later on. The next few highest states include Illinois, California, Texas, Flordia, and Pennsylvania. In this specific set of data we were able to include the District of Columbia, Guam, Mariana Islands, Puerto Rico, and the Virgin Islands; but considering the fact that the firearm related homicides data only includes the District of Columbia, we ommited the other territories of the United States to stay on target and be accurate. 

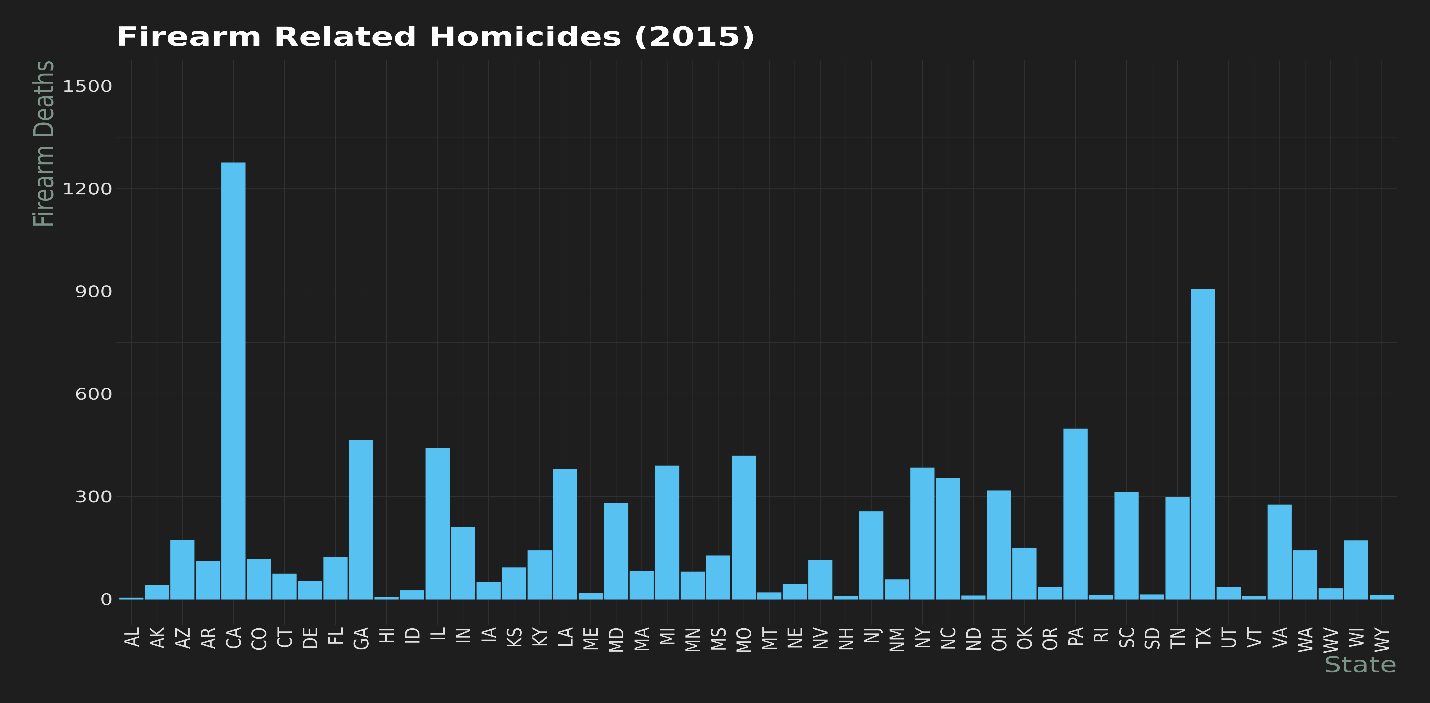
Firearm homicides account for almost fifty thousand murders out of a total of almost seventy thousand murders recorded in these UCR datasets for the years between 2014 and 2018. This is an average of 71.68 percent of murders according to the UCR data. To get a little more granular, in 2014 the percent of firearm murders that make up all murders in that year was about 68 percent, 2015 was about 71 percent, 2016 was about 73 percent, 2017 was about 73 percent, and 2018 was about 73 percent. This shows that there is a clear slight upward trend in firearms being the choice of weapon used for murder. The UCR datasets included many different firearms including handguns, rifles, shotguns, other firearms, knives, or other cutting instruments, other, and hands, fists, etc. In the figure below, you will see not only where most homicides occur but also the span of the data over these 5 years. This visualization gives us a great overview of the states who are having issues with firearm homicides, including those who are getting worse or are getting better. The box plot shows us not only that California is the leader in firearm related murders, but also that it is consistently the leader. It is also apparent that Iowa is having an increasing issue with firearm related homicides. It is important to note that firearm homicide data for Florida, Guam, the Mariana Islands, Puerto Rico, and the Virgin Islands was not available from the FBI datasets.

I think it is also important to view the data for each year, as it shows a telling picture. The two constant leaders in firearm related homicides are always California and Texas. These graphs are a good way to see that.

