

Mandates and COVID19

A capstone project by Meredith Newhouse

Purpose

- Covid-19 has impacted the world for over a year.
- In the United States, states have set different mandates around masks, restaurants, and gatherings in an attempt to mitigate the effects of the virus.

Have these mandates been effective?

What mandates were the most critical?

- This project aims to create a model to understand the impact of the mandates on Covid cases.
- This will help us understand if mandates are effective and if governments should use them in the future.



Data Used

The data used in this project was aggregated from multiple sources

→ **Data on COVID-19 cases by state and county along with the population of each county was found on USAfacts.org**

◆ <https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/>

→ **Data on restaurant mandates, mask mandates, and gathering ban mandates were found on Data.gov**

◆ <https://catalog.data.gov/dataset/u-s-state-and-territorial-orders-closing-and-reopening-restaurants-issued-from-march-1-2020-f454b>

◆ <https://catalog.data.gov/dataset/u-s-state-and-territorial-gathering-bans-march-11-december-31-2020-by-county-by-day-79295>

◆ <https://catalog.data.gov/dataset/u-s-state-and-territorial-public-mask-mandates-from-april-10-2020-through-january-10-2021-e0ce3>

Data Manipulation

- A data table for each state was created and then organized by county and date.
- The mandates for mask usage, gatherings, and restaurants were correlated with each county by the date they were made effective in that county.
- Cases in each county were recorded with the corresponding date.
- An extra column was engineered to create Cases/Population for each county.
- Model was built to predict Cases/Population given the effective mandates in each county.

Sample of a portion of the Colorado data table, full table has 20,928 rows

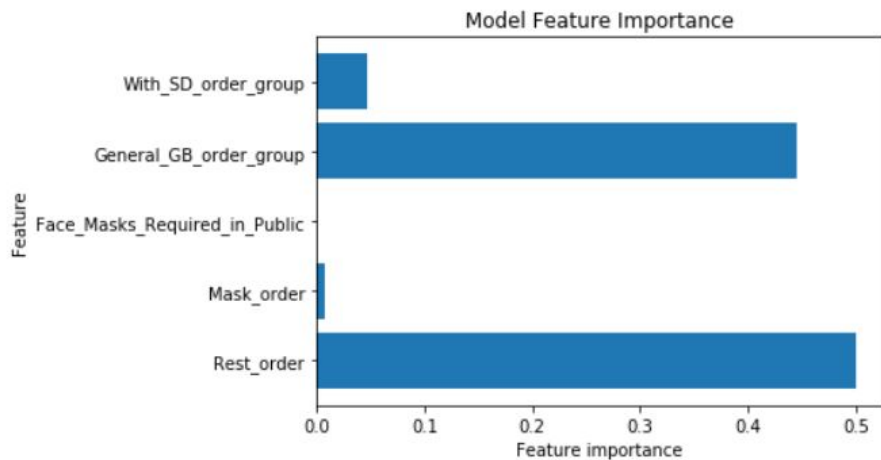
County_Name	date	Rest_order	Mask_order	Face_Masks_Required_in_Public	General_GB_order_group	With_SD_order_group	Cases	population	Cases/Population
Adams County	2020-03-11	0	0	0	1	2	0	517421	0.000000
Alamosa County	2020-03-11	0	0	0	1	2	0	16233	0.000000
Arapahoe County	2020-03-11	0	0	0	1	2	3	656590	0.000005
Archuleta County	2020-03-11	0	0	0	1	2	0	14029	0.000000
Baca County	2020-03-11	0	0	0	1	2	0	3581	0.000000

