Covid Multi-State Data Analysis

Goal

The purpose of this notebook is to show the analysis of Covid data using data from all of the states

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Data can be found here:

https://covidtracking.com/data

Methodology

The CDC has released the IFR (Infection fatality rate) of 0.26%

Reference: https://reason.com/2020/06/28/cdc-antibody-studies-confirm-huge-gap-between-covid-19-infections-and-known-cases/

Using this we can calculate the number of people who have actually had Covid because we know the number of deaths.

(number of individuals who have had covid) = total deaths / .0026

We can calculate the percentage immune by dividing the (number of individuals who have had it) / (total population)

Preparing the data

First we need to prepare the data and read it in from a CSV as a dataframe in R.

```
rawData <- read.csv("daily.csv", stringsAsFactors = FALSE)

rawData$date <- as.character(rawData$date)
# Fix the date field
rawData$FixedDate <- as.Date(rawData$date, format = "%Y%m%d")

# We also need to read in the data for the US
dataUS <- read.csv("daily-us.csv", stringsAsFactors = FALSE)

dataUS$date <- as.character(dataUS$date)
# Fix the date field
dataUS$FixedDate <- as.Date(dataUS$date, format = "%Y%m%d")
```

Now we build a dataframe for just the states we are interested in.

```
dataVirginia     <- subset(rawData,
                           rawData$'state' == "VA")
dataFlorida      <- subset(rawData,
                           rawData$'state' == "FL")
dataNewYork      <- subset(rawData,
                           rawData$'state' == "NY")
dataCali         <- subset(rawData,
                           rawData$'state' == "CA")
```

```
dataWashington   <- subset(rawData,
                          rawData$'state' == "WA")
dataNewJersey    <- subset(rawData,
                          rawData$'state' == "NJ")
dataConnecticut  <- subset(rawData,
                          rawData$'state' == "CO")
dataMass         <- subset(rawData,
                          rawData$'state' == "MA")
dataTexas        <- subset(rawData,
                          rawData$'state' == "TX")
dataArizona      <- subset(rawData,
                          rawData$'state' == "AZ")
```

Calculating the Totals for the State

In order to get an idea of overall statistics for the state we will total the numbers in the raw data set.

```
VAtotalCases            = head(dataVirginia$positive,1)
VAtotalHospitalizations = head(dataVirginia$hospitalizedCumulative,1)
VAtotalDeaths           = head(dataVirginia$death,1)
FLtotalCases            = head(dataFlorida$positive,1)
FLtotalHospitalizations = head(dataFlorida$hospitalizedCumulative,1)
FLtotalDeaths           = head(dataFlorida$death,1)
NYtotalCases            = head(dataNewYork$positive,1)
NYtotalHospitalizations = head(dataNewYork$hospitalizedCumulative,1)
NYtotalDeaths           = head(dataNewYork$death,1)
```

Totals for the States:

Virginia

- Cases: 78375
- Hospitalizations: 11265
- Deaths: 2031

Florida

- Cases: 360394
- Hospitalizations: 21605
- Deaths: 5183

New York

- Cases: 407326
- Hospitalizations: 89995
- Deaths: 25056

Calculate heard immunity rate of a subset of states

The CDC has released the infection fatility rate (IFR) as 0.26%. Using the total number of deaths in specific states, we can calculate the total number of people who have had COVID in this region.

```
VAnumberHadit = VAtotalDeaths / .0026
FLnumberHadit  = FLtotalDeaths / .0026
NYnumberHadit  = NYtotalDeaths / .0026
```

Individuals who have had Covid:

- Virginia: 781153.8
- Florida: 1993462
- New York: 9636923

Using the number of individuals who have had COVID divided by the total population of the states, we can calculate the heard immunity threshold of the region.

Total Population in 2020:

- VA: 8,536,000
- FL: 21,480,000
- NY: 19,450,000

Percentage of individuals who have had Covid:

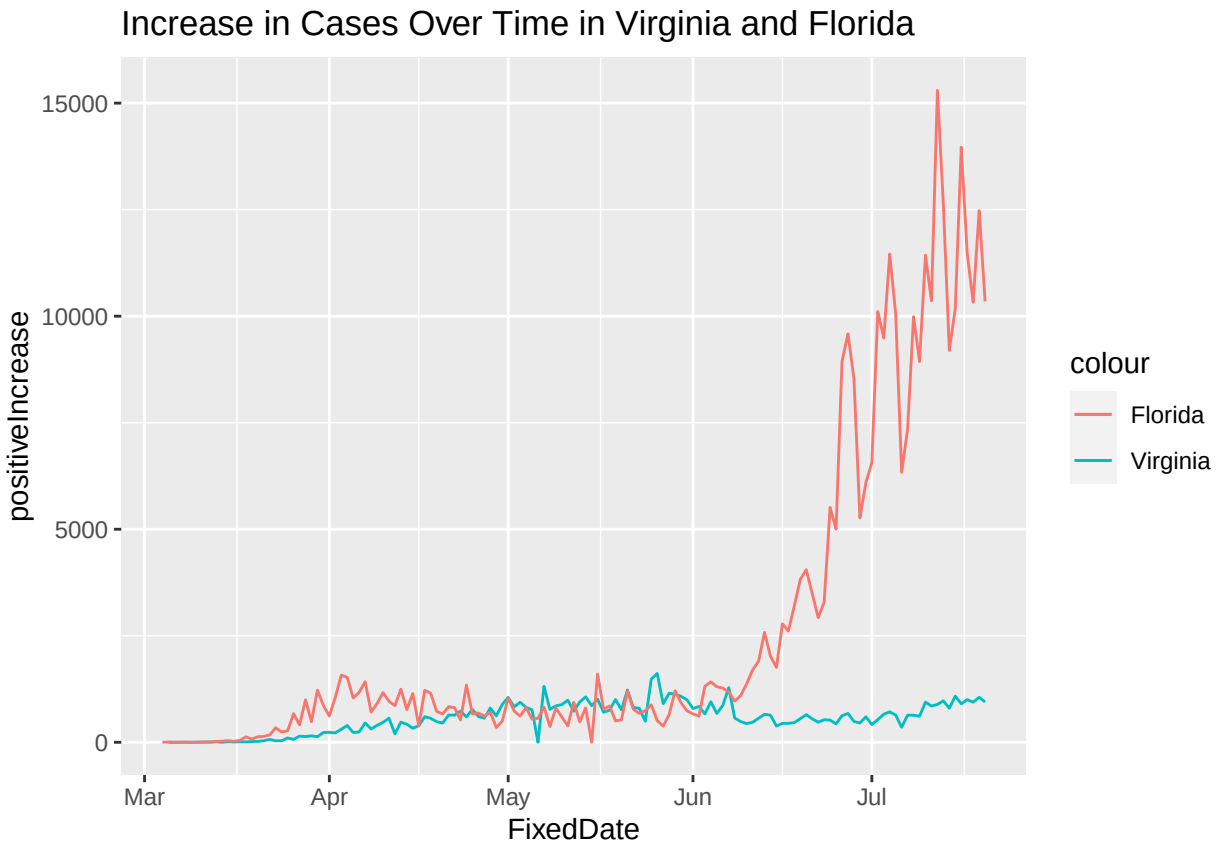
- Virginia: 9.1512869%
- Florida: 9.2805472%
- New York: 49.5471623%

