Mask Mandates, Economic Activity, and COVID-19 Spread in the United States

IPAL CAPSTONE PROJECT

Author: Serena Huang

Date: July 31th, 2020

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1. Capstone Project

1) Summaries of the five readings

Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis

This paper measures the effects of physical distance, face masks, and eye protection in preventing further transmission of viruses such as COVID-19 and SARS. These studies take place in either healthcare or non-healthcare settings. The researchers obtained data by screening titles, abstracts and going over full texts. To cross-check the screening results, they used artificial intelligence. The researchers find that as the physical distancing lengthens, the transmission of viruses lowers, the use of face masks and the protection of the eyes also lead to a large reduction in risk of infection.

The effect of large-scale anti-contagion policies on the COVID-19 pandemic

This paper aims to investigate the effect of anti-contagion policies, such as travel restrictions, social distancing and quarantines, on the growth rate of infections. China, South Korea, Italy, Iran, France and the United States were the main countries the researchers evaluated as they compiled data on the timing of policies deployments and daily infection growth. The results are that deployment of anti-contagion policies in the countries mentioned above have significantly reduced the growth rate of infections, slowing the spread of the pandemic remarkably.

The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak

This paper mainly focuses on the effects of the Wuhan travel ban. By using the global metapopulation disease transmission model, the researchers seek to find out how the travel limitations affected the spread of COVID-19. They come to the conclusion that the travel ban in Wuhan only slightly delayed the spread of the disease in mainland China, however, the ban had a more distinct effect at reducing international case importations.

Identifying airborne transmission as the dominant route for the spread of COVID-19

This paper stresses that airborne transmission is the dominant way to spread COVID-19, therefore, while most mitigation measures are effective in reducing infection, they don't directly protect against airborne transmission. The researchers take data on trends and mitigation measures in Wuhan, Italy and New York City. It is revealed that mandated face covering is the most crucial measure in preventing airborne transmission. Social distancing and quarantining minimize contact transmission but are still insufficient when protecting oneself.

Evidence that high temperatures and intermediate relative humidity might favor the spread of COVID-19 in tropical climate: A case study for the most affected Brazilian cities

The authors focus on the relationship between meteorological conditions and the transmission of COVID-19. They obtained epidemiological data, weather data, cumulative cases and contamination rates of five cities in Brazil to assist their studies. The results show that higher temperatures and intermediate relative humidity may lead to a faster transmission rate of the COVID-19.

2) List of sources

[1] Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., Schünemann, H. J., ... & Hajizadeh, A. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *The Lancet*.

