

Covid

Ben Lewis

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```
library(stringr)
library(tidyverse)
```

```
url_in <- "https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse_covid_19_data/csse_covid_19_data"

file_names <- c("time_series_covid19_confirmed_global.csv", "time_series_covid19_deaths_global.csv", "time_series_covid19_us_confirmed.csv", "time_series_covid19_us_deaths.csv")

urls <- str_c(url_in, file_names)

global_cases <- read_csv(urls[1])
global_deaths <- read_csv(urls[2])
us_cases <- read_csv(urls[3])
us_deaths <- read_csv(urls[4])
```

```
global_cases <- global_cases %>% pivot_longer(cols = -c(`Province/State`, `Country/Region`, `Lat`, `Longitude`))
global_deaths <- global_deaths %>% pivot_longer(cols = -c(`Province/State`, `Country/Region`, `Lat`, `Longitude`))
global <- global_cases %>% full_join(global_deaths) %>% rename(Country_Region = `Country/Region`, Province_State = `Province/State`)
```

```
## Joining with 'by = join_by('Province/State', 'Country/Region', date)'
```

```
global <- global %>% filter(cases > 0)

us_cases <- us_cases %>% pivot_longer(cols = -(UID:Combined_Key),
                                     names_to = "date",
                                     values_to = "cases") %>%
  select(Admin2:cases) %>%
  mutate(date = mdy(date)) %>%
  select(-c(Lat, Long_))

us_deaths <- us_deaths %>%
  pivot_longer(cols = -(UID:Population),
               names_to = "date",
               values_to = "deaths") %>%
  select(Admin2:deaths) %>%
  mutate(date = mdy(date)) %>%
  select(-c(Lat, Long_))
```

```
us <- us_cases %>%
  full_join(us_deaths)
```

```
## Joining with 'by = join_by(Admin2, Province_State, Country_Region,
## Combined_Key, date)'
```

```
global <- global %>%
  unite("Combined_Key",
        c(Province_State, Country_Region),
        sep = ", ",
        na.rm = TRUE,
        remove = FALSE)
```

```
uid_lookup_url <- "https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse_covid_19_data/"
```

```
uid <- read_csv(uid_lookup_url) %>%
  select(-c(Lat, Long_, Combined_Key, code3, iso2, iso3, Admin2))
```

```
## Rows: 4321 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (7): iso2, iso3, FIPS, Admin2, Province_State, Country_Region, Combined_Key
## dbl (5): UID, code3, Lat, Long_, Population
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
```

```
global <- global %>%
  left_join(uid, by = c("Province_State", "Country_Region")) %>%
  select(-c(UID, FIPS)) %>%
  select(Province_State, Country_Region, date,
        cases, deaths, Population,
        Combined_Key)
```

```
us_by_state <- us %>%
  group_by(Province_State, Country_Region, date) %>%
  summarize(cases = sum(cases), deaths = sum(deaths),
            Population = sum(Population)) %>%
  mutate(deaths_per_mill = deaths * 1000000 / Population) %>%
  select(Province_State, Country_Region, date,
        cases, deaths, deaths_per_mill, Population) %>%
  ungroup()
```

```
## 'summarise()' has grouped output by 'Province_State', 'Country_Region'. You can
## override using the '.groups' argument.
```

```
us_totals <- us_by_state %>%
  group_by(Country_Region, date) %>%
  summarize(cases = sum(cases), deaths = sum(deaths),
            Population = sum(Population)) %>%
  mutate(deaths_per_mill = deaths * 1000000 / Population) %>%
```

```
select(Country_Region, date,
       cases, deaths, deaths_per_mill, Population) %>%
ungroup() %>%
filter(cases > 0)
```

'summarise()' has grouped output by 'Country_Region'. You can override using
the '.groups' argument.