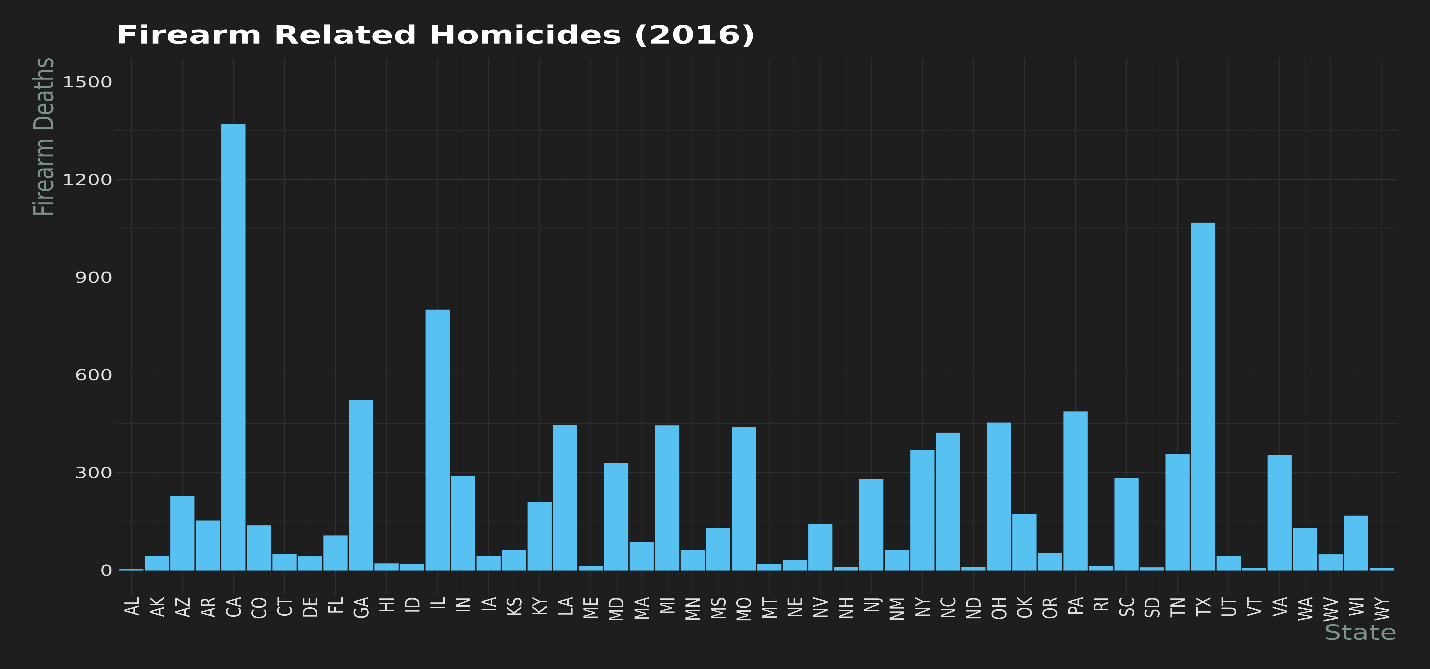
**2014**



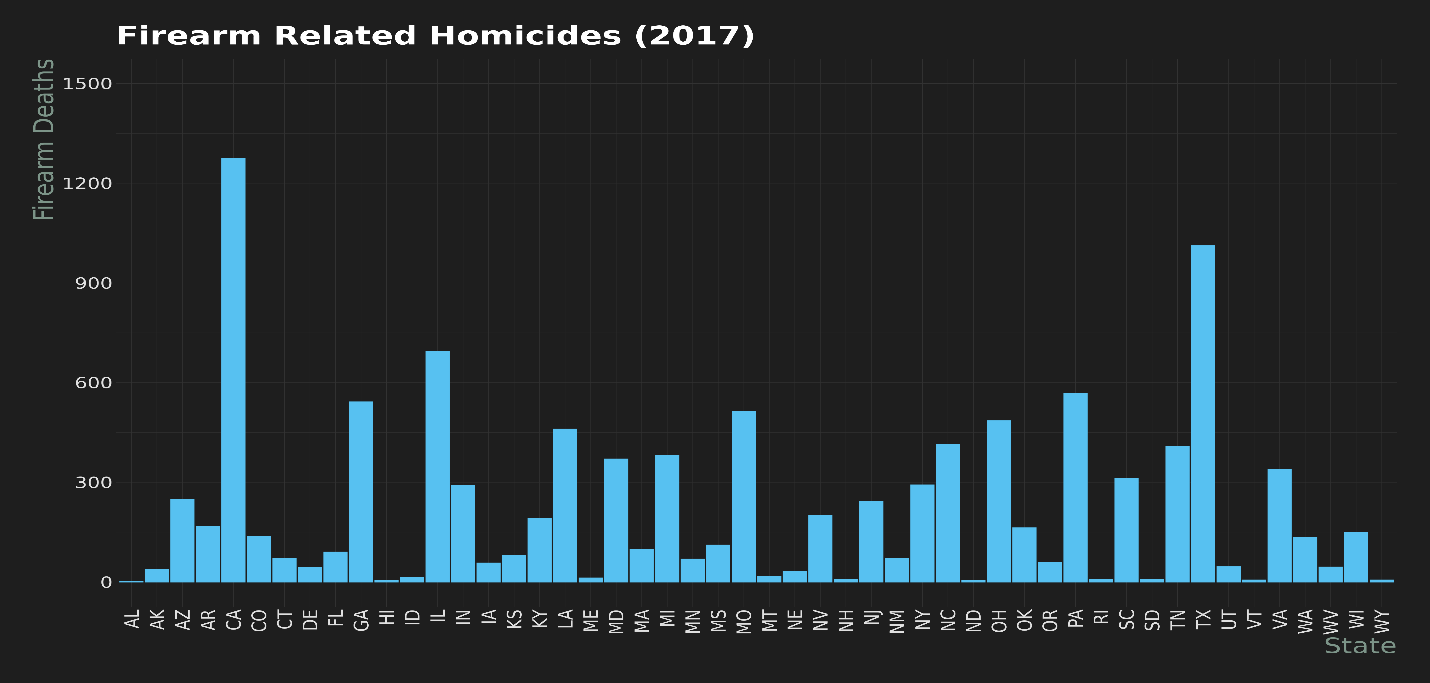
**2015**

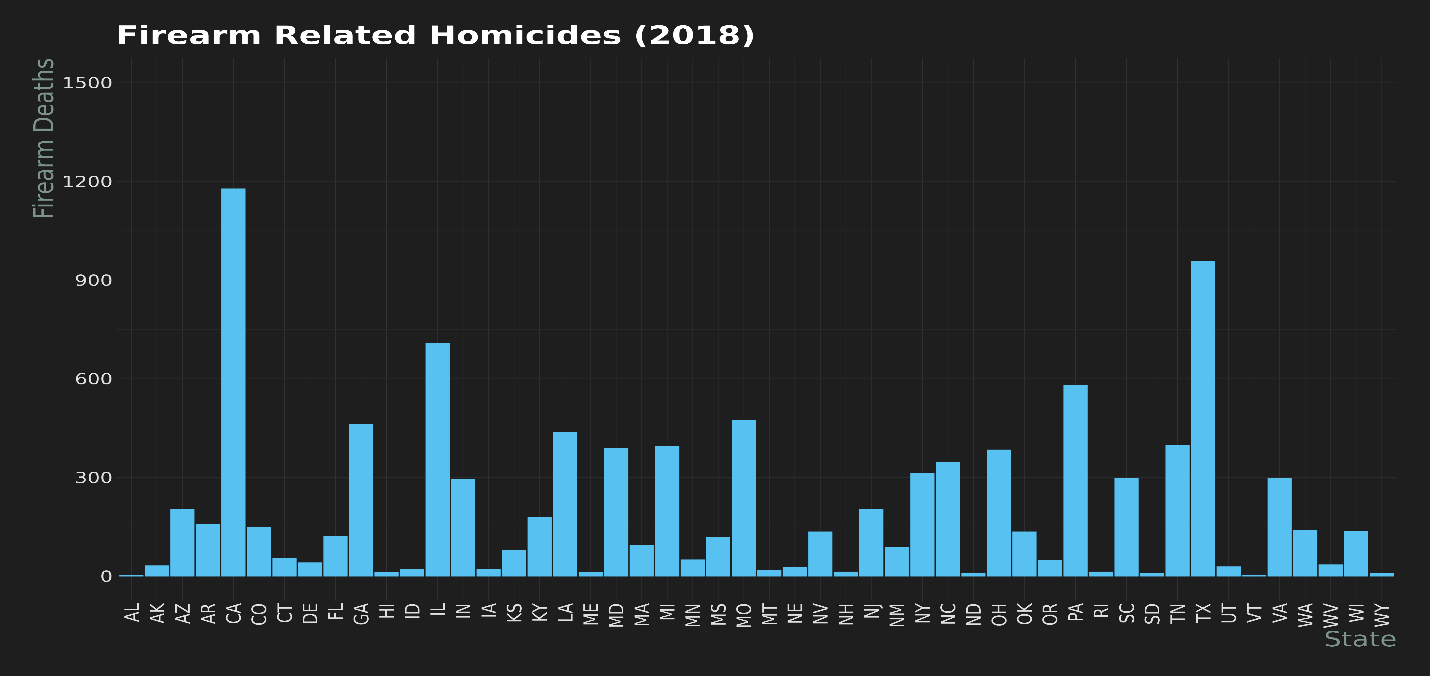


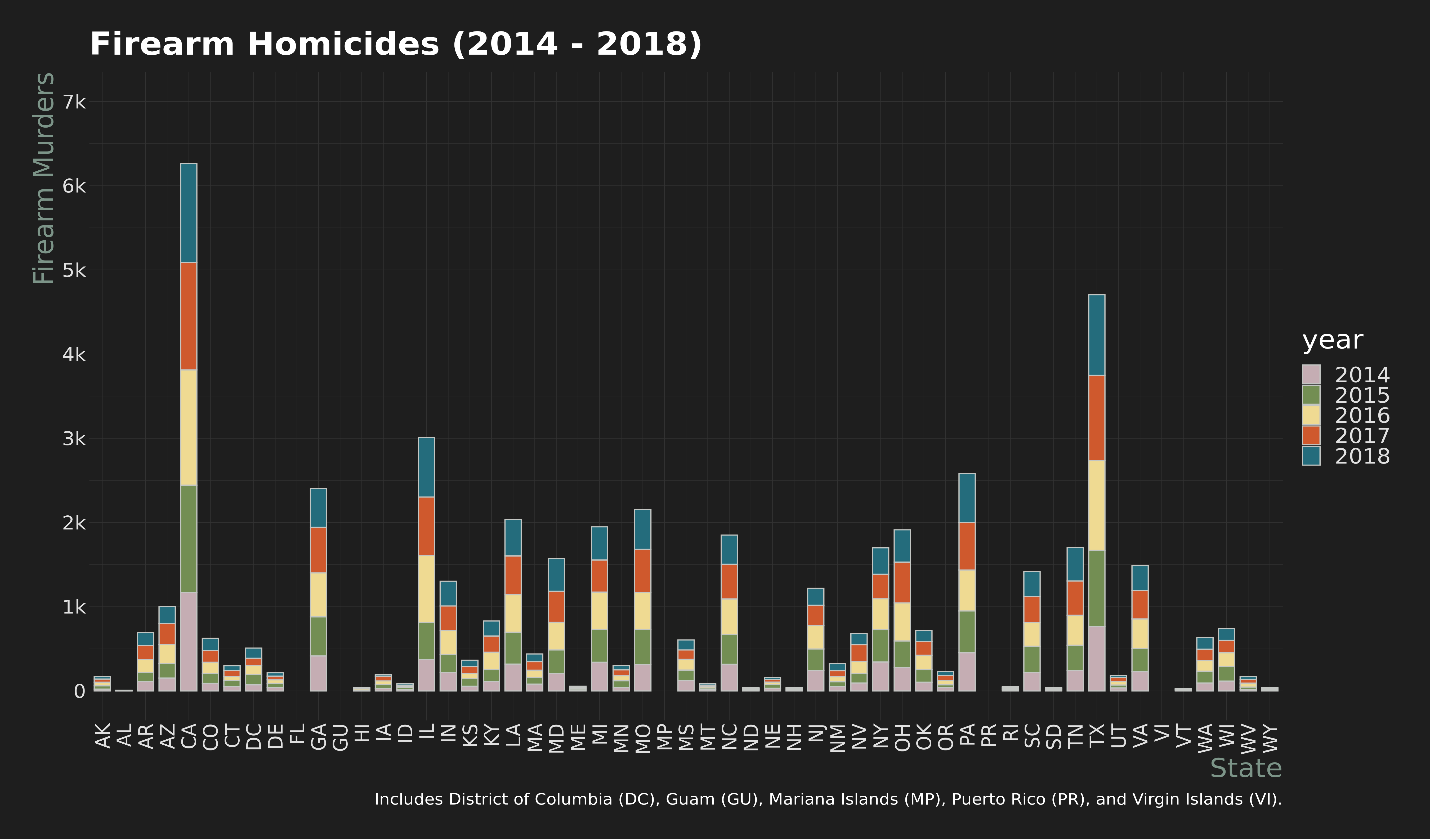
**2016**

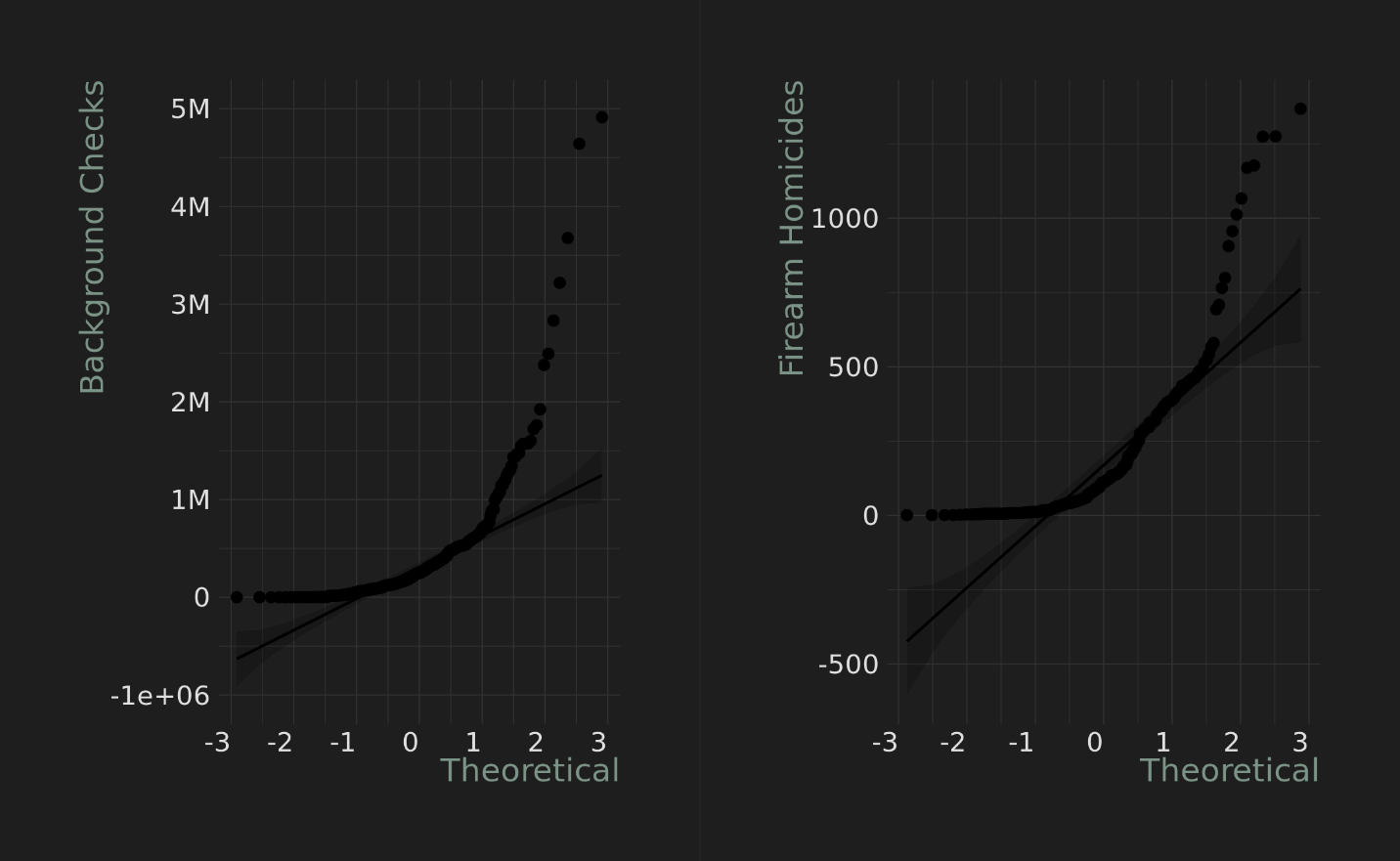


**2017**



**2018**

One of my favorite charts to show data of this type is a stacked bar chart like we used for the background check data. Below this paragraph we will include the stacked chart for firearm related homicides between the years of 2014 to 2018. It provides a large amount of data and details in a relatively small image. This should not be a surprise considering the other data we have analyzed so far that California is the leader, followed by Texas, Iowa, Pennsylvania, and Georgia. The most interesting part of this is that over the course of 5 years, California has had a little more that a thousand more homicides that Texas, and if you ignore Texas the next highest state is almost three thousand firearm homicides lower. It is important to know that