

Project, STAT 650

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<https://www.kaggle.com/datasets/georgesaavedra/covid19-dataset>

(<https://www.kaggle.com/datasets/georgesaavedra/covid19-dataset>) (<https://ourworldindata.org/covid-vaccinations>) (<https://ourworldindata.org/covid-vaccinations>) (<https://github.com/owid/covid-19-data/tree/master/public/data>) (<https://github.com/owid/covid-19-data/tree/master/public/data>)

```
library(ggplot2)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##   filter, lag
```

```
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
library(tidyverse)
```

```
## — Attaching packages
## _____
## tidyverse 1.3.2 —
```

```
## ✓ tibble 3.1.8      ✓ purrr 0.3.4
## ✓ tidyr 1.2.0       ✓ stringr 1.4.1
## ✓ readr 2.1.2       ✓ forcats 0.5.2
## — Conflicts ————— tidyverse_conflicts() —
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag() masks stats::lag()
```

```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(scales)
```

```
##
## Attaching package: 'scales'
##
## The following object is masked from 'package:purrr':
##
##     discard
##
## The following object is masked from 'package:readr':
##
##     col_factor
```

```
covid <- read_csv("owid-covid-data.csv")
```

```
## Rows: 221268 Columns: 67
## — Column specification —————
## Delimiter: ","
## chr   (4): iso_code, continent, location, tests_units
## dbl   (62): total_cases, new_cases, new_cases_smoothed, total_deaths, new_dea...
## date   (1): date
##
## 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.
```

```
head(covid)
```

```
## # A tibble: 6 × 67
##   iso_code continent location date          total...1 new_c...2 new_c...3 total...4 new_d...5
##   <chr>      <chr>      <chr>      <date>          <dbl>      <dbl>      <dbl>      <dbl>      <dbl>
## 1 AFG        Asia        Afghani... 2020-02-24          5          5      NA          NA          NA
## 2 AFG        Asia        Afghani... 2020-02-25          5          0      NA          NA          NA
## 3 AFG        Asia        Afghani... 2020-02-26          5          0      NA          NA          NA
## 4 AFG        Asia        Afghani... 2020-02-27          5          0      NA          NA          NA
## 5 AFG        Asia        Afghani... 2020-02-28          5          0      NA          NA          NA
## 6 AFG        Asia        Afghani... 2020-02-29          5          0    0.714          NA          NA
## # ... with 58 more variables: new_deaths_smoothed <dbl>,
## #   total_cases_per_million <dbl>, new_cases_per_million <dbl>,
## #   new_cases_smoothed_per_million <dbl>, total_deaths_per_million <dbl>,
## #   new_deaths_per_million <dbl>, new_deaths_smoothed_per_million <dbl>,
## #   reproduction_rate <dbl>, icu_patients <dbl>,
## #   icu_patients_per_million <dbl>, hosp_patients <dbl>,
## #   hosp_patients_per_million <dbl>, weekly_icu_admissions <dbl>, ...
```

```
glimpse(covid)
```

```

## Rows: 221,268
## Columns: 67
## $ iso_code           <chr> "AFG", "AFG", "AFG", "AFG",...
## $ continent         <chr> "Asia", "Asia", "Asia", "As...
## $ location          <chr> "Afghanistan", "Afghanistan...
## $ date              <date> 2020-02-24, 2020-02-25, 20...
## $ total_cases       <dbl> 5, 5, 5, 5, 5, 5, 5, 5, 5, ...
## $ new_cases         <dbl> 5, 0, 0, 0, 0, 0, 0, 0, 0, ...
## $ new_cases_smoothed <dbl> NA, NA, NA, NA, NA, 0.714, ...
## $ total_deaths      <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_deaths        <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_deaths_smoothed <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_cases_per_million <dbl> 0.125, 0.125, 0.125, 0.125, ...
## $ new_cases_per_million <dbl> 0.125, 0.000, 0.000, 0.000, ...
## $ new_cases_smoothed_per_million <dbl> NA, NA, NA, NA, NA, 0.018, ...
## $ total_deaths_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_deaths_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_deaths_smoothed_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ reproduction_rate <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ icu_patients      <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ icu_patients_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ hosp_patients     <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ hosp_patients_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ weekly_icu_admissions <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ weekly_icu_admissions_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ weekly_hosp_admissions <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ weekly_hosp_admissions_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_tests       <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_tests         <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_tests_per_thousand <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_tests_per_thousand <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_tests_smoothed <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_tests_smoothed_per_thousand <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ positive_rate     <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ tests_per_case    <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ tests_units       <chr> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_vaccinations <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ people_vaccinated <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ people_fully_vaccinated <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_boosters    <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_vaccinations  <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_vaccinations_smoothed <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_vaccinations_per_hundred <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ people_vaccinated_per_hundred <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ people_fully_vaccinated_per_hundred <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ total_boosters_per_hundred <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_vaccinations_smoothed_per_million <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_people_vaccinated_smoothed <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ new_people_vaccinated_smoothed_per_hundred <dbl> NA, NA, NA, NA, NA, NA, NA, ...
## $ stringency_index  <dbl> 8.33, 8.33, 8.33, 8.33, 8.3...
## $ population        <dbl> 40099462, 40099462, 4009946...
## $ population_density <dbl> 54.422, 54.422, 54.422, 54...

```

```
## $ median_age <dbl> 18.6, 18.6, 18.6, 18.6, 18...
## $ aged_65_older <dbl> 2.581, 2.581, 2.581, 2.581,...
## $ aged_70_older <dbl> 1.337, 1.337, 1.337, 1.337,...
## $ gdp_per_capita <dbl> 1803.987, 1803.987, 1803.98...
## $ extreme_poverty <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ cardiovasc_death_rate <dbl> 597.029, 597.029, 597.029, ...
## $ diabetes_prevalence <dbl> 9.59, 9.59, 9.59, 9.59, 9.5...
## $ female_smokers <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ male_smokers <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ handwashing_facilities <dbl> 37.746, 37.746, 37.746, 37...
## $ hospital_beds_per_thousand <dbl> 0.5, 0.5, 0.5, 0.5, 0.5, 0...
## $ life_expectancy <dbl> 64.83, 64.83, 64.83, 64.83,...
## $ human_development_index <dbl> 0.511, 0.511, 0.511, 0.511,...
## $ excess_mortality_cumulative_absolute <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ excess_mortality_cumulative <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ excess_mortality <dbl> NA, NA, NA, NA, NA, NA, NA,...
## $ excess_mortality_cumulative_per_million <dbl> NA, NA, NA, NA, NA, NA, NA,...
```

```
unique(covid$location)
```

##	[1]	"Afghanistan"	"Africa"
##	[3]	"Albania"	"Algeria"
##	[5]	"Andorra"	"Angola"
##	[7]	"Anguilla"	"Antigua and Barbuda"
##	[9]	"Argentina"	"Armenia"
##	[11]	"Aruba"	"Asia"
##	[13]	"Australia"	"Austria"
##	[15]	"Azerbaijan"	"Bahamas"
##	[17]	"Bahrain"	"Bangladesh"
##	[19]	"Barbados"	"Belarus"
##	[21]	"Belgium"	"Belize"
##	[23]	"Benin"	"Bermuda"
##	[25]	"Bhutan"	"Bolivia"
##	[27]	"Bonaire Sint Eustatius and Saba"	"Bosnia and Herzegovina"
##	[29]	"Botswana"	"Brazil"
##	[31]	"British Virgin Islands"	"Brunei"
##	[33]	"Bulgaria"	"Burkina Faso"
##	[35]	"Burundi"	"Cambodia"
##	[37]	"Cameroon"	"Canada"
##	[39]	"Cape Verde"	"Cayman Islands"
##	[41]	"Central African Republic"	"Chad"
##	[43]	"Chile"	"China"
##	[45]	"Colombia"	"Comoros"
##	[47]	"Congo"	"Cook Islands"
##	[49]	"Costa Rica"	"Cote d'Ivoire"
##	[51]	"Croatia"	"Cuba"
##	[53]	"Curacao"	"Cyprus"
##	[55]	"Czechia"	"Democratic Republic of Congo"
##	[57]	"Denmark"	"Djibouti"
##	[59]	"Dominica"	"Dominican Republic"
##	[61]	"Ecuador"	"Egypt"
##	[63]	"El Salvador"	"Equatorial Guinea"
##	[65]	"Eritrea"	"Estonia"
##	[67]	"Eswatini"	"Ethiopia"
##	[69]	"Europe"	"European Union"
##	[71]	"Faeroe Islands"	"Falkland Islands"
##	[73]	"Fiji"	"Finland"
##	[75]	"France"	"French Polynesia"
##	[77]	"Gabon"	"Gambia"
##	[79]	"Georgia"	"Germany"
##	[81]	"Ghana"	"Gibraltar"
##	[83]	"Greece"	"Greenland"
##	[85]	"Grenada"	"Guam"
##	[87]	"Guatemala"	"Guernsey"
##	[89]	"Guinea"	"Guinea-Bissau"
##	[91]	"Guyana"	"Haiti"
##	[93]	"High income"	"Honduras"
##	[95]	"Hong Kong"	"Hungary"
##	[97]	"Iceland"	"India"
##	[99]	"Indonesia"	"International"
##	[101]	"Iran"	"Iraq"
##	[103]	"Ireland"	"Isle of Man"