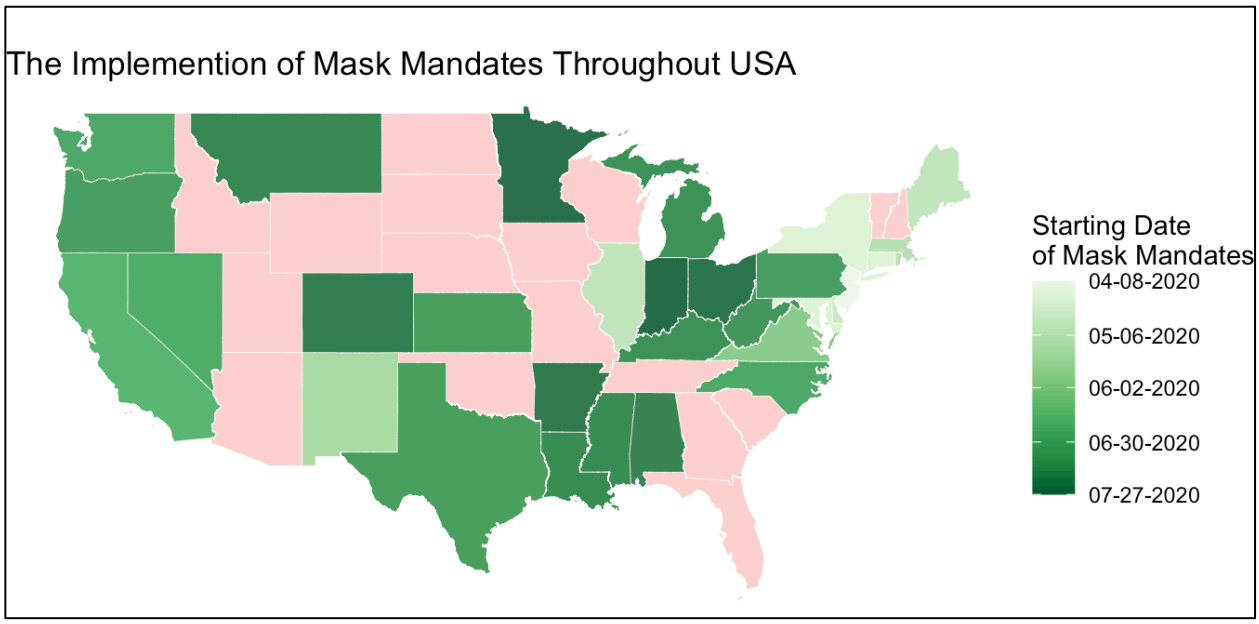
[2] Hsiang, S., Allen, D., Annan-Phan, S., Bell, K., Bolliger, I., Chong, T., ... & Lau, P. (2020). The effect of large-scale anti-contagion policies on the coronavirus (covid-19) pandemic. *MedRxiv*.

[3] Chinazzi, M., Davis, J. T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., ... & Viboud, C. (2020). The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. *Science*, *368*(6489), 395-400.

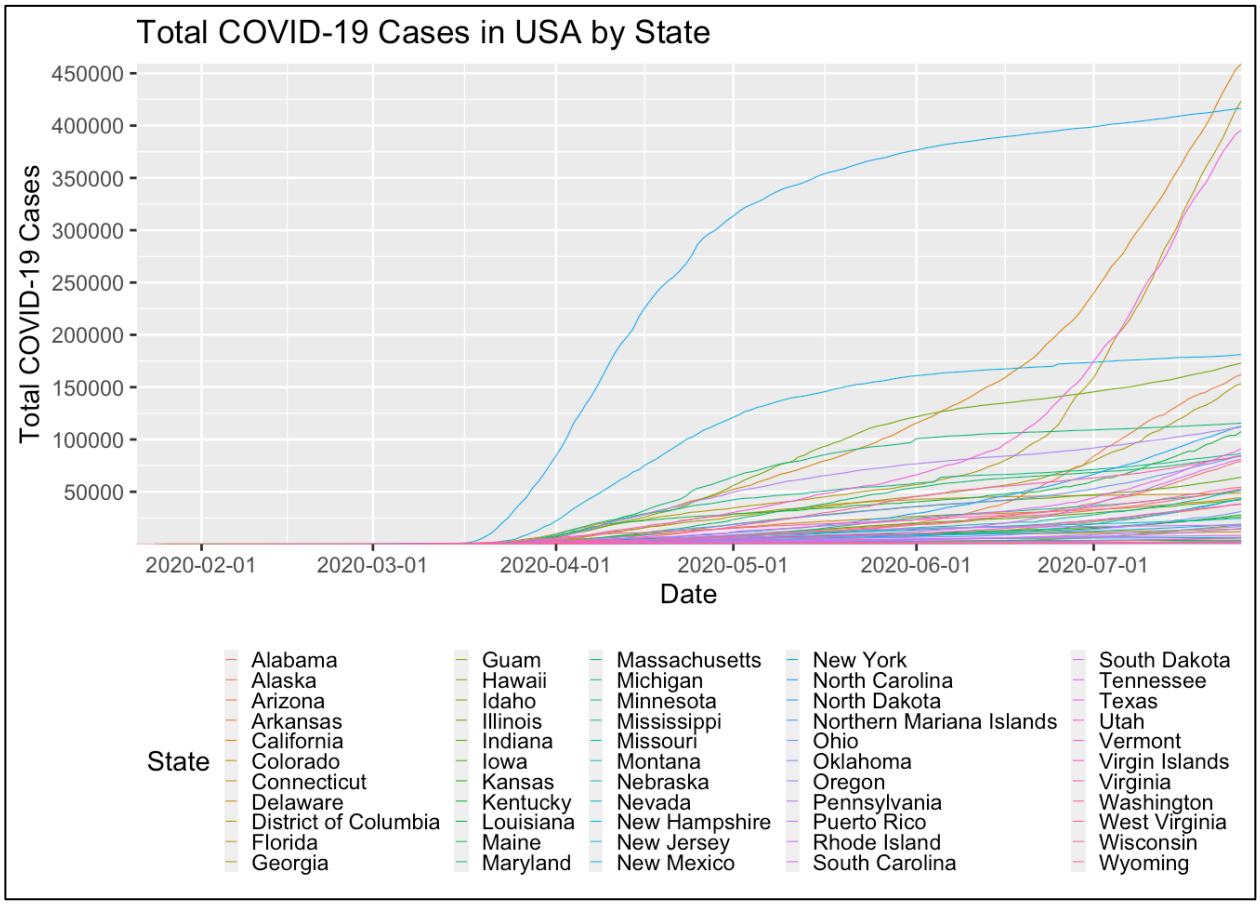
[4] Zhang, R., Li, Y., Zhang, A. L., Wang, Y., & Molina, M. J. (2020). Identifying airborne transmission as the dominant route for the spread of COVID-19. *Proceedings of the National Academy of Sciences*.