homicide data for Florida, Guam, the Mariana Islands, Puerto Rico, and the Virgin Islands was not available from the FBI databases, so they are marked 0, or NA. 

One of the points of this research assignment was to deduct if there was a correlation between federal firearm licenses and firearm related homicides. When we use R to run a Pearson’s Product-Moment correlation test, our result include some interesting results. The returned P-value is about 5.0894 e-19 or 0.00000000000000000050894 with a correlation coefficient of about 0.524. This means that there is a slight, and I mean ever so slight positive correlation but ultimately this means there is no correlation since it is so close to 0. When trying to learn more I found that a good way to confirm this hypothesis is to generate a side by side Q-Q plot for these two datasets. Below is that chart for you to analyze as well. Ultimately this does not provide an answer to my initial question and the best way to go about analyzing that question is to make a request to the FBI for the data that I need. I think minus the waiting time for the data request process to be completed and the data to be transferred, the data exploration on this topic would be very telling and important.

\*Note: All images are available in my GitHub, at <https://github.com/danner26/Stockton-DSSA/tree/main/R/Data%20Exploration%20Project/png>

\*\*Note: All the cleaned data I used is available in my GitHub, at <https://github.com/danner26/Stockton-DSSA/tree/main/R/Data%20Exploration%20Project/data>

**Citations**

Cohn, D’Vera, et al. “Gun Homicide Rate Down 49% Since 1993 Peak; Public Unaware.” *Pew Research Center’s Social & Demographic Trends Project*, 30 May 2020, www.pewsocialtrends.org/2013/05/07/gun-homicide-rate-down-49-since-1993-peak-public-unaware. Accessed 3 Dec. 2020.

“NICS Firearm Checks: Month/Year by State.” *Federal Bureau of Investigation*, Federal Bureau of Investigation, www.fbi.gov/file-repository/nics\_firearm\_checks\_-\_month\_year\_by\_state.pdf/view. Accessed 2 Dec. 2020.

“NICS Firearm Checks: Year by State/Type.” *Federal Bureau of Investigation*, Federal Bureau of Investigation, www.fbi.gov/file-repository/nics\_firearm\_checks\_-\_year\_by\_state\_type.pdf/view. Accessed 2 Dec. 2020.

“Table 12.” *FBI*, Federal Bureau of Investigation, ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/topic-pages/tables/table-12. Accessed 1 Dec. 2020.

“Table 20.” *FBI*, Federal Bureau of Investigation, ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/tables/table-20. Accessed 1 Dec. 2020.

“Table 20.” *FBI*, Federal Bureau of Investigation, ucr.fbi.gov/crime-in-the-u.s/2015/crime-in-the-u.s.-2015/tables/table-20. Accessed 1 Dec. 2020.

“Table 20.” *FBI*, Federal Bureau of Investigation, ucr.fbi.gov/crime-in-the-u.s/2017/crime-in-the-u.s.-2017/topic-pages/tables/table-20. Accessed 1 Dec. 2020.

“Table 20.” *FBI*, Federal Bureau of Investigation, ucr.fbi.gov/crime-in-the-u.s/2018/crime-in-the-u.s.-2018/topic-pages/tables/table-20. Accessed 1 Dec. 2020.

