A Descriptive Analysis of County-level Confirmed COVID-19 Cases in U.S.

The COVID-19 Possion Model Project

NYU A3SR

```
if(!requireNamespace("dplyr"))
  install.packages("dplyr", repos = "https://cloud.r-project.org")
if(!requireNamespace("data.table"))
  install.packages("data.table", repos = "https://cloud.r-project.org")
if(!requireNamespace("here"))
  install.packages("here", repos = "https://cloud.r-project.org")
if(!requireNamespace("ggplot2"))
  install.packages("ggplot2", repos = "https://cloud.r-project.org")
if(!requireNamespace("cowplot"))
  install.packages("cowplot", repos = "https://cloud.r-project.org")
require(data.table)
require(dplyr)
library(here)
require(ggplot2)
require(cowplot)
```

Introduction

This descriptive analysis illustrates how county-level confirmed COVID-19 cases were developed in the United States, starting from January, 2020. The data we used in this study come from USA FACTS. The data files are updated on a daily basis and are stored in time stamp formats. We applied multiple statistical tools to analyze and visualize the outbreak development.

Creating Data Files

Through data processing, we created two levels of data files for the analysis:

- National Level:
  - Daily nation-wide total confirmed cases
- County Level:
  - Daily new cases by county and state
  - Cumulative cases by county and state
  - Most recent confirmed cases by county (as of 03-29-2020)

```
# Unify variable naming using lower_snack_case
confirmed_cases <- as_tibble(dat) %>%
  rename(
    county_fips = countyFIPS,
```

```
    county_name = "County Name",
    state_name = State,
    state_fips = stateFIPS
  ) %>%
  subset(
    select = c(1, 4, 2, 3, 5:72)
  )

# Check if there are missing values
table(is.na(confirmed_cases))
```

Descriptive Analysis

Variables and Values

Below is a table listing all primary and supplementary variables in the data file. Primary data are columned by dates.

```
# Create a table to describe variables
variable_name <- append(
  x = colnames(confirmed_cases)[1:4],
  values = "date"
)
variable_description <- c(
  "FIPS county code",
  "FIPS state code",
  "County name",
  "State name",
  "Date period 01/22/2020 to 03/29/2020, 68 days, column 5 to 72"
)

# To display a summary table
variable_display <- data.frame(
  variable_name,
  variable_description
)
variable_display
```

```
##   variable_name
variable_description
## 1   county_fips                                                FIPS
county code
## 2    state_fips                                                 FIPS
state code
## 3   county_name
County name
## 4    state_name
State name
## 5          date Date period 01/22/2020 to 03/29/2020, 68 days,
column 5 to 72
```

```r
# Review the distribution of confirmed cases as of 03-29-2020
county_level_most_cases <- max(confirmed_cases$"3/29/20")
summary(confirmed_cases[, "3/29/20"])
```

```
##     3/29/20
##  Min.   :    0.00
##  1st Qu.:    0.00
##  Median :    1.00
##  Mean   :   44.27
##  3rd Qu.:    7.00
##  Max.   :10737.00
```

```r
# Queens County, NY has the highest total as of 03-29-2020,
# with 10,737 confirmed cases.
county_with_most_cases <-
  confirmed_cases$county_name[confirmed_cases$"3/29/20" ==
county_level_most_cases]
state_with_most_cases <-
  confirmed_cases$state_name[confirmed_cases$"3/29/20" ==
county_level_most_cases]
# 1,325 counties have zero confirmed case as of 03-29-2020
N <- nrow(confirmed_cases)
n_statewide_unallocated <-
  table(confirmed_cases$county_name == "Statewide Unallocated")["TRUE"]
n_county <- N - n_statewide_unallocated
county_with_zero_cases <- table(confirmed_cases$"3/29/20" == 0)["TRUE"]
county_with_five_more <- table(confirmed_cases$"3/29/20" >=5)["TRUE"]
county_with_ten_more <- table(confirmed_cases$"3/29/20" >= 10)["TRUE"]
```

Data Structure

Starting from 01/22/2020, county-level confirmed cases were reported daily. Each value in date variables is cumulative. For example, the value of confirmed cases in Queens, NY on Mar. 29, 2020 is calculated by adding cumulative confirmed cases on Mar. 28, 2020 with new cases confirmed on Mar. 29. Therefore, to get daily new cases, we can simply subtract the value on a particular day with the value in the previous day.

Daily New Cases

Below is a table showing 10 counties with highest total confirmed cases, along with number of daily new cases from 01/22/2020 to 03/29/2020 (68 days).