It looks like we are a couple of percentage points below the threshold needed for herd immunity.

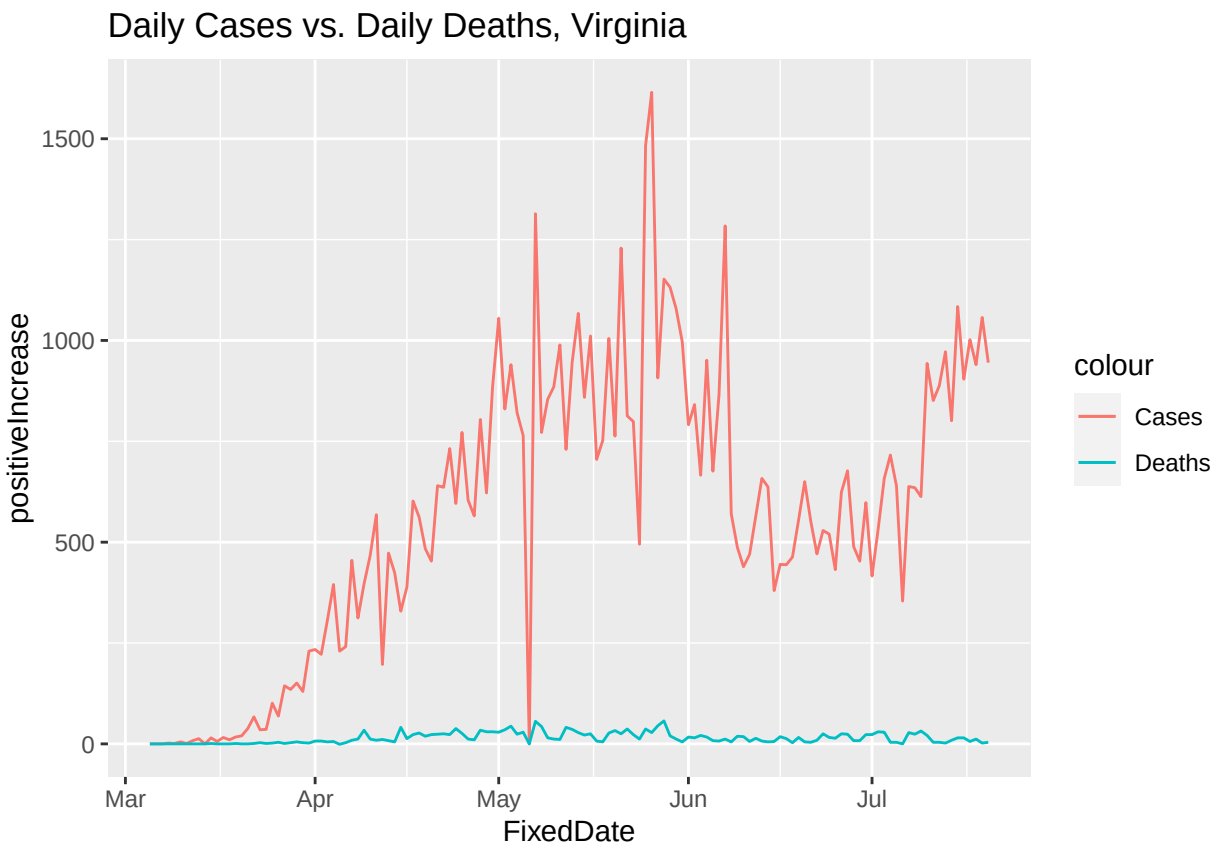
Total Cases Over Time

Some additional data gleaned from the data set:

```
totalCases_vs_Deaths_Plot = ggplot() +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = positiveIncrease, color='Virginia')) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = positiveIncrease, color='Florida'))
print(totalCases_vs_Deaths_Plot +
        ggtitle("Increase in Cases Over Time in Virginia and Florida"))
```