## [105]	"Israel"	"Italy"
## [107]	"Jamaica"	"Japan"
## [109]	"Jersey"	"Jordan"
## [111]	"Kazakhstan"	"Kenya"
## [113]	"Kiribati"	"Kosovo"
## [115]	"Kuwait"	"Kyrgyzstan"
## [117]	"Laos"	"Latvia"
## [119]	"Lebanon"	"Lesotho"
## [121]	"Liberia"	"Libya"
## [123]	"Liechtenstein"	"Lithuania"
## [125]	"Low income"	"Lower middle income"
## [127]	"Luxembourg"	"Macao"
## [129]	"Madagascar"	"Malawi"
## [131]	"Malaysia"	"Maldives"
## [133]	"Mali"	"Malta"
## [135]	"Marshall Islands"	"Mauritania"
## [137]	"Mauritius"	"Mexico"
## [139]	"Micronesia (country)"	"Moldova"
## [141]	"Monaco"	"Mongolia"
## [143]	"Montenegro"	"Montserrat"
## [145]	"Morocco"	"Mozambique"
## [147]	"Myanmar"	"Namibia"
## [149]	"Nauru"	"Nepal"
## [151]	"Netherlands"	"New Caledonia"
## [153]	"New Zealand"	"Nicaragua"
## [155]	"Niger"	"Nigeria"
## [157]	"Niue"	"North America"
## [159]	"North Korea"	"North Macedonia"
## [161]	"Northern Cyprus"	"Northern Mariana Islands"
## [163]	"Norway"	"Oceania"
## [165]	"Oman"	"Pakistan"
## [167]	"Palau"	"Palestine"
## [169]	"Panama"	"Papua New Guinea"
## [171]	"Paraguay"	"Peru"
## [173]	"Philippines"	"Pitcairn"
## [175]	"Poland"	"Portugal"
## [177]	"Puerto Rico"	"Qatar"
## [179]	"Romania"	"Russia"
## [181]	"Rwanda"	"Saint Helena"
## [183]	"Saint Kitts and Nevis"	"Saint Lucia"
## [185]	"Saint Pierre and Miquelon"	"Saint Vincent and the Grenadines"
## [187]	"Samoa"	"San Marino"
## [189]	"Sao Tome and Principe"	"Saudi Arabia"
## [191]	"Senegal"	"Serbia"
## [193]	"Seychelles"	"Sierra Leone"
## [195]	"Singapore"	"Sint Maarten (Dutch part)"
## [197]	"Slovakia"	"Slovenia"
## [199]	"Solomon Islands"	"Somalia"
## [201]	"South Africa"	"South America"
## [203]	"South Korea"	"South Sudan"
## [205]	"Spain"	"Sri Lanka"
## [207]	"Sudan"	"Suriname"

```
## [209] "Sweden" "Switzerland"
## [211] "Syria" "Taiwan"
## [213] "Tajikistan" "Tanzania"
## [215] "Thailand" "Timor"
## [217] "Togo" "Tokelau"
## [219] "Tonga" "Trinidad and Tobago"
## [221] "Tunisia" "Turkey"
## [223] "Turkmenistan" "Turks and Caicos Islands"
## [225] "Tuvalu" "Uganda"
## [227] "Ukraine" "United Arab Emirates"
## [229] "United Kingdom" "United States"
## [231] "United States Virgin Islands" "Upper middle income"
## [233] "Uruguay" "Uzbekistan"
## [235] "Vanuatu" "Vatican"
## [237] "Venezuela" "Vietnam"
## [239] "Wallis and Futuna" "Western Sahara"
## [241] "World" "Yemen"
## [243] "Zambia" "Zimbabwe"
```

```
covid %>%
  group_by(location) %>%
  summarise(
    avg_cases = mean(new_cases_per_million, na.rm = TRUE),
    sd_cases = sd(new_cases_per_million, na.rm = TRUE)
  ) %>%
  arrange(desc(avg_cases)) %>%
  slice_head(n = 10)
```

```
## # A tibble: 10 × 3
##   location      avg_cases sd_cases
##   <chr>          <dbl>   <dbl>
## 1 Nauru          2003.    9122.
## 2 Cook Islands   749.    2258.
## 3 Palau          741.    2172.
## 4 Cyprus         702.    1551.
## 5 Faeroe Islands 693.    2946.
## 6 Gibraltar      654.    1330.
## 7 San Marino     652.    1499.
## 8 Andorra        618.    1875.
## 9 Austria        612.    1054.
## 10 Slovenia      596.    1033.
```

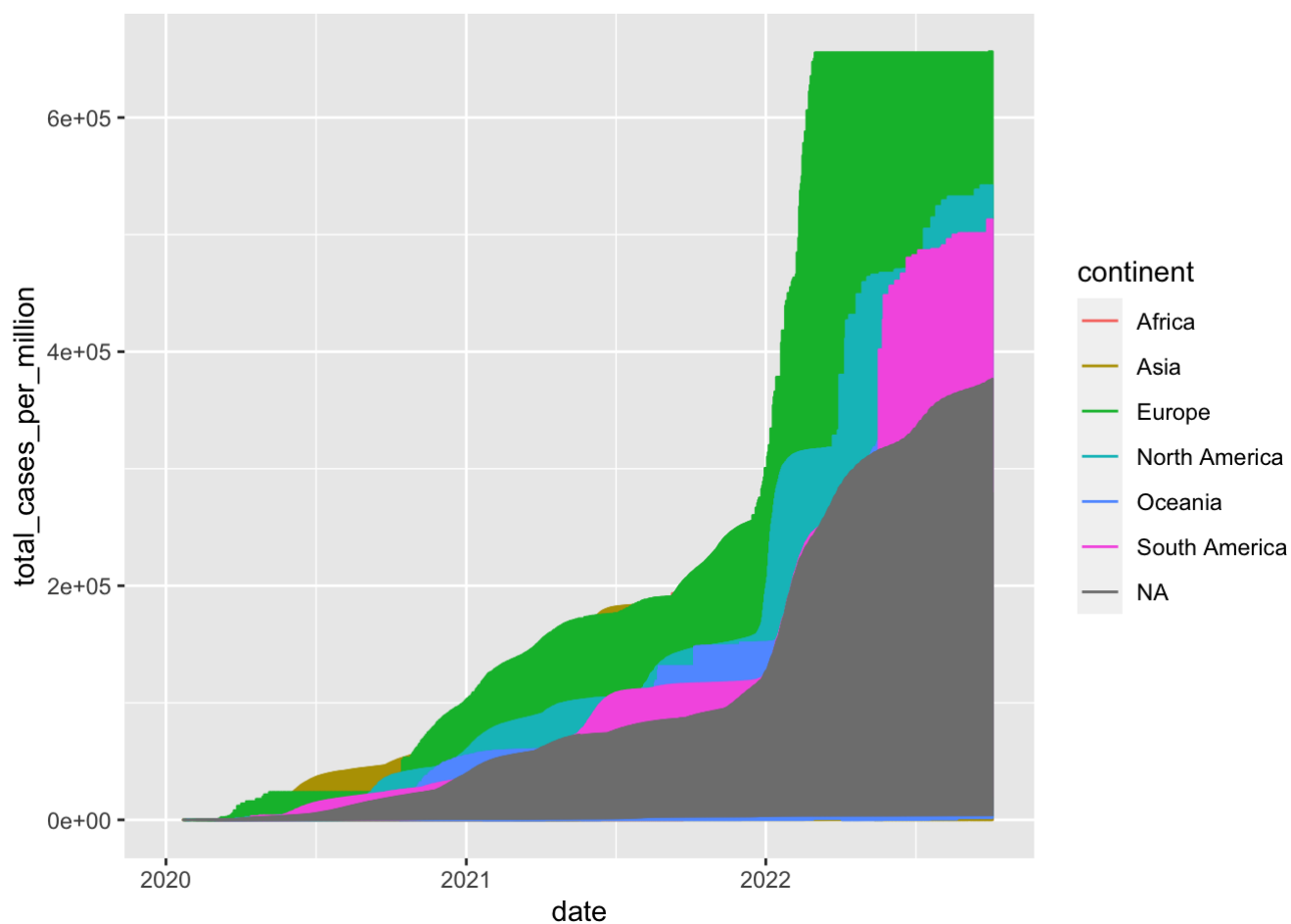
```
covid %>%
  group_by(location) %>%
  summarise(
    avg_cases = mean(new_cases_per_million, na.rm = TRUE),
    sd_cases = sd(new_cases_per_million, na.rm = TRUE)
  ) %>%
  arrange(avg_cases) %>%
  slice_head(n = 10)
```



```
## # A tibble: 10 × 3
##   location          avg_cases sd_cases
##   <chr>          <dbl>    <dbl>
## 1 North Korea    0.000271 0.00325
## 2 Yemen          0.399    0.748
## 3 Niger          0.402    0.807
## 4 Chad           0.475    1.88
## 5 Tanzania       0.665   12.7
## 6 China           0.708    2.54
## 7 Sierra Leone  1.00     2.00
## 8 Democratic Republic of Congo 1.03     2.78
## 9 Burkina Faso   1.04     2.91
## 10 Macao          1.17    7.78
```

```
ggplot(data = covid, aes(x = date, y = total_cases_per_million, color = continent)) +
  geom_line()
```

```
## Warning: Removed 128 row(s) containing missing values (geom_path).
```