A complete `csv` data file has been exported as *daily_new_cases_03292020.csv*.

```r
primary_data <- confirmed_cases[, -(1:4)]
supplementary_data <- confirmed_cases[, 1:4]
county_daily_new_temp <- primary_data
primary_one_last_day <- cbind("initial" = 0, primary_data[, -
ncol(primary_data)])
for (i in 1:N) {
```

```
  county_daily_new_temp[i, ] <- primary_data[i, ] -
primary_one_last_day[i, ]
}
most_recent_total <- primary_data[, ncol(primary_data)]
colnames(most_recent_total) <- "current_total"
daily_new_cases <- cbind(
  supplementary_data,
  most_recent_total,
  county_daily_new_temp
)

# Save to data folder
write.csv(
  daily_new_cases,
  file = "../data/raw/case data/usa-facts/03-29-
2020/daily_new_cases_03292020.csv"
)

# To display a summary table
daily_new_cases_display <- daily_new_cases[order(-
daily_new_cases$current_total), ]
daily_new_cases_display <- subset(
  daily_new_cases_display,
  subset = county_fips != 0
)
head(daily_new_cases_display, 10)
```

```
##      county_fips state_fips        county_name state_name
current_total 1/22/20
## 1904       36081         36      Queens County         NY
10737       0
## 1887       36047         36       Kings County         NY
8887       0
## 1923       36119         36 Westchester County         NY
8519       0
## 1893       36059         36      Nassau County         NY
6445       0
## 1866       36005         36       Bronx County         NY
6250       0
## 1894       36061         36    New York County         NY
5582       0
## 1915       36103         36     Suffolk County         NY
5023       0
## 626        17031         17        Cook County         IL
3445       0
## 1337       26163         26       Wayne County         MI
2704       0
## 1907       36087         36    Rockland County         NY
2209       0
##      1/23/20 1/24/20 1/25/20 1/26/20 1/27/20 1/28/20 1/29/20 1/30/20
```

```
1/31/20
## 1904       0       0       0       0       0       0       0       0
0
## 1887       0       0       0       0       0       0       0       0
0
## 1923       0       0       0       0       0       0       0       0
0
## 1893       0       0       0       0       0       0       0       0
0
## 1866       0       0       0       0       0       0       0       0
0
## 1894       0       0       0       0       0       0       0       0
0
## 1915       0       0       0       0       0       0       0       0
0
## 626        0       1       0       0       0       0       0       0
1
## 1337       0       0       0       0       0       0       0       0
0
## 1907       0       0       0       0       0       0       0       0
0
##      2/1/20 2/2/20 2/3/20 2/4/20 2/5/20 2/6/20 2/7/20 2/8/20 2/9/20
2/10/20
## 1904      0      0      0      0      0      0      0      0      0
0
## 1887      0      0      0      0      0      0      0      0      0
0
## 1923      0      0      0      0      0      0      0      0      0
0
## 1893      0      0      0      0      0      0      0      0      0
0
## 1866      0      0      0      0      0      0      0      0      0
0
## 1894      0      0      0      0      0      0      0      0      0
0
## 1915      0      0      0      0      0      0      0      0      0
0
## 626       0      0      0      0      0      0      0      0      0
0
## 1337      0      0      0      0      0      0      0      0      0
0
## 1907      0      0      0      0      0      0      0      0      0
0
##      2/11/20 2/12/20 2/13/20 2/14/20 2/15/20 2/16/20 2/17/20 2/18/20
2/19/20
## 1904       0       0       0       0       0       0       0       0
0
## 1887       0       0       0       0       0       0       0       0
0
## 1923       0       0       0       0       0       0       0       0
```

```
0
## 1893       0       0       0       0       0       0       0       0
0
## 1866       0       0       0       0       0       0       0       0
0
## 1894       0       0       0       0       0       0       0       0
0
## 1915       0       0       0       0       0       0       0       0
0
## 626        0       0       0       0       0       0       0       0
0
## 1337       0       0       0       0       0       0       0       0
0
## 1907       0       0       0       0       0       0       0       0
0
##      2/20/20 2/21/20 2/22/20 2/23/20 2/24/20 2/25/20 2/26/20 2/27/20
2/28/20
## 1904       0       0       0       0       0       0       0       0
0
## 1887       0       0       0       0       0       0       0       0
0
## 1923       0       0       0       0       0       0       0       0
0
## 1893       0       0       0       0       0       0       0       0
0
## 1866       0       0       0       0       0       0       0       0
0
## 1894       0       0       0       0       0       0       0       0
0
## 1915       0       0       0       0       0       0       0       0
0
## 626        0       0       0       0       0       0       0       0
0
## 1337       0       0       0       0       0       0       0       0
0
## 1907       0       0       0       0       0       0       0       0
0
##      2/29/20 3/1/20 3/2/20 3/3/20 3/4/20 3/5/20 3/6/20 3/7/20 3/8/20
3/9/20
## 1904       0      0      0      0      0      0      0      1      0
1
## 1887       0      0      0      0      0      1      0      2      0
1
## 1923       0      0      0      1      9      8      1     38     26
15
## 1893       0      0      0      0      0      1      0      3      1
14
## 1866       0      0      0      0      0      0      0      0      1
1
## 1894       0      0      1      0      0      2      1      4      0
```

```
3
## 1915       0      0      0      0      0      0      0      0      1
0
## 626        0      1      1      0      0      1      0      1      1
4
## 1337       0      0      0      0      0      0      0      0      0
0
## 1907       0      0      0      0      0      0      0      2      0
2
##      3/10/20 3/11/20 3/12/20 3/13/20 3/14/20 3/15/20 3/16/20 3/17/20
3/18/20
## 1904       2       0      13       9      29      23      40     130
285
## 1887       6       4      10       0      10      19       9      95
348
## 1923      10      13      27      10      20      18      24     160
158
## 1893       0       9      13      10      28      19      11      22
52
## 1866       1       0       7       3       0       8      13      62
207
## 1894       6       1      21      -4      36       1      39     166
313
## 1915       0       5      14       8      13       6      16      21
32
## 626        6       5       5      13      11       0      26      30
71
## 1337       1       0       0       5       2       5       1       3
6
## 1907       2       0       1       2       3       1       3       6
8
##      3/19/20 3/20/20 3/21/20 3/22/20 3/23/20 3/24/20 3/25/20 3/26/20
3/27/20
## 1904     509     364     848     461     906     743    2056     942
852
## 1887     690     323     966     373     637     743     995     863
655
## 1923     260     293     294     488    1021     997     800    1253
1243
## 1893     189     382     480     666     542     427     416     629
743
## 1866     193     171     404     340     418     499    1214     701
412
## 1894     448     276     549     209     500     315     729     430
432
## 1915      62     193     291     372     424     422     380     475
651
## 626      100     133     137     257     117     272     224     486
335
## 1337      96      97     133     128     161     235     248     268
```

```
421
## 1907      23      48     161     193     137      79     297     229
260
##      3/28/20 3/29/20
## 1904    1617     906
## 1887    1379     758
## 1923     688     644
## 1893     880     908
## 1866    1097     498
## 1894     759     345
## 1915     752     885
## 626      374     832
## 1337     506     388
## 1907     439     313
```

