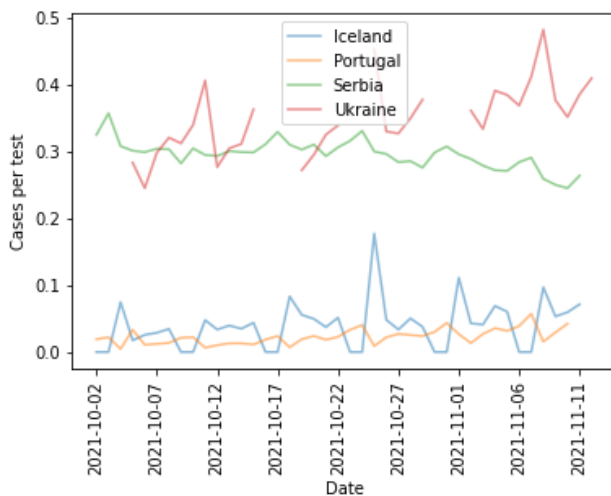


CSC343 Phase 3 Report

1. How did people who were fully/partially vaccinated respond to COVID-19 compared to those who were unvaccinated?

We decided to answer this question using a few specific countries. To have a meaningful comparison, we decided to compare two countries with high vaccination rates, and two countries with relatively low vaccination rates. After calculating the percentage of the population that was vaccinated for each country (this table can be seen in the demo under the label Percent Vaccinated), we chose the following two countries with high vaccination rates: Portugal (88%), Iceland (83%), and the following ones with low rates: Serbia(46%) and Ukraine (28%).

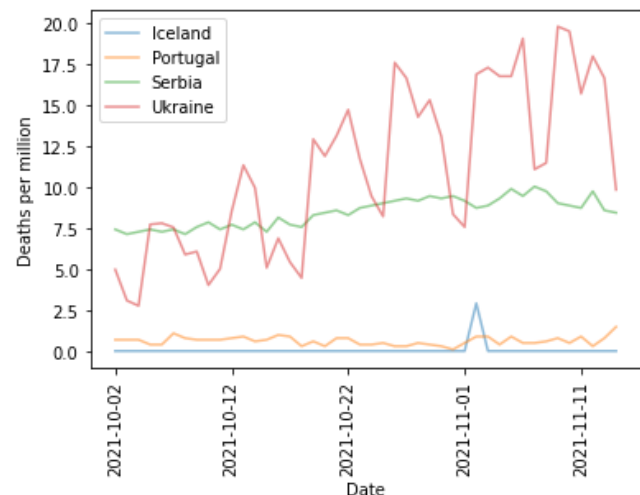


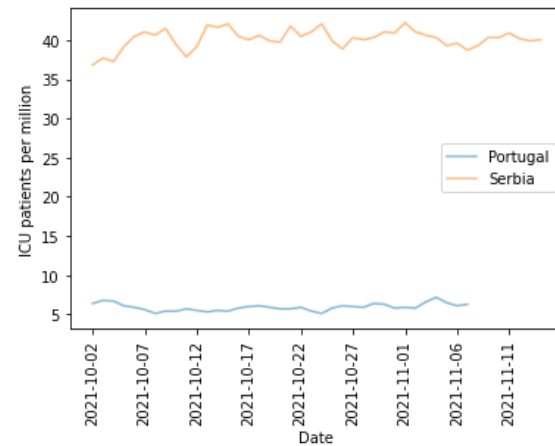
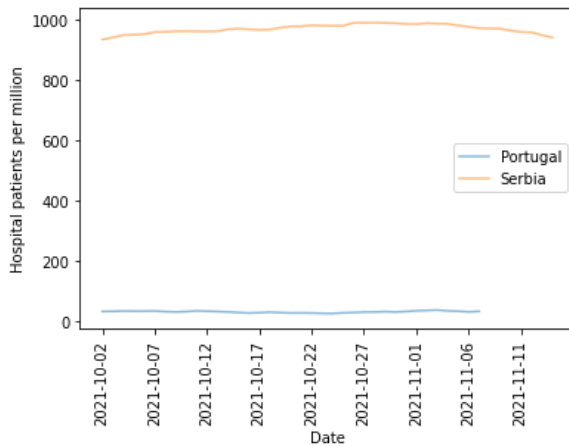
We began by comparing the number of new COVID cases for each country, adjusted for the number of tests carried out for the past month.

