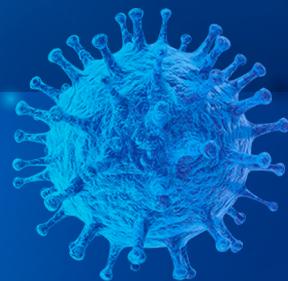
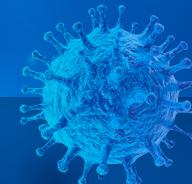


Analyzing the spread of COVID-19 in Ontario.



Project Members

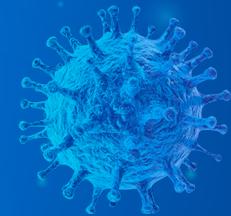
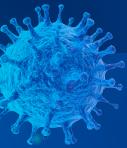
Dayo Thompson

Kirushan Kirubaharan

Sushant Deshpande

At the end of this report, we will know....

1. Who was affected by the virus?
2. Which regions in Ontario were affected?
3. How was the virus contracted?
4. What roles do weather conditions play in the spread of the virus in Toronto?



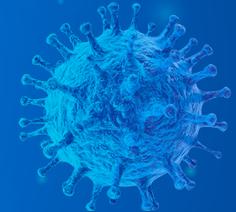
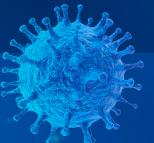
Data Sources

All data collected from January 23, 2020 to June 30, 2020

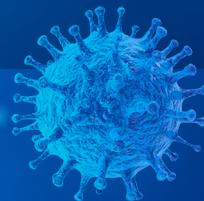
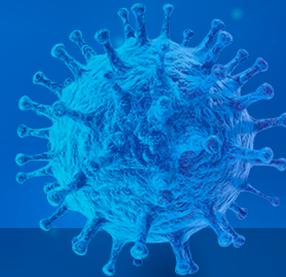
<https://data.ontario.ca>

<https://www.wunderground.com/history/monthly/ca/toronto>

<https://www.kaggle.com>



1. Data Exploring and Cleanup



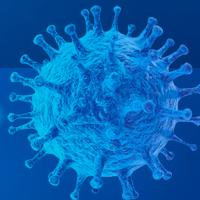
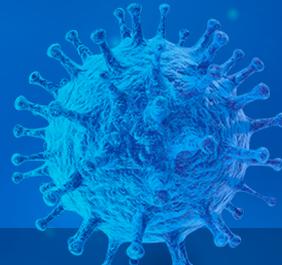
Ontario Dataset (before)

_id	Row_ID	Accurate_Episode_Date	Case_Reported_Date	Test_Reported_Date	Specimen_Date	Age_Group	Client_Gender	Case_AcquisitionInfo	Outcome	Outbreak_Related	Reporting_PHU	Reporting_PHU_Address	Reporting_PHU_City	Reporting_PHU_Postal_Code	Reporting_PHU_Website	Reporting_PHU_Latitude	Reporting_PHU_Longitude	
0	1	1	2020-03-08T00:00:00	2020-03-08T00:00:00	2020-03-10T00:00:00	40s	FEMALE	Travel	Resolved	NaN	Ottawa Public Health	100 Constellation Drive	Ottawa	K2G 6J8	www.ottawapublichealth.ca	45.345665	-75.763912	
1	2	2	2020-03-11T00:00:00	2020-03-11T00:00:00	2020-03-15T00:00:00	2020-03-11T00:00:00	60s	FEMALE	CC	Resolved	NaN	Sudbury & District Health Unit	1300 Paris Street	Sudbury	P3E 3A3	www.phsd.ca	46.466092	-80.998059
2	3	3	2020-03-07T00:00:00	2020-03-11T00:00:00	2020-03-11T00:00:00	2020-03-10T00:00:00	20s	FEMALE	Travel	Resolved	NaN	Toronto Public Health	277 Victoria Street, 5th Floor	Toronto	M5B 1W2	www.toronto.ca/community-people/health-wellness..	43.656591	-79.379358
3	4	4	2020-03-07T00:00:00	2020-03-10T00:00:00	2020-03-11T00:00:00	2020-03-10T00:00:00	50s	MALE	Travel	Resolved	NaN	Hamilton Public Health Services	110 King St. West, 2nd Floor	Hamilton	L8P 4S6	www.hamilton.ca/publichealth	43.257631	-79.871341
4	5	5	2020-03-09T00:00:00	2020-03-11T00:00:00	2020-03-10T00:00:00	2020-03-10T00:00:00	<20	FEMALE	Travel	Resolved	NaN	Toronto Public Health	277 Victoria Street, 5th Floor	Toronto	M5B 1W2	www.toronto.ca/community-people/health-wellness..	43.656591	-79.379358

Ontario Dataset (after)

	Case_Reported_Date	Age	Gender	Virus_Acquired	Outcome	Hospital	City	Hospital_Postal_Code	Hospital_Latitude	Hospital_Longitude	Month
0	2020-03-08	40s	FEMALE	Travel	Resolved	Ottawa Public Health	Ottawa	K2G 6J8	45.345665	-75.763912	03
1	2020-03-11	60s	FEMALE	CC	Resolved	Sudbury & District Health Unit	Sudbury	P3E 3A3	46.466092	-80.998059	03
2	2020-03-11	20s	FEMALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	03
3	2020-03-10	50s	MALE	Travel	Resolved	Hamilton Public Health Services	Hamilton	L8P 4S6	43.257631	-79.871341	03
4	2020-03-11	<20	FEMALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	03

Using the Ontario dataset and Toronto weather dataset, we decided to merge data frames.