Cumulative Cases (Raw Data)

Here is a table showing the first 10 rows of the original data table with cumulative confirmed cases.

```
cumulative_cases <- confirmed_cases

# To display a summary table
head(cumulative_cases, 10)

## # A tibble: 10 x 72
##    county_fips state_fips county_name state_name `1/22/20` `1/23/20`
`1/24/20`
##          <int>      <int> <chr>       <chr>          <int>     <int>
<int>
##  1           0          1 Statewide ~ AL                 0         0
0
##  2        1001          1 Autauga Co~ AL                 0         0
0
##  3        1003          1 Baldwin Co~ AL                 0         0
0
##  4        1005          1 Barbour Co~ AL                 0         0
0
##  5        1007          1 Bibb County AL                 0         0
0
##  6        1009          1 Blount Cou~ AL                 0         0
0
##  7        1011          1 Bullock Co~ AL                 0         0
0
##  8        1013          1 Butler Cou~ AL                 0         0
0
##  9        1015          1 Calhoun Co~ AL                 0         0
0
## 10        1017          1 Chambers C~ AL                 0         0
0
```

```
## # ... with 65 more variables: `1/25/20` <int>, `1/26/20` <int>,
## #   `1/27/20` <int>, `1/28/20` <int>, `1/29/20` <int>, `1/30/20`
<int>,
## #   `1/31/20` <int>, `2/1/20` <int>, `2/2/20` <int>, `2/3/20` <int>,
## #   `2/4/20` <int>, `2/5/20` <int>, `2/6/20` <int>, `2/7/20` <int>,
## #   `2/8/20` <int>, `2/9/20` <int>, `2/10/20` <int>, `2/11/20`
<int>,
## #   `2/12/20` <int>, `2/13/20` <int>, `2/14/20` <int>, `2/15/20`
<int>,
## #   `2/16/20` <int>, `2/17/20` <int>, `2/18/20` <int>, `2/19/20`
<int>,
## #   `2/20/20` <int>, `2/21/20` <int>, `2/22/20` <int>, `2/23/20`
<int>,
## #   `2/24/20` <int>, `2/25/20` <int>, `2/26/20` <int>, `2/27/20`
<int>,
## #   `2/28/20` <int>, `2/29/20` <int>, `3/1/20` <int>, `3/2/20`
<int>,
## #   `3/3/20` <int>, `3/4/20` <int>, `3/5/20` <int>, `3/6/20` <int>,
## #   `3/7/20` <int>, `3/8/20` <int>, `3/9/20` <int>, `3/10/20` <int>,
## #   `3/11/20` <int>, `3/12/20` <int>, `3/13/20` <int>, `3/14/20`
<int>,
## #   `3/15/20` <int>, `3/16/20` <int>, `3/17/20` <int>, `3/18/20`
<int>,
## #   `3/19/20` <int>, `3/20/20` <int>, `3/21/20` <int>, `3/22/20`
<int>,
## #   `3/23/20` <int>, `3/24/20` <int>, `3/25/20` <int>, `3/26/20`
<int>,
## #   `3/27/20` <int>, `3/28/20` <int>, `3/29/20` <int>
```

Daily Nation-wide Total

Here is a table showing nation-wide daily total confirmed cases of the most recent 10 days as of 03/29/2020.

```
# Create a table showing daily total confirmed cases, nation-wide
date <- as.Date(
  paste(
    "0",
    colnames(primary_data),
    sep = ""
  ),
  format = "%m/%d/%y"
)
nation_wide_total <- lapply(primary_data, FUN = sum)
nation_wide_total <- t(as.matrix(as.data.frame(nation_wide_total)))
nation_wide_total <- data.frame(
  date = date,
  total_confirmed = nation_wide_total
)
row.names(nation_wide_total) <- NULL
```

```r
# Save to data folder
write.csv(
  nation_wide_total,
  file = "../data/raw/case data/usa-facts/03-29-
2020/nation_wide_total_03292020.csv"
)

# To display a summary table
tail(nation_wide_total, 10)
```

```
##          date total_confirmed
## 59 2020-03-20           18837
## 60 2020-03-21           26184
## 61 2020-03-22           33469
## 62 2020-03-23           43544
## 63 2020-03-24           53552
## 64 2020-03-25           68245
## 65 2020-03-26           84680
## 66 2020-03-27          102291
## 67 2020-03-28          122662
## 68 2020-03-29          141529
```

