Introduction:

I have chosen COVID-19 global pandemic as the topic for analysis and visualization. The presentation has been divided into three sections:

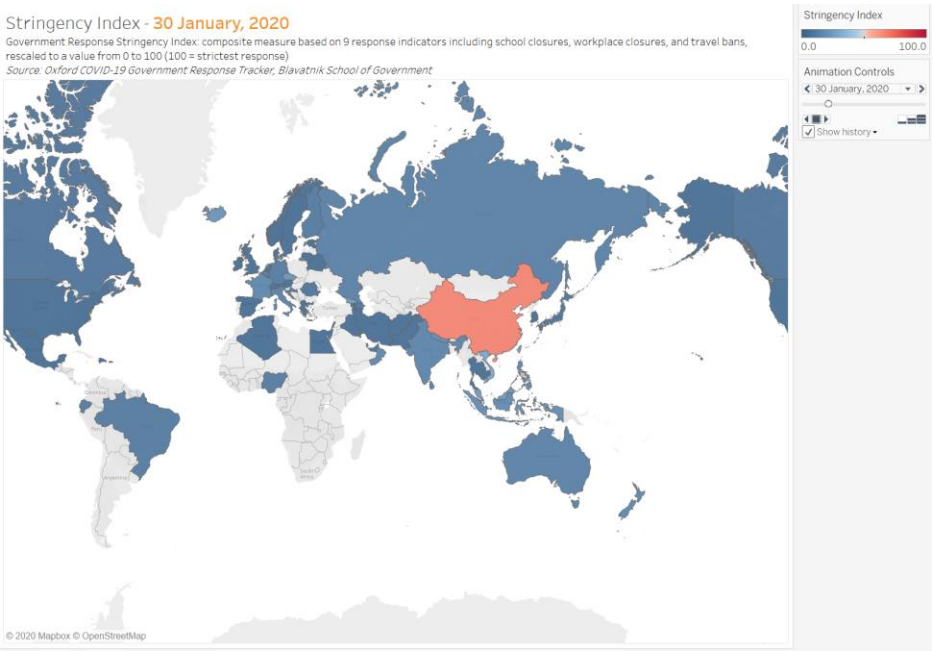
1. Global cases by country, which countries have successfully flattened the curve and why?
2. How have the various Canadian provinces handled the epidemic?
3. Economic impact of COVID-19 in Canada, specifically in terms of employment hours, retail, and manufacturing sales.

Therefore, the target for the presentation is anyone interested in seeing the spread of COVID-19 and measures taken to curb it. The second and third part are mostly for Canadian citizens who would be interested in seeing a detailed impact.

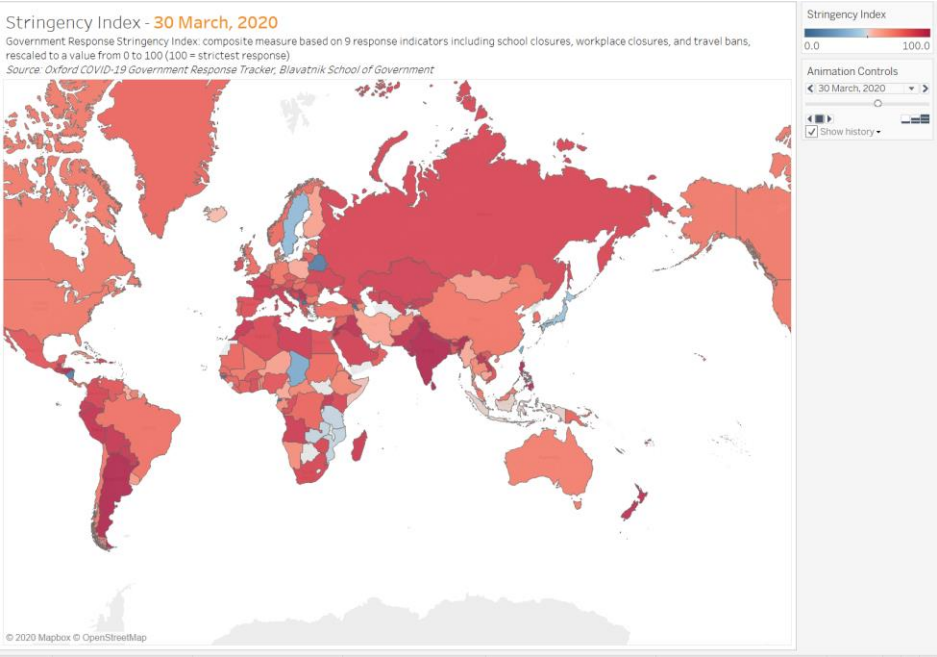
The data was sourced from multiple locations:

1. Canadian COVID data - https://resources-covid19canada.hub.arcgis.com/datasets/provincial-daily-totals . The data from the website was mostly clean and needed minimal changes. I did however use Tableau prep builder to remove some null values from the date field and change some column names for better readability. The original data, data flow and the output file are attached with the other data that is being submitted.
2. Global COVID data - https://ourworldindata.org/coronavirus-source-data . This dataset was very clean and readily usable. The column names and headings were self explanatory for the most part and the data dictionary helped clarify certain fields.
3. Canadian economic impact – This data was sourced from Stats Canada and Yahoo Finance. The data from Yahoo Finance was readily usable. The date field in all Stats Canada data had to be pivoted in Tableau to make it more usable.

