Mental Health Disorders Pre & Post Pandemic

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Economics 2nd

Probability and Statistics

Covid-19 has been the most relevant topic and the main concern of the world of the past year. This crisis not only affected countries economies, but also affected people as individuals and specially the mental health issues cases during the lockdown. With our project, we wanted to study the correlation between the pandemic and how it has affected the rate level of different mental health disorders across the world. Our hypothesis states that if a country has been badly impacted by Covid-19, then mental health disorders will exponentially grow. We expect that the countries that were most affected by the pandemic and struggled the most to recover, will show higher levels of mental health disorders from pre pandemic to post-pandemic.

The population we used were the following countries:

1. Canada
2. USA
3. Japan
4. UK
5. South Korea
6. Iran
7. Italy

Our variables were:

1. Anxiety disorders
2. Bipolar affective disorder
3. Depression
4. Eating disorders
5. Obsessive compulsive disorder
6. Paranoia
7. Post-traumatic stress disorder
8. Psychosis

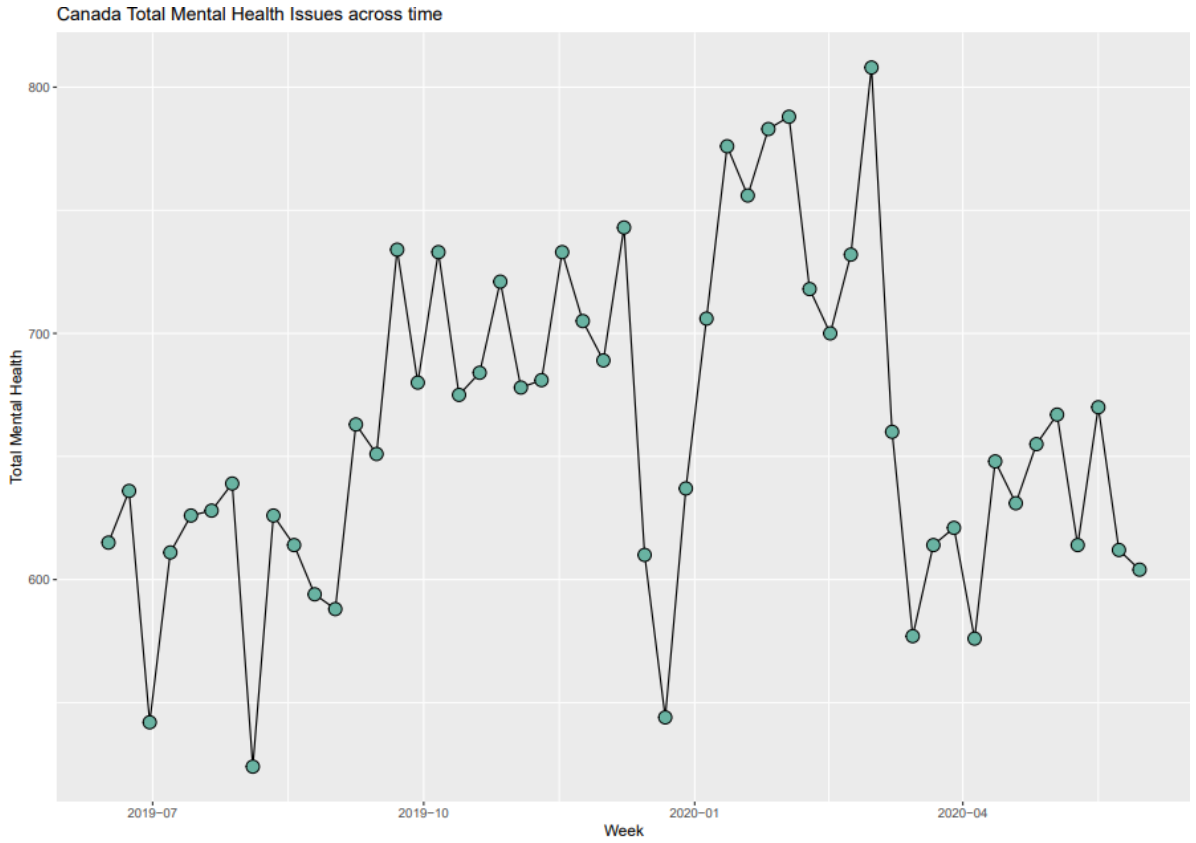
To begin our analysis we downloaded the data from kaggle which represented the mental health issues of the seven different countries we are going to analyze across time, specifically from June 2019 to May 2020, which covers the pre and post pandemic events.

First we decided to graph, for each country, the sum of its total mental health issues across time in order to study it's variation and especially to analyze the period when the pandemic arrived. We wanted to see from the macro perspective if there was a remarkable change as a consequence of the break of the pandemic.

Canada

In Canada's graph we can see that the variables had been very volatile across time and this volatility hasn't shown a constant growth of mental health issues. However, there is a sudden drop in cases at the end of December 2019.

However, during March 2020, we observe that there is a sudden increase in cases which coincides with the time Canada started taking the first Covid-19 measures. On March 17 they declared a state of emergency and by March 28 the unemployment figures for the month of March were that the economy had shed 1,000,000 jobs, pushing the official jobless rate to 7.8 percent. The sudden drop of cases also coincides with the declaration of a state of emergency.

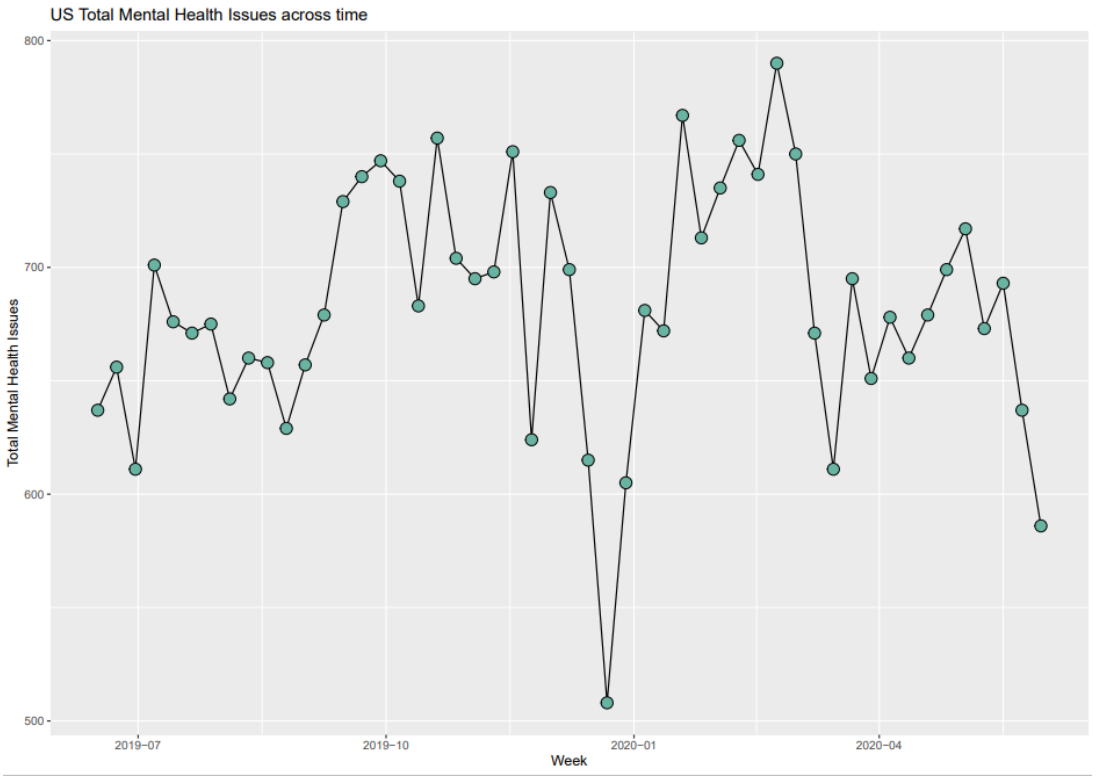


Graph 1: Canada's Total Mental Health Issues Across Time

United States of America

Seeing the total number of mental health disorders during the selected period of time, we observe that the amount of cases are very volatile, fluctuating a lot with many maximums and minimus and without a constant rate of growth. Around December of 2019 there was a sudden drop in cases, which can be related to the start of the Covid-19 in the country, even though the country didn't declare the pandemic as oficial until the next year. Between January and March 2020 there was an increase in cases which can be caused by the spread of Covid-19 and people starting to have more mental health issues.