Visualization

National Level

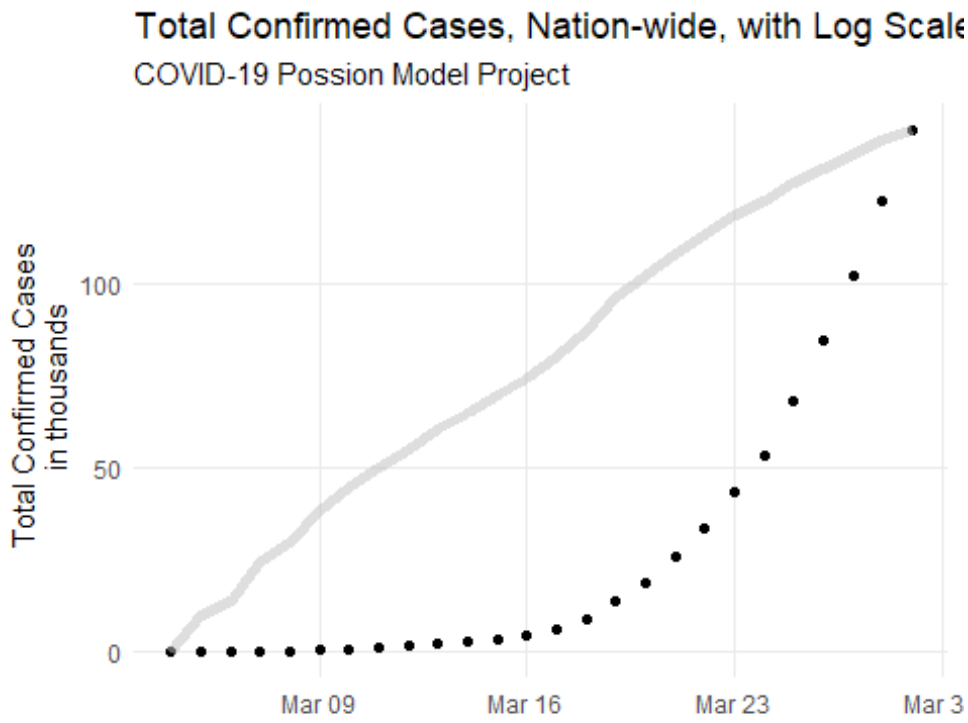
Below is a scatter plot showing the increase of nation-wide confirmed cases with a log scaled (`log10`) reference line.

```r
# Change the scale to thousands
# Start when there were more than 100 cases
nation_wide_total_over_100 <-
  table(nation_wide_total$total_confirmed >= 100)["TRUE"]
nation_wide_total_viz <- nation_wide_total %>%
  mutate(
    total_confirmed_in_thousand = round(total_confirmed / 1000,
                                        digits = 2)
  ) %>%
  top_n(nation_wide_total_over_100)
# Create a scatter plot showing the trend of case increases in US
nation_wide_total_plt <- ggplot(nation_wide_total_viz)
p1 <- nation_wide_total_plt +
  geom_point(
    aes(
      x = date,
      y = total_confirmed_in_thousand
    )
  ) +
  theme_minimal() +
```

```r
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Total Confirmed Cases, Nation-wide, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Total Confirmed Cases \n in thousands")

# Log transformation
p2 <- nation_wide_total_plt +
  geom_line(
    aes(
      x = date,
      y = total_confirmed
    ),
    size = 2,
    col = "grey",
    alpha = .5
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



County Level

Queens, NY

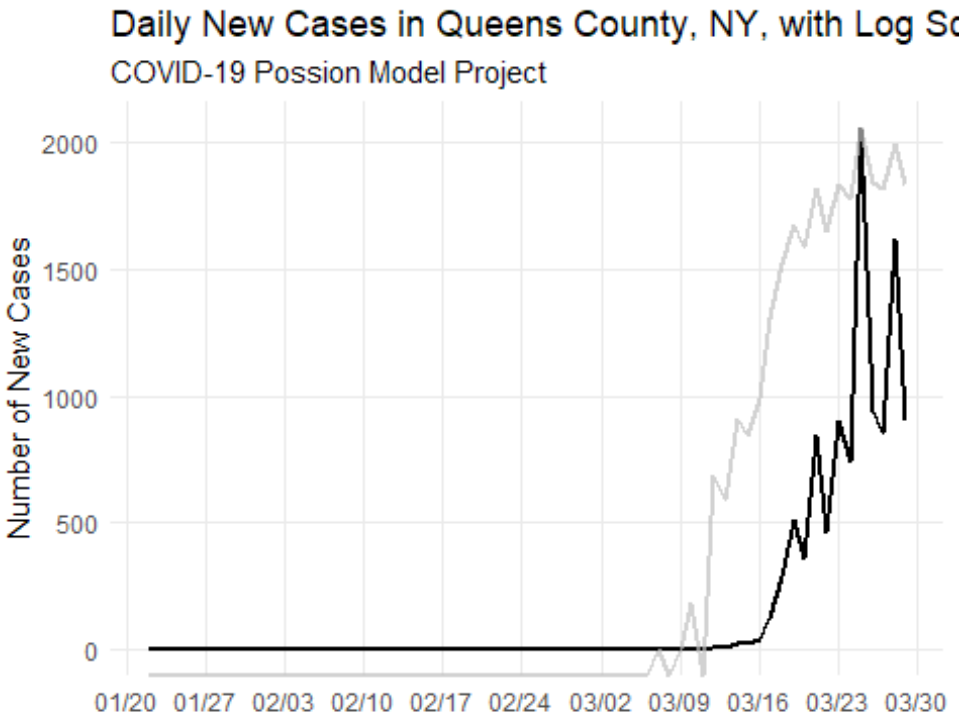
```
### Need to clean up
daily_new_cases_plt_temp <-
  as.data.frame(t(as.matrix(daily_new_cases_display[1:10, ])))
daily_new_cases_plt <- daily_new_cases_plt_temp[-(1:5), ]
daily_new_cases_plt_info <- daily_new_cases_plt_temp[1:5, ]
colnames(daily_new_cases_plt) <- paste("N", 1:10, sep = "") # N1 to N10
daily_new_cases_plt <- tibble::rownames_to_column(daily_new_cases_plt,
"date")
daily_new_cases_plt$date <- as.Date(
  daily_new_cases_plt$date,
  format = "%m/%d/%y"
)
index <- sapply(daily_new_cases_plt, is.factor)
daily_new_cases_plt[index] <- lapply(daily_new_cases_plt[index],
function(x) as.numeric(as.character(x)))

# Create a plot showing daily new cases in
# Queens County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N1))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
```

```
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Queens County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