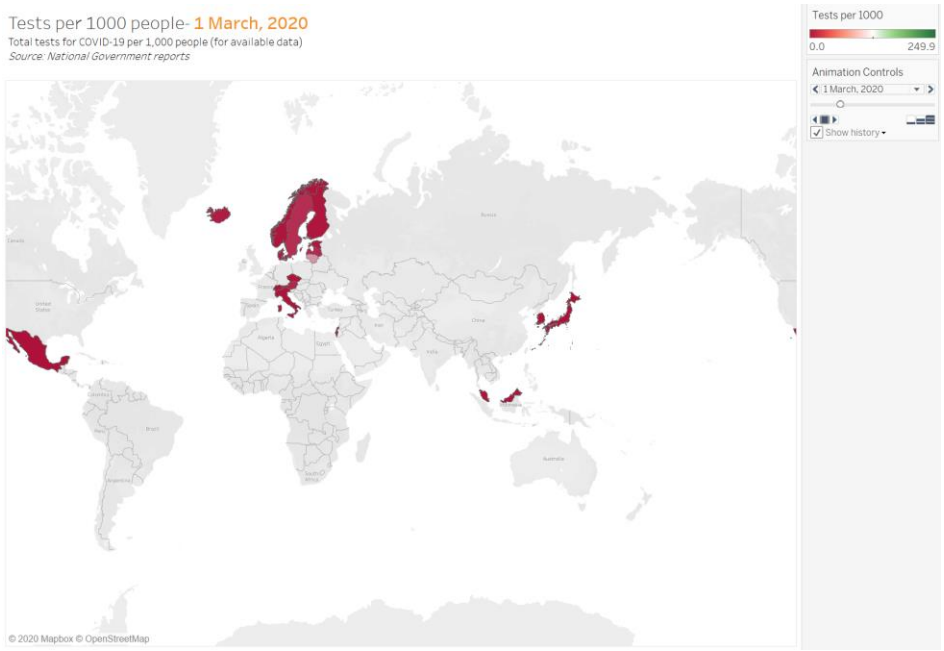
Animation #1



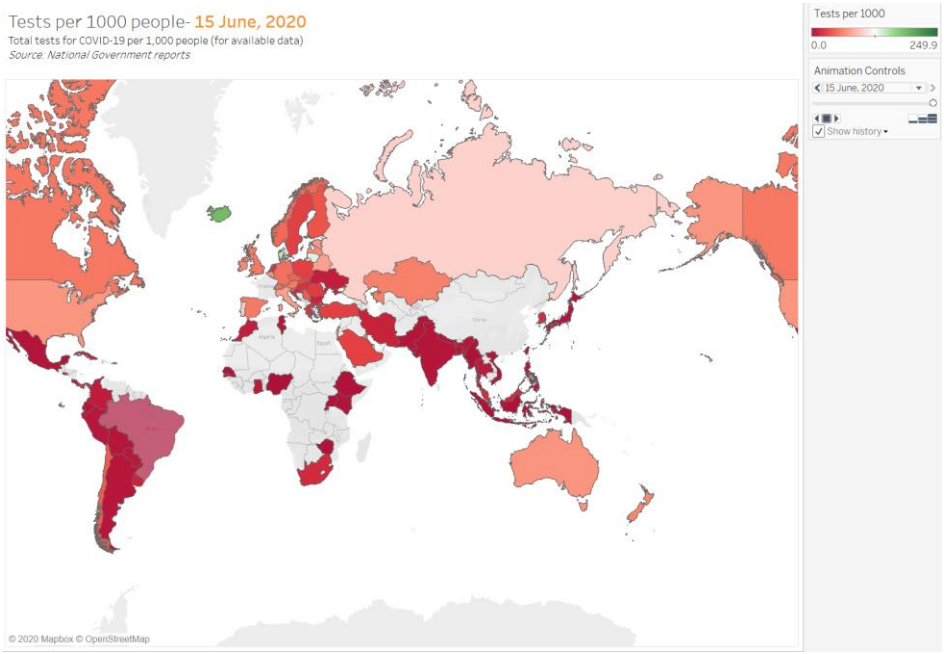
The first visualization is an animation over time and shows how governments around the world responded with stringency measures which include school closures, workplace closures, travel bans etc. The stringency index in the dataset has been taken from the Oxford COVID-19 Government Response Tracker. As you can see above, on January 30th, 2020, China had stringency measures in place while the rest of the world did not. The screenshot below, two months later, shows most governments reacting with high levels of stringency.