```
tail(us_totals)
```

```
## # A tibble: 6 x 6
##   Country_Region date      cases  deaths deaths_per_mill Population
##   <chr>          <date>    <dbl>   <dbl>         <dbl>    <dbl>
## 1 US            2023-03-04 103650837 1122172         3371.  332875137
## 2 US            2023-03-05 103646975 1122134         3371.  332875137
## 3 US            2023-03-06 103655539 1122181         3371.  332875137
## 4 US            2023-03-07 103690910 1122516         3372.  332875137
## 5 US            2023-03-08 103755771 1123246         3374.  332875137
## 6 US            2023-03-09 103802702 1123836         3376.  332875137
```

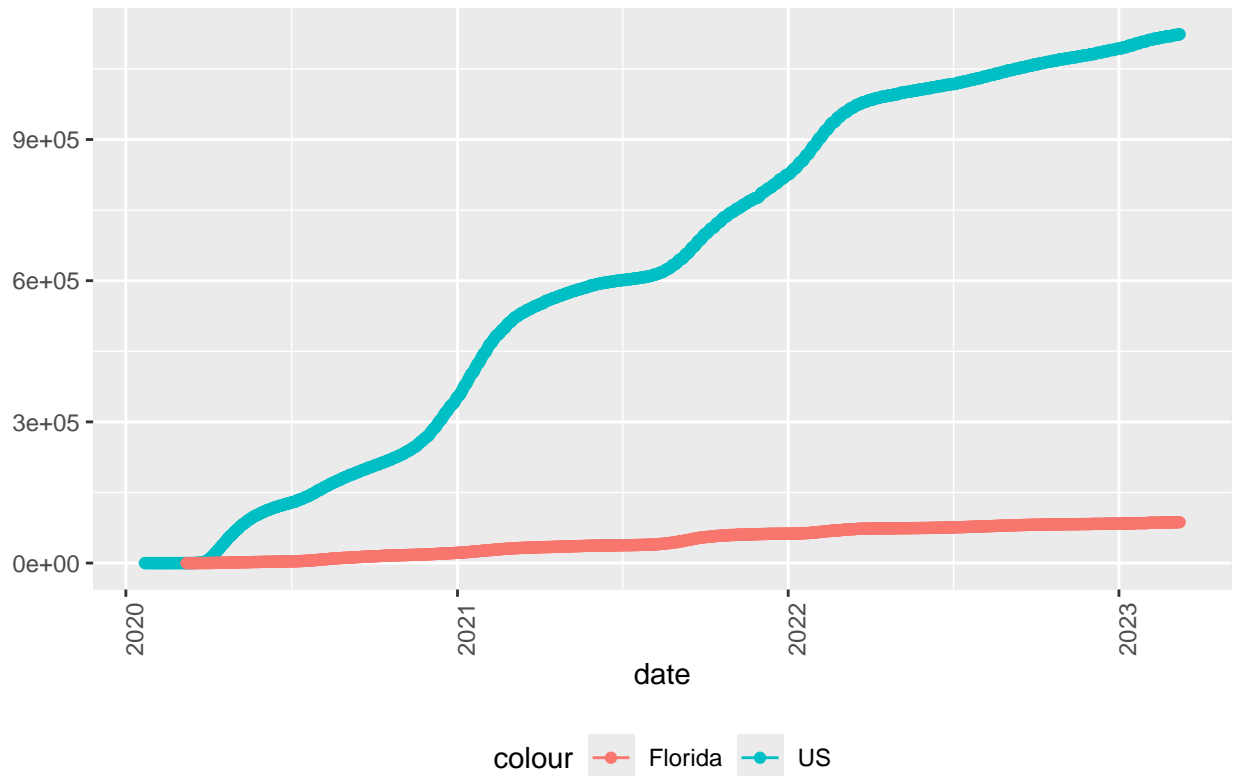
```
state <- "Florida"
state_totals <- us_by_state %>%
  filter(Province_State == state) %>%
  filter(cases > 0 & deaths > 0)
```