Modeling Process

Built a *Gradient Boosting Regression* model for Colorado and Florida

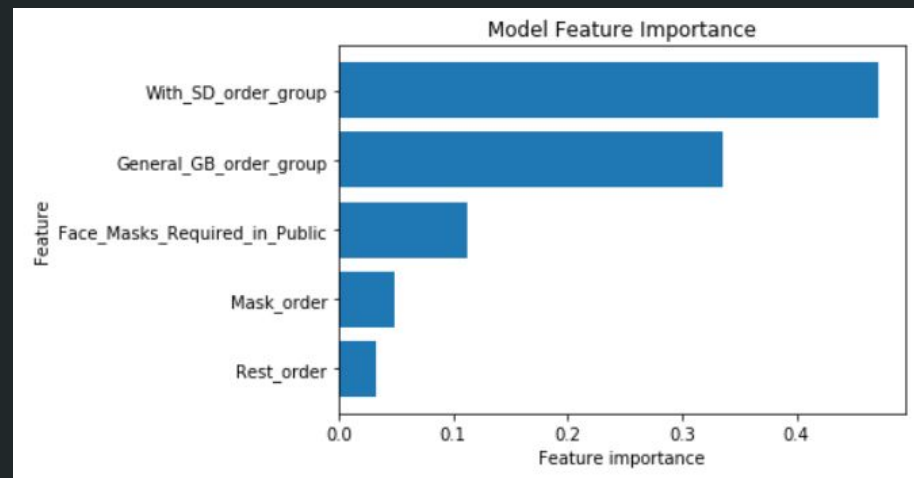
- Florida had an extra category for restaurant orders - 'Authorized to fully open'
 - Due to this category the Florida model performed best
 - Error rates,
 - Mean Absolute Error: 0.011297040577091784
 - Mean Squared Error: 0.0003035919001125868
 - Root Mean Squared Error: 0.017423888776980492
 - Cases/Population average: 0.02791
- Colorado model
 - Colorado counties were more likely to put in a mandate and keep it for a long time
 - Error rates,
 - Mean Absolute Error: 0.008024926274175495
 - Mean Squared Error: 0.0003489350913987028
 - Root Mean Squared Error: 0.01867980437260259
 - Cases/Population average: 0.01687

Florida Important Features

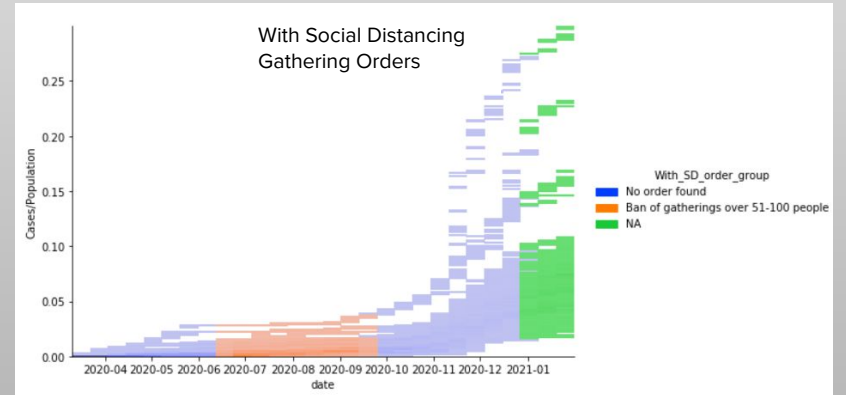
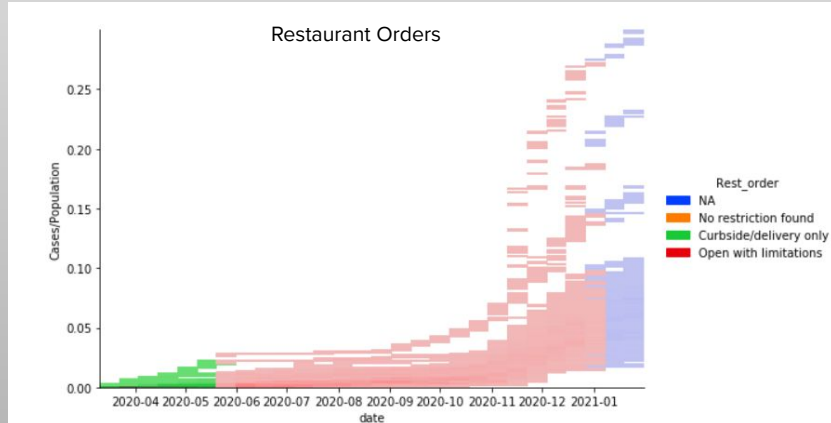
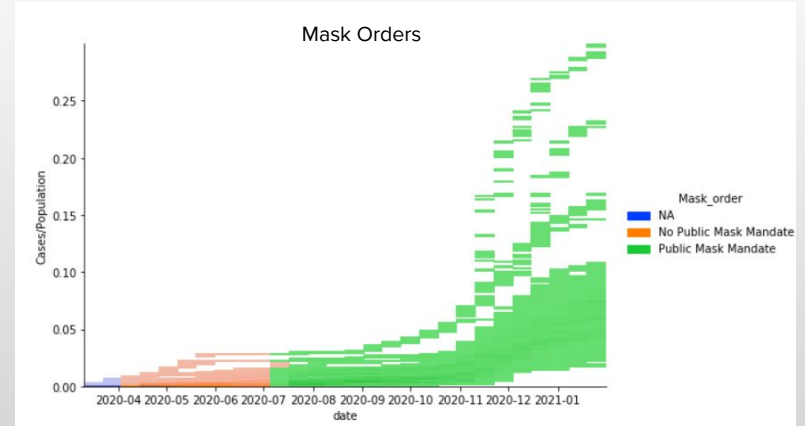
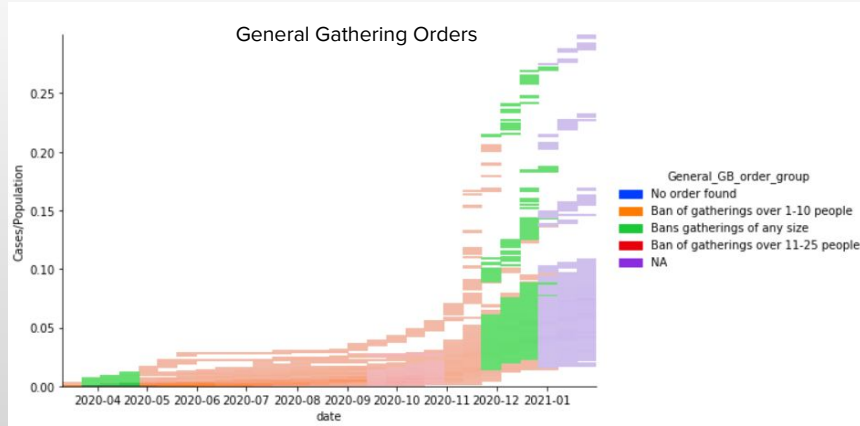