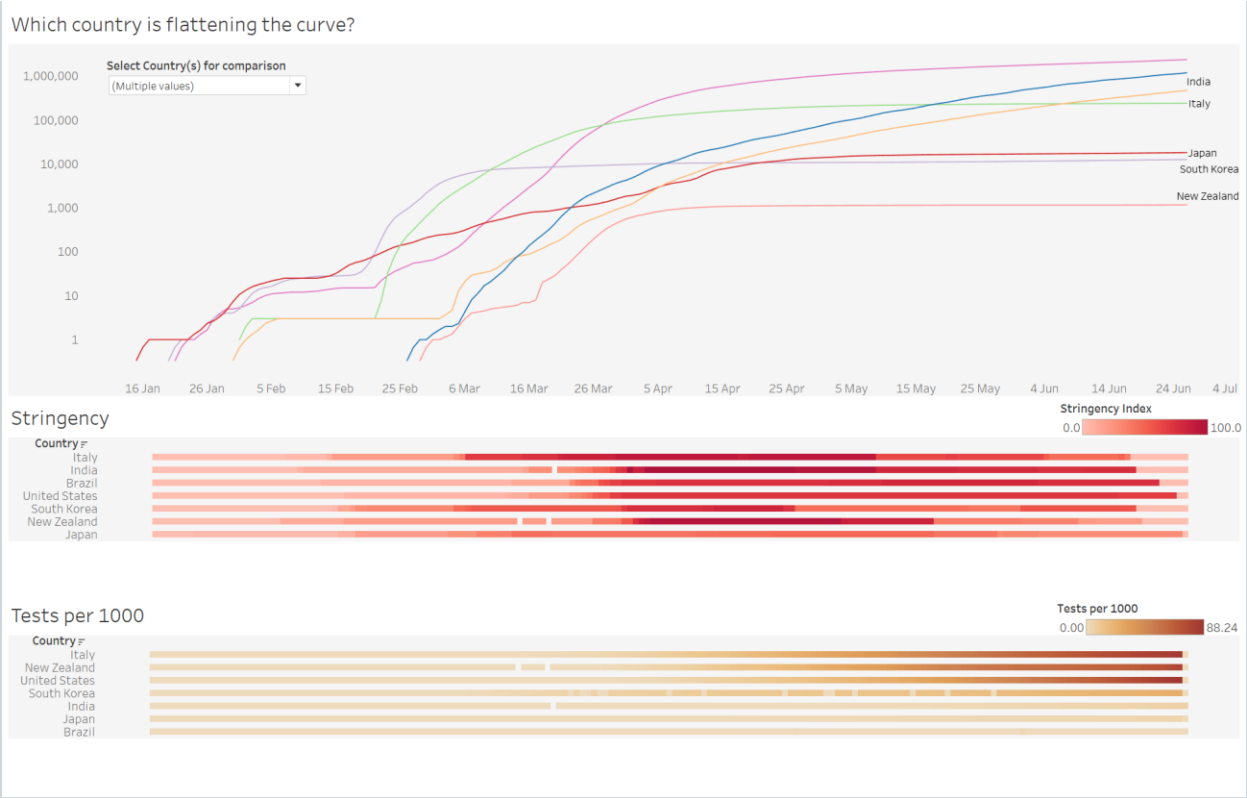
Animation #2



The second visualization is also an animation over time which aims to see the tests per 1000 in different countries. I was unable to source testing data for China and therefore nothing shows up for them in terms of testing as of March 1st, 2020. The visual below is from June 15th, 2020 and shows the rapid increase in global testing. Please note that the tests per 1000 is a better indicator than total tests as the latter is not standardized. Tests per 1000 is based on a fixed denominator and respective population and is more of an 'apples to apples' comparison.



Dashboard #1

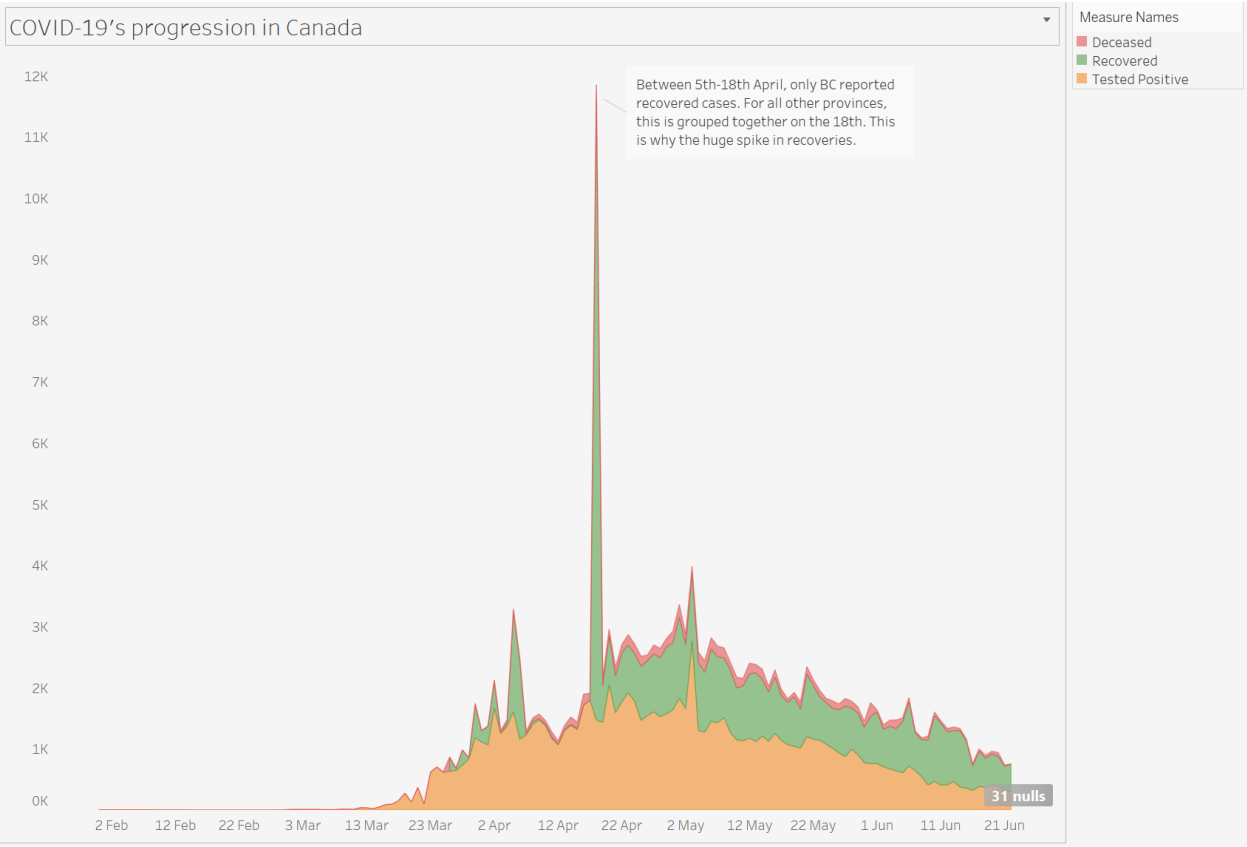


All the visualizations seen in the dashboard are over the same time-period. The y-axis on the graph that shows total case count is logarithmic. A logarithmic scale is itself exponential and therefore a natural fit when displaying exponential growth – for example, a viral epidemic. Another point to keep in mind here is that minor directional changes on a logarithmic scale represent a huge impact – especially at the upper end of the scale. Also, the data represented by the individual line graphs is a 3-day moving average to smooth out any sharp spikes or dips. The dashboard tries to relate the 'flattening of the curve' with stringency measures and tests conducted per 1000. The viewer has the option to chose as many countries as possible, however, after a certain point the visualization becomes very busy and messy.