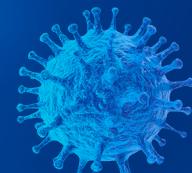


Toronto Weather Dataset (after)

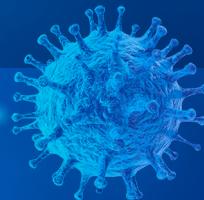
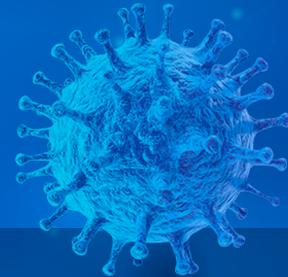
	Case Reported Date	Temp Max (F)	Temp Avg (F)	Temp Min (F)	Humidity Max	Humidity Avg	Humidity Min	Wind Speed Max (mph)	Wind Speed Avg (mph)	Wind Speed Min (mph)
0	2020-01-01	32	30.0	NaN	81	72.9	60	24	18.9	9
1	2020-01-02	41	38.5	34.0	93	80.5	70	20	13.6	6
2	2020-01-03	45	41.4	37.0	100	80.7	65	16	8.4	5
3	2020-01-04	39	34.6	32.0	100	84.5	65	18	7.7	2
4	2020-01-05	36	33.0	30.0	100	81.8	60	23	12.6	3

Toronto Weather Dataset (after)

	Case Reported Date	Age	Gender	Virus Acquired	Outcome	Hospital	City	Hospital Postal Code	Hospital Latitude	Hospital Longitude	Month	Temp Max (F)	Temp Avg (F)	Temp Min (F)	Humidity Max	Humidity Avg	Humidity Min	Wind Speed Max (mph)	Wind Speed Avg (mph)	Wind Speed Min (mph)
0	2020-01-23	50s	FEMALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	01	36	32.4	28.0	93	76.9	69	13	5.3	0
1	2020-01-23	50s	MALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	01	36	32.4	28.0	93	76.9	69	13	5.3	0
0	2020-02-21	20s	FEMALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	02	34	25.6	18.0	74	62.0	44	28	19.3	10
1	2020-02-25	60s	FEMALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	02	43	38.7	36.0	93	74.3	53	14	9.8	6
2	2020-02-26	60s	MALE	Travel	Resolved	Toronto Public Health	Toronto	M5B 1W2	43.656591	-79.379358	02	39	32.7	27.0	93	83.5	52	16	11.1	6