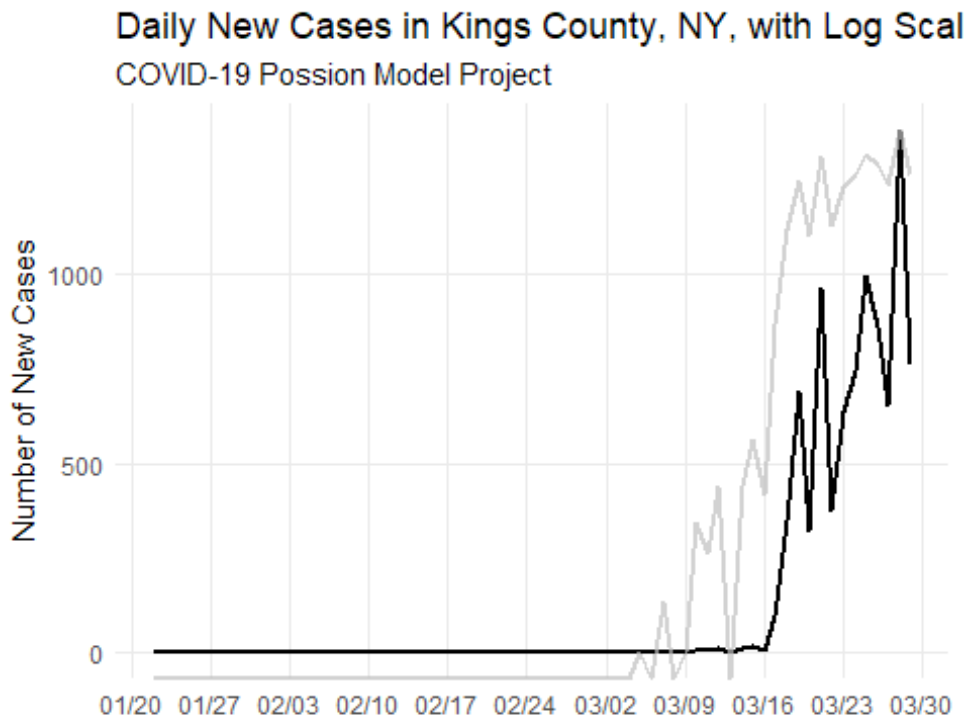
Kings, NY

```
# Create a plot showing daily new cases in
# Kings County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N2))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Kings County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
```

```
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



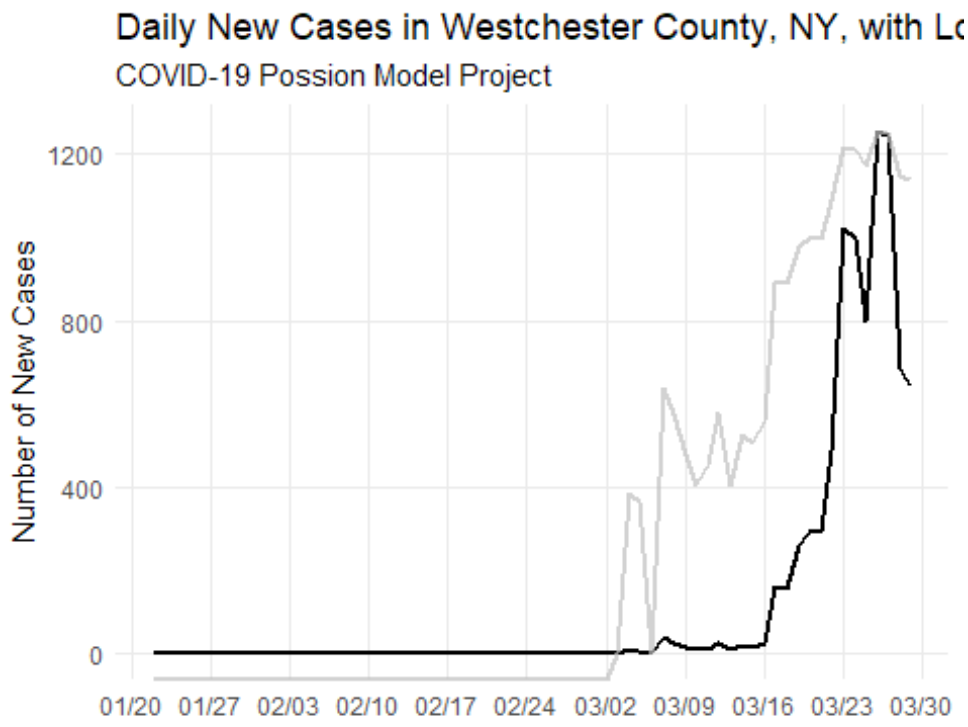
Westchester County, NY

```
# Create a plot showing daily new cases in
# Westchester County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N3))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Westchester County, NY, with Log
Scale",
```