Features with the most variations proved to be the most important for the model, like restaurant orders in Florida

Colorado Important Features

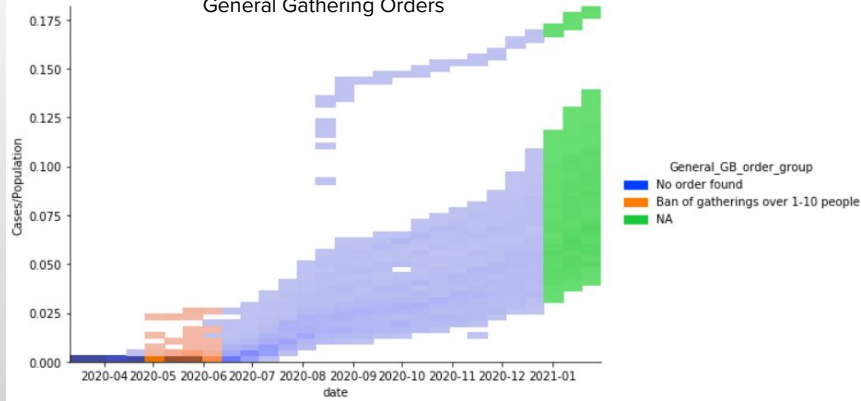


Colorado Mandates

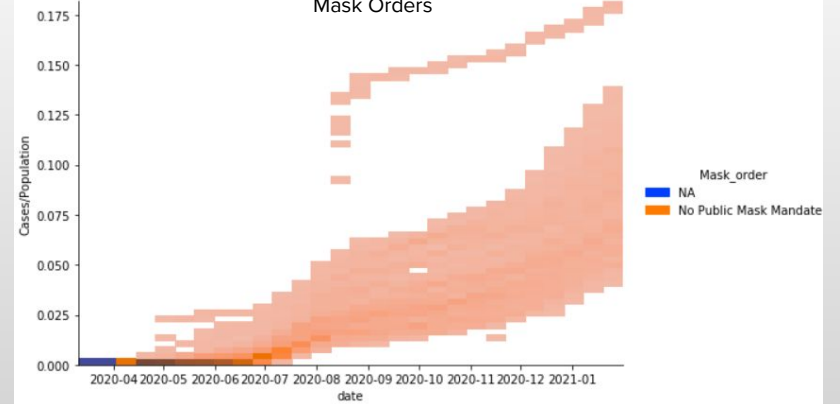


Florida Mandates

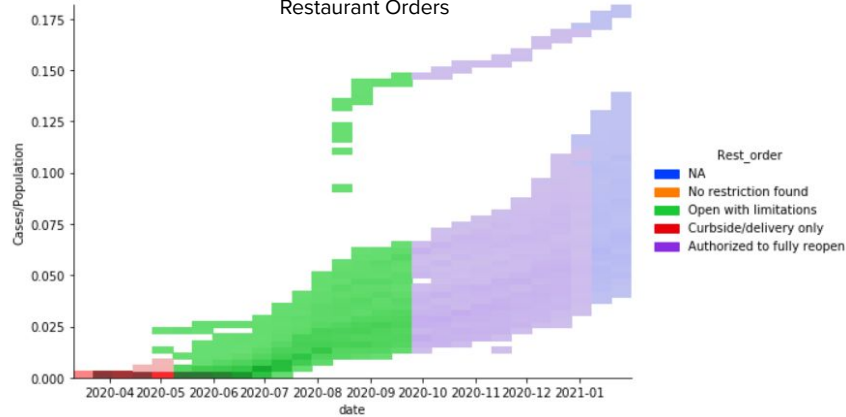
General Gathering Orders



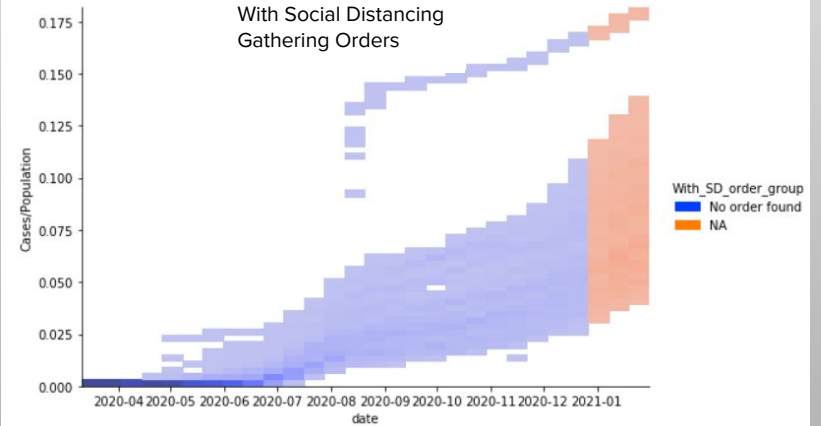
Mask Orders



Restaurant Orders


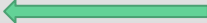


With Social Distancing Gathering Orders

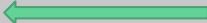


Restaurant Mandates by the Numbers

Florida restaurant orders and the average rate of cases:

Authorized to fully reopen: 0.046655 
Curbside/delivery only: 0.000488
Open with limitations: 0.015066 
NA: 0.066253

Colorado restaurant orders and the average rate of cases:

Curbside/delivery only: 0.001484
No restriction found: 0.000029
Open with limitations: 0.015408 
NA: 0.058282

Conclusions

- The implementation of mandates may have affected case rate
 - Florida average case rate = 0.02791
 - Colorado average case rate = 0.01687
- The model used Florida's implementations of restaurant orders to better predict case outcome due to its variation
- Colorado had more consistent limitations across restaurant orders so it wasn't as important for the Colorado model
- The average case rate when Florida restaurants were authorized to open: 0.046655
 - At the end of 2020 and beginning of 2021 case rate climbed to 0.066253
 - Comparatively, Colorado's case rate average climbed to 0.058282 over that time

It is clear that Florida's cases continuously climbed, where Colorado's cases stayed more consistent and only increased dramatically during the winter of 2020-2021 when cases increased dramatically across the country.