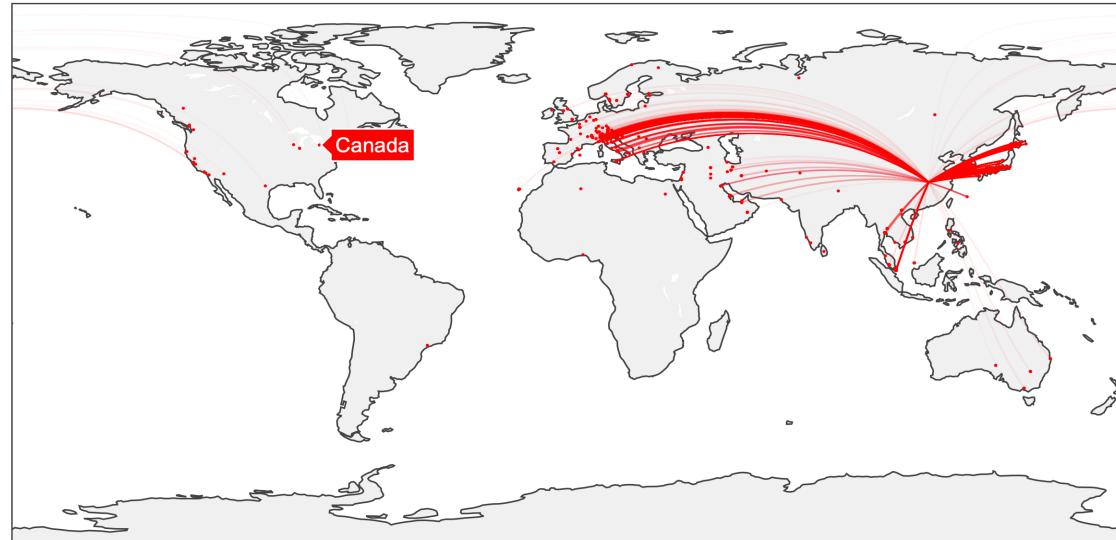


Data Analysis

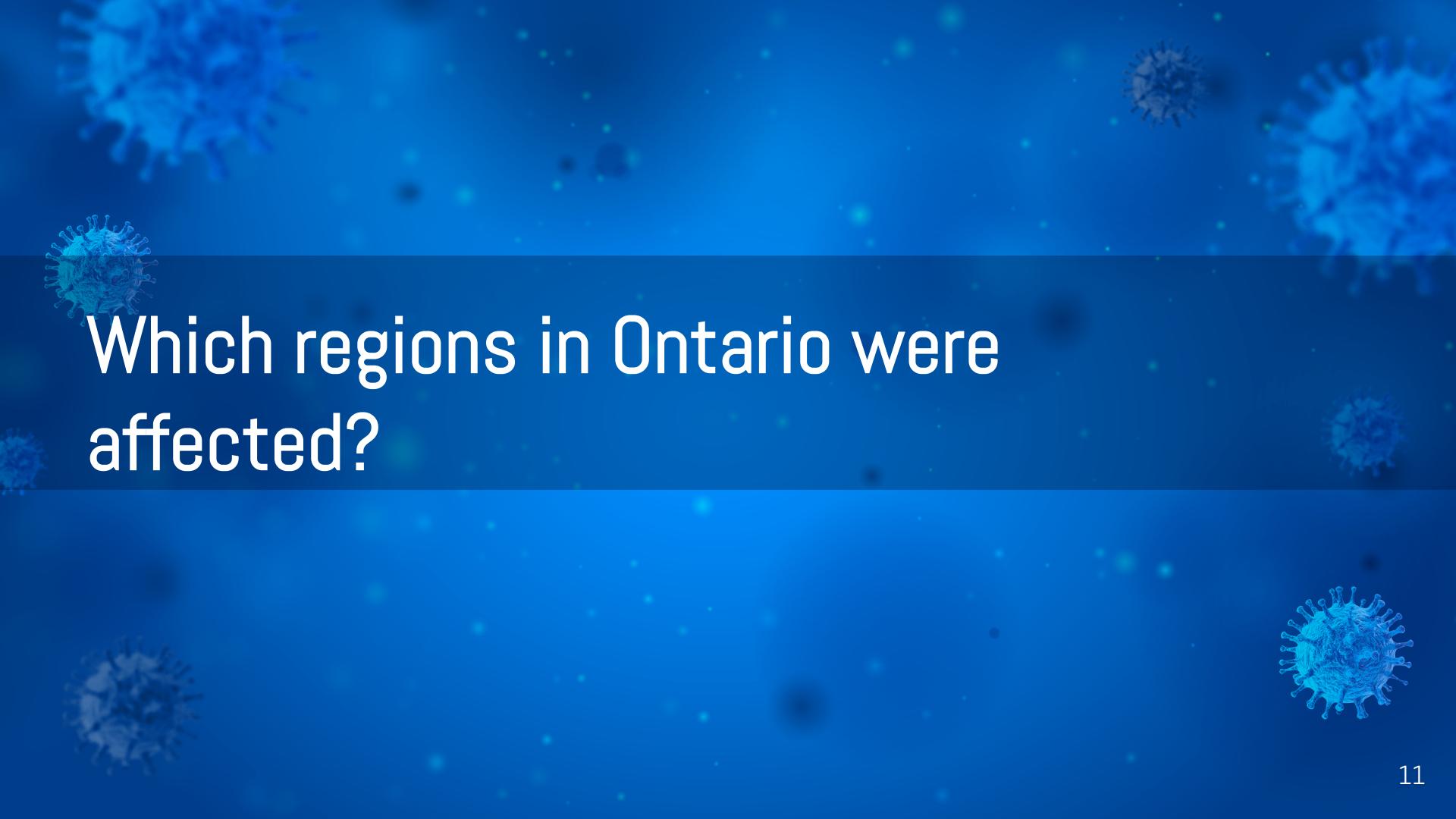


By 24th Feb. 2020, ten travelers had arrived Canada from Wuhan, China. Seven of them landed in British Columbia and three in Ontario. One of the three cases was in London. The other two, both in their 50s, were in Toronto.

COVID-19 Outbreak from the epi-center, Wuhan, to the World
(Hover for Country names)

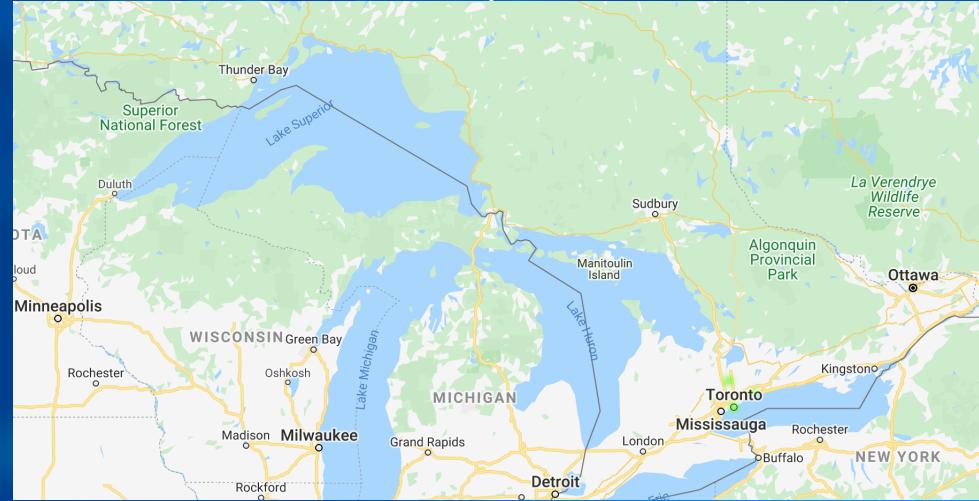


Now, let's look at the numbers in Ontario four months later and a deep dive into weather conditions in Toronto later in this analysis.

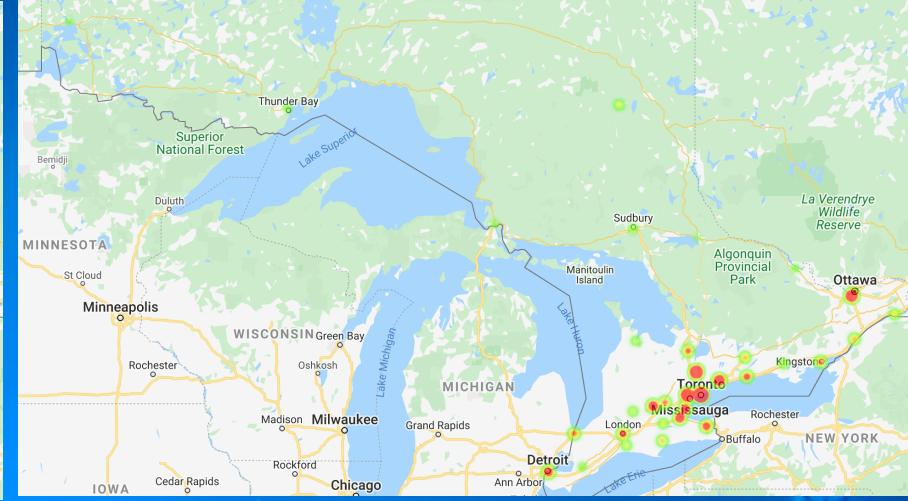


Which regions in Ontario were affected?