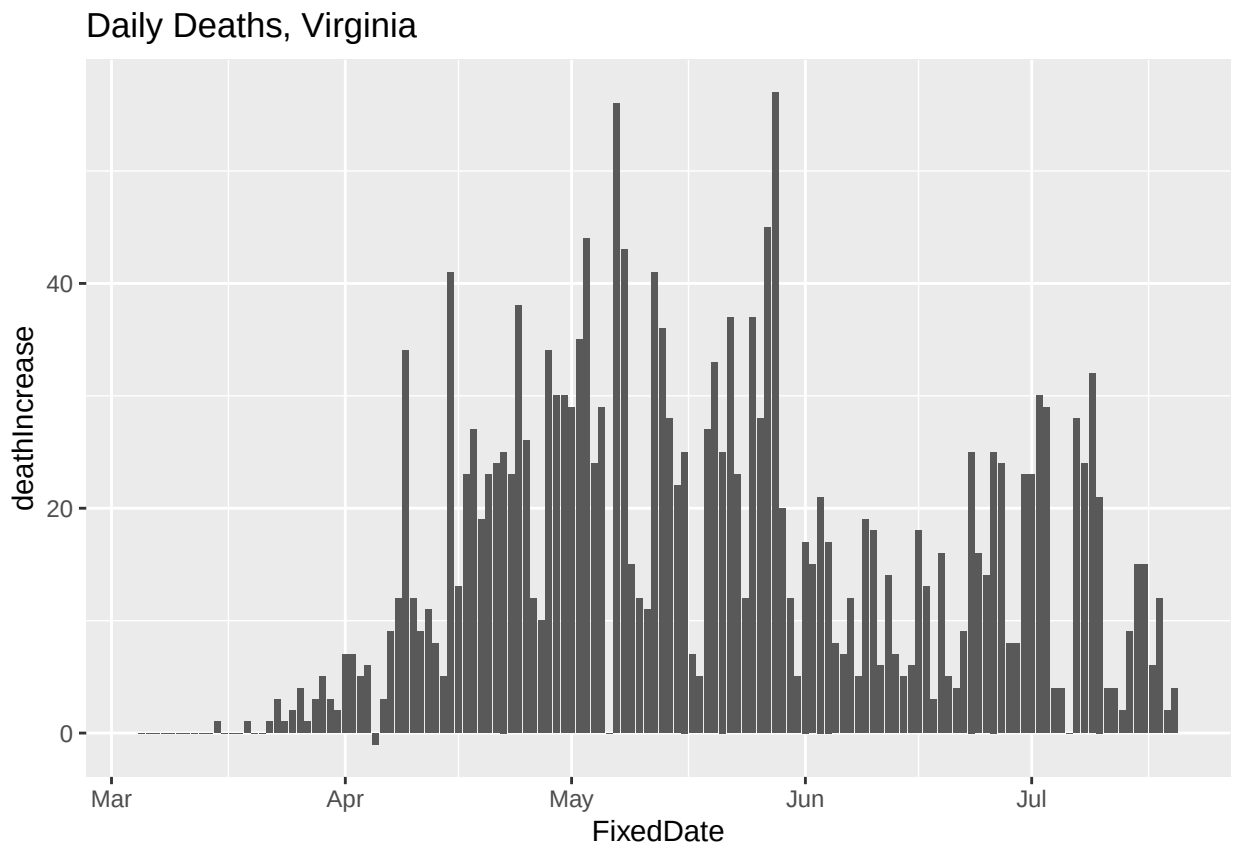



```
totalCases_Eastern_Plot <- ggplot() +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = positiveIncrease, color='Cases')) +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = deathIncrease, color = 'Deaths'))
print(totalCases_Eastern_Plot +
        ggtitle("Daily Cases vs. Daily Deaths, Virginia"))
```



We can also separate out the graph of deaths related to COVID to more closely examine the trend. Although the number of cases is rising, the number of deaths is not.

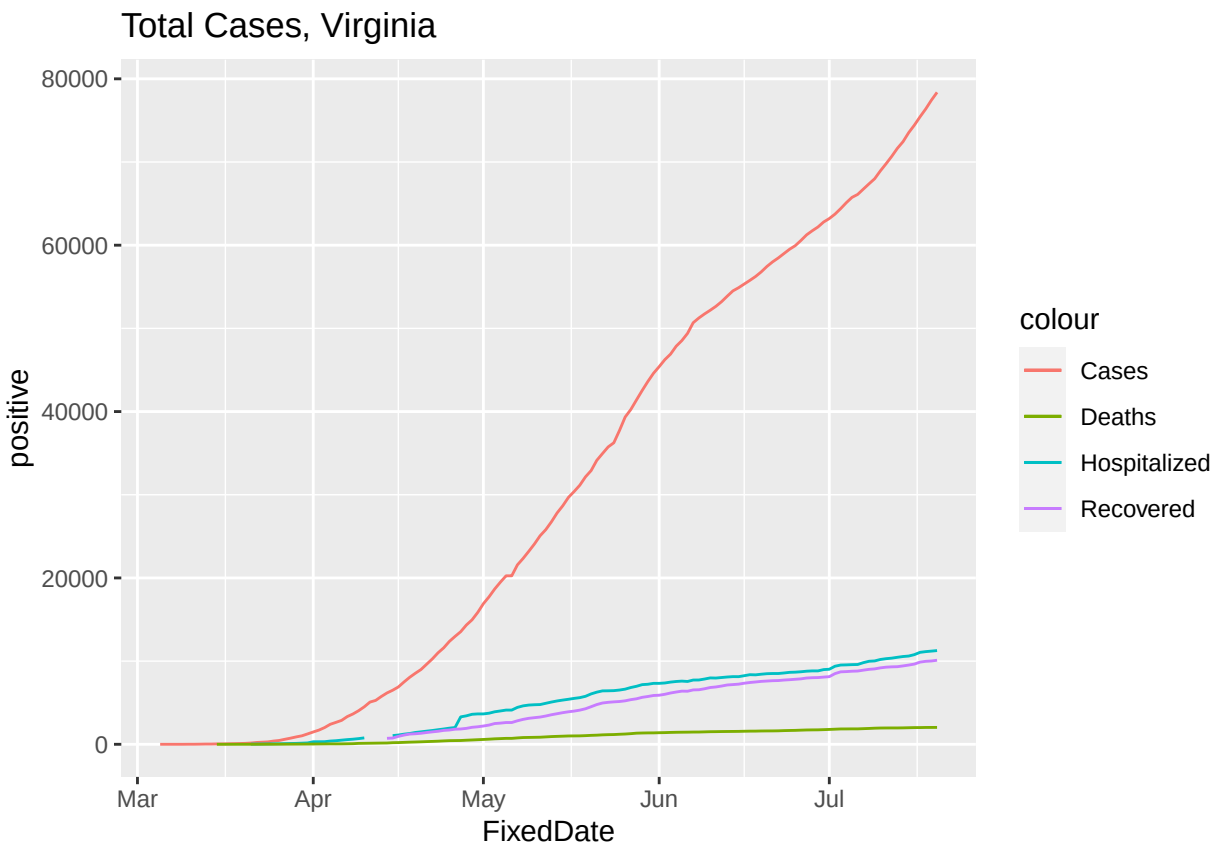
```
totalDeaths_Eastern_Plot =
  ggplot(data = dataVirginia, aes(x = FixedDate, y=deathIncrease)) +
  geom_bar(stat="identity")
print(totalDeaths_Eastern_Plot +
        ggtitle("Daily Deaths, Virginia"))
```