As can be seen from the figure to the left (and in the demo under Question 1 with the labels Result 1-4), Portugal and Iceland have substantially less cases per test as opposed to Serbia and Ukraine. It is evident that at least for these four samples, the countries with higher vaccination rates have considerably less cases per test.

To compare the response to Covid-19 between vaccinated and unvaccinated people, we also thought to compare Covid related deaths. In the figure to the right, we compared deaths per million. Once again, the countries with higher vaccination rates had significantly lower Covid-19 related deaths.

Finally, we tried to compare the number of Covid related ICU and hospital patients. Since this data was only available for Portugal and Serbia, those were the countries we compared.





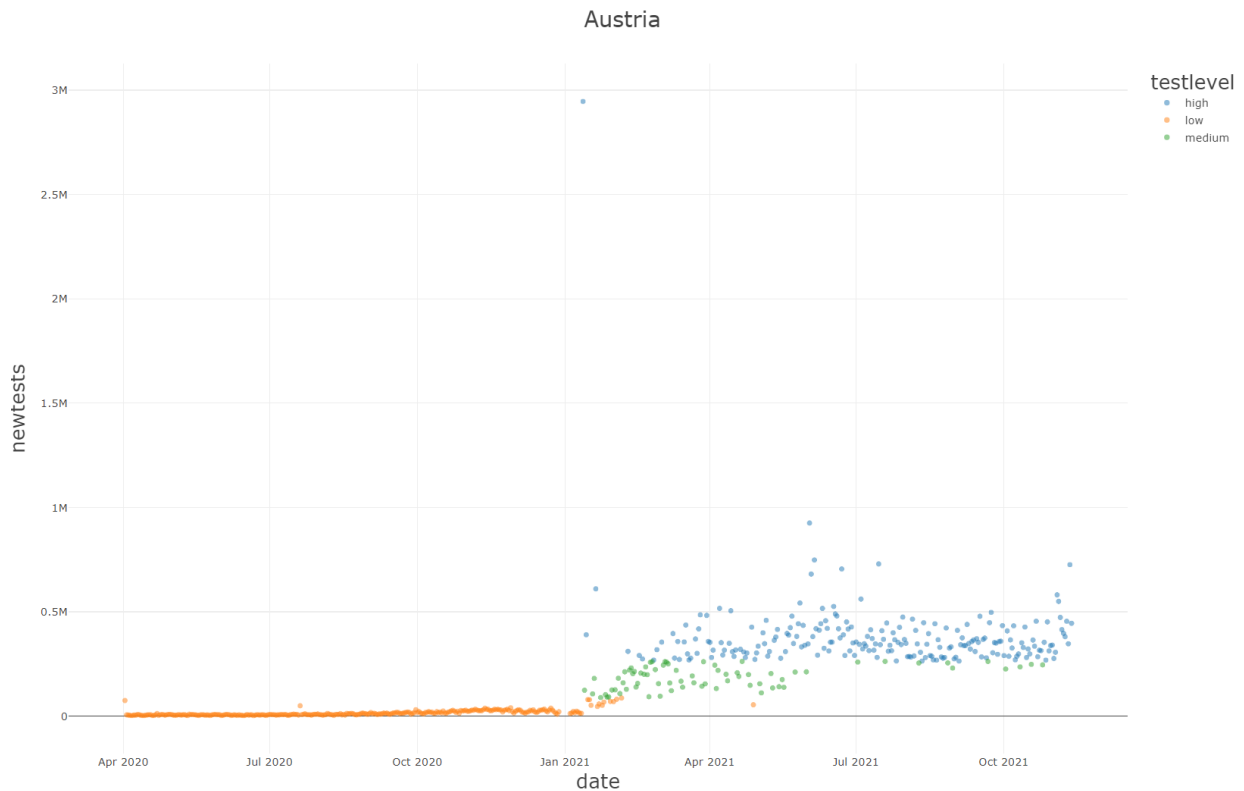
As can be seen in the above figures, Serbia has many more hospital and ICU patients compared to Portugal. This implies that the vaccinations help reduce the severity of Covid-19, as Portugal has a lower number of people in critical care than Serbia and a higher vaccination rate.