I have specifically chosen the above countries as some of them have successfully flattened their epidemic curve while others are heading in the wrong direction. It is clearly visible that countries such as New Zealand, South Korea, and Japan have been successful in curbing the spread of the virus while India, Brazil (blue) and United States of America (pink) are struggling. Italy had an early rise in cases but has successfully curtailed the spread of COVID-19 by strict stringency measures and aggressive testing.

For me, Japan stands out the most as they have flattened their epidemic curve with the lowest stringency measures and testing numbers in comparison with the others. The heat maps for stringency and testing per 1000 have been arranged in descending order based on the sum of daily respective values. Therefore, Italy is at the top of the stringency index, as the daily stringency scores when added up over the selected time-period, is the highest out of the selected countries.

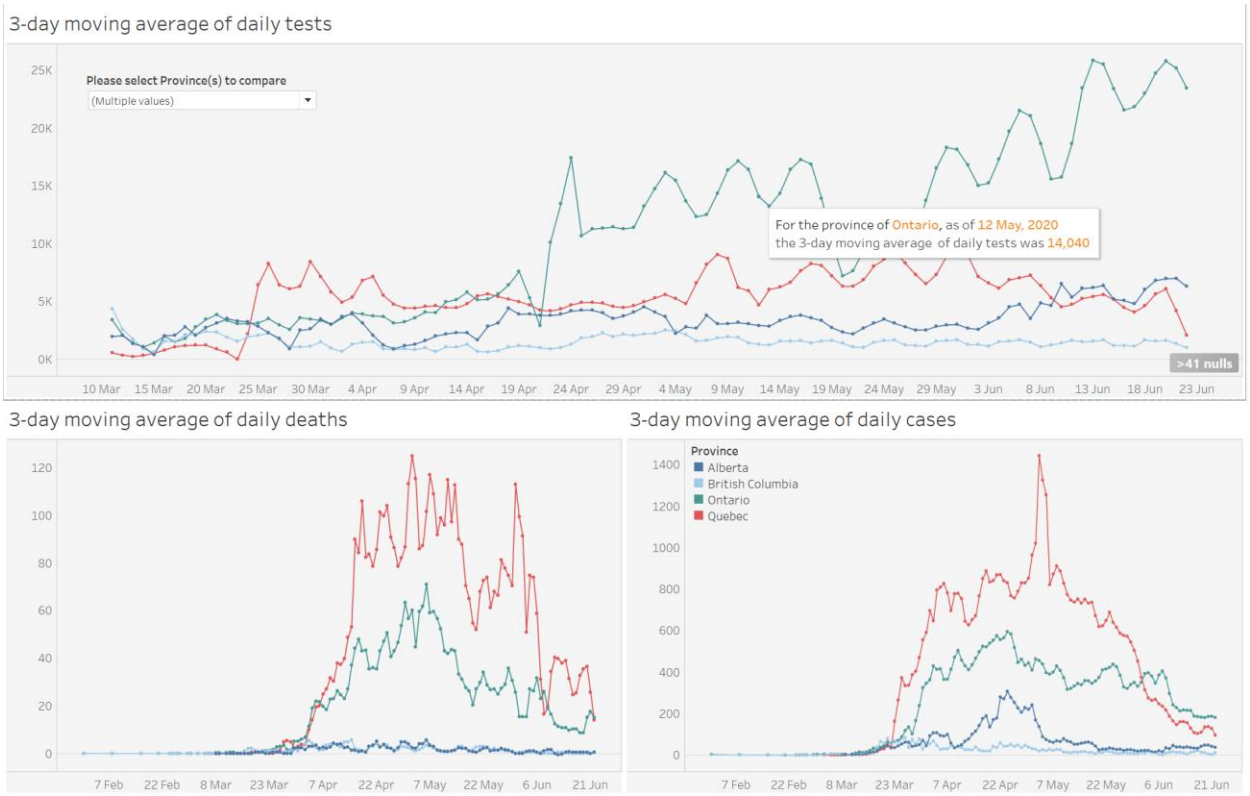
Please note: Brazil's and China's testing numbers are not available as part of the dataset.



This visualization shows the progression of COVID-19 in Canada. The different measures are stacked on top of each other to visualize daily positive cases, recoveries, and deaths in relation to one another.

Please note that the spike was caused as some provinces did not release their recovered cases data for approximately two weeks and then released it all together. The noticeable spike represents approximately two weeks of data for recovered cases.