**Appendix (R Code)**

This data, images and code base is available on my GitHub, at <https://github.com/danner26/Stockton-DSSA/tree/main/R/Data%20Exploration%20Project>

Also this notebook can be viewed at <https://htmlpreview.github.io/?https://github.com/danner26/Stockton-DSSA/blob/main/R/Data%20Exploration%20Project/DataAnalysis.nb.html>

# **Firearms Data**

Hide

#install.packages(c("devtools", "tidyverse", "readr", "dplyr", "fiftystatr", "viridis", "mapproj", "ggpubr", "ggmap", "chron", "lubridate", "list", "ggthemes"))

library(devtools)

install\_github("wmurphyrd/fiftystater")

library(tidyverse)

library(readr)

library(dplyr)

library(fiftystater)

library(viridis)

library(mapproj)

library(ggmap)

library(ggpubr)

library(chron)

library(lubridate)

library(list)

library(hrbrthemes)

setwd('/home/rstudio/dssa\_workspace/R/Data Exploration Project/')

# **Read in the data**

Hide

FirearmLicenses <- read\_csv("data/federal\_firearms\_licenses\_1975-2019.csv")

BackgroundChecks\_2014 <- read\_csv("data/firearm\_background\_checks\_bystate\_2014.csv")

BackgroundChecks\_2015 <- read\_csv("data/firearm\_background\_checks\_bystate\_2015.csv")

BackgroundChecks\_2016 <- read\_csv("data/firearm\_background\_checks\_bystate\_2016.csv")

BackgroundChecks\_2017 <- read\_csv("data/firearm\_background\_checks\_bystate\_2017.csv")

BackgroundChecks\_2018 <- read\_csv("data/firearm\_background\_checks\_bystate\_2018.csv")

HomicideData\_2014 <- read\_csv("data/MurderVictims-2014.csv")

HomicideData\_2015 <- read\_csv("data/MurderVictims-2015.csv")

HomicideData\_2016 <- read\_csv("data/MurderVictims-2016.csv")

HomicideData\_2017 <- read\_csv("data/MurderVictims-2017.csv")

HomicideData\_2018 <- read\_csv("data/MurderVictims-2018.csv")

#Helper function

Hide

# Ref: https://5harad.com/mse125/r/visualization\_code.html

addUnits <- function(n) {

labels <- ifelse(n < 1000, n, # less than thousands

ifelse(n < 1e6, paste0(round(n/1e3), 'k'), # in thousands

ifelse(n < 1e9, paste0(round(n/1e6), 'M'), # in millions

ifelse(n < 1e12, paste0(round(n/1e9), 'B'), # in billions

ifelse(n < 1e15, paste0(round(n/1e12), 'T'), # in trillions

'too big!'

)))))

return(labels)

}

#Total firearms plot

Hide

ggplot(FirearmLicenses, aes(x=year, y=total)) +

theme\_modern\_rc() +

geom\_line() +

geom\_point() +

scale\_y\_continuous(limits = c(0, 300000), breaks=seq(0, 300000, by = 50000)) +

scale\_x\_continuous(limits = c(1975, 2020), breaks=seq(1975, 2020, by = 5)) +

labs(x = "Year", y = "Firearm Licenses", title = "Firearm Licenses (1975-2019)")

ggsave("png/firearmlicenses\_1975-2020.png")

#Summation Data

Hide

paste(sum(FirearmLicenses$total), "in 1975 - 2019")

FirearmLicenses\_1418 <- FirearmLicenses %>% filter(between(year, 2014, 2018))

paste(sum(FirearmLicenses\_1418$total), "in 2014 - 2018")

#2014 Homicide Data by State

Hide

ggplot(HomicideData\_2014, aes(x=state, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 300)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2014)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides-2014.png")

#2015 Homicide Data by State

Hide

ggplot(HomicideData\_2015, aes(x=state, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 300)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2015)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides-2015.png")

#2016 Homicide Data by State

Hide

ggplot(HomicideData\_2016, aes(x=state, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 300)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2016)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides-2016.png")

#2017 Homicide Data by State

Hide

ggplot(HomicideData\_2017, aes(x=state, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 300)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2017)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides-2017.png")

#2018 Homicide Data by State

Hide

ggplot(HomicideData\_2018, aes(x=state, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 300)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2018)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides-2018.png")

Hide

SelectHomicideData\_2014 <- HomicideData\_2014 %>% select(state, total\_murders, total\_firearms) %>% mutate(year = 2014)

SelectHomicideData\_2015 <- HomicideData\_2015 %>% select(state, total\_murders, total\_firearms) %>% mutate(year = 2015)

SelectHomicideData\_2016 <- HomicideData\_2016 %>% select(state, total\_murders, total\_firearms) %>% mutate(year = 2016)

SelectHomicideData\_2017 <- HomicideData\_2017 %>% select(state, total\_murders, total\_firearms) %>% mutate(year = 2017)