In April there is again a sudden decrease of the cases that likely occurred due to the fact that this was the time when covid was starting to be taken seriously and quarentines were made. As a consequence these cases stopped being recorded.



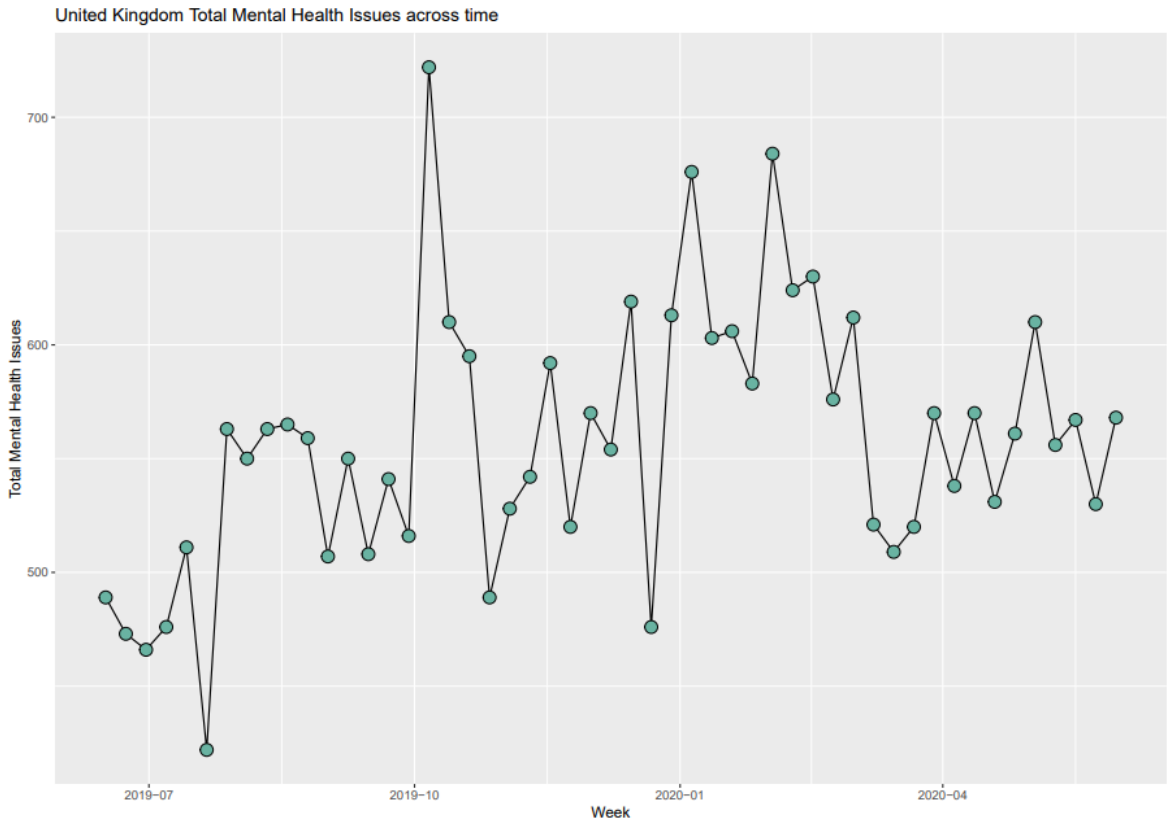
Graph 2: US Total Mental Health Issues Across Time

United Kingdom

The UK, like the US, had a high volatility of cases. There is a clear maximum around October 2019, this could have happened because around this time the Brexit deal was being made and this could have provoked a lot of anxiety in UK citicents. Like in the US, there is also a drop of cases around December 2019 and also around March, this can be attributed to

the fact of starting the lockdowns and people focusing more on the pandemic than recording mental health issues . In fact, the UK started it's lockdown around the 23rd of March 2020.

As a remark we can see that although the cases are relatively volatile, there is a subtle increasing tendency. A reason for this could be that the unemployment rate increased from 3.9% in December 2019 to eventually getting to 5.2% in October 2020.



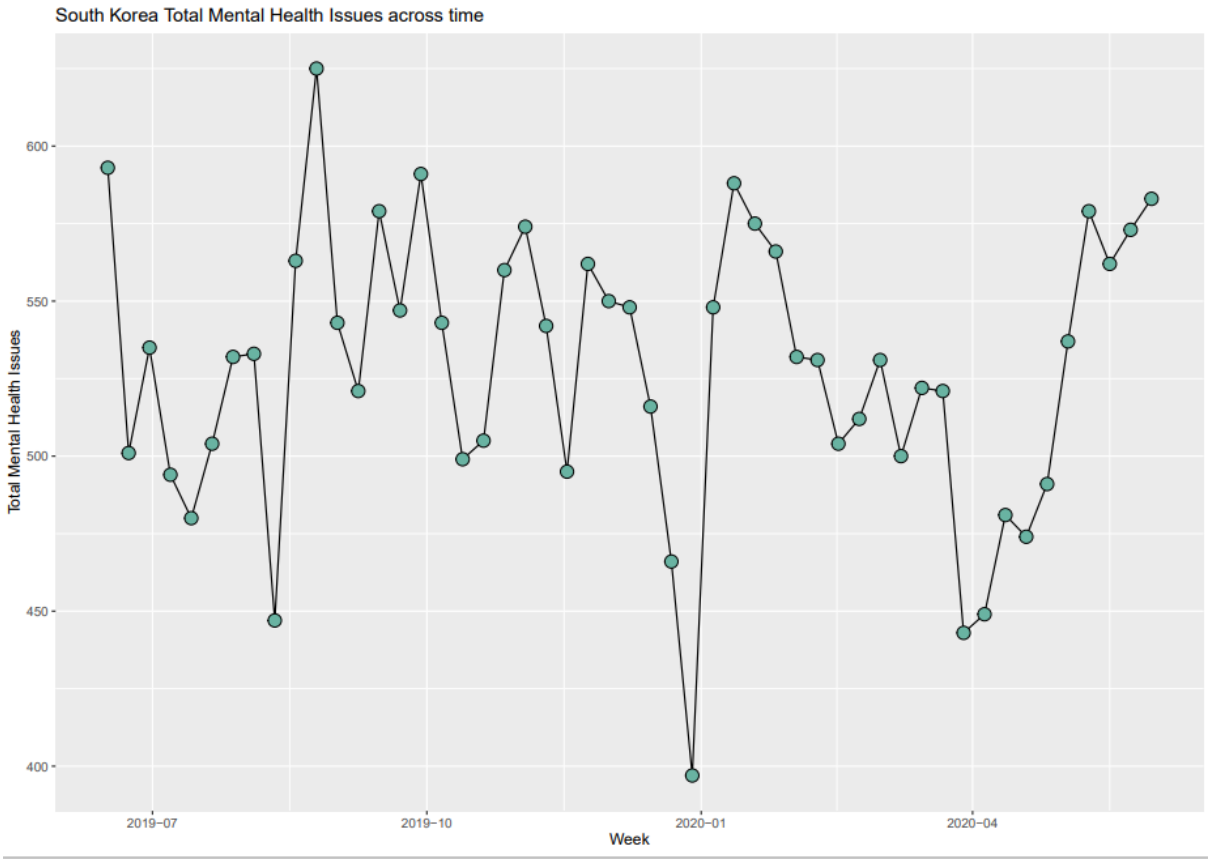
Graph 3: UK Total Mental Health Issues Across Time

South Korea

South Korea's one is even more volatile than the rest, with a lot of distincts maximums and minimums. Political tensions between South Korea and other countries around 2019 could be the case for such dispersion of points in the graph across time.