Dashboard #2

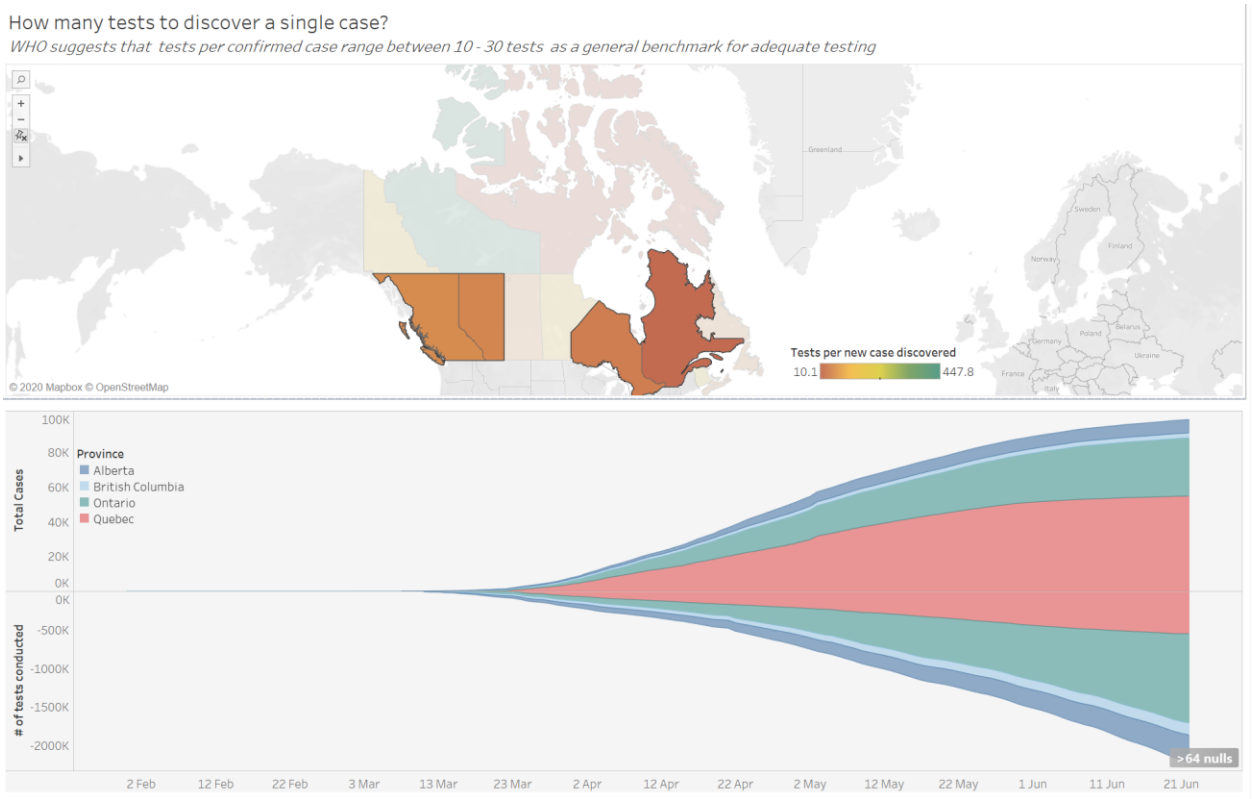


The above dashboard compares the daily tests to the daily deaths and cases for different provinces. For demo purposes, I have chosen Alberta, British Columbia, Ontario, and Quebec as they account for over 95% of all cases in Canada.

The bottom two graphs are over the same time-period while the third graph starts approximately a month later. The viewer has the option to select the desired provinces and view the performance. From the above dashboard, Quebec had an uptick in testing right around the time they started seeing increase in daily cases and deaths. However, they reduced the amount of testing which may have resulted in the sharp increase in cases and deaths.

On the other hand, Ontario consistently kept increasing their testing numbers and there is a relative decrease in cases and deaths that can be noted.

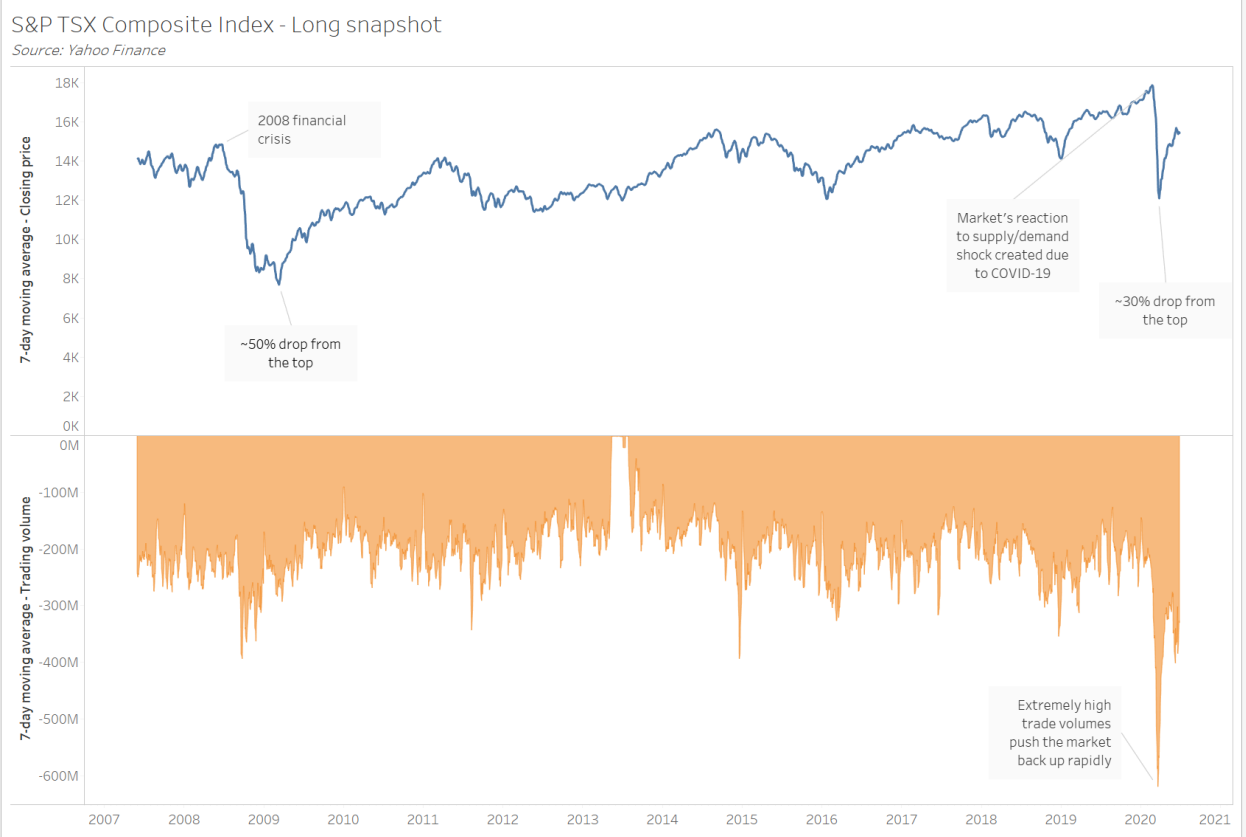
Dashboard #3



To create the above dashboard, I had to create a calculation that shows the number of tests conducted to discover a single case. This is simply SUM (daily tests) / SUM (daily cases). As per the WHO, the benchmark for adequate testing is anywhere between 10 – 30 tests per discovered case. The color-coded map is to show the tests conducted per case discovered for different provinces. As displayed, Quebec was the lowest on this count with 10.1 tests per single case discovered – this is at the bottom end of the WHO benchmark guidelines while Ontario is at the top end of that range. All other provinces have far exceeded the top end of the benchmark.