Conclusions cont.

- In the US, where travel between states is frequent, isolating states and the impact of their individual mandates is difficult.
 - However, with the data in two states that implemented mandates very differently, Florida and Colorado, it is clear that mandates may have helped mitigate the impact of the virus.
- From the model, we can see that the restaurant orders, and the removal of restrictions, in Florida had an impact on the case rate predictions made by the model.
- Florida's restaurant mandates, and lack of mandates, helped the model predict the case rate. This indicates that having restaurants fully reopen, along with no mask mandates, and less gathering bans, may negatively impact COVID case rate.

The use of mandates are important, and governments should continue to implement them based on current risks with the current COVID19 pandemic and should use them for pandemics in the future.

Next Steps

- Analysis across all 50 states and considering federal mandates may help understand the impact of mandates more.
- Analysis of other countries and their mandates.
- Analysis of other measures used to mitigate the virus like testing frequency and quarantine protocols.
- Due to the 14 day incubation period for COVID19 symptoms to develop, it may be helpful to offset cases by two weeks compared to mandate implementation.

Thank You

Check out my github repo here:

https://github.com/newhousem/Capstone_Project

Contact me: meredithnewhouse@gmail.com

Thank you to data.gov and USAfacts.org for providing the data sets used in this analysis and Yish for helping to answer all of my questions.