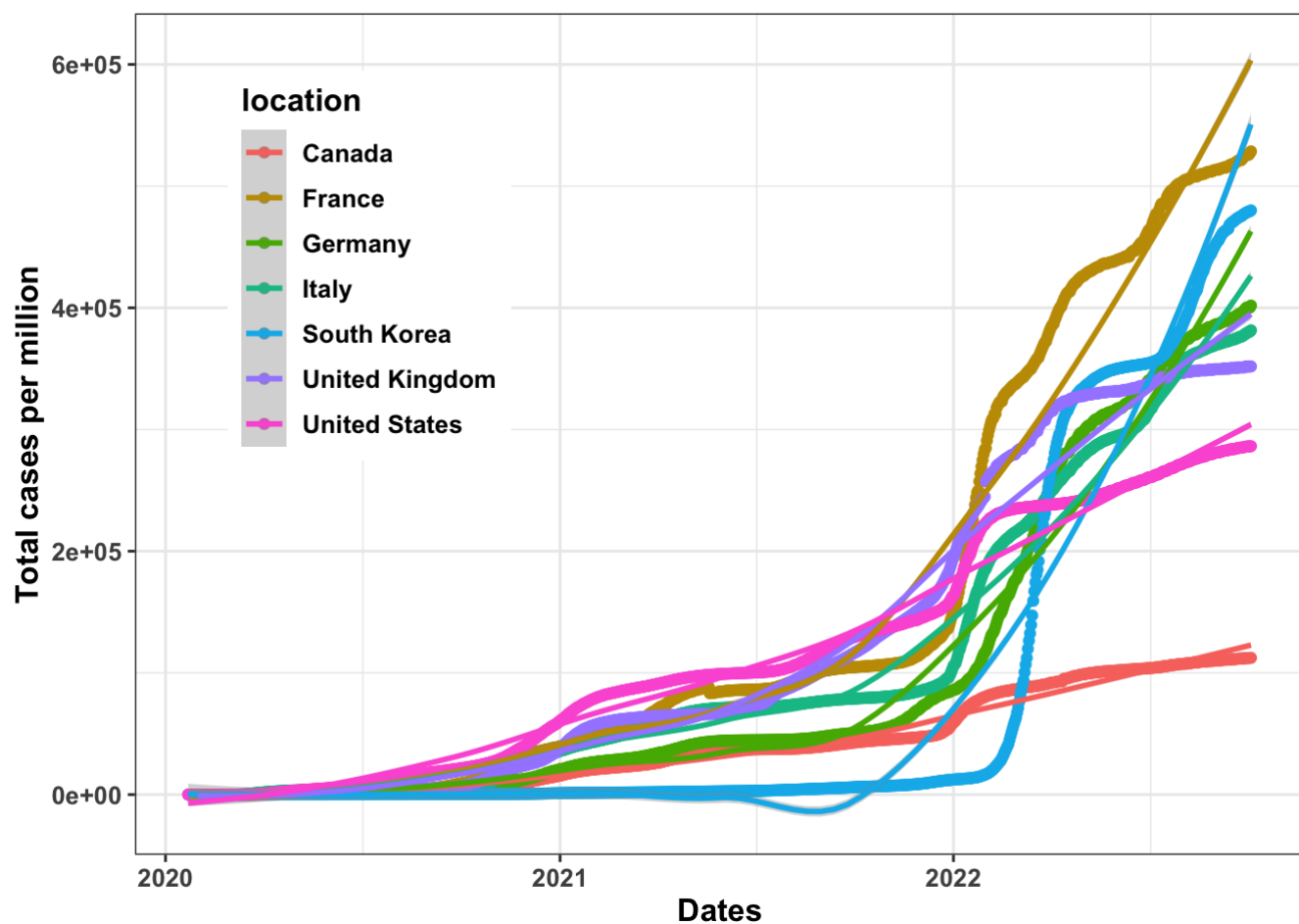
```
covid7 <- covid %>%
  filter(location == "United States" | location == "Germany" | location == "South Korea"
| location == "Canada" | location == "Italy" | location == "France" | location == "United Kingdom")

ggplot(covid7, aes(x = date, y = total_cases_per_million, col = location)) +
  geom_point() +
  geom_smooth() +
  xlab("Dates") + ylab("Total cases per million") +
  theme_bw() +
  theme(text = element_text(size = 12, face = "bold"),
        legend.position = c(0.2,0.70))
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

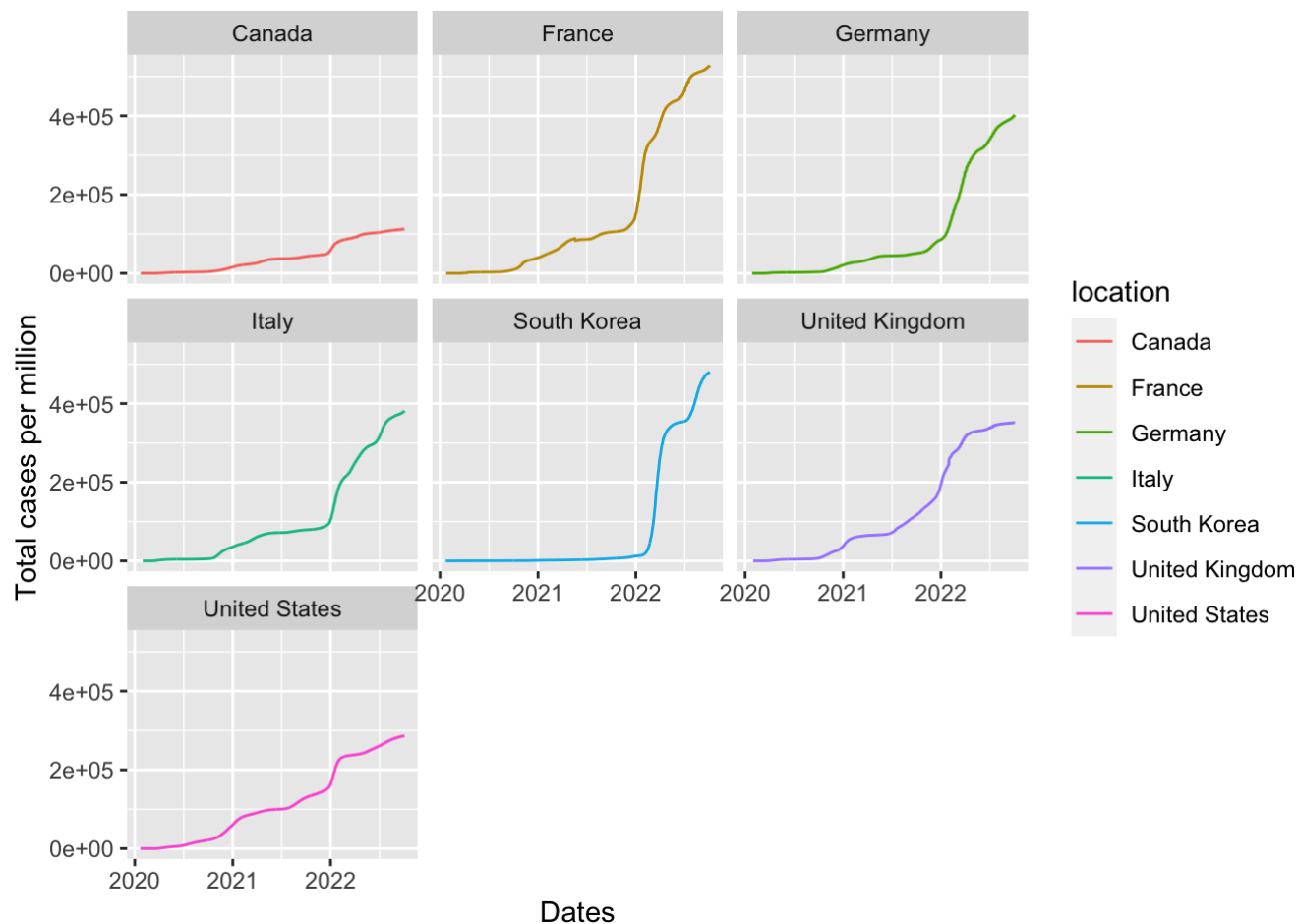
```
## Warning: Removed 3 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 3 rows containing missing values (geom_point).
```