The second visualization is an above and below the axis area chart. The total cases are above the X-axis and total tests conducted are below the X-axis – all values are cumulative. They are not on a synchronized dual axis as the ranges for the two measures are very different from each other. From the viz it is clear that Quebec has the most cases (shown above the axis) but did not conduct the most tests (shown below the axis). Ontario had the second highest number of cases but ranked highest in terms of testing.

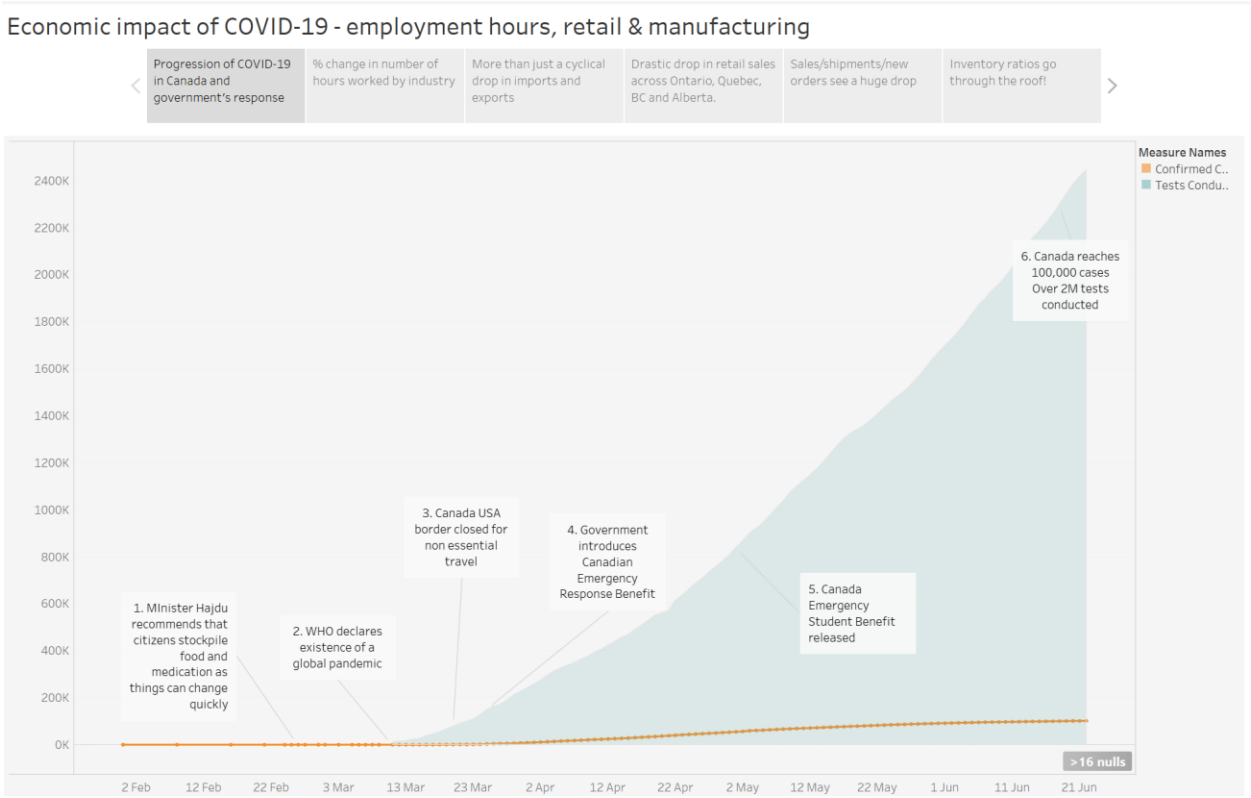
This dashboard, as the one above, aims at showing the effects of under testing.



The above chart is a long snapshot of the TSX S&P composite index. The index includes 250 companies that represent approximately 70% of the entire Toronto Stock Exchange.

The annotations indicate the financial crisis of 2008 and the recent negative market reaction due to COVID-19 and the uncertainties it presents. The trading volume has increased sharply thereby pushing the market back up.

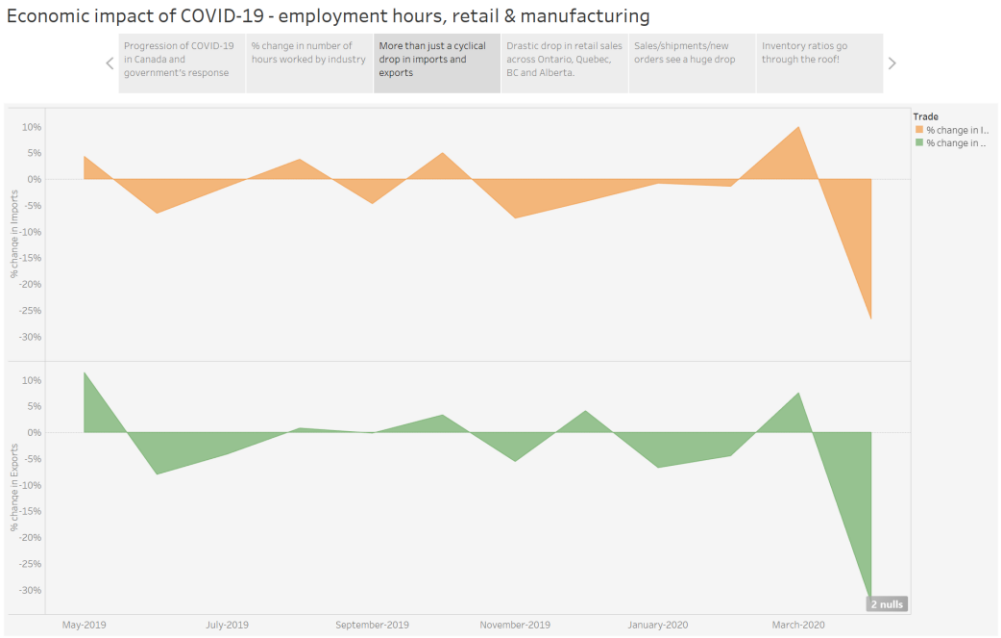
COVID-19's economic impact on Canada - Story