[5] Auler, A. C., Cássaro, F. A. M., da Silva, V. O., & Pires, L. F. (2020). Evidence that high temperatures and intermediate relative humidity might favor the spread of COVID-19 in tropical climate: A case study for the most affected Brazilian cities. *Science of The Total Environment*, 139090.

3) State-wide map of mask mandates

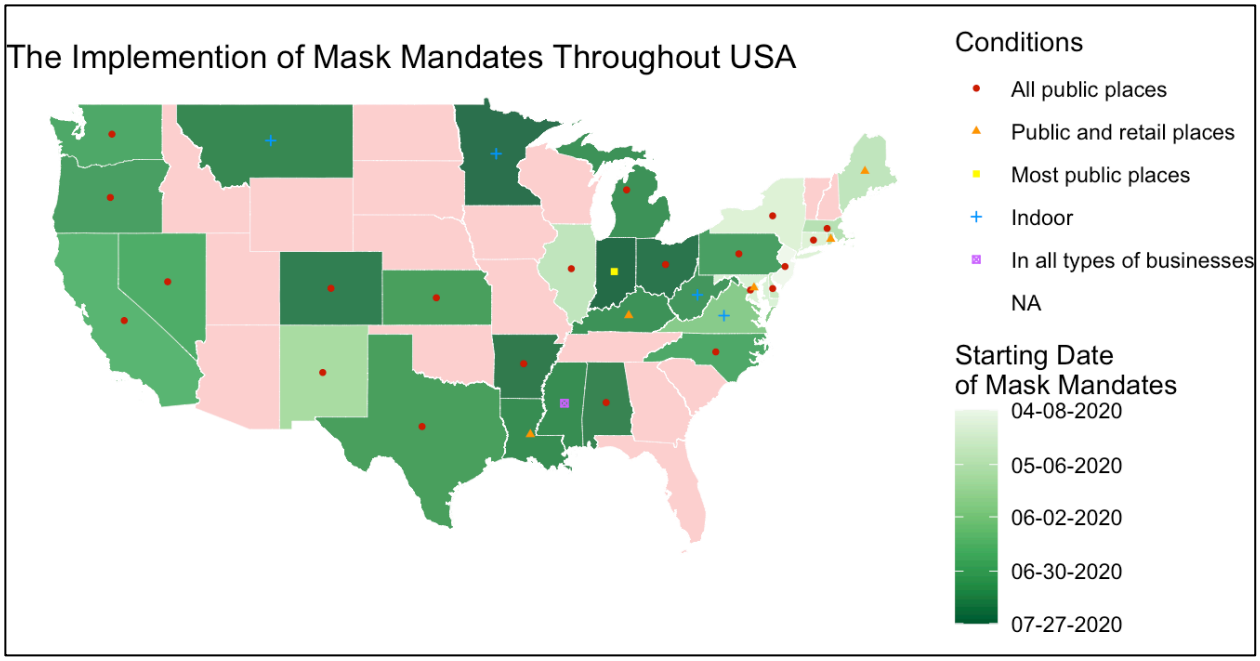