```
ggplot(data = covid7, aes(x = date, y = total_cases_per_million, col = location, group = location)) +
  geom_line() +
  xlab("Dates") + ylab("Total cases per million") +
  facet_wrap(~location)
```

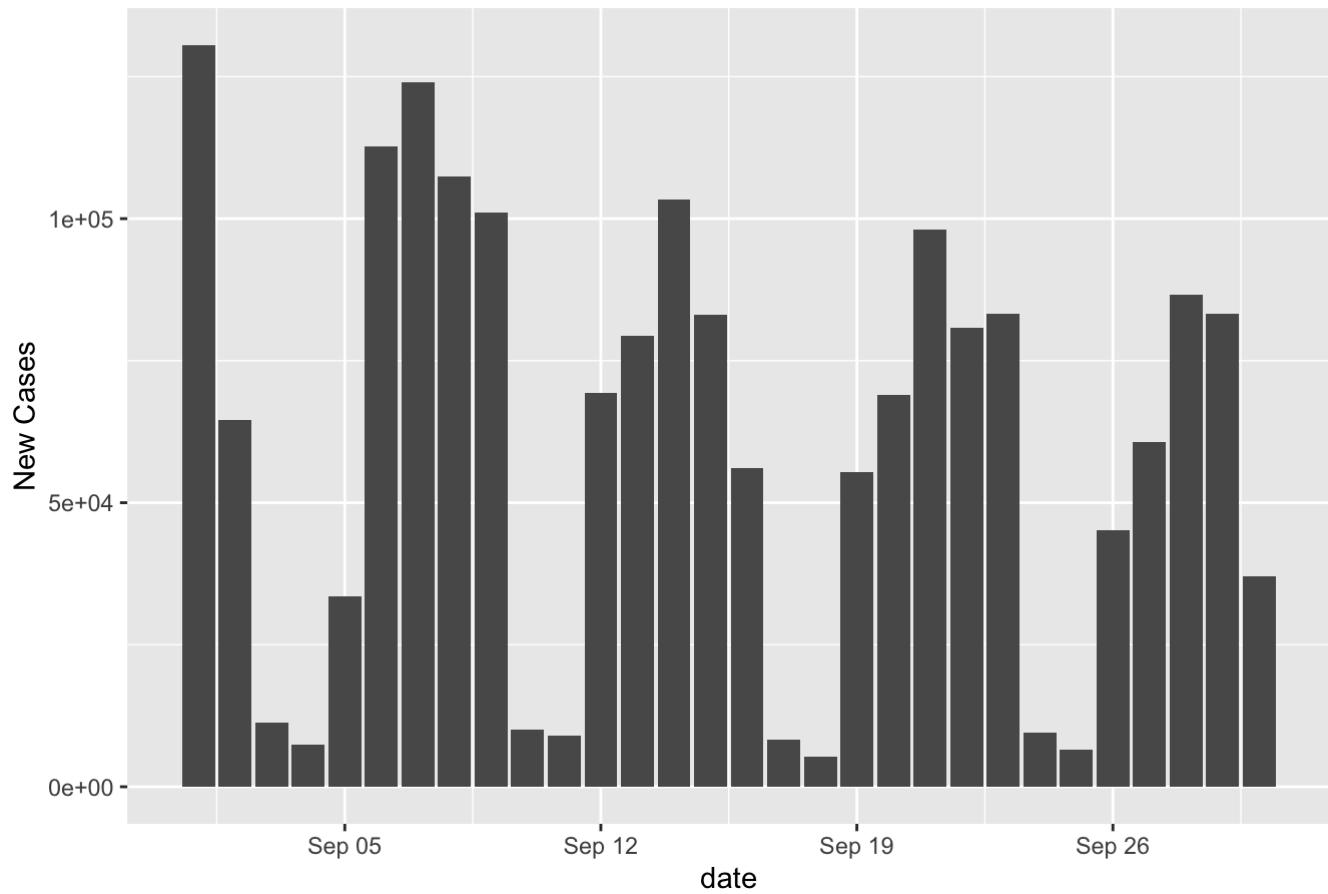
```
## Warning: Removed 3 row(s) containing missing values (geom_path).
```



```
uscovid <- covid %>%
  filter(location == "United States")
view(uscovid)
```

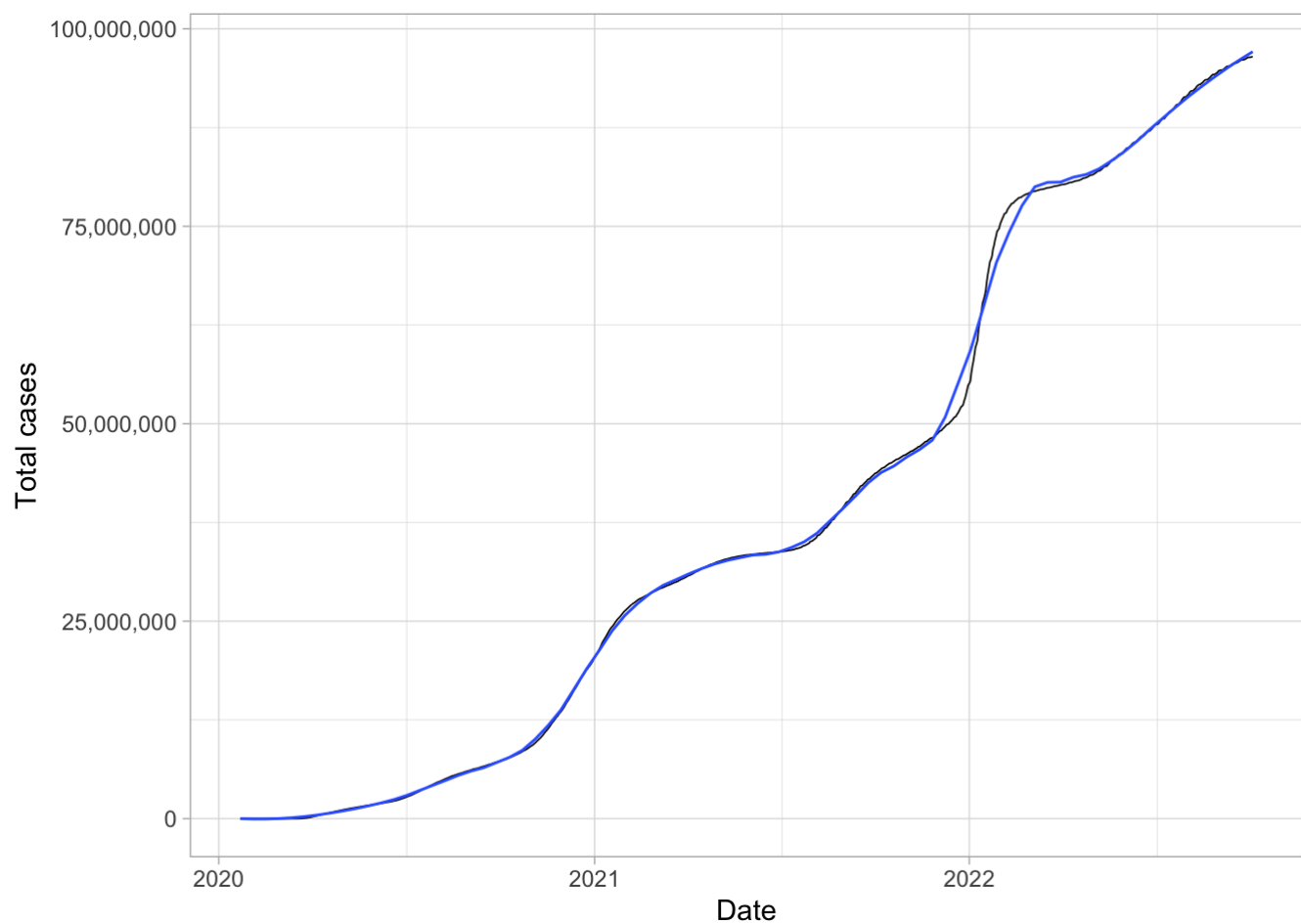
```
uscovid %>%
  filter(date >= as.Date("2022-09-01") & date <= as.Date("2022-09-30")) %>%
  ggplot(aes(x = date, y = new_cases)) +
  geom_col() +
  ylab("New Cases") +
  ggtitle("Covid19 New Cases in September")
```

Covid19 New Cases in September



```
ggplot(usccovid, aes(x = date, y = total_cases)) +  
  geom_line(size = 0.3) +  
  geom_smooth(span = 0.2, se = FALSE, size = 0.5) +  
  xlab("Date") + ylab("Total cases") +  
  scale_y_continuous(labels = comma) +  
  theme_light()
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