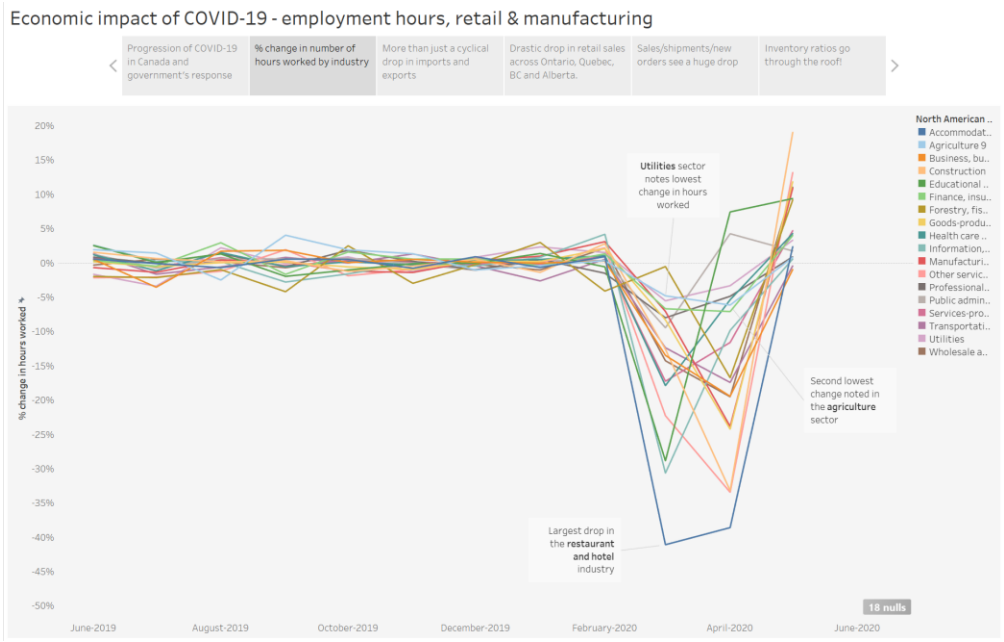
The story that I have chosen to display is the economic impact of COVID-19 on Canada – especially in terms of employment hours, retail spending and manufacturing output. There are some annotations indicating key announcements by the Government of Canada that have been obtained from the following sources. The visualization shows increased testing thereby slowing the spread of the epidemic.

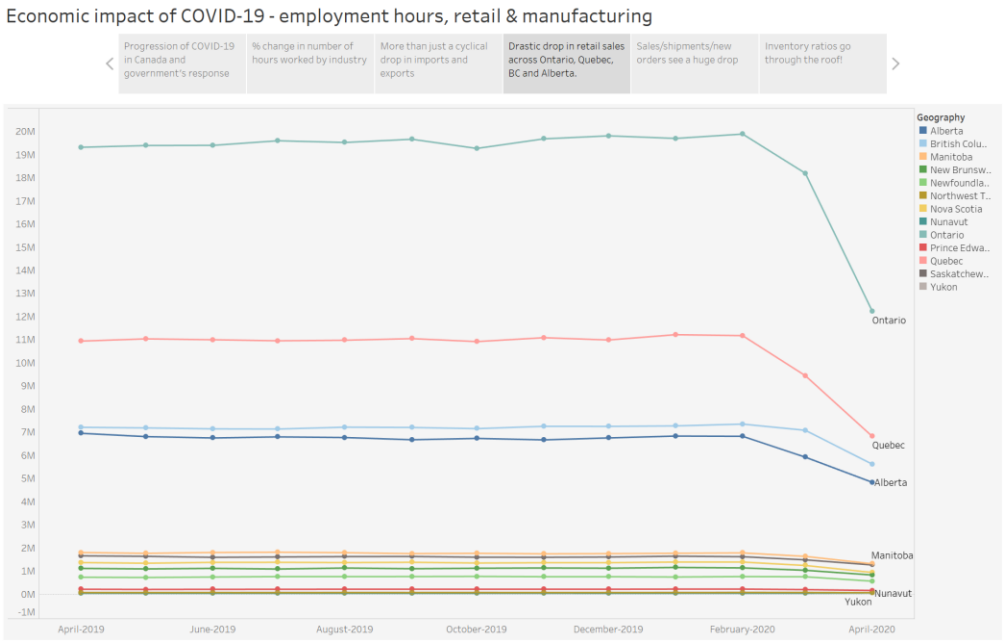
1. https://nationalpost.com/pmn/news-pmn/canada-news-pmn/advice-to-stockpile-supplies-can-cause-undue-concern-over-covid-19-tory-mp
2. https://time.com/5791661/who-coronavirus-pandemic-declaration/
3. https://globalnews.ca/news/6711194/canada-us-border-closes/
4. https://www.canada.ca/en/department-finance/news/2020/03/introduces-canada-emergency-response-benefit-to-help-workers-and-businesses.html
5. https://www.canada.ca/en/department-finance/news/2020/04/support-for-students-and-recent-graduates-impacted-by-covid-19.html
6. https://globalnews.ca/news/7029817/canada-100k-coronavirus-cases/

The second story point shows the percent change in total imports and exports in Canada. The negative percent change in April 2020 is out of the ordinary and cannot be seen as cyclical.