Some additional plots for comparison

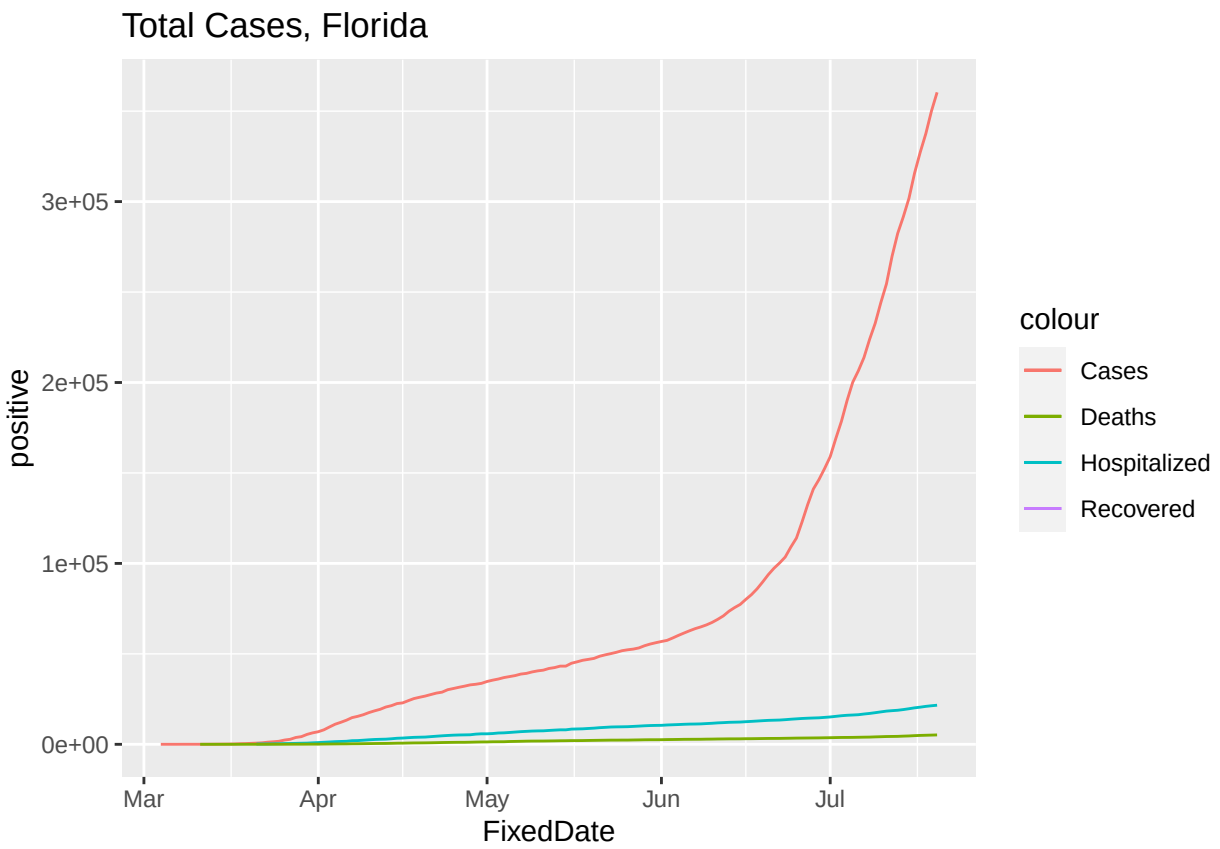
```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, Virginia"))
```