From the above results, we can see that Covid-19 vaccinations significantly reduced the number of new Covid-19 cases, the number of Covid-19 related deaths, and the severity of the virus once contracted.

2. How did testing procedures and other COVID-19 responses in a country affect the spread of COVID-19?

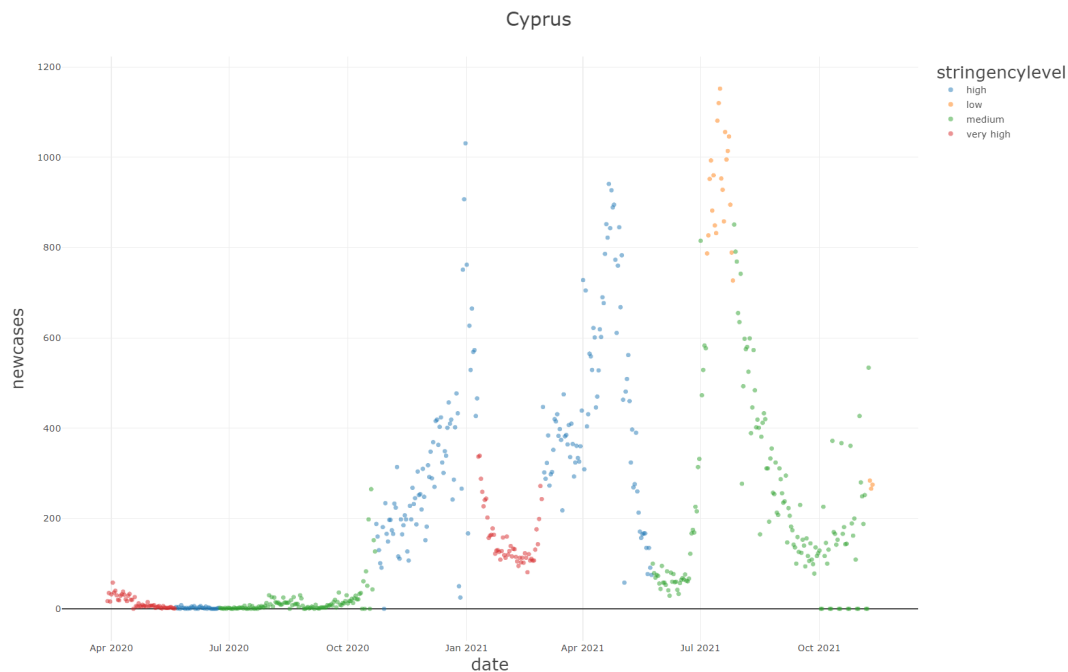
We will split the question into two queries: the first being how the number of new tests relates to the number of new cases, and the second being how the stringency index relates to the number of new cases.

It is impractical to investigate every country, so for the first query, we decided to use the country with the largest difference in their maximum and minimum number of new tests on a given date, divided by population (for a bigger contrast to better show the relationships), which we found to be Austria. To compare the intensity of testing procedures, we created a new categorical variable that separates the number of new tests into 3 levels: low, medium, and high.



From the graph, we can see that when the testing level is low, the number of new cases is also low. We noticed that near Feb 2021, Austria raised the testing level and the number of new cases also increased. Research tells us that Austria adopted a mass-testing strategy near the beginning of 2021. The graph suggests that the mass-testing probably helped identify many who were already infected. The strategy also may have helped contain the spread of the virus, since the number of new cases remained roughly the same, instead of increasing.

For the second query, we decided to use the country with the largest difference in their maximum and minimum stringency index. We found that there are 11 countries that are tied. So from those, we decided to choose the country with the highest total tests divided by population, which turns out to be Cyprus. To compare the strictness of the COVID-19 regulations and responses, we created a new column that separates the stringency index into 4 levels: low, medium, high, and very high.