```
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



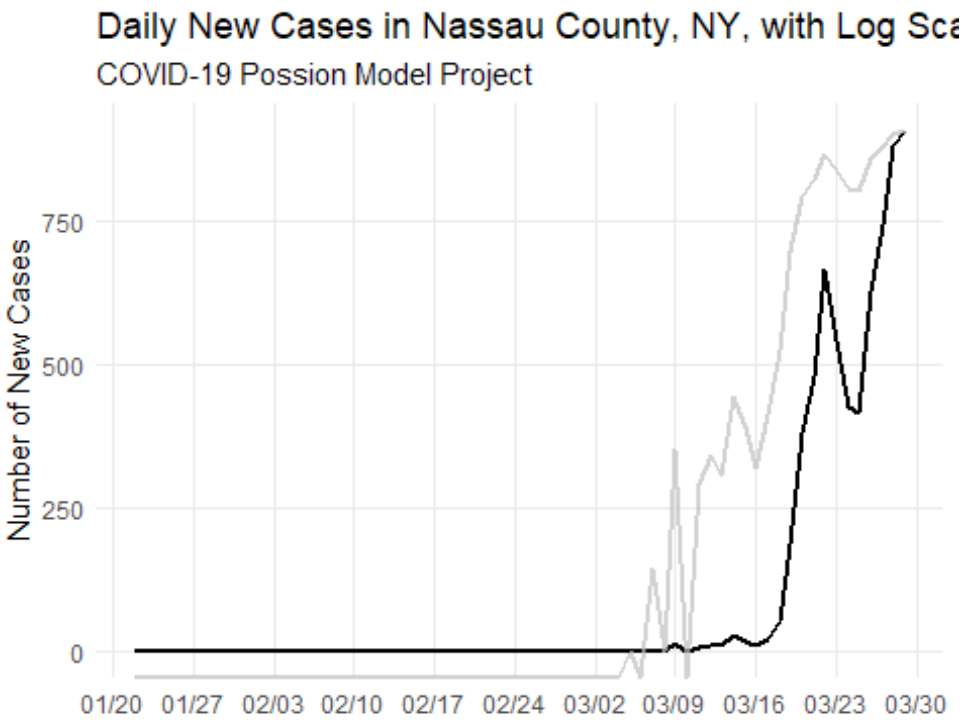
Nassau County, NY

```
# Create a plot showing daily new cases in
# Nassau County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N4))
p1 <- p0 +
```

```
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Nassau County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



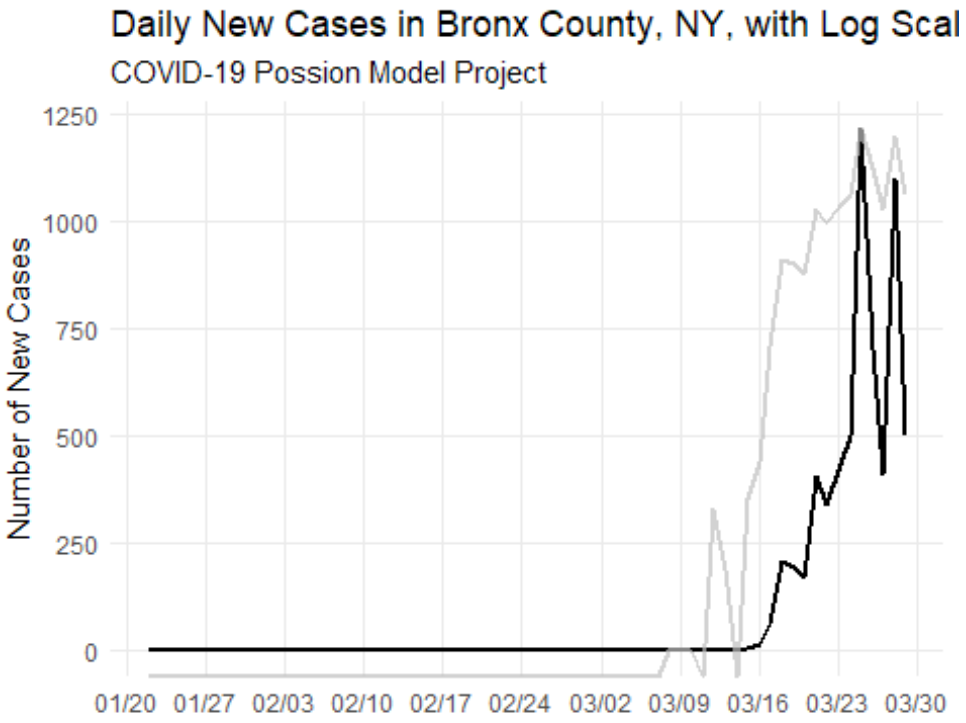
Bronx County, NY

```
# Create a plot showing daily new cases in
# Bronx County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N5))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Bronx County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
```