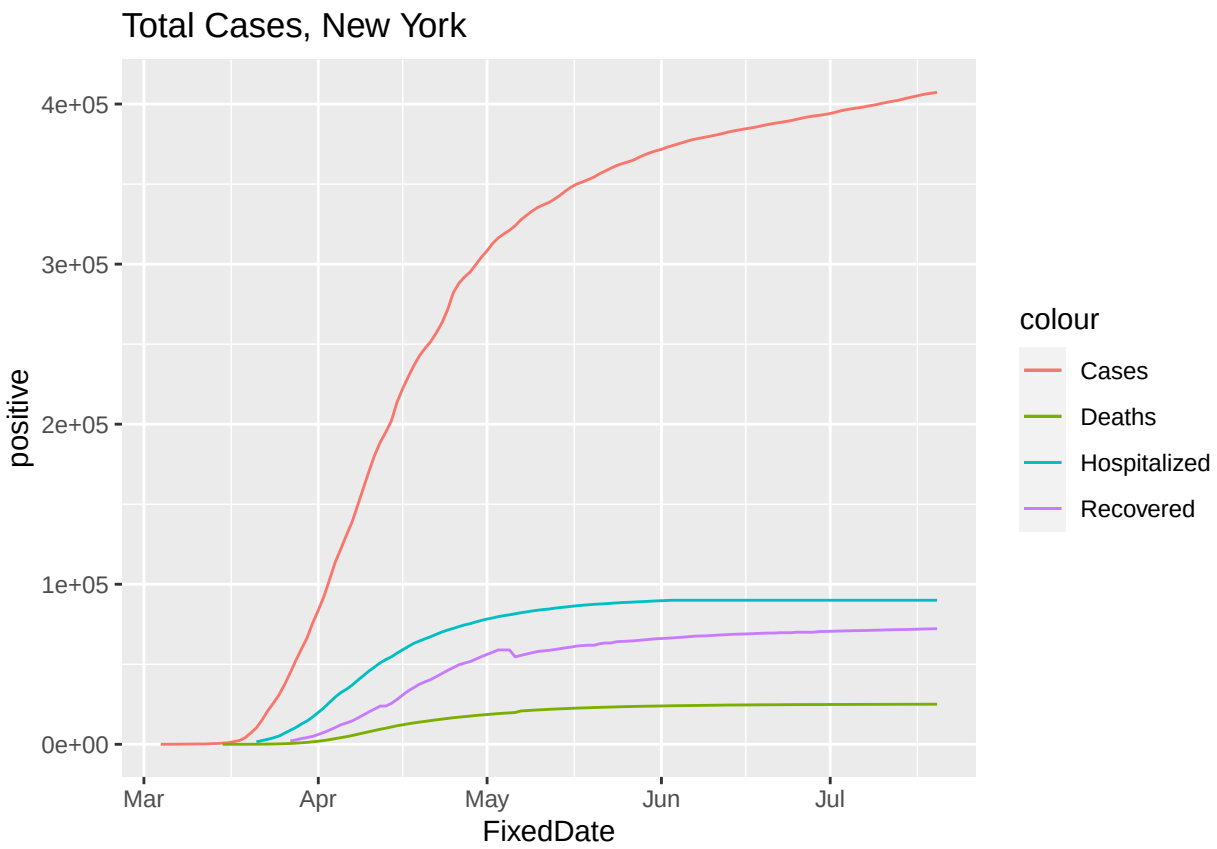

```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, Florida"))
```



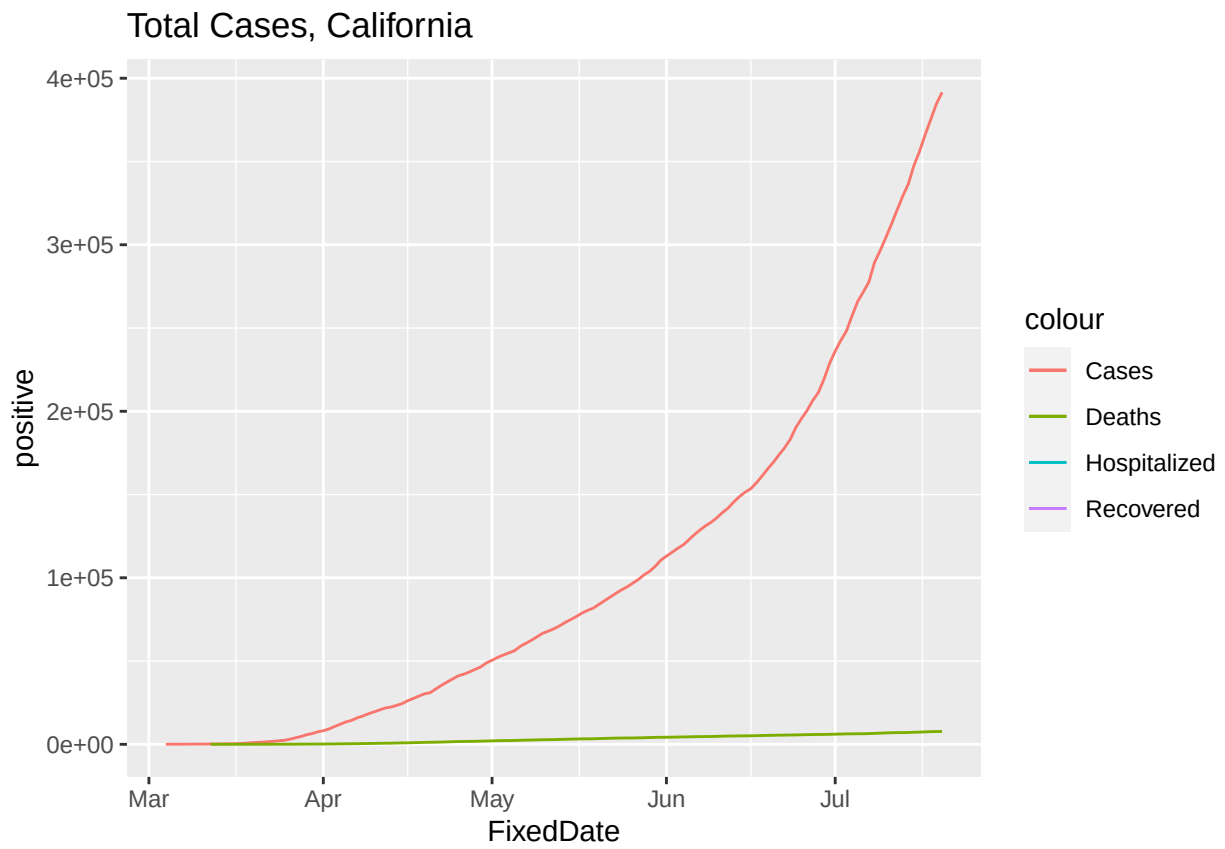

```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, New York"))
```