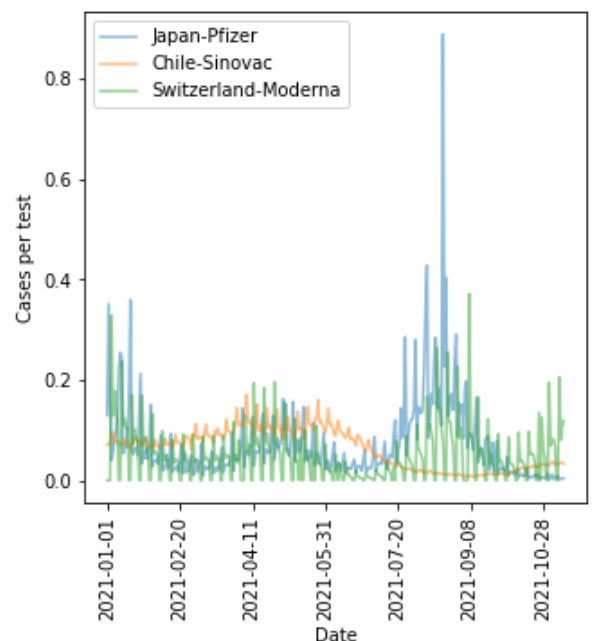


From this graph, we see that at first, Cyprus had a very high stringency level, which seems to slightly lower the number of new cases. A recurring trend seems to be that once the number of new cases are low, Cyprus relaxes regulations. However, once the stringency level reaches medium, the number of new cases start increasing after a while. This causes Cyprus to raise stringency level again, which then results in a decrease in new cases. Strangely, after July 2021, the stringency level of Cyprus remains medium and even drops to low, despite having a similar pattern.

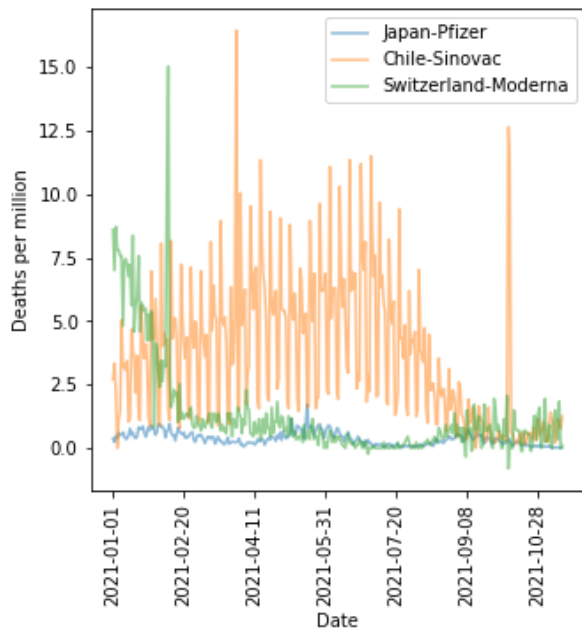
3. How does having a different manufacturer affect the efficacy of the vaccine for COVID-19?

To answer this question, we first determined the manufacturer ratios for each country with available data, which is available under the label "Vaccine Ratios" in the demo. From these countries, we chose three countries that had the largest ratios for one vaccine manufacturer. The countries we chose were: Japan (96% Pfizer), Chile (75% Sinovac), and Switzerland (63% Moderna). While comparing vaccines, it was also important to note that the overall vaccination rates for these countries were relatively equal with 79%, 87%, and 66%, respectively.

Similar to question 1, we compared the cases per test and the deaths per million for the countries. As can be seen in the figure to the right (and in the demo under Question 3 with the labels Results 1-4), it seems that other than a large spike from 2021-07-20 to 2021-09-08, Pfizer has the



fewest cases per test, with Sinovac and Moderna being relatively equal to each other.



In the figure to the left, we compared the deaths per million for the different vaccines. Pfizer consistently has the lowest deaths per million, while Sinovac has the highest death rate compared to Pfizer and Moderna.

While these graphs are in no way conclusive in deciding which vaccines are the most effective, given the data we have we see that Pfizer generally performs the best in both the tests per case and deaths per million metrics.