CALIFORNIA LUTHERAN UNIVERSITY - DEPARTMENT OF MATHEMATICS

Modeling effects of interventions on COVID-19 spread

Gianna Alamillo, Christopher Brown, Ph.D., Paloma Vargas, Ph.D.

Research Question

- How do interventions in different counties in the U.S. affect the growth rate of the coronavirus disease COVID-19?

INTRODUCTION

- COVID-19 began December 2019
- Virus was declared a global pandemic after making its way throughout the world
- Knowing the future rate of spread of virus can prepare society for future pandemics.
- Mathematical modeling known as SIR compartmental modeling was used to simulate the future rate of spread of COVID-19.

Method

- All data analysis was completed using the computer software RStudio
- Time period was selected to specify the days and months that were looked at.
- Eight counties from four different states where COVID-19 was located and interventions used were selected as the main focus for comparison
- Data was collected between the time period of January 22, 2020 - July 13, 2020 from the counties selected and intervention outcomes.
- SIR compartmental modeling was used to organize data and analyze the rate of change between each stage of the virus.
- Model was manipulated to fit characteristics being analyzed as seen in Figure 1 and Figure 2.
- Once the rates of change were found for each stage with each intervention applied, graphs were used to interpret findings.

METHOD

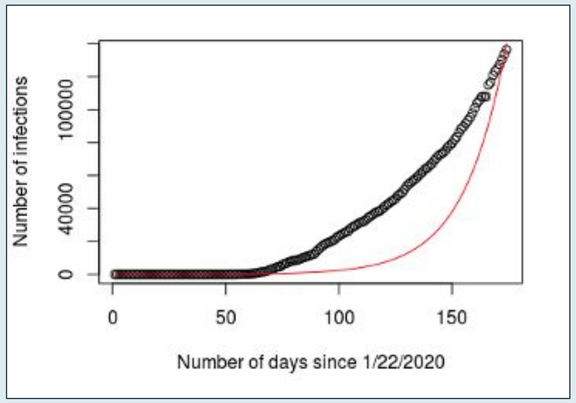

Figure 1: Model data for Los Angeles County. The model (red line) is not fit to the original data (black line).

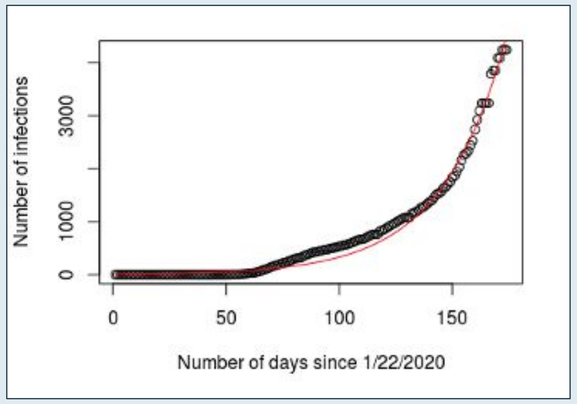

Figure 2: Model data for Ventura County. The model (red line) was manipulated to fit the original data (black line).

RESULTS

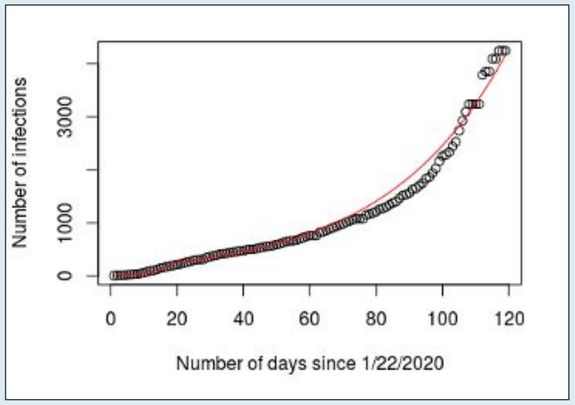

Figure 3: Model data of Interventions in Ventura County. Intervention was implemented on day 75 and removed on day 106. That's represented by the dip in the graph.

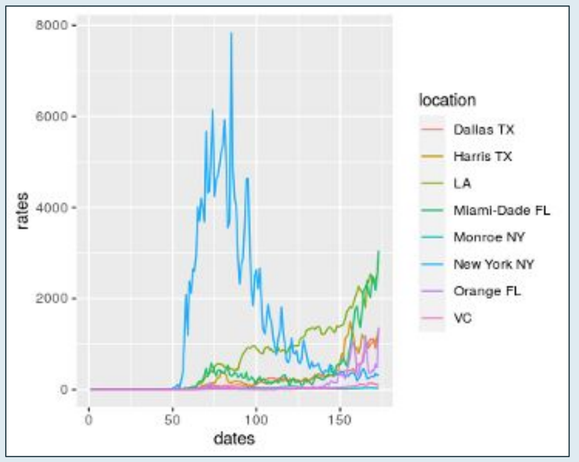

Figure 4: PCapita rates (rate of new infections per person per day) in 8 counties from 4 different states.

DISCUSSION

- The rate of spread when interventions were applied, slowed down the rate of spread during that specific time period (when intervention(s) were applied) as seen in figure 3.
- The rate of spread when interventions were removed, caused a large increase in the rate of spread as seen in fIgure 3.
- PCapita rates were very high in counties that had large populations as seen in figure 4.
  - Highest population: New York County population is 18.8 million

ACKNOWLEDGEMENTS

I would like to thank ALLIES in STEM, Office of Undergraduate Research and Creative Scholarship, California Lutheran University, Christopher Brown, Ph.D and Paloma Vargas, Ph.D for allowing me this opportunity.

REFERENCES

Centers for Disease Control and Prevention. (2020).
https://www.cdc.gov/media/releases/2020/p0121-novel-coronavirus-travel-case.html

Rochester Regional Health. (2020).
https://www.rochesterregional.org/news/2020/03/pandemic-vs-epidemic

California Lutheran UNIVERSITY