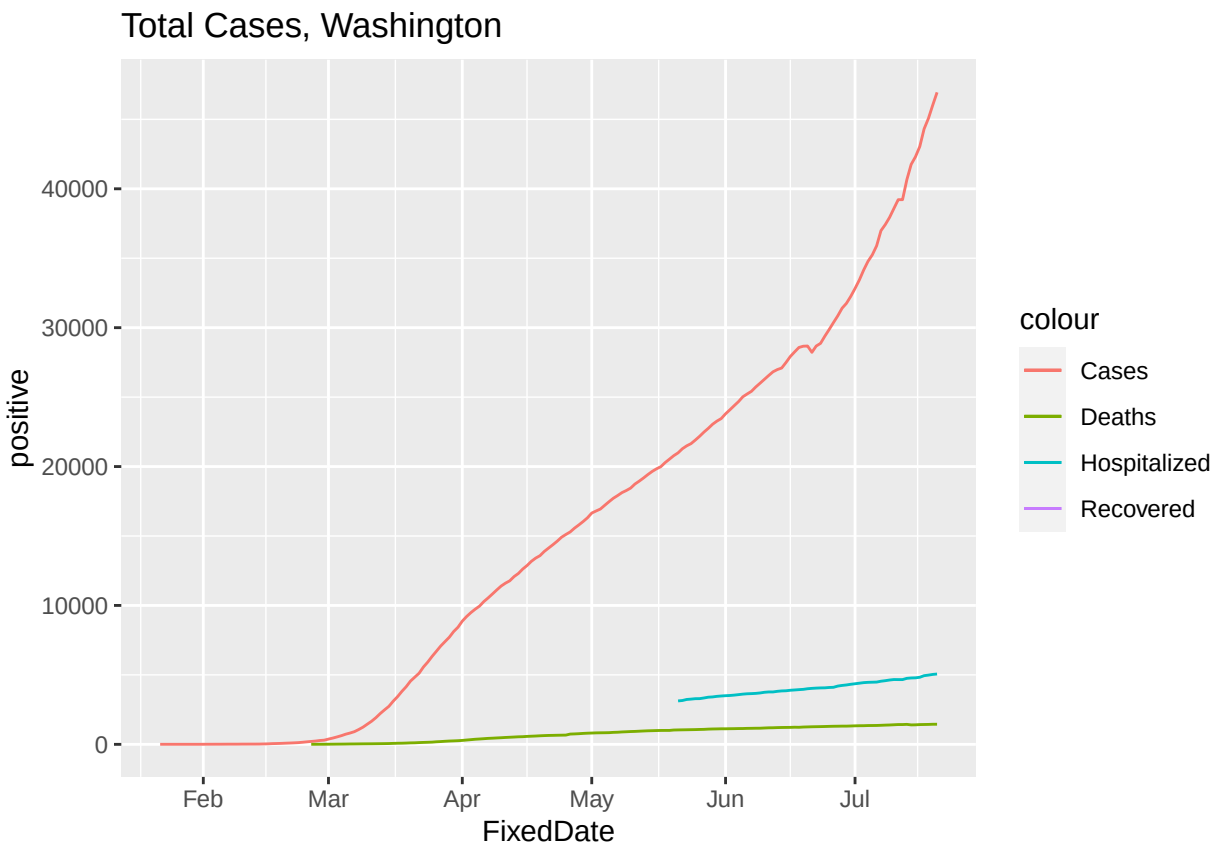

```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, California"))
```



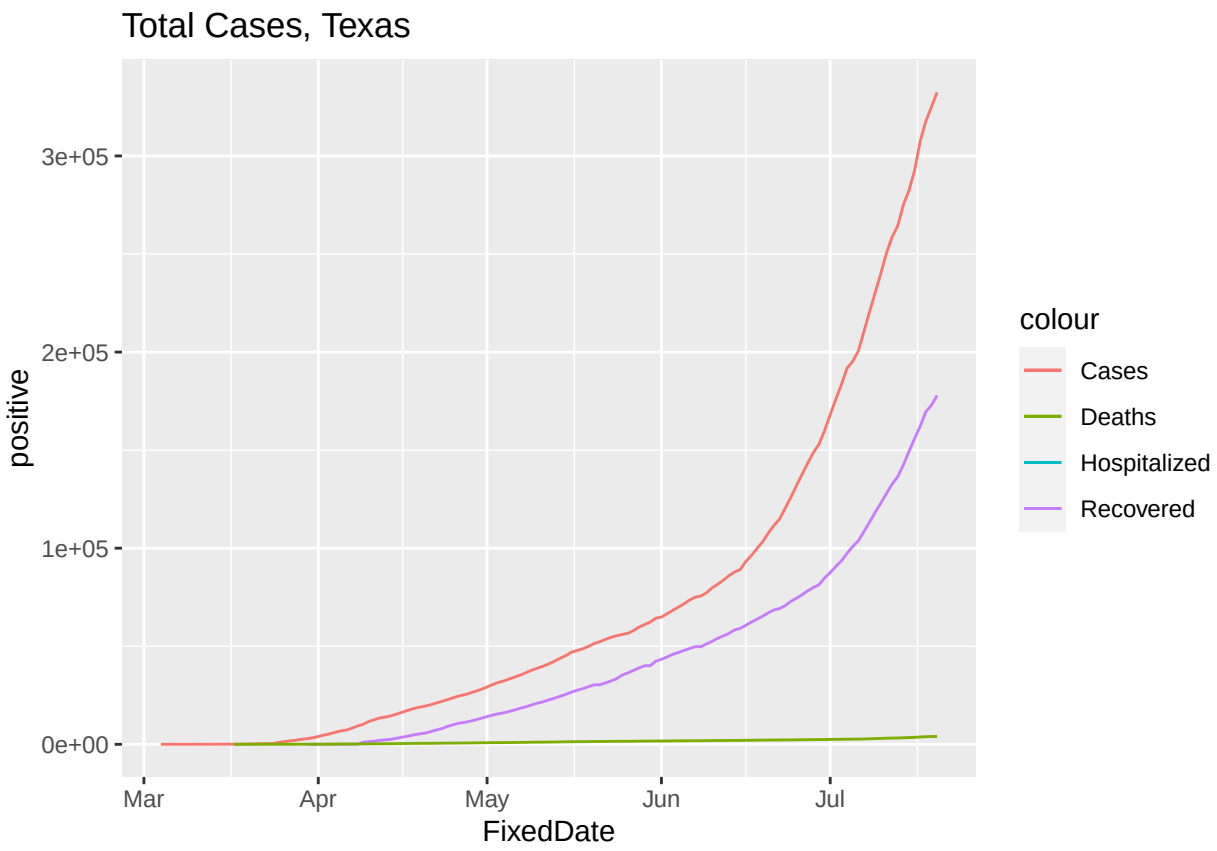

```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, Washington"))
```




```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = positive, color = "Cases")) +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = hospitalizedCumulative, color = "Hospitalized")) +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = recovered, color = "Recovered")) +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = death, color = "Deaths"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, Texas"))
```