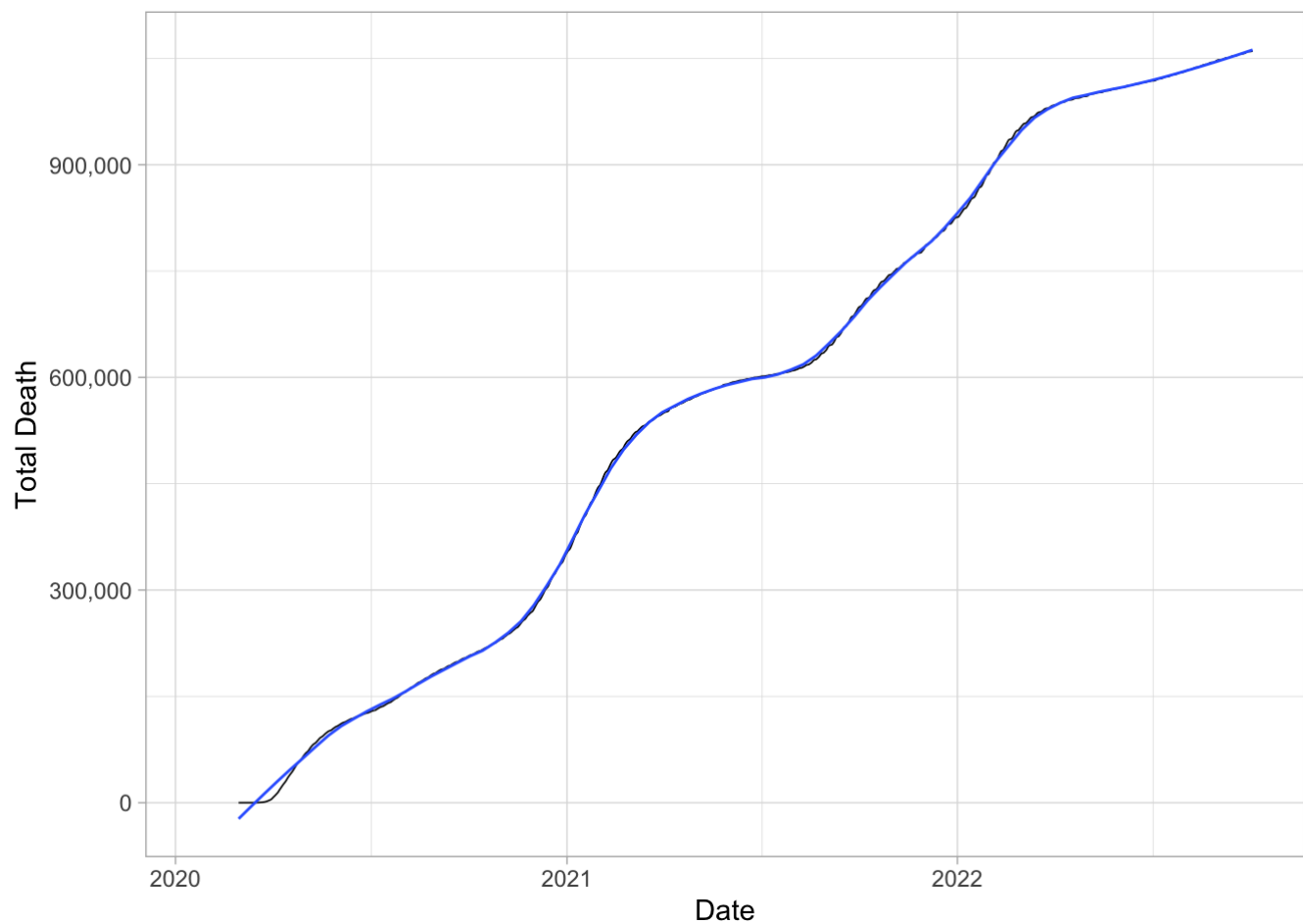


```
ggplot(uscovid, aes(x = date, y = total_deaths)) +  
  geom_line(size = 0.3) +  
  geom_smooth(span = 0.2, se = FALSE, size = 0.5) +  
  xlab("Date") + ylab("Total Death") +  
  scale_y_continuous(labels = comma) +  
  theme_light()
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

```
## Warning: Removed 38 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 38 row(s) containing missing values (geom_path).
```

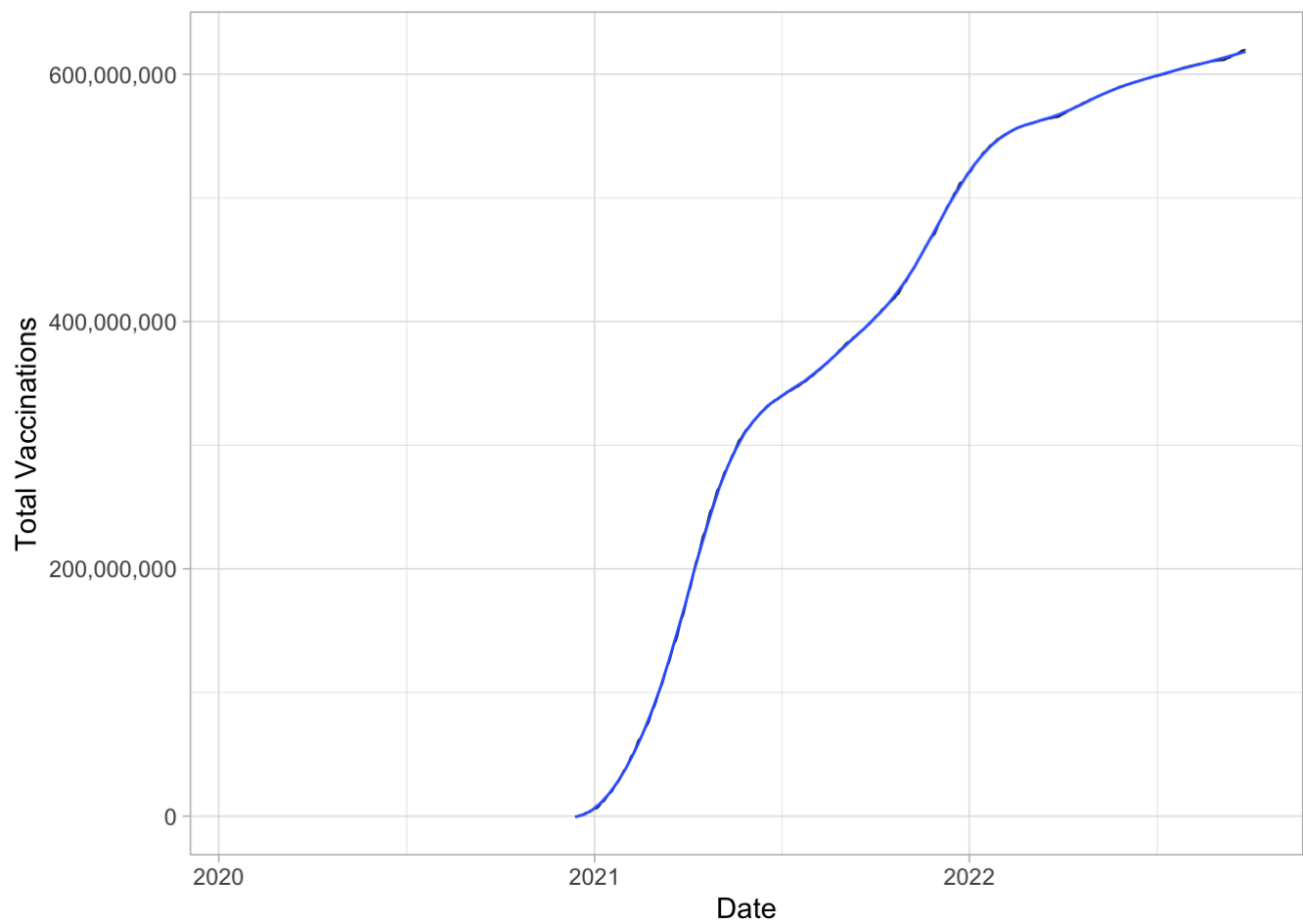


```
ggplot(uscovid, aes(x = date, y = total_vaccinations)) +  
  geom_line(size = 0.3) +  
  geom_smooth(span = 0.2, se = FALSE, size = 0.5) +  
  xlab("Date") + ylab("Total Vaccinations") +  
  scale_y_continuous(labels = comma) +  
  theme_light()
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

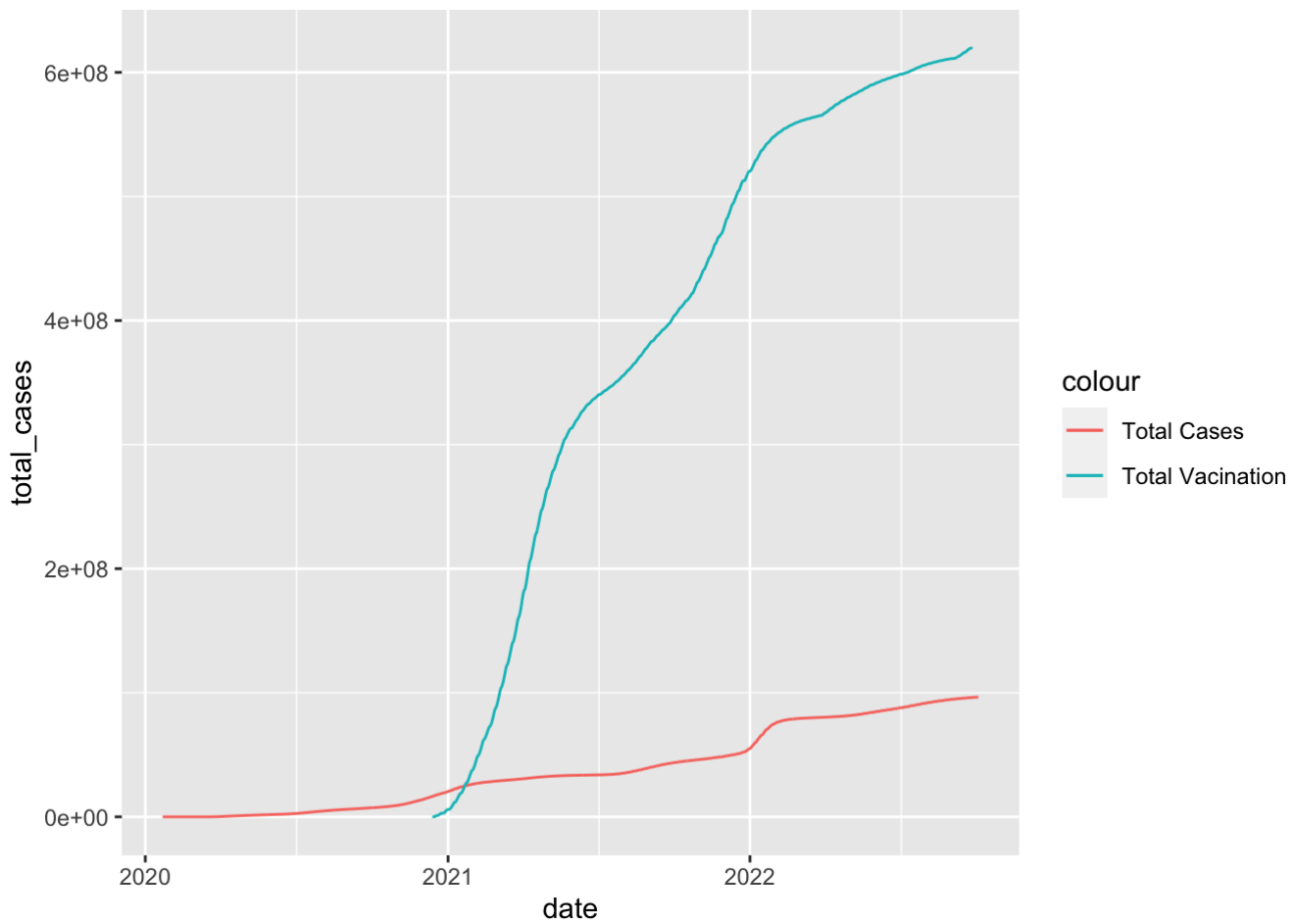
```
## Warning: Removed 333 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 333 row(s) containing missing values (geom_path).
```