Like the other countries there is a sudden drop around December 2019, caused by the lack of information received or data collected. This country stands out because, even though they had a drop in cases around March likely caused by the pandemic, it is not as big as the other countries had. This could be due to the fact that South Korea was one of the most effective countries containing the virus. It is also important to remark that after March, the record of cases started again to increase, maybe to the fact of rapid recovery or adapting fast

to the new era that Covid-19 created, which helped to resume the MHI cases and showed this increasing trend.

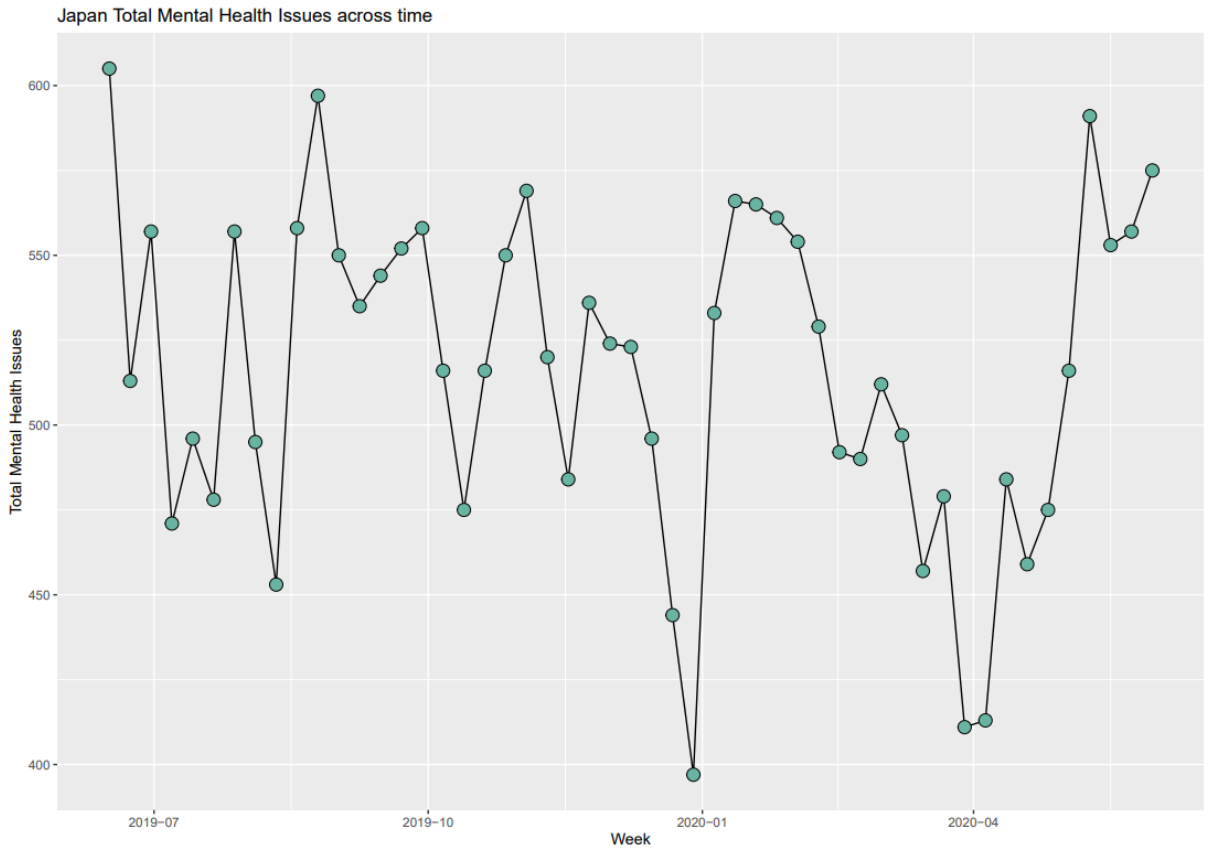


Graph 4: South Korea Total Mental Health Issues Across Time

Japan

Japan is an interesting case since its maximum was way before the covid outbreak. Summer 2019 was a season of many disasters. Beginning on June 18 where the Yamagata earthquake impacted Japan, followed by the typhoon season from August to October 2019. These events might be the cause of a lot of anxiety, depression and loss in Japanese society and it could explain the first and following peaks of this period.

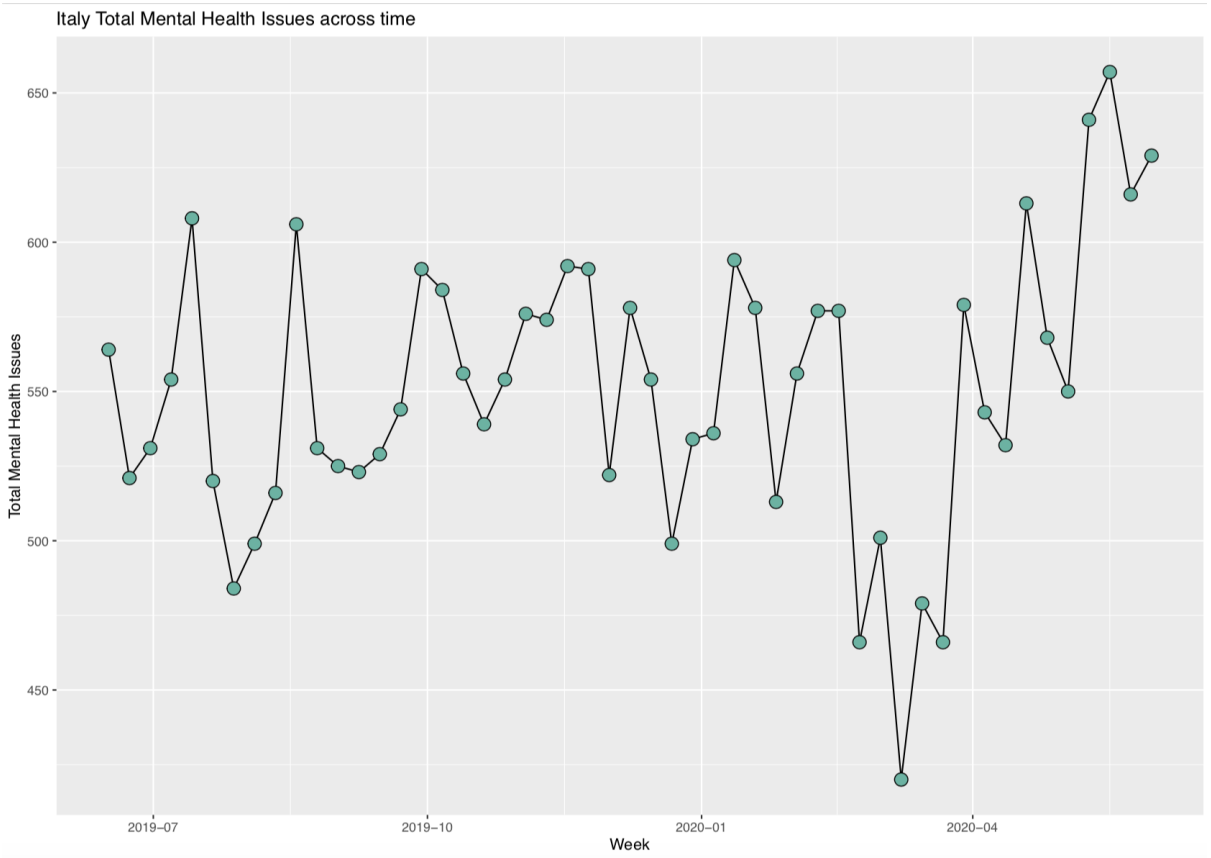
Like in the other countries there is a sudden drop of cases around the end of December followed by a drop at the beginning of April which coincides with the declaration of the state of emergency likely due to the fact that cases stopped being recorded. After these events, the total mental health issues cases showed a pattern of growth which could reflect the return of recording mental health issues (MHI) cases and how the pandemic affected people's mental health in Japan.