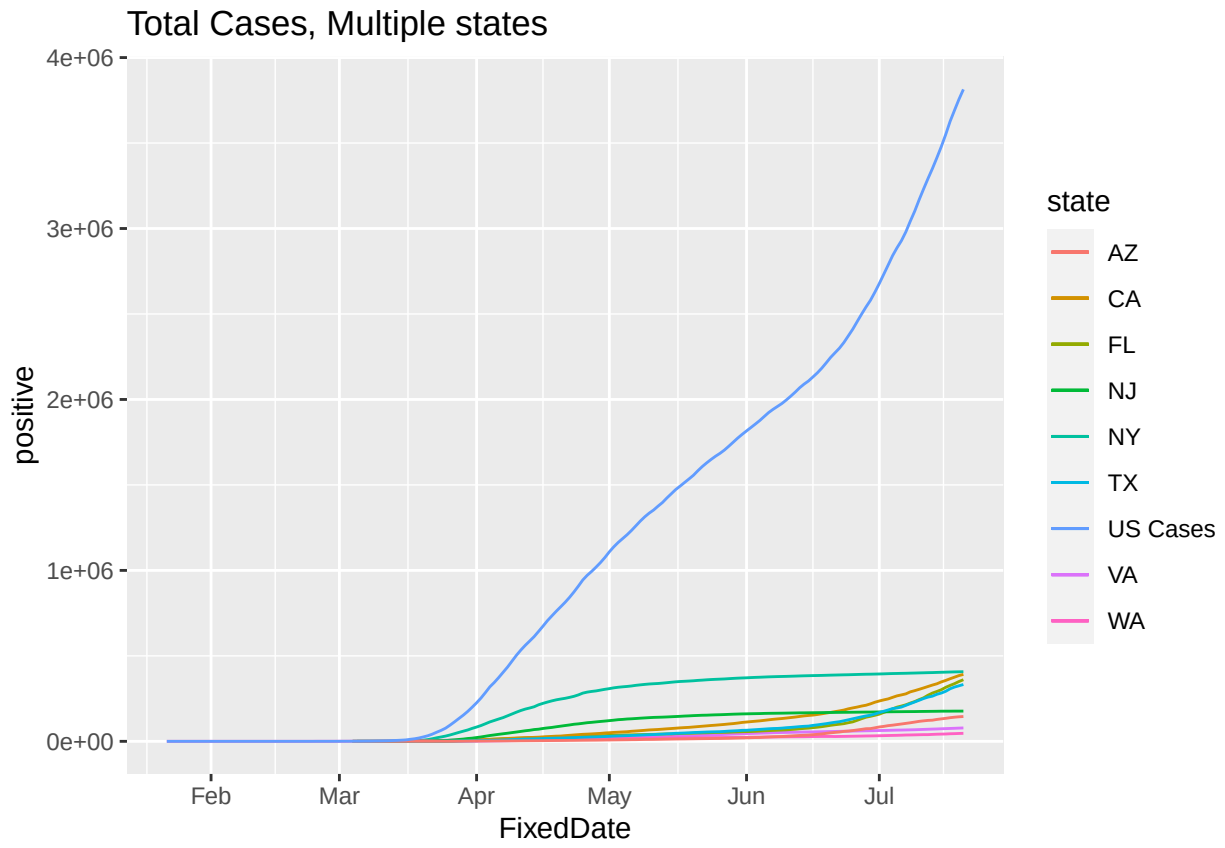
Analysis

In my opinion, the interesting thing about the data below is that while the number of case is climbing steadily, the number of deaths is leveling out. The media presents the rising number of cases in states like Florida and Texas but if you look at the number of deaths over time in states like New York, New Jersey, Massachusetts and Connecticut, they had a huge number of deaths early on and still top the number of deaths in the other states by a wide margin.

```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataNewJersey,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataArizona,
            aes(x = FixedDate, y = positive, color = state)) +
  geom_line(data = dataUS,
```