4) Plot of COVID-19 cases



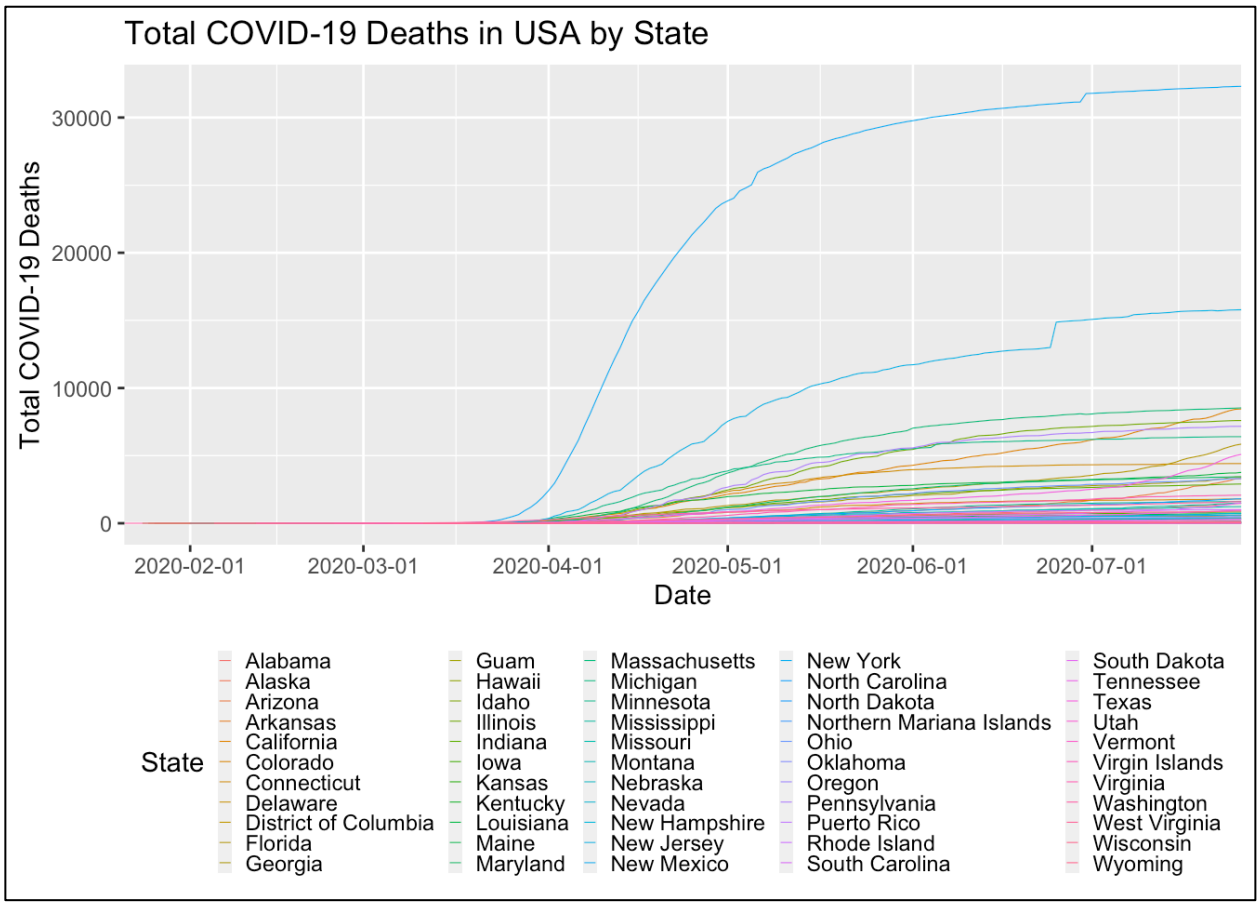
2. Extra Work

1) State-wide map of mask mandates including conditions



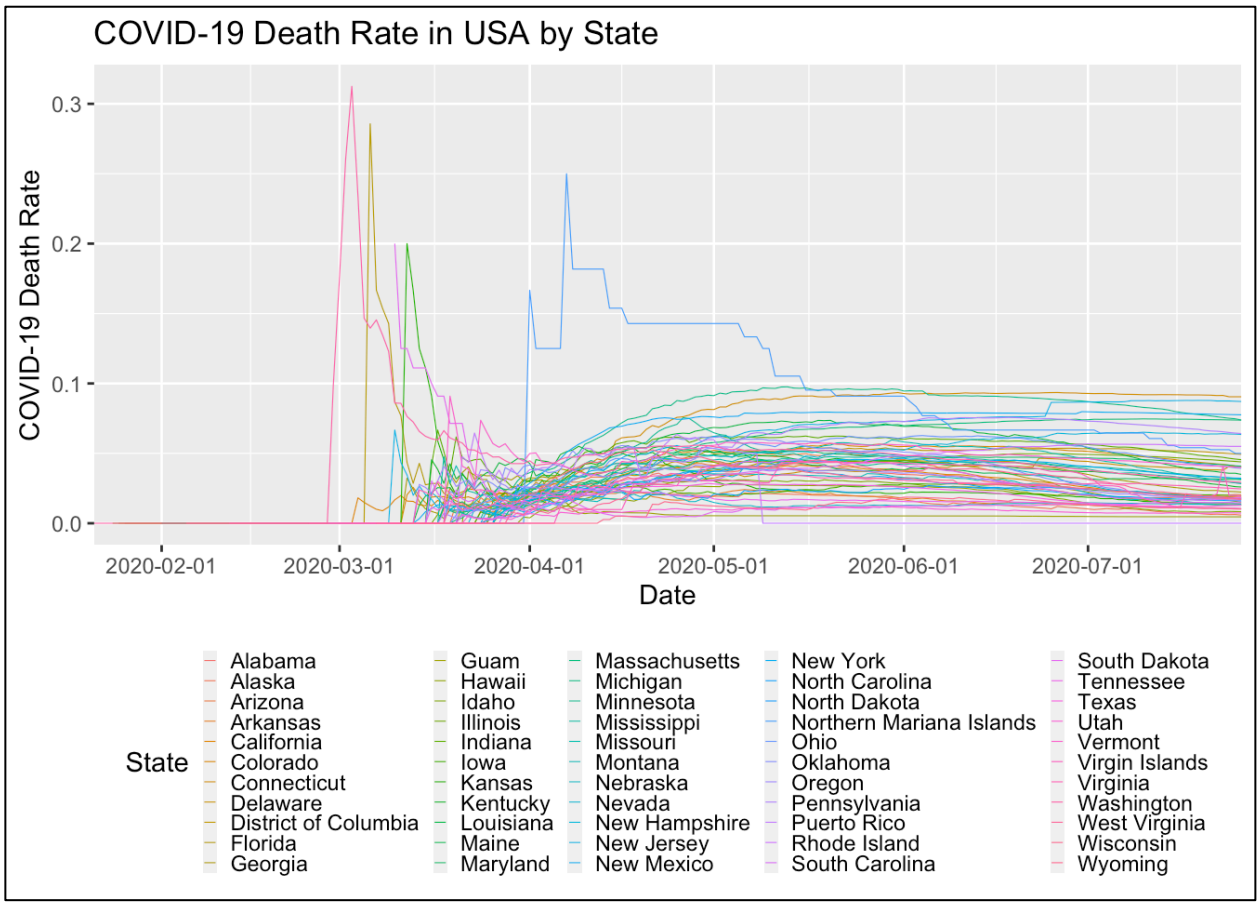
This map shows the conditions of the mask mandates on top of their starting date of the policy. I have adjusted the sequence of the conditions, from strict to loose (strict being “all public places”, loose being “in all types of businesses”). Therefore, we can see that for most states, the ones that were the latest to implement the mask policy, also tend to have the least strict policies. Dark green states (late bloomers) correlates with blue or purple points (loose conditions), while light green states (early birds) correlates with red or orange points (strict conditions)