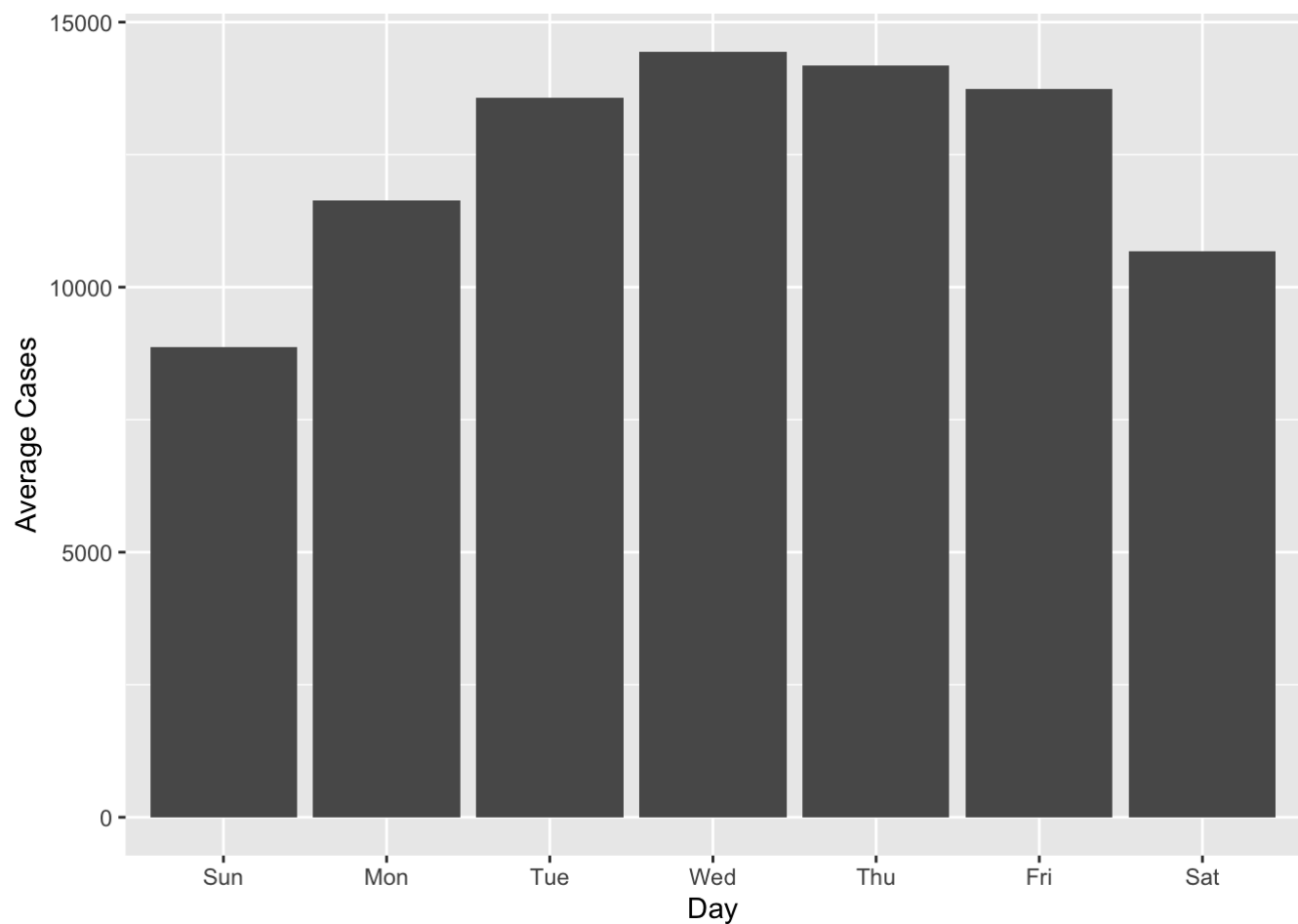
```
ggplot(uscovid, aes(x = date)) +  
  geom_line(aes(y = total_cases, color = 'Total Cases')) +  
  geom_line(aes(y = total_vaccinations, color = 'Total Vaccination'))
```

```
## Warning: Removed 333 row(s) containing missing values (geom_path).
```



```
t <- ymd(covid$date, tz = "America/Los_Angeles")
covid <- mutate(covid, wday = wday(t, label = T))

covid %>%
  group_by(wday) %>%
  summarise(
    avg_cases = mean(new_cases, na.rm = TRUE)
  ) %>%
  ggplot(aes(wday, avg_cases)) +
  geom_col() +
  xlab("Day") + ylab("Average Cases")
```

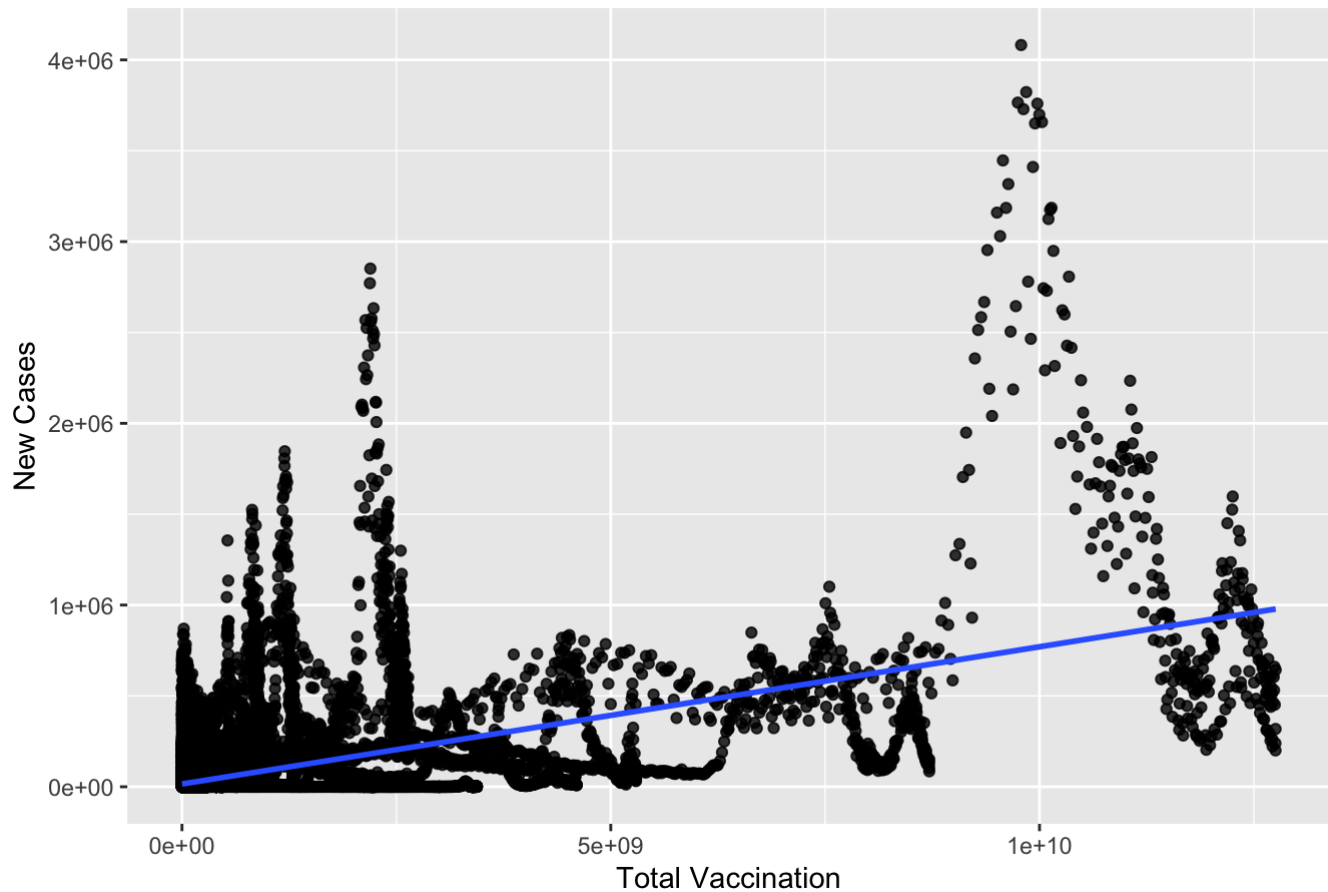
```
covid %>%  
  ggplot(aes(x = total_vaccinations, y = new_cases)) +  
  geom_point(alpha = 0.8) +  
  geom_smooth(method = "lm", se = FALSE) +  
  labs(x = "Total Vaccination",  
       y = "New Cases",  
       title = "Relationship between Vaccination & Covid-19")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 159724 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 159724 rows containing missing values (geom_point).
```