February

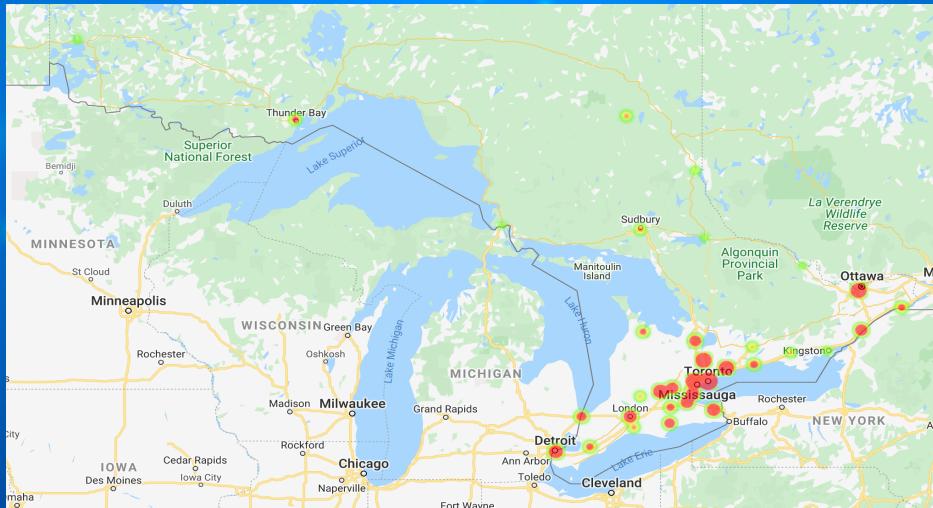


March

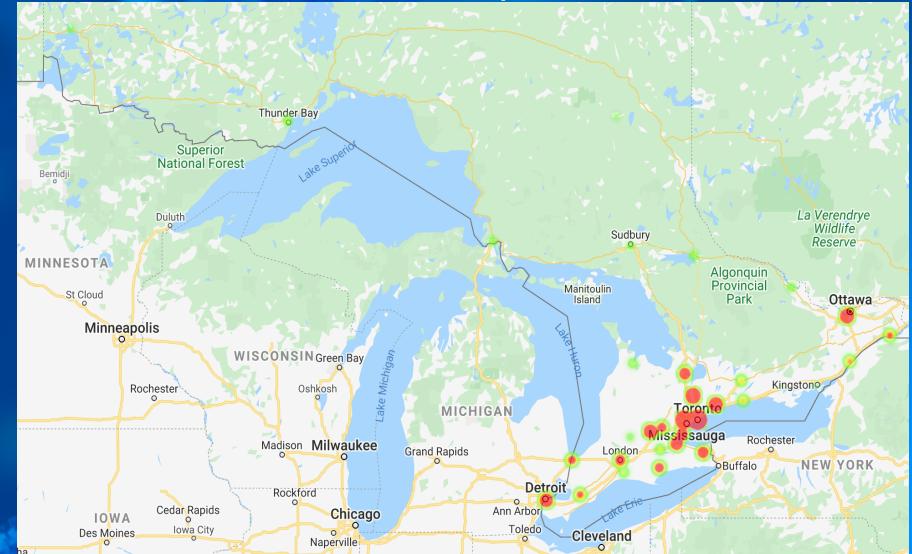


Which regions in Ontario were affected?