Graph 5: Japan Total Mental Health Issues Across Time

Italy

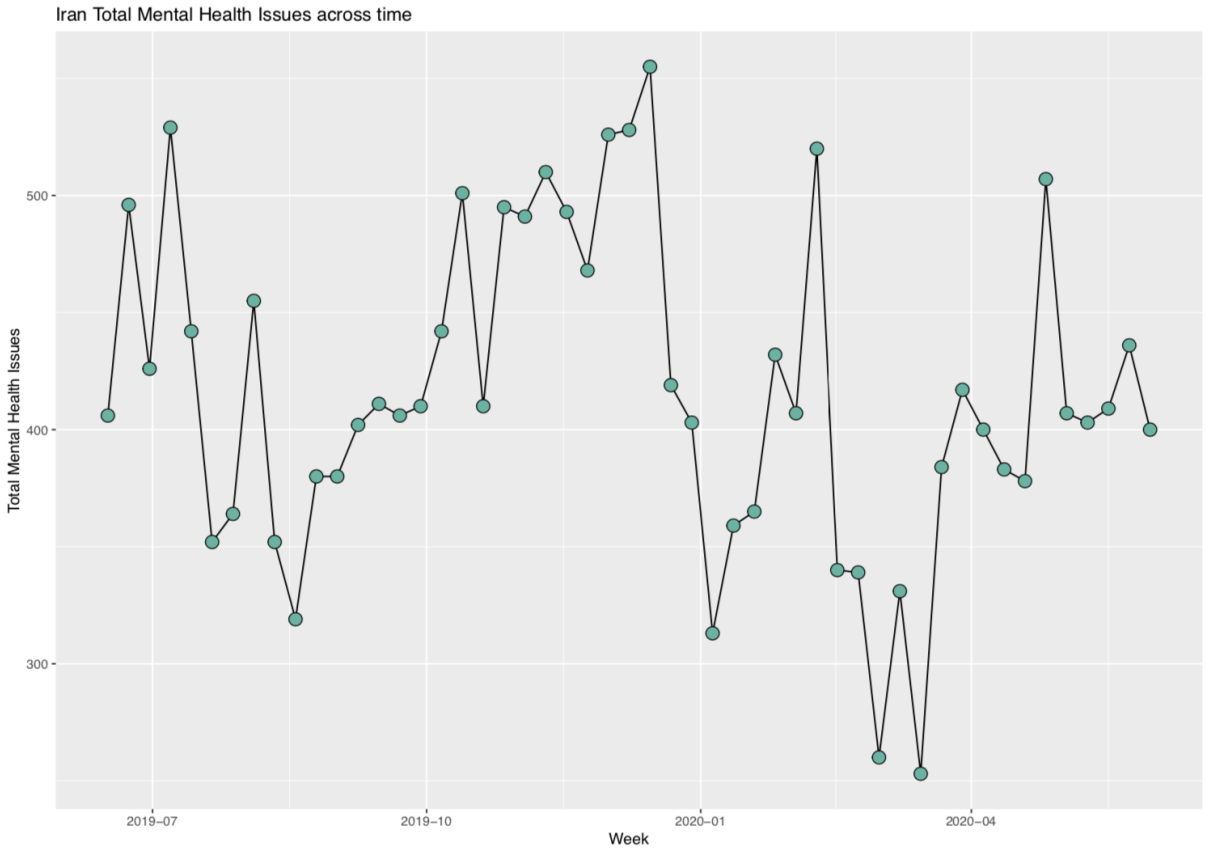
In Italy, the first covid outbreak occurred during the second half of February 2020. In the graph, we can observe that before that date, the cases of mental health disorders followed a certain trend however, right as Covid-19 hits the country at the end of February and beginning of March, there is a big drop in MHI cases, reaching its lowest in the middle of March, right were Italy faced one of the worst effects of the pandemic. We found this really interesting as we had hypothesized that the opposite would happen and that cases would increase as the pandemic hit. This could be due to the fact that hospitals were solely focused on covid cases and psychiatric wards were diverted to treat patients with covid. The country was so busy dealing with the virus, hospitals were completely full and therapists and mental health facilities closed, therefore it became extremely hard to record the cases. In reality, we all agree that if the actual cases were recorded, the graph would show that mental health issues would have actually increased.



Graph 6: Italy Total Mental Health Issues Across Time

Iran

Iran is classified as a developing country, but in many ways it can be considered to be developed as its healthcare system is not underdeveloped. However, mental health issues are present in Iran as ⅕ of people have a mental illness. The problem is that many don't receive any treatment and only about 25% of people get the correct treatment. As seen on the graph below, we can see that mental health issues slightly decreased at the beginning of 2019, but near August 2019 cases started to increase. This could be related to the fact that the country has started an initiative to lessen the inequality of primary health care between urban and rural areas. Meaning that there is a high chance that there have been more recorded cases of mental illnesses as the gap started to decrease. A huge drop was seen in December 2019 as Covid-19 cases started to rise in Iran. Iran was the worst affected country in the Middle East and North Africa region. As mentioned before, many healthcare institutions started diverting their attention to Covid-19 cases rather than mental health issues. As the outbreak progressed they started to neglect the reports of this mental health issue. As covid cases started to decrease later on in 2020, we can see that there is a volatile increase in mental health issues. Though records were now collected, the pandemic caused lots of troubles for many. Not only did unemployment worsen the mental health of many, the various deaths due to covid might have also affected the number of mental health cases in Iran.



Graph 7: Iran Total Mental Health Issues Across Time

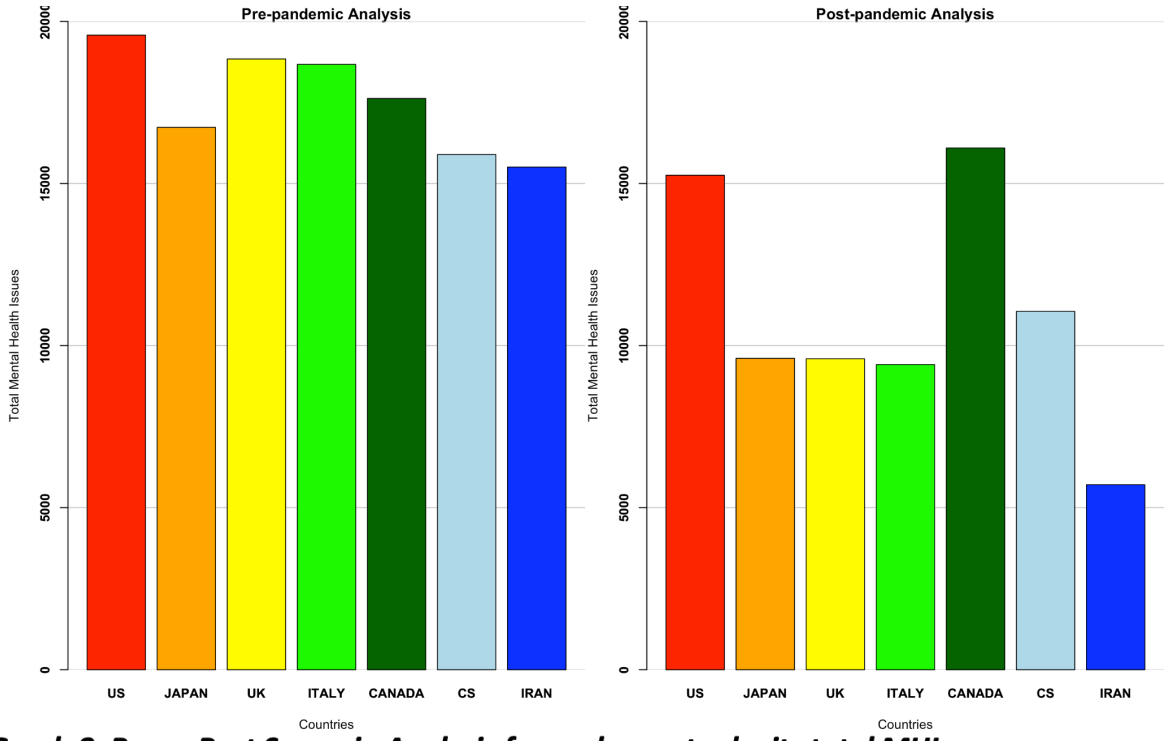
Having analyzed the graph of each country and the total mental health issues, we realized that it was important to determine the approximate date in our graphs, with the date in which the pandemic was officially started in each country, in order to have an accurate outcome that would help us to compare the cases before and after pandemic for each country. Finally we chose the following dates:

Table 1.

Country	Date we chose to indicate the beginning of the pandemic
US	29-12-2019
Japan	19-12-2019
UK	02-02-2020
South Korea	03-01-2020
Italy	02-02-2020
Iran	16-02-2020

Canada	15-12-2019

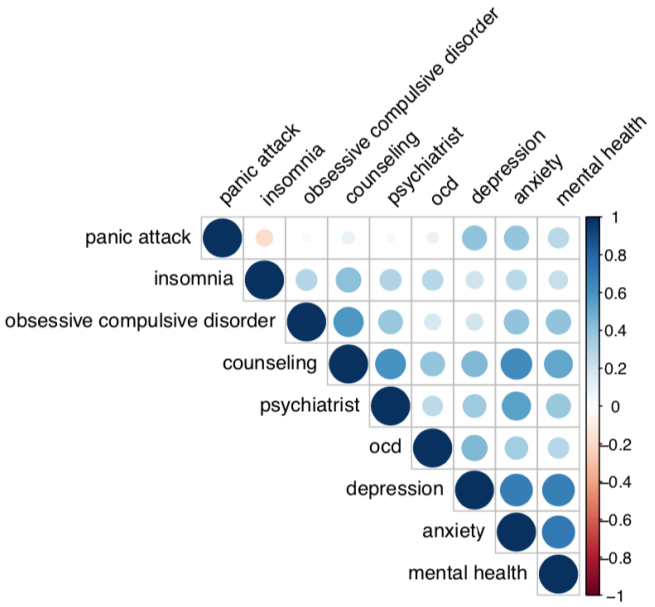
We examine a pre and post pandemic scenario for each country with their respective total MHI, to see if there was a change caused by Covid-19 lockdown or simply to see if the pandemic had any impact on the overall cases of MHI, but as we said before, the pandemic hit countries in different dates and if we had chosen a general date to determine pre and post pandemic scenario, the result might have been inexact to what we wanted to analyze. As we can observe, the graph #8 shows a decrease in the number of cases of all mental health issues, but this decrease does not necessarily represent a "natural" decrease of MHI, but instead it can be attributed for the lack of registered cases during the pandemic and the global lockdown as we saw in the previous graphs where some valleys were form representing this absence of data.



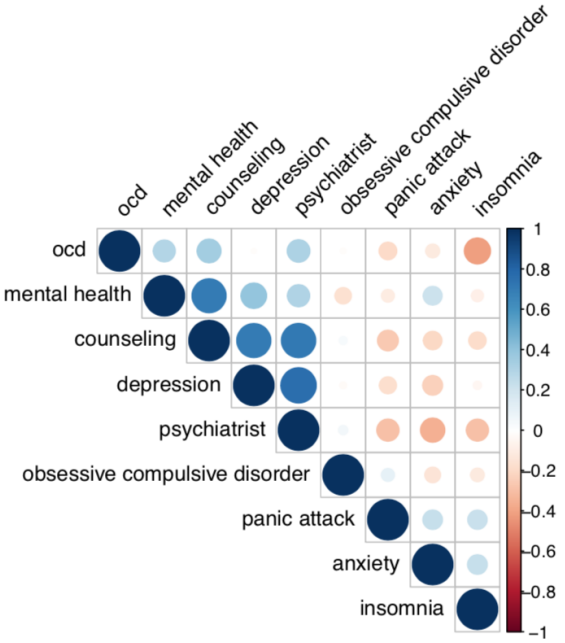
Graph 8: Pre vs Post Scenario Analysis for each country by its total MHI

From graph #8, we decided to select a sample from the population so we could make a deeper analysis first by country and then by specific MHI. The countries we selected were Italy, Iran and Canada as they would provide us with varied results of the pandemic. Italy was the first Western democratic country that faced the Covid-19 crisis, Iran was the worst affected country in the middle east and Canada was one of the few countries that managed the pandemic decently.

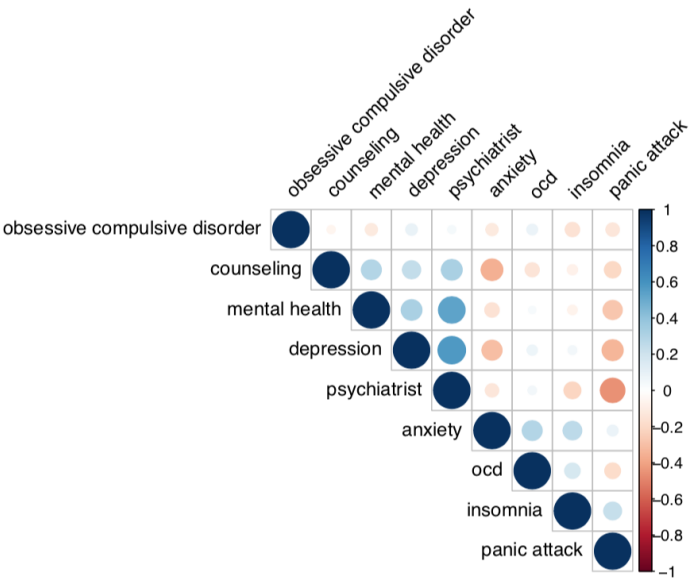
Once we chose the sample of three countries from the seven, we decided to create correlation matrices for each country (Canada, Italy & Iran), which we portrayed in a heat map, in order to observe which illnesses have the greatest correlation. Departing from that, we chose those illnesses which draw more attention so that we can make a more profound analysis.



Graph 9: Canada Heat Map Correlations



Graph 10: Iran Heat Map Correlations



Graph 11: Italy Heat Map Correlations

As seen in the correlation matrices above, we found that the mental health disorders that are most prevalent in all three countries, and the ones that called more our attention, are depression, anxiety and OCD. These specific samples of illnesses are more easily diagnosed than others, and since the pandemic outbreak started, it was easier to have a record of these MHI and that is another reason why we chose these MHI.

Once we decided the three countries and the three MHI we wanted to analyze more deeply, we needed to specify again the dates of the beginning of the pandemic and also the pre pandemic period with the purpose of taking away those valleys in the graphs where the amount of cases decreased due to Covid-19 lockdown, so the analysis wouldnt be bias by those outliers. The new dates are the following:

Table 2.