Relationship between Vaccination & Covid-19



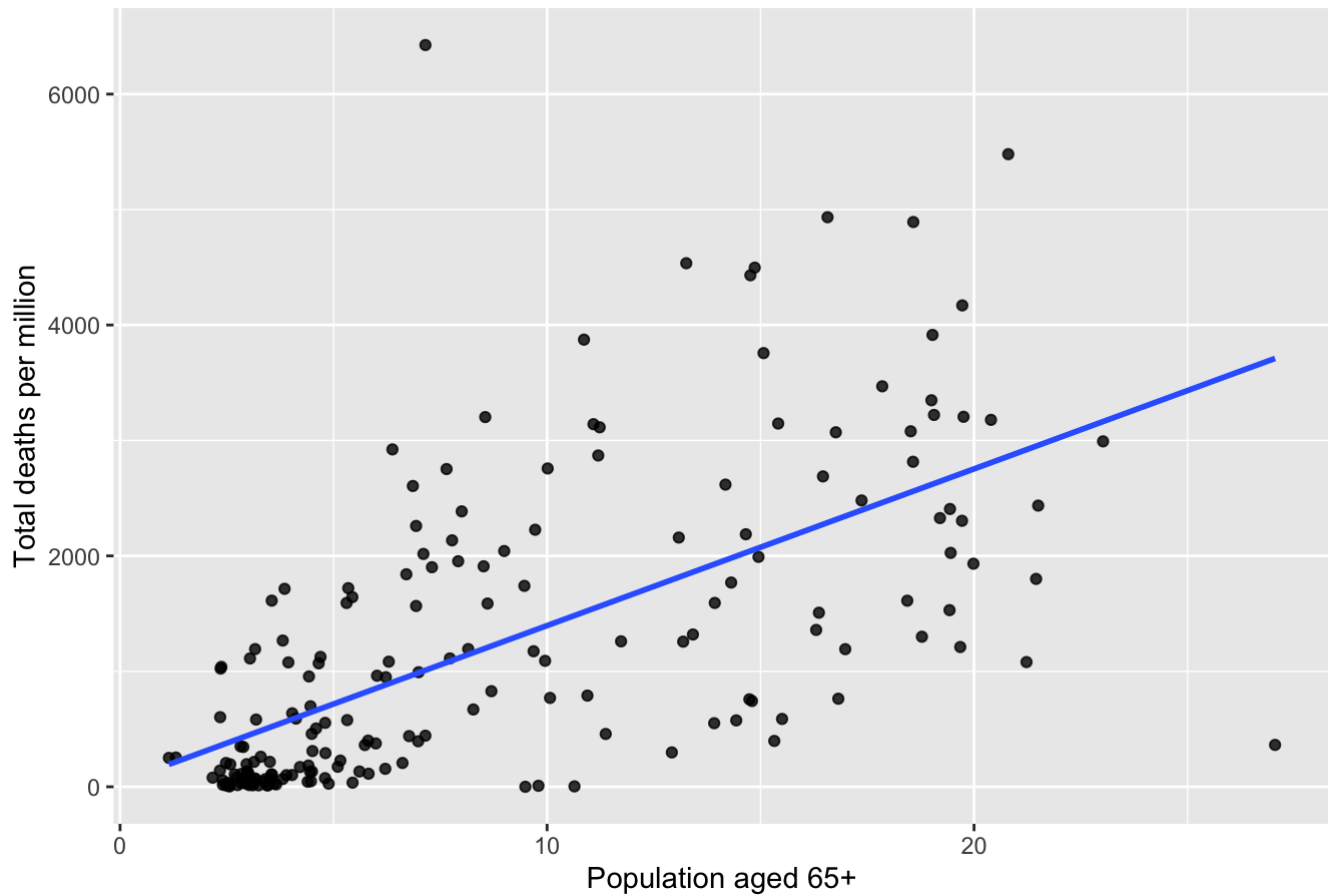
```
covid %>%
  filter(date == "2022-10-04") %>%
  ggplot(aes(x = aged_65_older, y = total_deaths_per_million)) +
  geom_point(alpha = 0.8) +
  geom_smooth(method = "lm", se = FALSE) +
  labs(x = "Population aged 65+",
       y = "Total deaths per million",
       title = "Relationship between the Elderly & Mortality")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 42 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 42 rows containing missing values (geom_point).
```

Relationship between the Elderly & Mortality



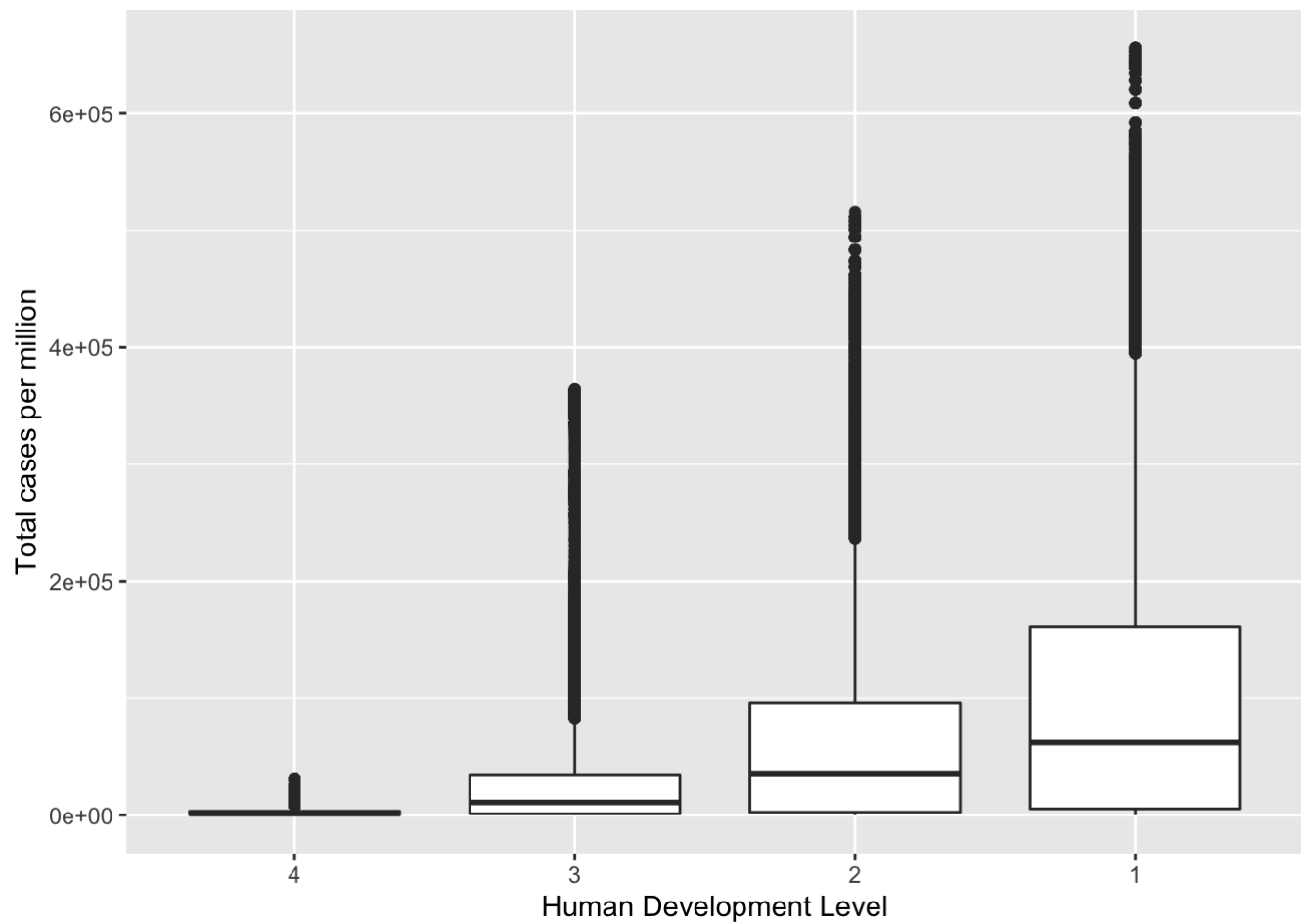
```
summary(covid$human_development_index)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.39	0.60	0.74	0.72	0.84	0.96	44411