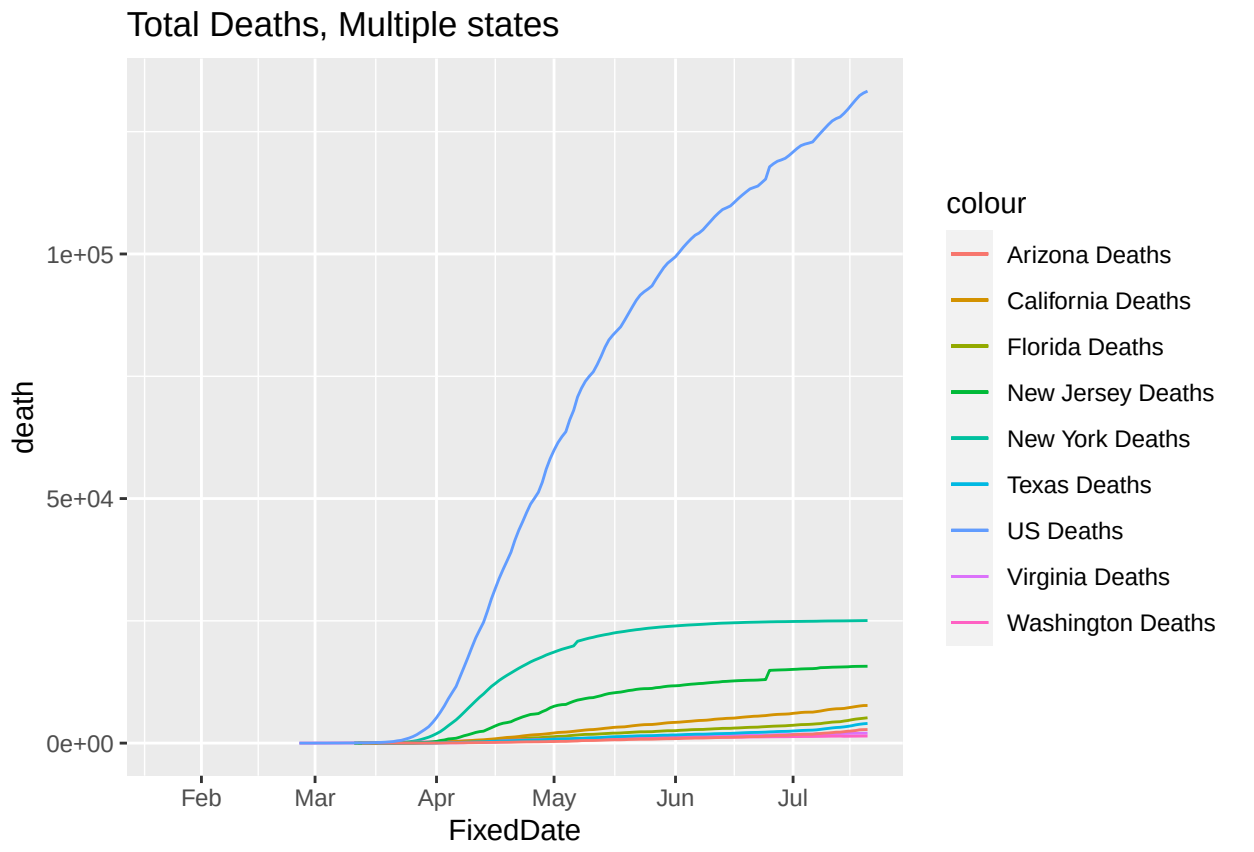
```
            aes(x = FixedDate, y = positive, color = "US Cases"))


print(totalCases_Central_Plot +
        ggtitle("Total Cases, Multiple states"))
```

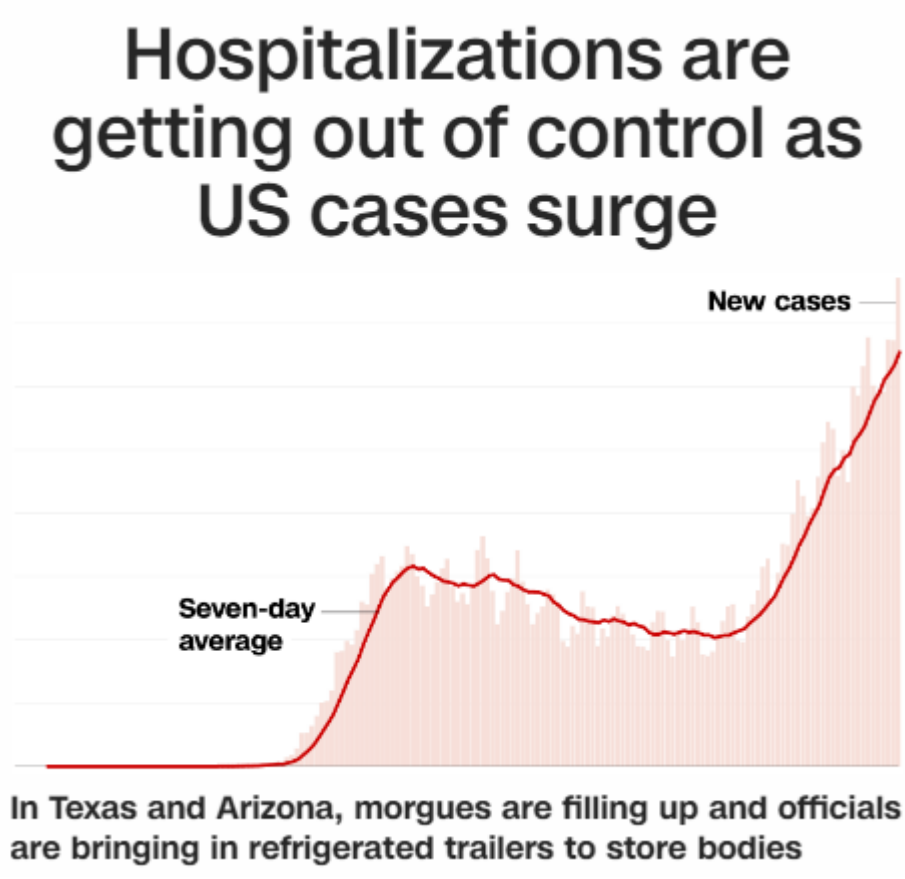



```
totalCases_Central_Plot = ggplot() +
  geom_line(data = dataVirginia,
            aes(x = FixedDate, y = death, color = "Virginia Deaths")) +
  geom_line(data = dataNewYork,
            aes(x = FixedDate, y = death, color = "New York Deaths")) +
  geom_line(data = dataFlorida,
            aes(x = FixedDate, y = death, color = "Florida Deaths")) +
  geom_line(data = dataWashington,
            aes(x = FixedDate, y = death, color = "Washington Deaths")) +
  geom_line(data = dataCali,
            aes(x = FixedDate, y = death, color = "California Deaths")) +
  geom_line(data = dataNewJersey,
            aes(x = FixedDate, y = death, color = "New Jersey Deaths")) +
  geom_line(data = dataTexas,
            aes(x = FixedDate, y = death, color = "Texas Deaths")) +
  geom_line(data = dataArizona,
            aes(x = FixedDate, y = death, color = "Arizona Deaths")) +
  geom_line(data = dataUS,
            aes(x = FixedDate, y = death, color = "US Deaths"))
```

```
print(totalCases_Central_Plot +
        ggtitle("Total Deaths, Multiple states"))
```



CNN shows the alarming image below but doesn't really tell the whole story. We need these large number of cases to start rounding out the data and build the herd immunity that New York and the other states built early on.


Hospitalizations are getting out of control as US cases surge
New cases
Seven-day average
In Texas and Arizona, morgues are filling up and officials are bringing in refrigerated trailers to store bodies

#