Country	Pre- pandemic period	Post- pandemic period
Canada	(16-06-2019)-(8-12-19)	(05-01-2020)-(31-05-2020)
Iran	(16-06-2019)-(15-12-2019)	(16-02-2020)-(31-05-2020)
Italy	(16-06-2019)-(19-02-2020)	(29-03-2020)-(31-05-2020)

In the previous table, the dates that define the pre and post periods were chosen according to the points in the graphics before the values of the cases went down and after the valley passed and the new data collection started to appear after the Covid-19 impacted, so it would be more cohesive for the rest of the analysis. For each country we calculated the mean of the pre pandemic period and post pandemic period for the three mental health issues (anxiety, ocd and depression). And with this average we create the following tables that show us the values. The tables created are:

Canada:

	Mental_health_issues_cnd	period	value_1
1	depression	Pre_pandemic	78.92
2	depression	Post_pandemic	85.59
3	anxiety	Pre_pandemic	84.50
4	anxiety	Post_pandemic	86.59
5	OCD	Pre_pandemic	55.84
6	OCD	Post_pandemic	54.54

Iran:

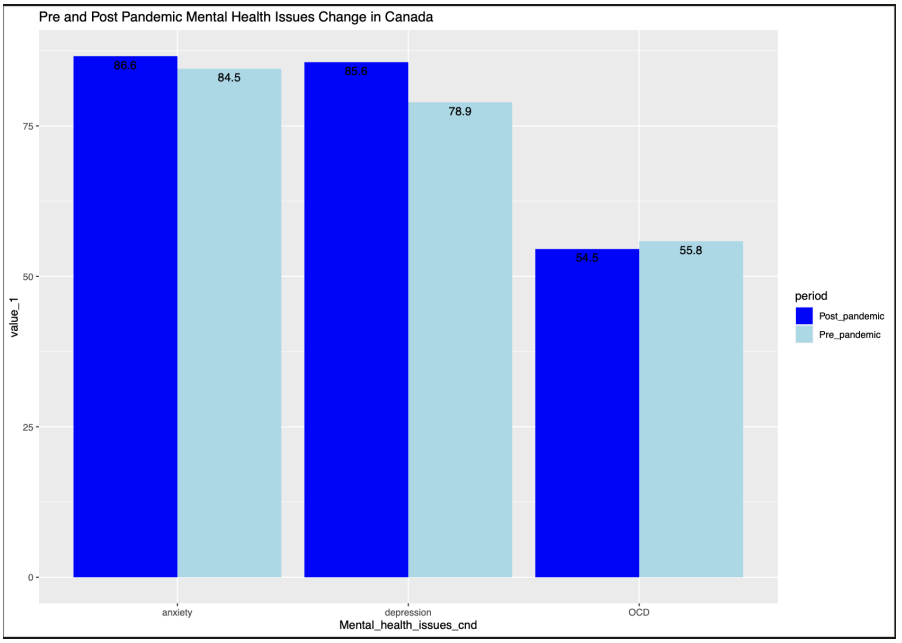
	Mental_health_issues_iran	period_iran	value_iran
1	depression	Pre_pandemic	83.88
2	depression	Post_pandemic	66.83
3	anxiety	Pre_pandemic	70.74
4	anxiety	Post_pandemic	78.79
5	OCD	Pre_pandemic	20.85
6	OCD	Post_pandemic	19.25

Italy:

	Mental_health_issues_italy	period_italy	value_italy
1	depression	Pre_pandemic	87.92
2	depression	Post_pandemic	74.60
3	anxiety	Pre_pandemic	75.86
4	anxiety	Post_pandemic	87.93
5	OCD	Pre_pandemic	34.19
6	OCD	Post_pandemic	33.80

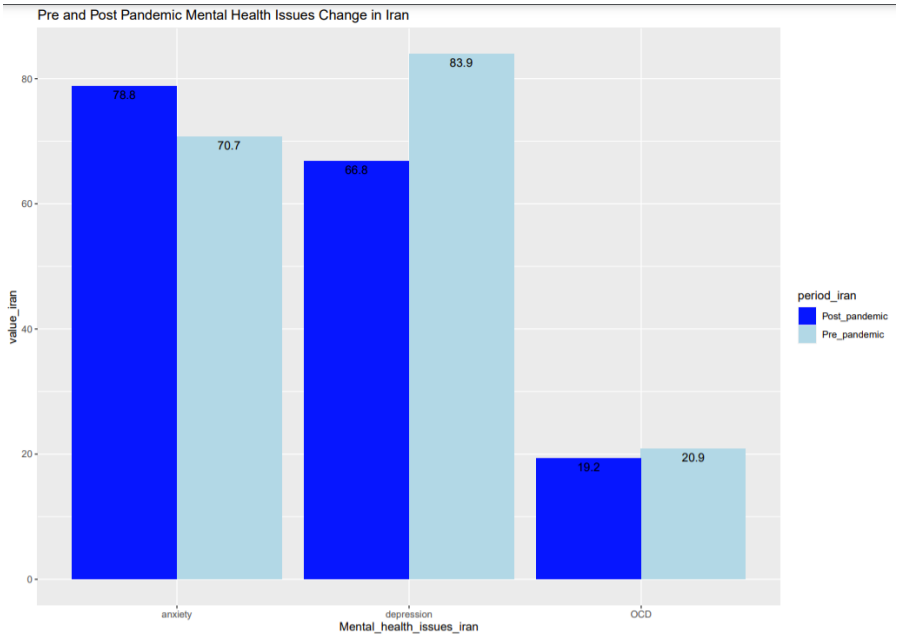
Using the previous tables we generate the following graphs for each country that compares the changes from pre-pandemic to post-pandemic for each mental health issue corresponding to each country.

Canada:



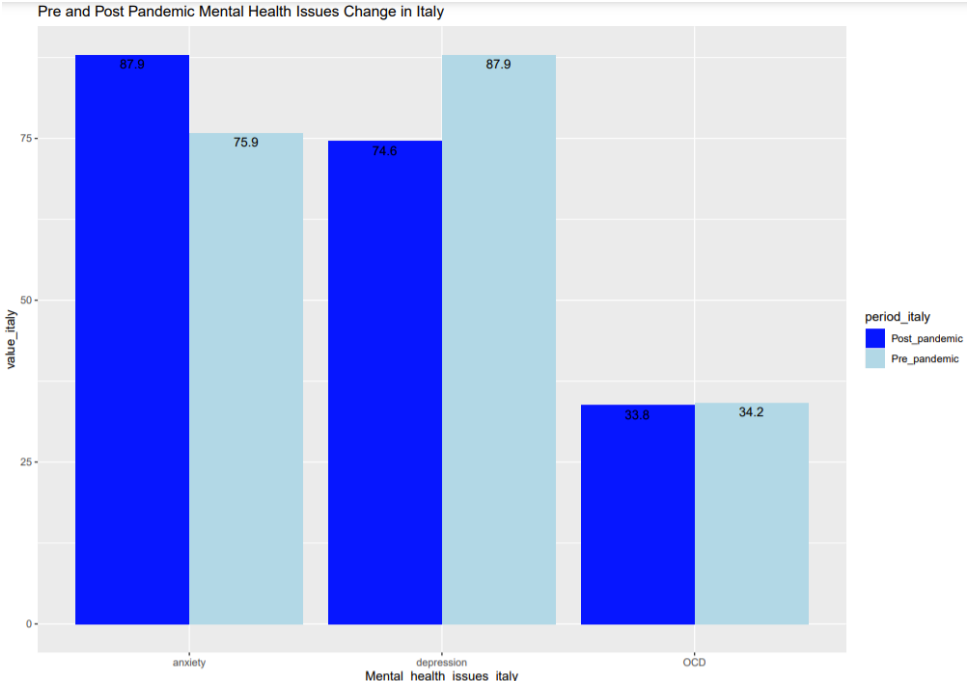
Graph 12: Pre and Post Pandemic MHI change in Canada

Iran:



Graph 13: Pre and Post Pandemic MHI change in Iran

Italy:



Graph 14: Pre and Post Pandemic MHI change in Italy

These graphs show how in the post-pandemic period there is an increase in the number of cases in the majority of the mental health issues, for example, in Canada ``anxiety" and "depression" indicate to have increased by 2.1 and 6.7 cases respectively. Same happened for Italy and Iran, especially for "anxiety". Moreover, if we take a look at the "OCD" variable in the three graphs, all of them present a different pattern than the other mental health issues, in most of the cases either decreasing or remaining almost constant. This demonstrates how some MHI increased in the post pandemic scenario and most important, this reveals why we decided to analyze the variables from a very micro perspective view than if we looked it from the graph #8 with a macro perspective where all of the MHI showed a decrease.