```
covid <- mutate(covid, human_development_lv = cut(human_development_index, breaks = c(0, 0.6, 0.74, 0.84, 0.96), labels = c("4", "3", "2", "1")))
```

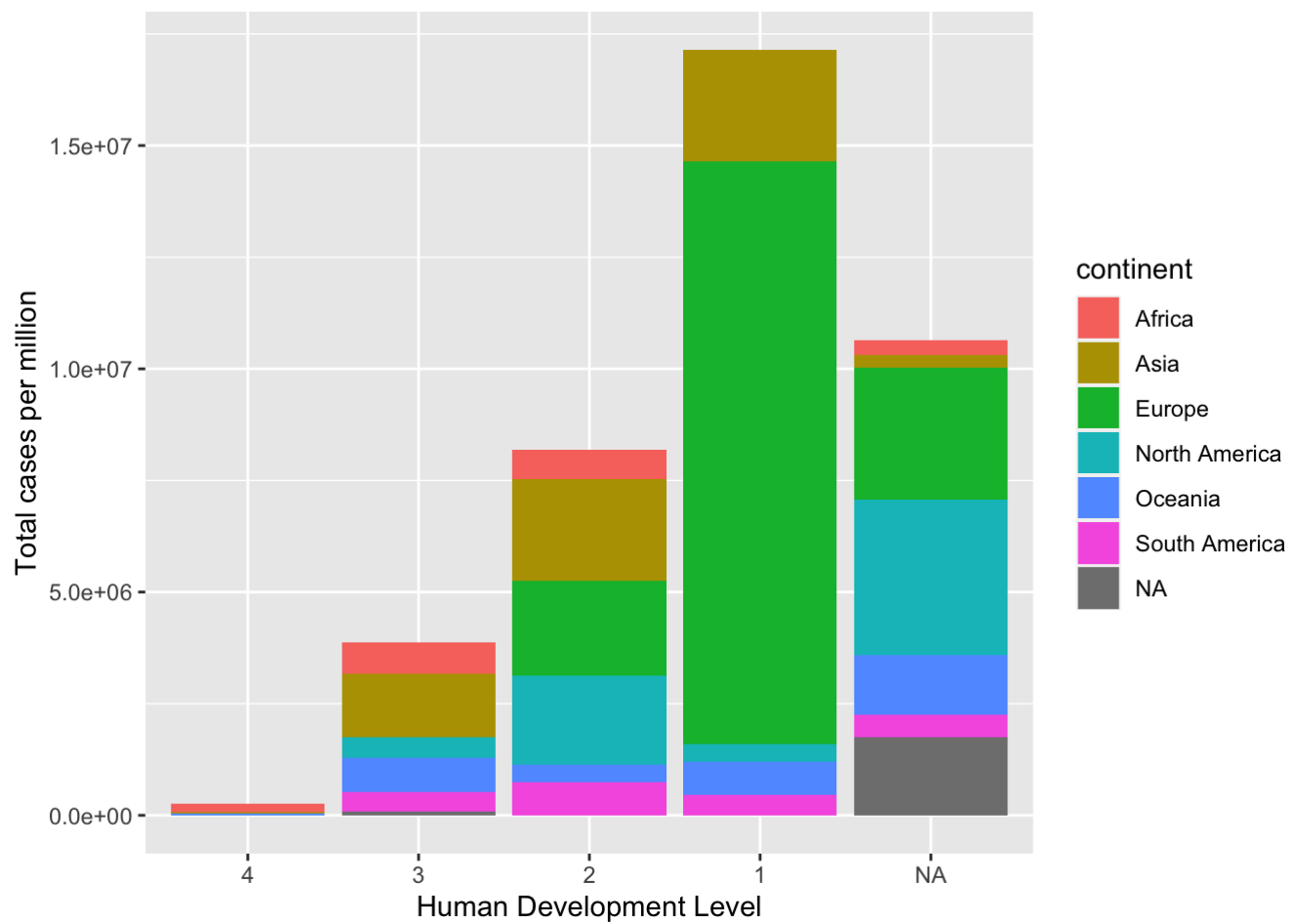
```
covid %>%  
  filter(!is.na(human_development_lv)) %>%  
  ggplot(aes(x = human_development_lv, y = total_cases_per_million)) +  
  geom_boxplot() +  
  xlab("Human Development Level") + ylab("Total cases per million")
```

```
## Warning: Removed 1201 rows containing non-finite values (stat_boxplot).
```

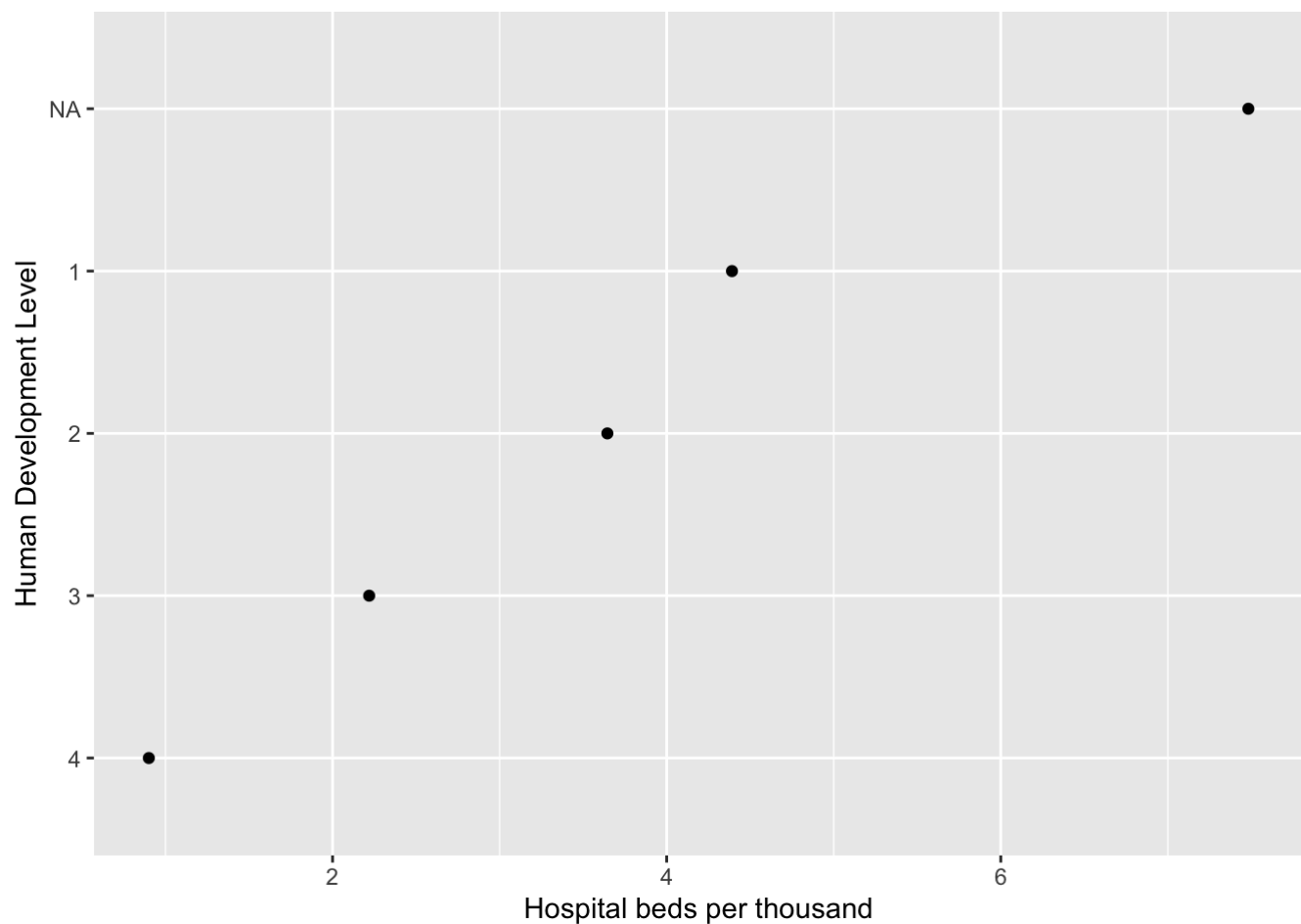


```
covid %>%
  filter(date == "2022-10-04") %>%
  ggplot(aes(x = human_development_lv, y = total_cases_per_million, fill = continent)) +
  geom_col() +
  xlab("Human Development Level") + ylab("Total cases per million")
```

```
## Warning: Removed 1 rows containing missing values (position_stack).
```



```
covid %>%
  group_by(human_development_lv) %>%
  summarise(
    avg_hospital = mean(hospital_beds_per_thousand, na.rm = TRUE)
  ) %>%
  ggplot(aes(avg_hospital, fct_reorder(human_development_lv, avg_hospital))) +
  geom_point() + xlab("Hospital beds per thousand") + ylab("Human Development Level")
```



```
covid %>%
  filter(date == "2022-10-04") %>%
  group_by(human_development_lv) %>%
  summarise(n = mean(total_vaccinations_per_hundred, na.rm = TRUE)) %>%
  ggplot(aes(reorder(human_development_lv, n), n)) +
  geom_bar(aes(fill=human_development_lv), stat="identity") +
  coord_flip() +
  theme_light() +
  ggtitle("Vaccination rate by Human Development Level") +
  xlab("Human Development Level") + ylab("Average Vaccinations") +
  theme(plot.title = element_text(hjust=0.5)) +
  theme(legend.position = "none")
```

Vaccination rate by Human Development Level