```
tail(state_totals)
```

```
## # A tibble: 6 x 7
##   Province_State Country_Region date      cases deaths deaths_per_mill
##   <chr>          <chr>          <date>    <dbl>   <dbl>         <dbl>
## 1 Florida      US            2023-03-04 7574590  86850         4044.
## 2 Florida      US            2023-03-05 7574590  86850         4044.
## 3 Florida      US            2023-03-06 7574590  86850         4044.
## 4 Florida      US            2023-03-07 7574590  86850         4044.
## 5 Florida      US            2023-03-08 7574590  86850         4044.
## 6 Florida      US            2023-03-09 7574590  86850         4044.
## # i 1 more variable: Population <dbl>
```

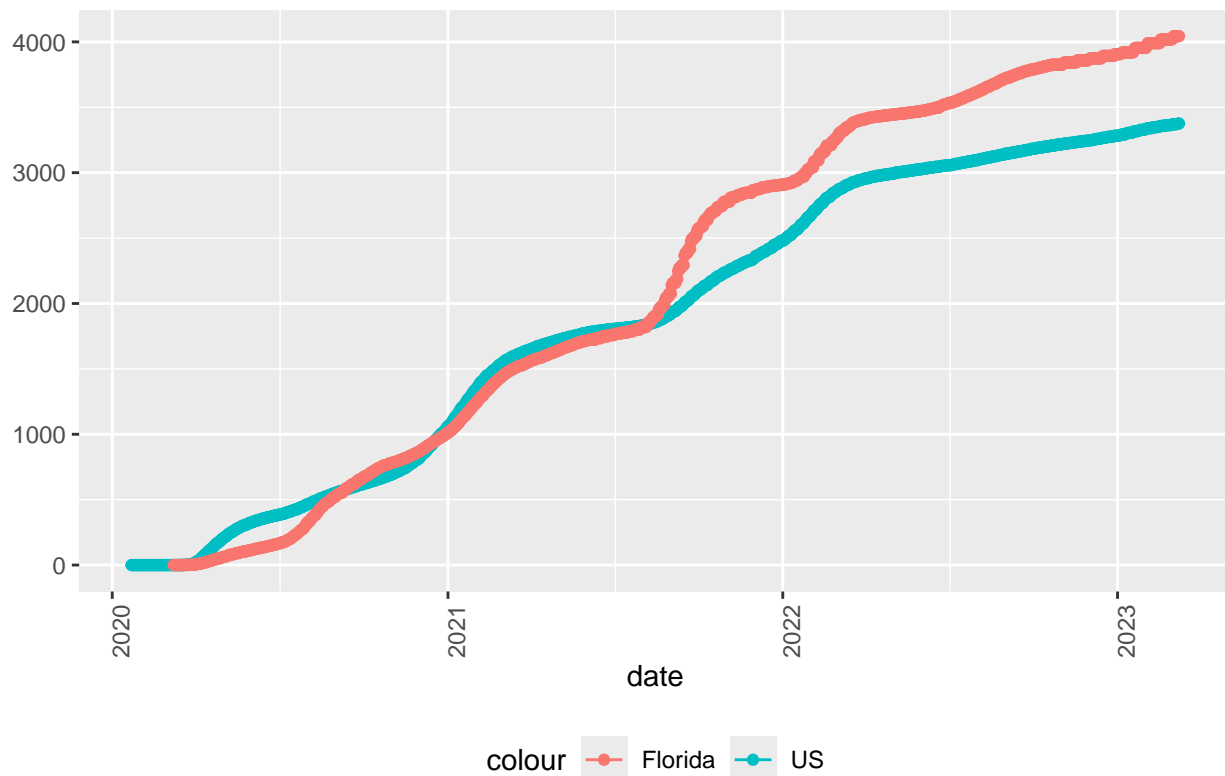
```
ggplot() +
  geom_line(data = us_totals, aes(x = date, y = deaths, color = "US")) +
  geom_point(data = us_totals, aes(x = date, y = deaths, color = "US")) +
  geom_line(data = state_totals, aes(x = date, y = deaths, color = state)) +
  geom_point(data = state_totals, aes(x = date, y = deaths, color = state)) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "Total COVID19 Deaths", y = NULL)
```

Total COVID19 Deaths



```
ggplot() +
  geom_line(data = us_totals, aes(x = date, y = deaths_per_mill, color = "US")) +
  geom_point(data = us_totals, aes(x = date, y = deaths_per_mill, color = "US")) +
  geom_line(data = state_totals, aes(x = date, y = deaths_per_mill, color = state)) +
  geom_point(data = state_totals, aes(x = date, y = deaths_per_mill, color = state)) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "COVID19 Deaths per Million", y = NULL)
```

COVID19 Deaths per Million



```
us_totals$days_since_start <- as.numeric(us_totals$date - min(us_totals$date))

us_mod <- lm(deaths ~ days_since_start, data = us_totals)
summary(us_mod)
```

```
##
## Call:
## lm(formula = deaths ~ days_since_start, data = us_totals)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -143657  -44489    -955    46232   107933
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -18367.12    3521.40  -5.216 2.17e-07 ***
## days_since_start  1125.97      5.34  210.869 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 59570 on 1141 degrees of freedom
## Multiple R-squared:  0.975, Adjusted R-squared:  0.975
## F-statistic: 4.447e+04 on 1 and 1141 DF, p-value: < 2.2e-16
```

```
state_totals$days_since_start <- as.numeric(state_totals$date - min(state_totals$date))
state_mod <- lm(deaths ~ days_since_start, data = state_totals)
summary(state_mod)
```