SelectHomicideData\_2018 <- HomicideData\_2018 %>% select(state, total\_murders, total\_firearms) %>% mutate(year = 2018)

state <- c('Guam', 'Guam', 'Guam', 'Guam', 'Guam', 'Mariana Islands', 'Mariana Islands', 'Mariana Islands', 'Mariana Islands', 'Mariana Islands', 'Puerto Rico', 'Puerto Rico', 'Puerto Rico', 'Puerto Rico', 'Puerto Rico', 'Virgin Islands', 'Virgin Islands', 'Virgin Islands', 'Virgin Islands', 'Virgin Islands', 'Florida', 'Florida', 'Florida', 'Florida', 'Florida')

total\_murders <- c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA)

total\_firearms <- c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA)

year <- c(2014, 2015, 2016, 2017, 2018, 2014, 2015, 2016, 2017, 2018, 2014, 2015, 2016, 2017, 2018, 2014, 2015, 2016, 2017, 2018, 2014, 2015, 2016, 2017, 2018)

SelectExtraHomicideData <- data.frame(state, total\_murders, total\_firearms, year)

HomicideData <- bind\_rows(list(SelectHomicideData\_2014, SelectHomicideData\_2015, SelectHomicideData\_2016, SelectHomicideData\_2017, SelectHomicideData\_2018, SelectExtraHomicideData)) %>% arrange(state)

st\_crosswalk <- tibble(state = state.name) %>%

bind\_cols(tibble(abb = state.abb)) %>%

bind\_rows(tibble(state = "District of Columbia", abb = "DC")) %>%

bind\_rows(tibble(state = "Guam", abb = "GU")) %>%

bind\_rows(tibble(state = "Mariana Islands", abb = "MP")) %>%

bind\_rows(tibble(state = "Puerto Rico", abb = "PR")) %>%

bind\_rows(tibble(state = "Virgin Islands", abb = "VI"))

HomicideData <- left\_join(HomicideData, st\_crosswalk, by = "state")

HomicideData

#2014 Homicide Data by State

Hide

ggplot(HomicideData, aes(x=state, y=total\_firearms, fill=year)) +

theme\_modern\_rc() +

geom\_boxplot(outlier.colour="red", outlier.size = 2, color="#CF592D", fill="#EFDA92") +

scale\_y\_continuous(limits = c(0, 1500), breaks=seq(0, 1500, by = 100)) +

scale\_x\_discrete(label=state.abb) +

labs(x = "State", y = "Firearm Deaths", title = "Firearm Related Homicides (2014-2018)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides\_boxppplot.png")

Hide

percent <- function(x, digits = 2, format = "f", ...) {

paste0(formatC(100 \* x, format = format, digits = digits, ...), "%")

}

paste("2014 Firearm Murder Percent: ", percent(sum(HomicideData\_2014$total\_firearms) / sum(HomicideData\_2014$total\_murders)))

paste("2015 Firearm Murder Percent: ", percent(sum(HomicideData\_2015$total\_firearms) / sum(HomicideData\_2015$total\_murders)))

paste("2016 Firearm Murder Percent: ", percent(sum(HomicideData\_2016$total\_firearms) / sum(HomicideData\_2016$total\_murders)))

paste("2017 Firearm Murder Percent: ", percent(sum(HomicideData\_2017$total\_firearms) / sum(HomicideData\_2017$total\_murders)))

paste("2018 Firearm Murder Percent: ", percent(sum(HomicideData\_2018$total\_firearms) / sum(HomicideData\_2018$total\_murders)))

total\_murders <- sum(sum(HomicideData\_2014$total\_murders) + sum(HomicideData\_2015$total\_murders) + sum(HomicideData\_2016$total\_murders) + sum(HomicideData\_2017$total\_murders) + sum(HomicideData\_2018$total\_murders))

total\_firearms <- sum(sum(HomicideData\_2014$total\_firearms) + sum(HomicideData\_2015$total\_firearms) + sum(HomicideData\_2016$total\_firearms) + sum(HomicideData\_2017$total\_firearms) + sum(HomicideData\_2018$total\_firearms))

paste("2014-2018 Firearm Murder Percent Average: ", percent(total\_firearms / total\_murders))

#Firearm murders stacked bar chart

Hide

color\_table <- tibble(

Year = c("2014", "2015", "2016", "2017", "2018"),

Color = c("#C5ADB3", "#738E53", "#EFDA92", "#CF592D", "#246C7C")

)

HomicideData$year <- factor(HomicideData$year, levels = color\_table$Year)

ggplot(HomicideData, aes(fill=year, x=abb, y=total\_firearms)) +

theme\_modern\_rc() +

geom\_bar(position=position\_stack(reverse = TRUE), stat="identity", width=0.75, color="#C3C6C3") +

scale\_y\_continuous(label=addUnits, limits = c(0, 7000), breaks=seq(0, 7000, by = 1000)) +

labs(x = "State", y = "Firearm Murders", title = "Firearm Homicides (2014 - 2018)", caption = "Includes District of Columbia (DC), Guam (GU), Mariana Islands (MP), Puerto Rico (PR), and Virgin Islands (VI).") +

scale\_fill\_manual(values=color\_table$Color) +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/firearmhomicides\_stacked\_2014-2018.png")

#2014 Background Check Data by State

Hide

ggplot(BackgroundChecks\_2014, aes(x=State, y=Totals)) +

theme\_modern\_rc() +

geom\_bar(stat="identity") +

scale\_x\_discrete(label=state.abb) +

scale\_y\_continuous(label=addUnits) +

labs(x = "State", y = "Firearm Deaths", title = "Background Checks (2014)") +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