```
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



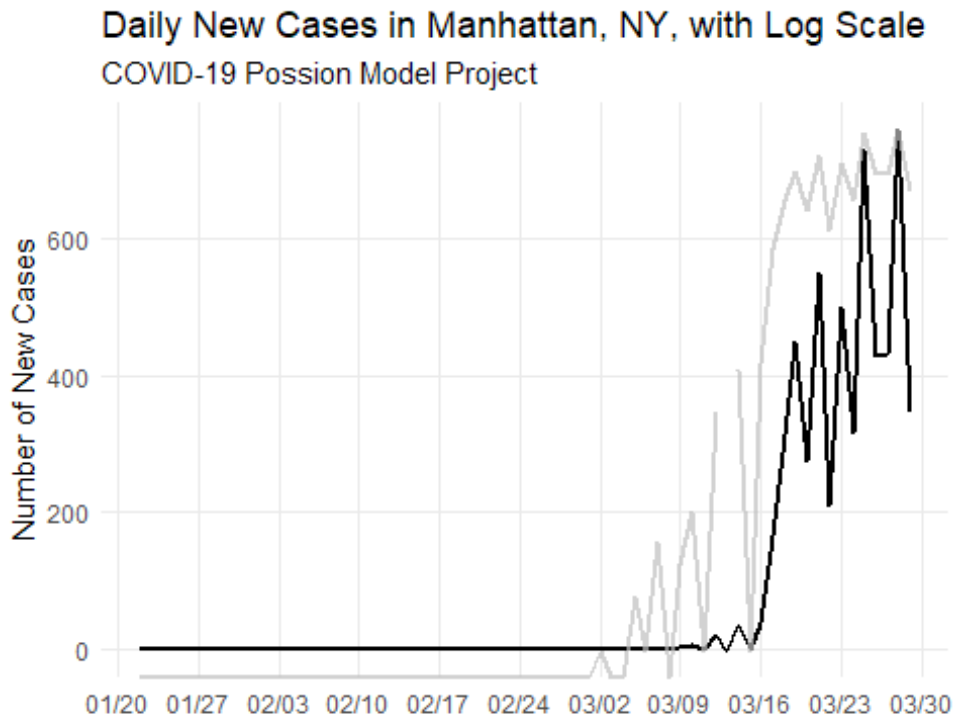
Manhattan, NY

```
# Create a plot showing daily new cases in
# Manhattan, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N6))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Manhattan, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
```

```
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



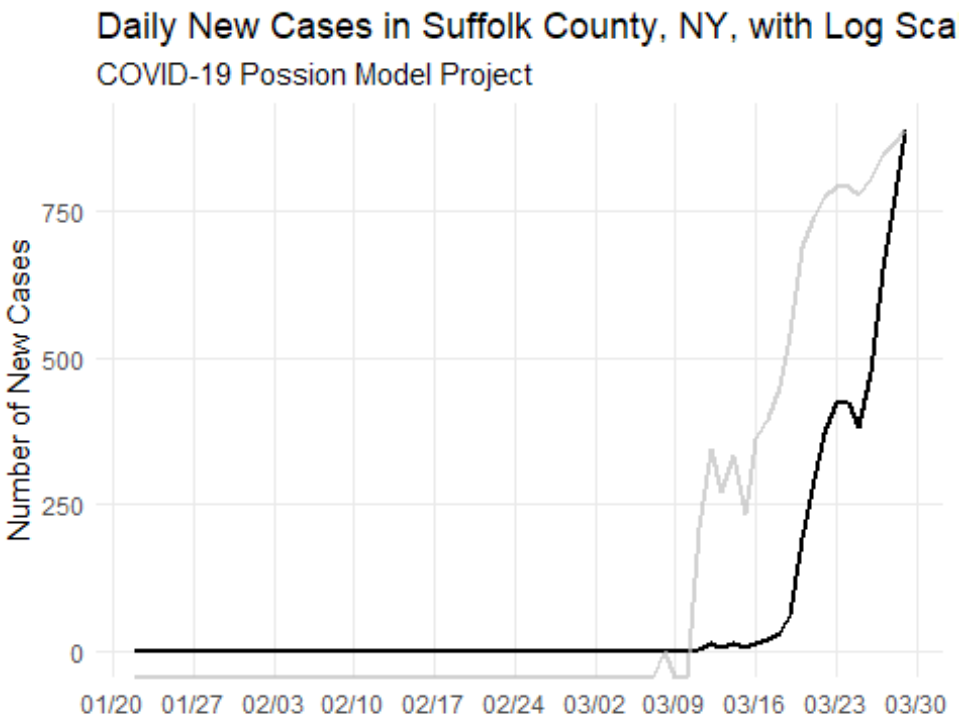
Suffolk County, NY

```
# Create a plot showing daily new cases in
# Suffolk County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N7))
p1 <- p0 +
  geom_line(
```

```
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Suffolk County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



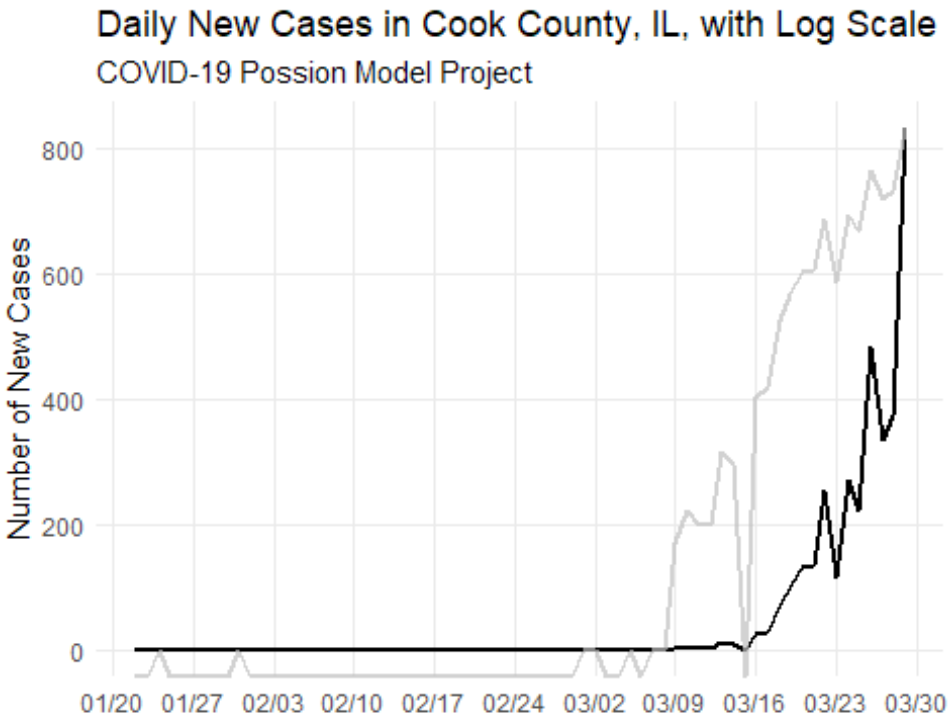
Cook County, IL

```
# Create a plot showing daily new cases in
# Cook County, IL
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N8))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Cook County, IL, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
```

```
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



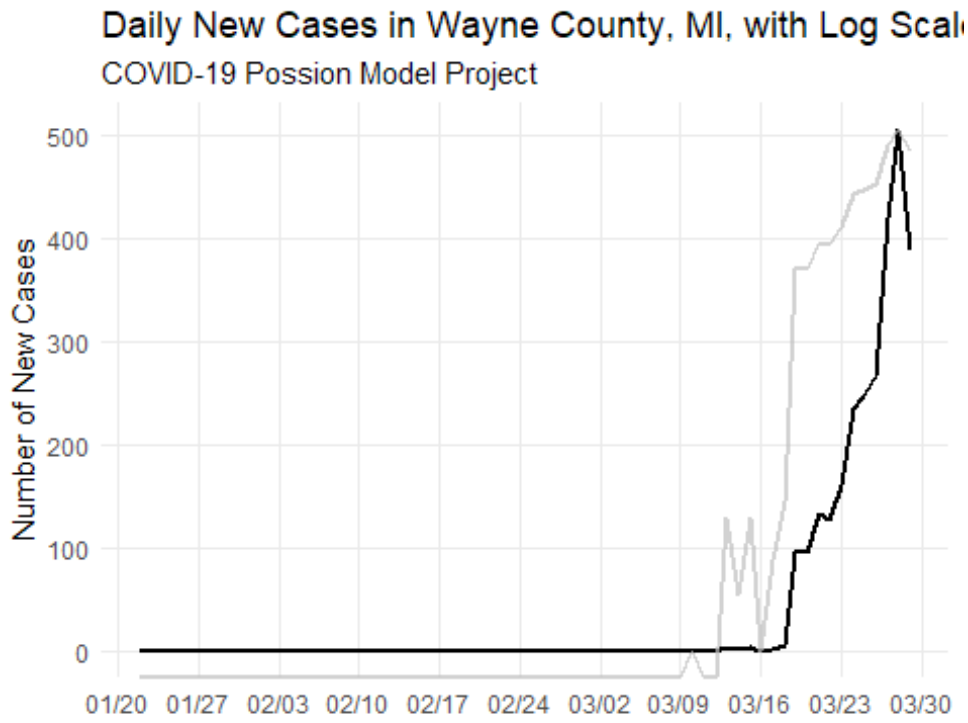
Wayne County, MI