2) Plot of COVID-19 death cases



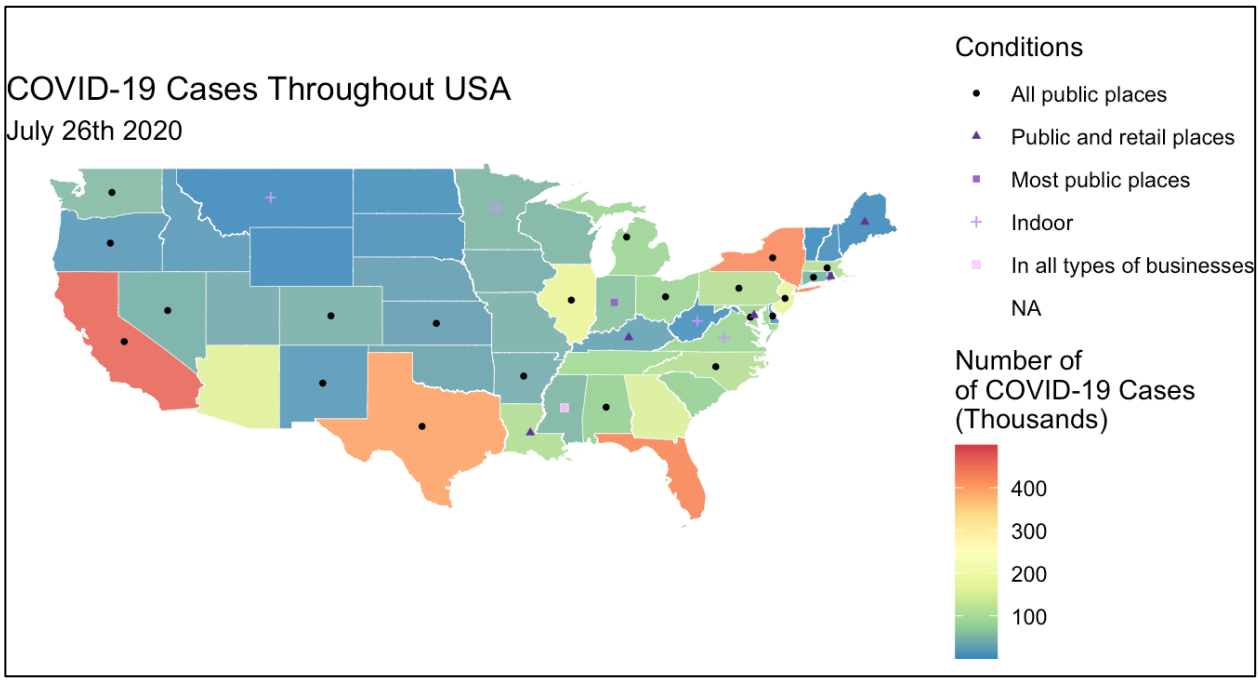
In addition, I have added plots of death cases. We can see that in the total cases plot, California (orange line), Florida (gold line) and Texas (pink line) are distinct on July 26th as they have hundreds of thousands more cases than the rest, but in the total deaths plot, they are indistinct as they are clumped with the others. This leads to the next plot:

3) Plot of COVID-19 death rate



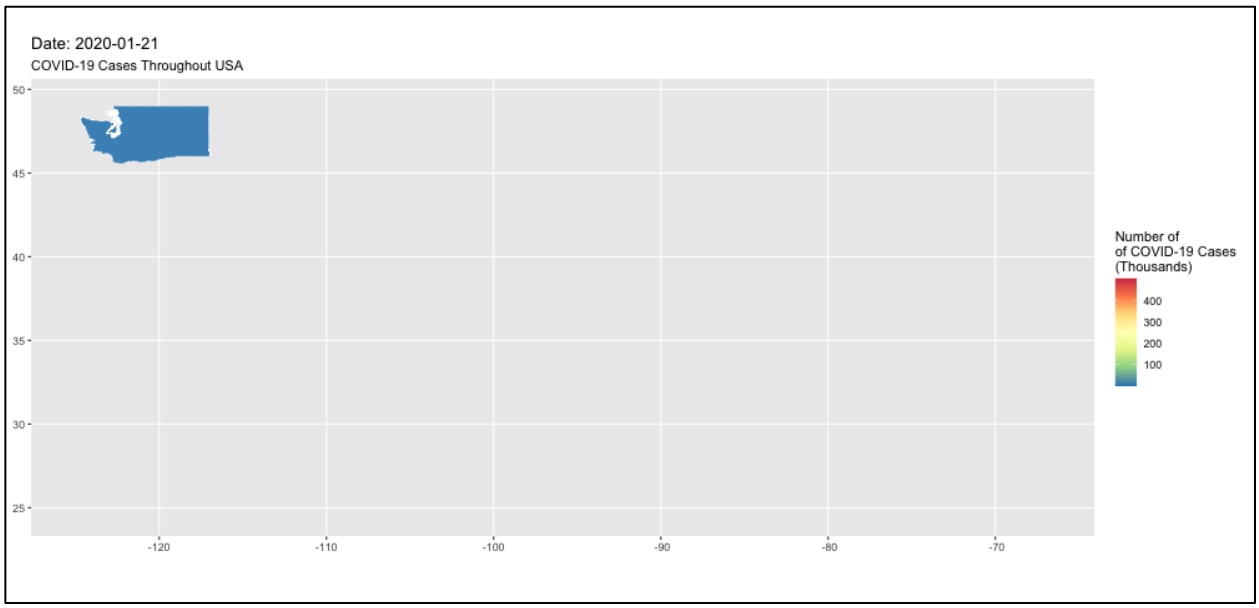
It would be more reasonable to compare the death rates (death cases/total cases) between the states. The plot reveals that a few states had spiking death rates between March and April. This is mainly because COVID-19 had just begun, and these states probably weren't prepared, as medical resources were insufficient. As time passes, experience grows, policies are implemented, finally leading to a downward scale in death rates.

4) State-wide map of COVID-19 cases



This map shows the combination of the conditions with the total cases on July 26th. There is no obvious pattern here, mostly because the conditions of the policies have been changing over time, and a static map cannot show the causal relationship between the two.

5) State-wide map of COVID-19 cases (animated version)



Last but not least, I have made an animated map version of the "Plot of COVID-19 cases". In this animated gif, the top left corner represents the date, and the colors represent the total cases on that specific date. We can see which state was infected last (West Virginia), which state spiked fast first (New York) etc. This is easier to visualize because in the plot, there are too many similar colors for each state, whereas in the animated map, we know exactly which states are in what conditions during the COVID-19.

However, because I cannot submit the gif file nor the word document, the gif becomes static. I would be happy to email or slack the gif to the professors and the teaching fellows if it is possible.