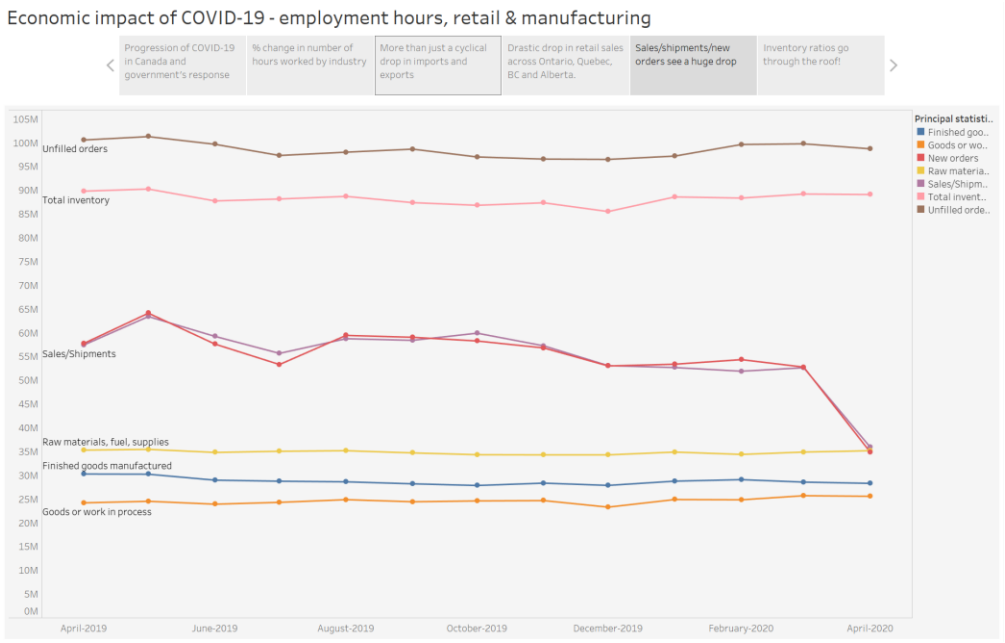


The third story point shows the change in the number of hours worked in different industries. The individual points represent percentage change from the previous point. As noted, and expected, restaurant and hotel industry saw the most reduction in number of hours worked in April 2020 after the lockdown was announced by the Federal Government. On the contrary, the utilities and agriculture sector saw the least reduction in hours worked as they can be deemed essential services.

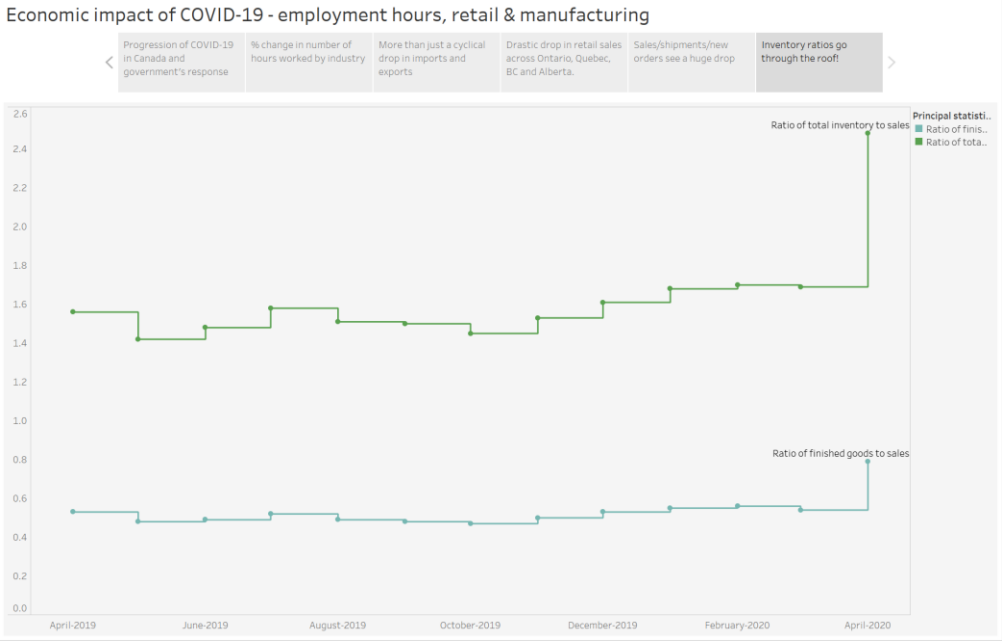




After the lockdown was announced in March 2020, retail sales fell drastically the following month. In the case of Ontario, the drop is approximately 30%.



Dollar value of manufacturing can be noted under various statistics such as unfilled orders, total inventory, raw materials, work in progress, finished goods, shipments, and new orders. Canada has seen a sharp decline in terms of shipments/sales and new orders. Therefore, as a country we are unable to sell our finished goods. Also, we are not able to convert raw materials on hand into finished products as new orders are not being received. The result is shown in the next story point.



Since, as a country we are unable to sell finished goods, the ratio of finished goods to sales has increased from ~0.5 to 0.8 in April 2020. Total inventory (which includes finished goods, raw materials, and work in progress) as a ratio of sales has shot up from ~1.6 to 2.5.

Aged inventory is a nightmare for any business – they must sell this inventory, likely at a discount and therefore incur the losses that go along with it. They cannot simply hold onto the inventory, fill up their warehouses, stop the factory lines and lay off their workers till they are able to sell it. To get the wheel moving from a dead stop is harder than keeping it rolling with some momentum.

Also, in this unique situation, all countries would have seen their inventory levels rise – this could mean that as soon as trade opens up to regular levels, there might be a possible glut in the short term as all the aged inventory is released into the market simultaneously by all countries.

Data sources:

1. https://resources-covid19canada.hub.arcgis.com/datasets/provincial-daily-totals - Canada COVID data
2. https://ourworldindata.org/coronavirus-source-data - Global COVID data
3. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1410028901#timeframe – Hours worked by NAICS class
4. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1610004701#timeframe – Manufacturer sales and inventory levels
5. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1210012101#timeframe – Import Export
6. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2010000801#timeframe – Retail sales by province