With the information we used before (in Table 2. and the tables after that one) we compute some statistical operations such as the median, media, standard deviation, and the variance for a pre and post pandemic scenario so we can look at the difference for each period. We represent the statistical operations in the following table:

Canada:

	stats_c	pre_pandemic_stats_c	post_pandemic_stats_c
1	Median	215	224
2	Mean	219	227
3	SD	25	26
4	Variance	624	680

Canada's table indicates that before the pandemic, Canada had a mean of 219, a median 215, a standard deviation of 25 and a variance of 624 with respect to the cases of depression, OCD, and anxiety. If we compare it to the post-pandemic period, we can say that with respect to the mean, there was an increase of 8 cases, in the case of the media, it increased 9 cases, in the case of the standard deviation by 1 case and in the case of variance by 56 cases.. This increase reflects the increase of MHI cases in the post pandemic scenario and proves our hypothesis that some MHI in fact increase in the post pandemic scenario.

Iran:

	stats_c	pre_pandemic_stats_iran	post_pandemic_stats_iran
1	Median	161	152
2	Mean	175	164
3	SD	39	36
4	Variance	1539	1323

Based on Iran´s statistics, the changes that can be seen here are mostly the opposite of what happened in Canada´s situation. We can see how a decrease in the variance from 1539 to 1323 makes the values of the variables to be more close to the mean. As the variance was changed, so did the standard deviation, having a drop that causes a lower dispersion of the values from the mean.

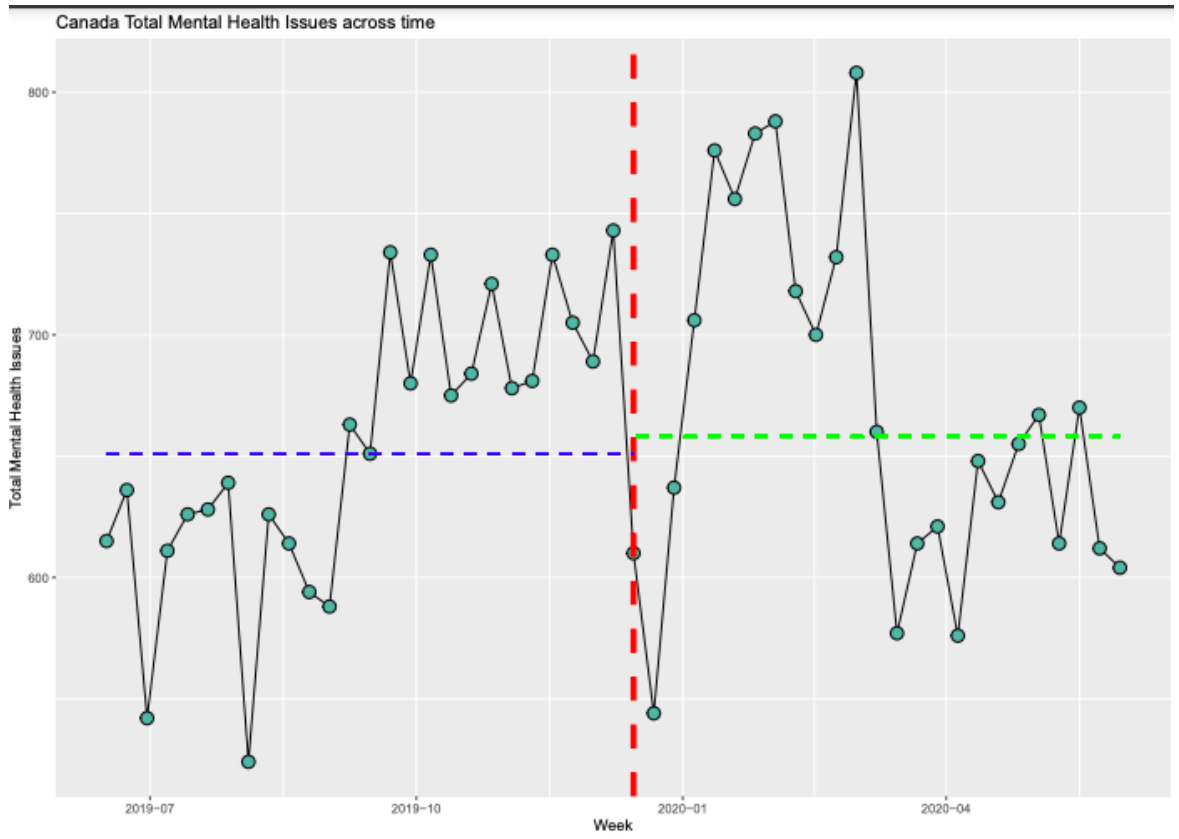
Italy:

	stats_c	pre_pandemic_stats_itl	post_pandemic_stats_itl
1	Median	202	212
2	Mean	198	209
3	SD	29	20
4	Variance	839	399

Italy's table indicates that before the pandemic, the country had a mean of 198, a median 202, a standard deviation of 29 and a variance 839 of the three cases of MHI. If we compare it to the post-pandemic period, we observe that with respect to the mean, there was an increase up to 209 cases, this reflects again the increase of MHI cases in the post-pandemic scenario even though it's just a small increase. Additionally, there has been a decrease of the standard deviation which means a lower dispersion of the data. This decrease can also be seen in the variance as it diminished, indicating that the numbers in the set are farther from the mean.

Once we analyzed our data from a macro perspective and then passed to a micro perspective to see any changes in a deeper analysis, we decided to make the last investigation in order to see the change in total cases of mental health disorders, for the three countries we choose, from a pre-pandemic and post-pandemic point of view. In the following graphs, the red line represents the week we choose to separate between pre and post-pandemic, the blue line the median of the pre-pandemic scenario and the green one the post-pandemic scenario.

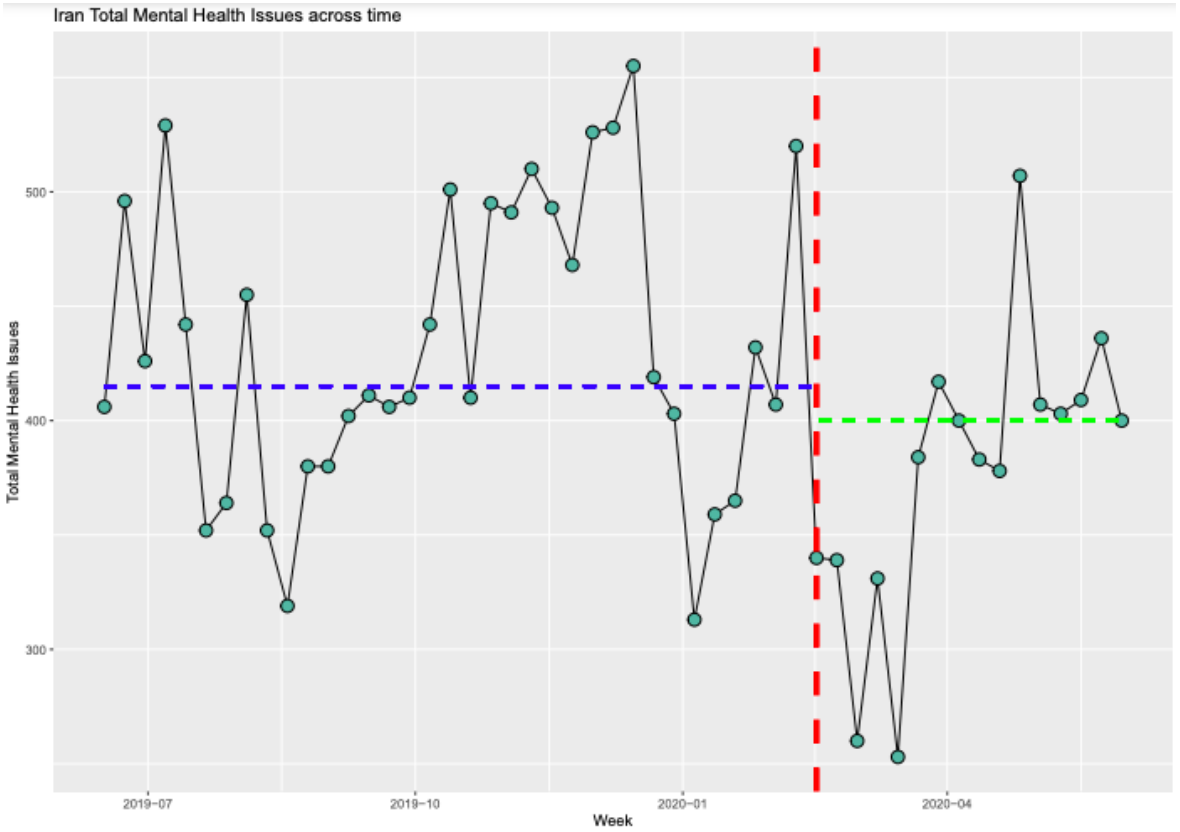
Canada:



Graph 15: Canada Pre vs Post Analysis graph by total MHI across time

Canada
Week: 2019-12-15
Median pre-pandemic: 651
Median post-pandemic: 658

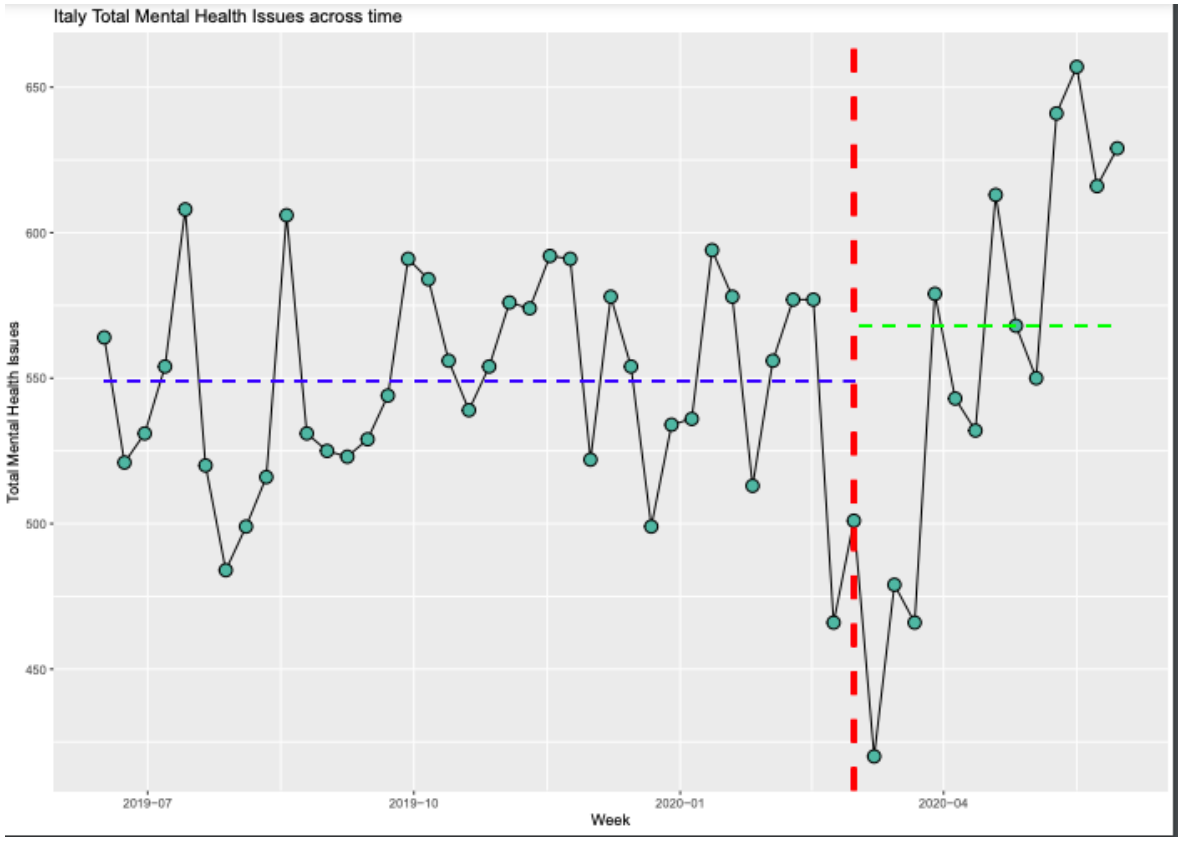
Iran:



Graph 16: Iran Pre vs Post Analysis graph by total MHI across time

Iran
Week: 2020-02-16
Median pre-pandemic: 415
Median post-pandemic: 400

Italy:



Graph 17: Italy Pre vs Post Analysis graph by total MHI across time

Italy
Week: 2020-03-01
Median pre-pandemic: 549
Median post-pandemic: 568

From the three graphs above, we can conclude that for all the three countries, except Iran, the median post pandemic is higher than the median pre pandemic, which tell us that MHI cases increase from the pre-pandemic scenario to the post-pandemic scenario proving our hypothesis once again. We can see this higher value by looking at the data or by looking at the graph and seeing this jump of the median from one scenario to the other. Finally, it's important to remark that only some MHI cases increase from one period to the next in some countries. The analysis we made shows this increase but it would be necessary to make the same analysis for all the countries and for all the MHI variables in order to observe all the MHI variables that increase or decrease from the pre-pandemic to the post-pandemic scenario. In the same way, having the valleys in the graphs may result in a bias analysis since having very low values can't distort the outcome and don't show the real data, this also must be taken into account for future analysis.

Conclusion:

Considering all the previous analyses, and taking into account our hypothesis that states that if a country has been badly impacted by Covid-19, then mental health disorders will exponentially grow, we were able to determine that certain mental health illnesses were indeed increasing in some countries after the pandemic, however we also found that there is a big lack of data that caused a downfall in most of our graphs attributed to the confinement of quarantine. During this period, the register of mental health disorders failed to account for most of the newly diagnosed mental health issues. Hospitals were too crowded and their focus was on Covid-19. Many mental institutions closed in order to provide space for the outbreak and as people stayed home, there was a decrease in those who attended the psychologist or psychiatrist.

In order to check if our hypothesis was correct more accurately, we chose specific dates with the purpose of leveling the field and getting rid of those short periods of time where the novelty of quarantine made the cases drop exponentially. This helped us get rid of the outliers. After interpreting all the data, we deduced that Canada did indeed comply with our hypothesis, Italy complied on some levels however there were some unexpected aspects that made the graph be more volatile and Iran was the country that least complied with our hypothesis. Something we found interesting was that anxiety and depression increased in Canada more than in Iran, Iran being the country with the lowest GDP.

In order to improve our project, we would recommend using more data points by analyzing more countries and having information until 2021 which will allow us to see if when the pandemic was somehow controlled in some countries, MHI cases were recounted and its trend increased. Overall we can state that because of the atypical data that we have, we can neither prove nor deny our hypothesis for all the countries in our population, but we can demonstrate that for some MHI in some countries, its trend tends to increase more than other MHI in the same country, which also tell us that not only it’s a lack of data we are facing, but also some MHI may simply didn’t increase or they might even decrease by a large amount that caused the decrease in MHI cases from a macro perspective.

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