```
##
## Call:
## lm(formula = deaths ~ days_since_start, data = state_totals)
##
## Residuals:
```

	Min	1Q	Median	3Q	Max
##	-10007.5	-2615.3	-532.2	2630.9	8194.1

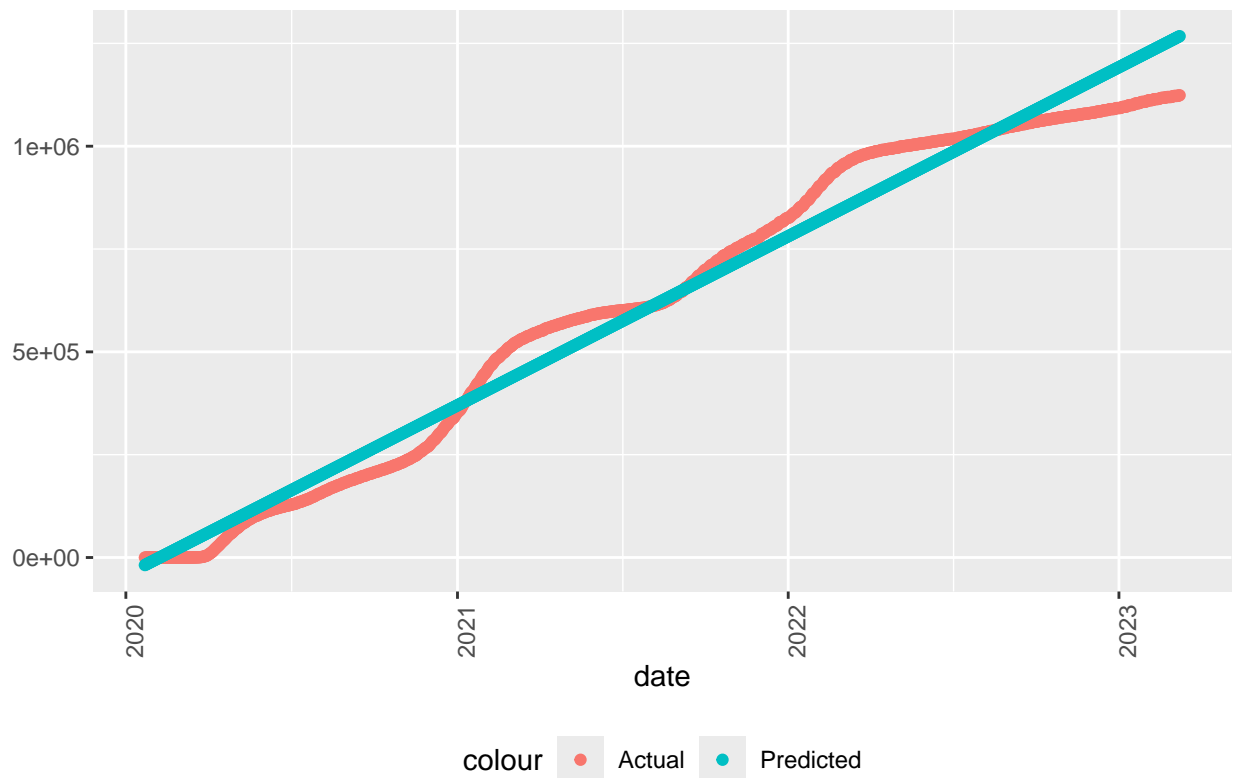
```
##
## Coefficients:
```

	Estimate	Std. Error	t value	Pr(> t)
## (Intercept)	-3010.0300	258.2885	-11.65	<2e-16 ***
## days_since_start	91.1200	0.4081	223.28	<2e-16 ***

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4280 on 1095 degrees of freedom
## Multiple R-squared:  0.9785, Adjusted R-squared:  0.9785
## F-statistic: 4.986e+04 on 1 and 1095 DF, p-value: < 2.2e-16
```

```
us_totals$pred_deaths <- predict(us_mod, newdata = us_totals)
ggplot(us_totals, aes(x = date)) +
  geom_point(aes(y = deaths, color = "Actual")) +
  geom_point(aes(y = pred_deaths, color = "Predicted")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = "US COVID19 Deaths", y = NULL)
```

US COVID19 Deaths



```
state_totals$pred_deaths <- predict(state_mod, newdata = state_totals)
ggplot(state_totals, aes(x = date)) +
  geom_point(aes(y = deaths, color = "Actual")) +
  geom_point(aes(y = pred_deaths, color = "Predicted")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  labs(title = paste(state, "COVID19 Deaths"), y = NULL)
```