#Merge background checks

Hide

BackgroundChecks\_2014 <- BackgroundChecks\_2014 %>% select(State, Totals) %>% mutate(Year = 2014)

BackgroundChecks\_2015 <- BackgroundChecks\_2015 %>% select(State, Totals) %>% mutate(Year = 2015)

BackgroundChecks\_2016 <- BackgroundChecks\_2016 %>% select(State, Totals) %>% mutate(Year = 2016)

BackgroundChecks\_2017 <- BackgroundChecks\_2017 %>% select(State, Totals) %>% mutate(Year = 2017)

BackgroundChecks\_2018 <- BackgroundChecks\_2018 %>% select(State, Totals) %>% mutate(Year = 2018)

Background\_Checks <- bind\_rows(list(BackgroundChecks\_2014, BackgroundChecks\_2015, BackgroundChecks\_2016, BackgroundChecks\_2017, BackgroundChecks\_2018)) %>% arrange(State)

st\_crosswalk <- tibble(State = state.name) %>%

bind\_cols(tibble(abb = state.abb)) %>%

bind\_rows(tibble(State = "District of Columbia", abb = "DC")) %>%

bind\_rows(tibble(State = "Guam", abb = "GU")) %>%

bind\_rows(tibble(State = "Mariana Islands", abb = "MP")) %>%

bind\_rows(tibble(State = "Puerto Rico", abb = "PR")) %>%

bind\_rows(tibble(State = "Virgin Islands", abb = "VI"))

Background\_Checks <- left\_join(Background\_Checks, st\_crosswalk, by = "State")

Background\_Checks

Hide

stateAbb <- function(n) {

labels <- ifelse(n == "Distric of Columbia", "DC",

state.abb)

return(labels)

}

#Background check stacked bar chart

Hide

color\_table <- tibble(

Year = c("2014", "2015", "2016", "2017", "2018"),

Color = c("#C5ADB3", "#738E53", "#EFDA92", "#CF592D", "#246C7C")

)

Background\_Checks$Year <- factor(Background\_Checks$Year, levels = color\_table$Year)

ggplot(Background\_Checks, aes(fill=Year, x=abb, y=Totals)) +

theme\_modern\_rc() +

geom\_bar(position=position\_stack(reverse = TRUE), stat="identity", width=0.75, color="#C3C6C3") +

scale\_y\_continuous(label=addUnits, limits = c(0, 20000000), breaks=seq(0, 20000000, by = 1000000)) +

labs(x = "State", y = "Background Checks", title = "Background Checks (2014 - 2018)", caption = "Includes District of Columbia (DC), Guam (GU), Mariana Islands (MP), Puerto Rico (PR), and Virgin Islands (VI).") +

scale\_fill\_manual(values=color\_table$Color) +

theme(plot.title = element\_text(size = 30), text = element\_text(size=25), axis.text.x = element\_text(angle=90, vjust=0.5, hjust=1, size = 18), axis.text.y = element\_text(hjust=1, size = 18), axis.title.x = element\_text(hjust = 1, size = 25, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 25, color = "#7C9488"), plot.caption = element\_text(size = 15))

ggsave("png/backgroundchecks\_stacked-2014-2018.png")

Hide

pearson\_correlation <- cor.test(Background\_Checks$Totals, HomicideData$total\_firearms, method = "pearson")

pearson\_correlation

paste("Pearson Correlation coefficient: ", pearson\_correlation$estimate)

paste("Pearson P value: ", pearson\_correlation$p.value)

kendall\_correlation <- cor.test(Background\_Checks$Totals, HomicideData$total\_firearms, method = "kendall")

kendall\_correlation

paste("Kendall Correlation coefficient: ", kendall\_correlation$estimate)

paste("Kendall P value: ", kendall\_correlation$p.value)

spearman\_correlation <- cor.test(Background\_Checks$Totals, HomicideData$total\_firearms, method = "spearman")

spearman\_correlation

paste("Spearman Correlation coefficient: ", spearman\_correlation$estimate)

paste("Spearman P value: ", spearman\_correlation$p.value)

Hide

bkchk\_corr <- ggqqplot(Background\_Checks$Totals, ylab = "Background Checks") + theme\_modern\_rc() + scale\_y\_continuous(label=addUnits, limits = c(-1000000, 5000000), breaks=seq(-1000000, 5000000, by = 1000000)) +

theme(axis.text.x = element\_text(vjust=0.5, hjust=1, size = 10), axis.text.y = element\_text(hjust=1, size = 10), axis.title.x = element\_text(hjust = 1, size = 12, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 12, color = "#7C9488"), plot.caption = element\_text(size = 15))

homicide\_corr <- ggqqplot(HomicideData$total\_firearms, ylab = "Firearm Homicides") + theme\_modern\_rc() +

theme(axis.text.x = element\_text(vjust=0.5, hjust=1, size = 10), axis.text.y = element\_text(hjust=1, size = 10), axis.title.x = element\_text(hjust = 1, size = 12, color = "#7C9488"), axis.title.y = element\_text(hjust = 1, size = 12, color = "#7C9488"), plot.caption = element\_text(size = 15))

cowplot::plot\_grid(bkchk\_corr, homicide\_corr)

ggsave("png/correlation\_qqplot.png")