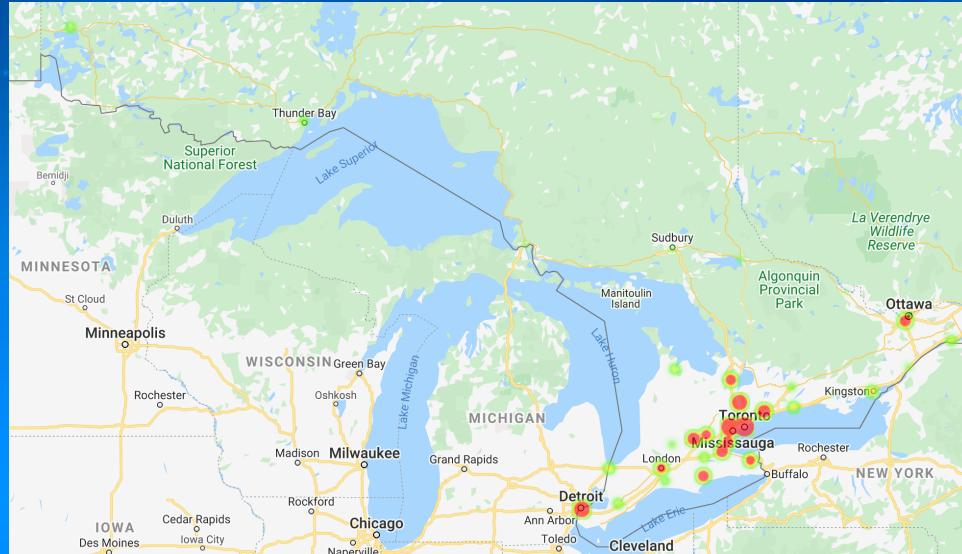
April



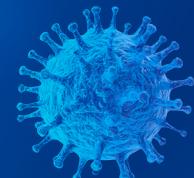
May



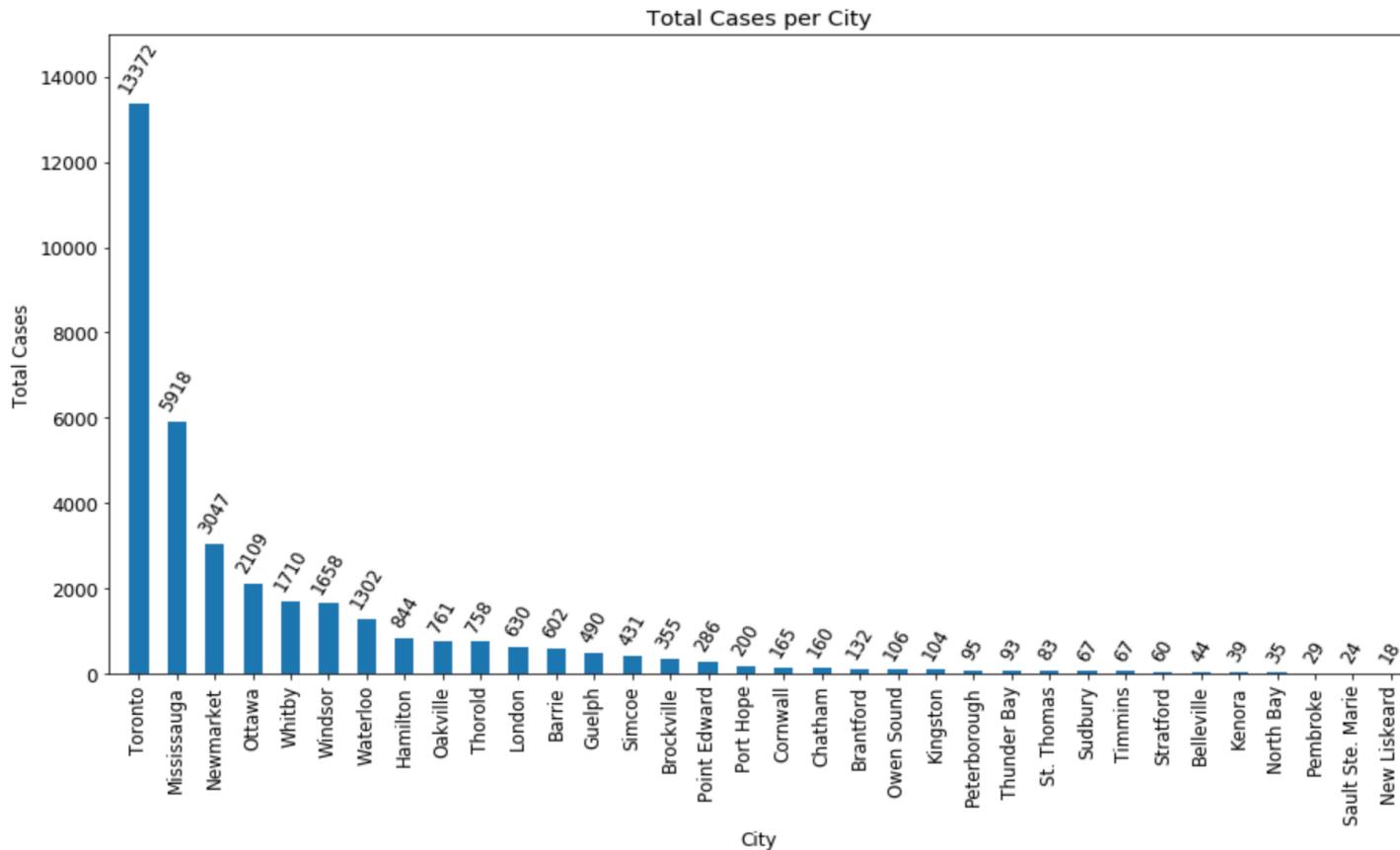
June



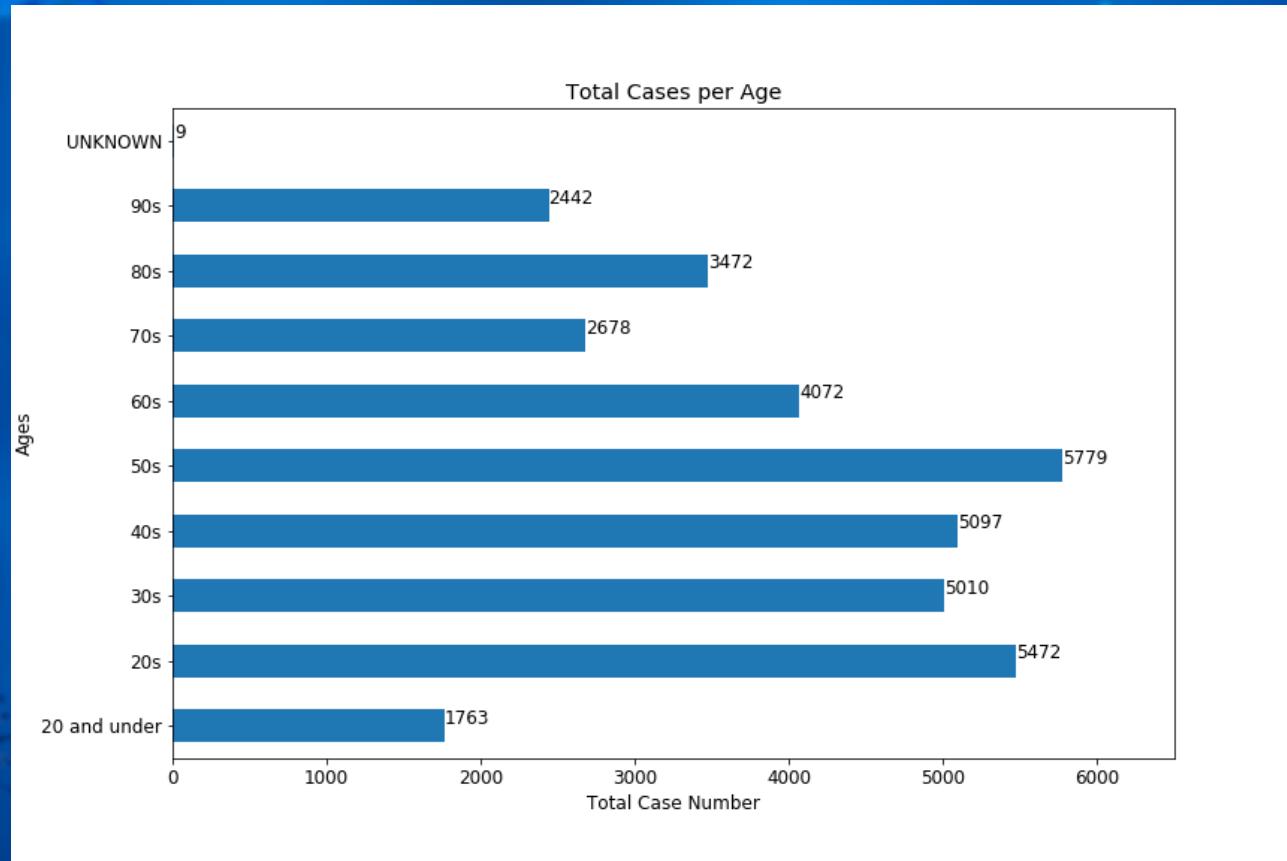
From April to May, there was a 25% decrease in the number of cases, while from May to June, there was a huge decline of 42% in the number of cases. By the end of June, New Liskeard did not report any cases.