```
# Create a plot showing daily new cases in
# Wayne County, MI
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N9))
p1 <- p0 +
  geom_line(
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Wayne County, MI, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
```

```
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```



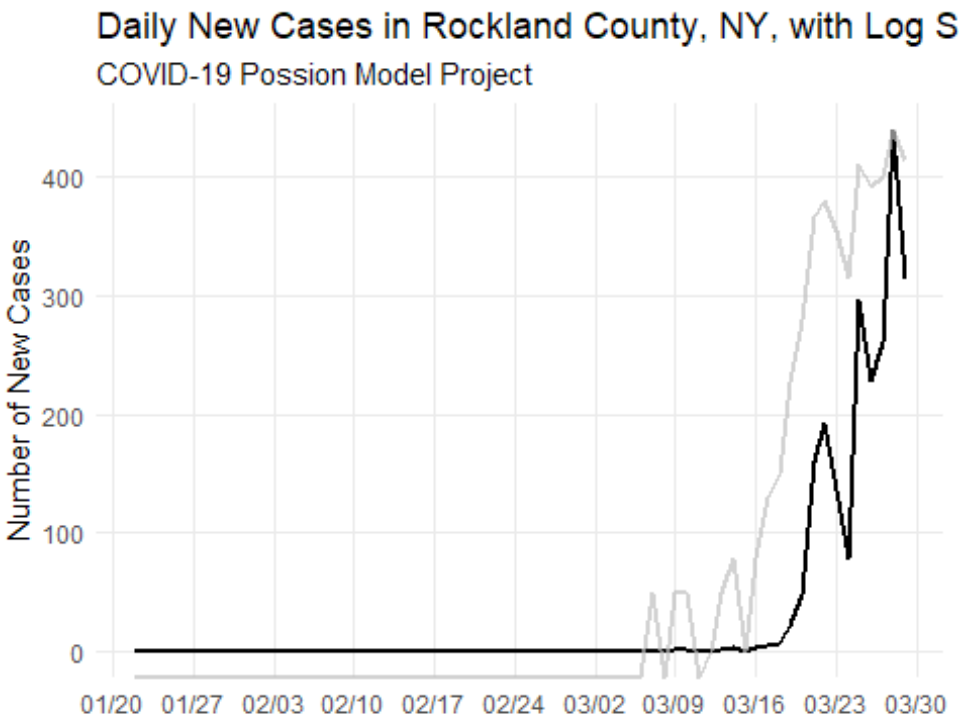
Rockland County, NY

```
# Create a plot showing daily new cases in
# Rockland County, NY
p0 <- ggplot(daily_new_cases_plt, aes(x = date, y = N10))
p1 <- p0 +
  geom_line(
```

```
    size = 1,
  ) +
  scale_x_date(date_labels = "%m/%d", date_breaks = "1 week") +
  theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
  ) +
  ggtitle(
    label = "Daily New Cases in Rockland County, NY, with Log Scale",
    subtitle = "COVID-19 Possion Model Project"
  ) +
  xlab("") +
  ylab("Number of New Cases")

p2 <- p0 +
  geom_line(
    size = 1,
    col = "grey",
    alpha = .7
  ) +
  scale_y_continuous(trans = "log10") +
  theme_void()

aligned_plt <- align_plots(
  p1, p2,
  align = "hv"
)
ggdraw(aligned_plt[[1]]) +
  draw_plot(aligned_plt[[2]])
```


Daily New Cases in Rockland County, NY, with Log S
COVID-19 Possion Model Project
Number of New Cases
400
300
200
100
0
01/20
01/27
02/03
02/10
02/17
02/24
03/02
03/09
03/16
03/23
03/30