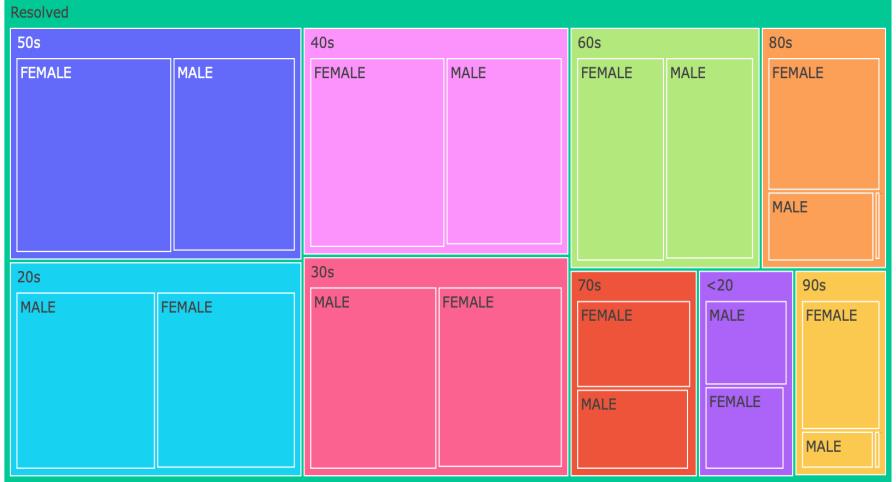
Which regions in Ontario were affected?



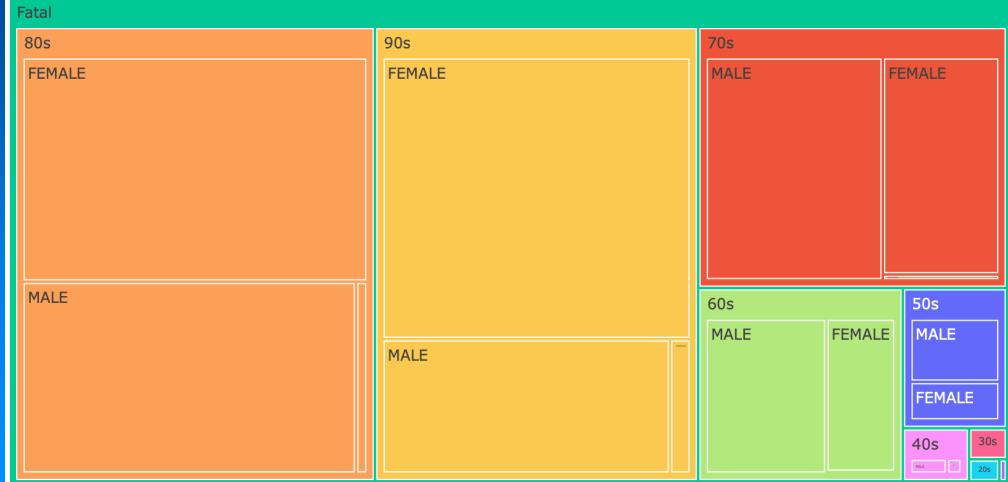
What age groups were mainly affected by the virus?



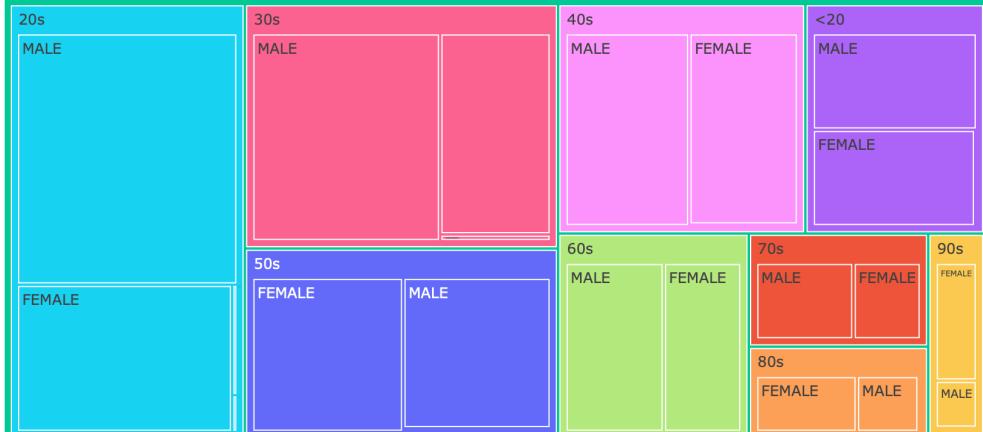
Resolved cases



Fatal cases



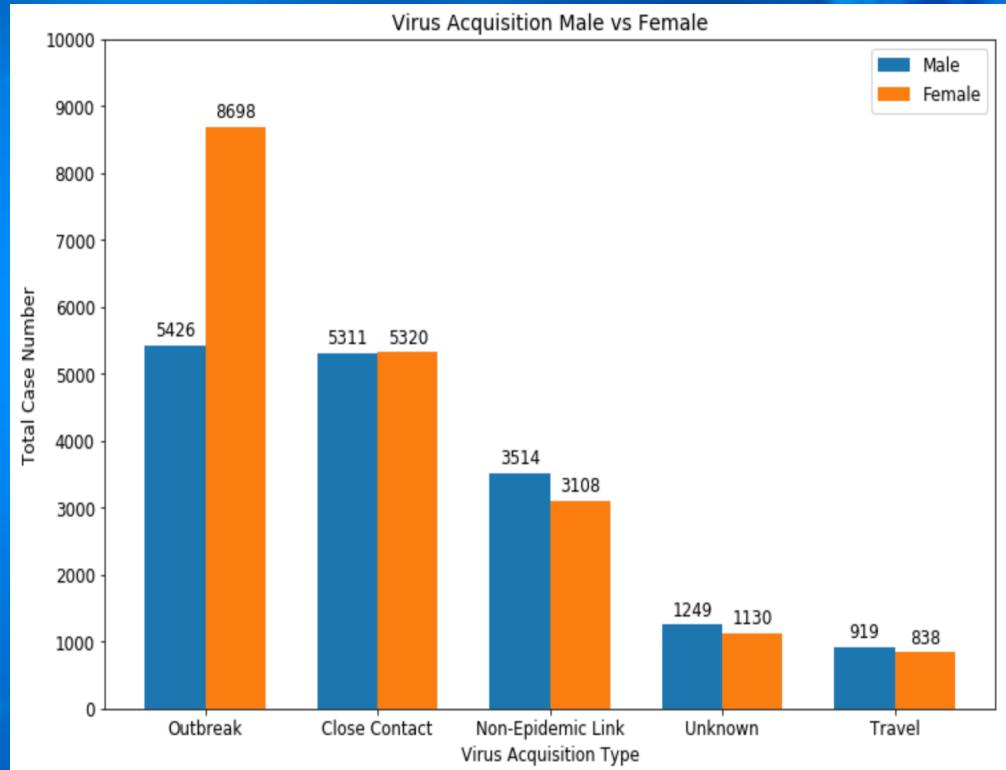
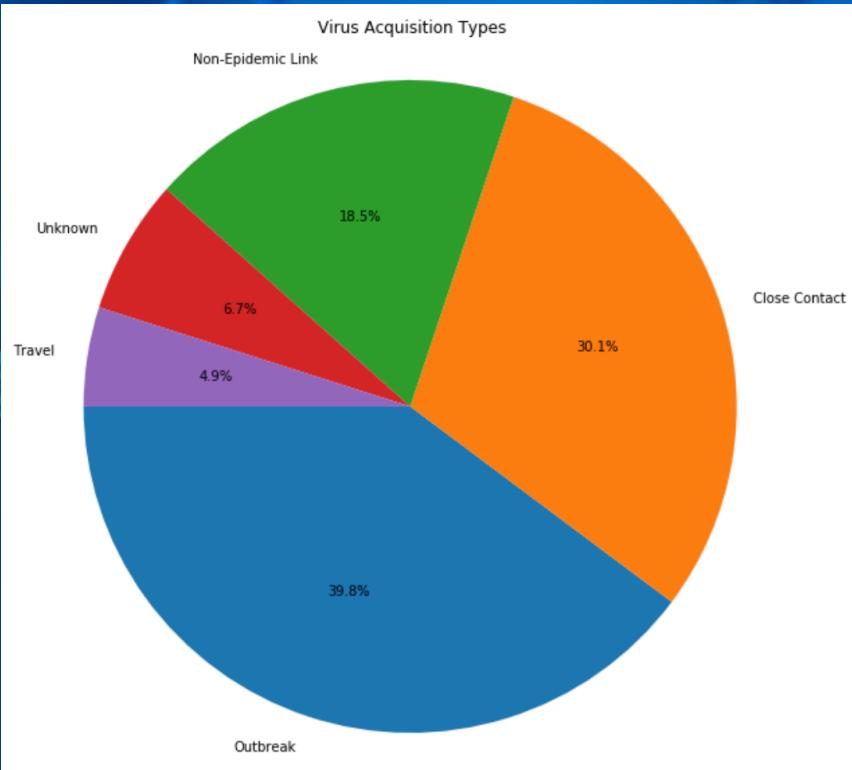
Not Resolved



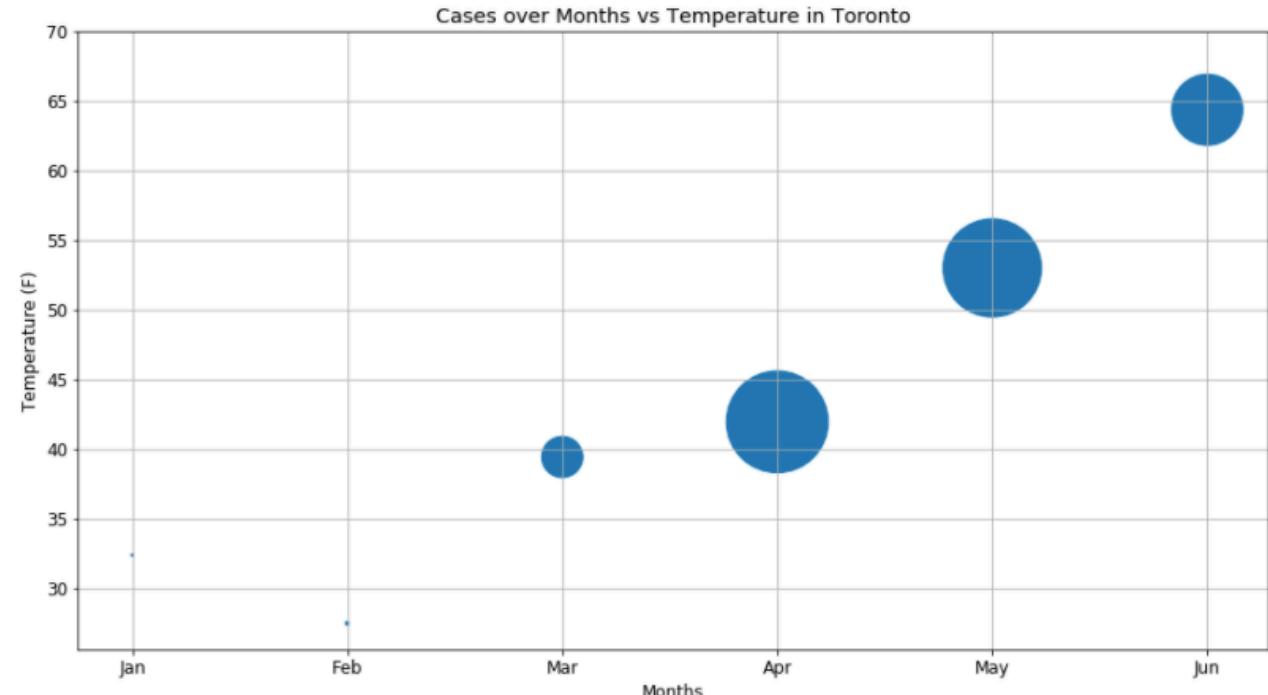
Not Resolved cases

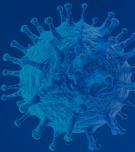
Resolved cases – 87.3%
Fatal cases – 7.5%
Not Resolved cases – 5.1%

How was the virus contracted?



What roles do weather conditions play in the spread of the virus in Toronto?

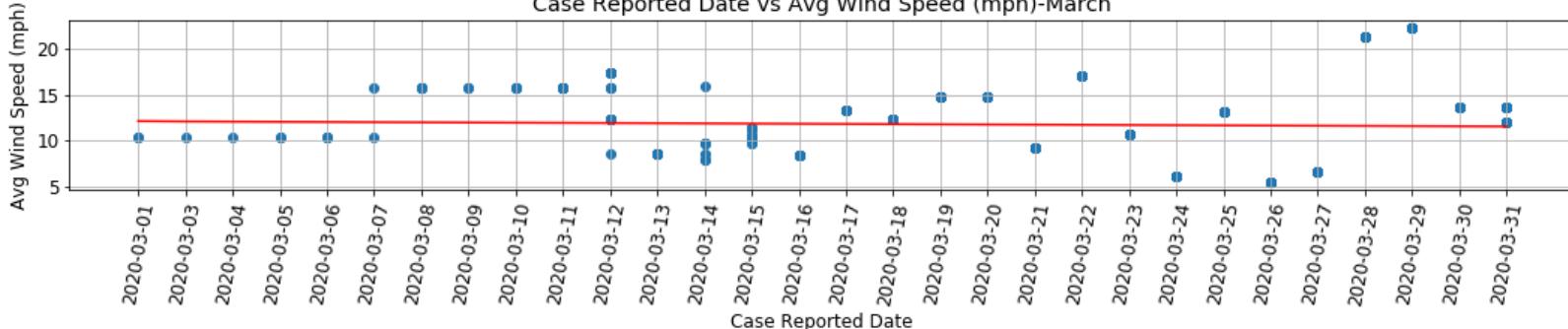




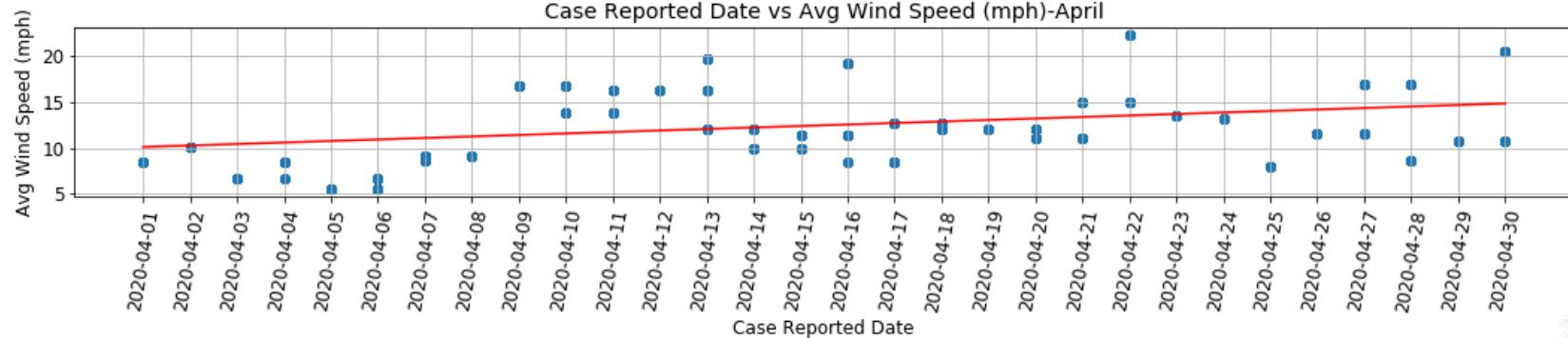
What roles do weather conditions play in the spread of the virus in Toronto?

Case Reported Date vs Wind Speed (mph)

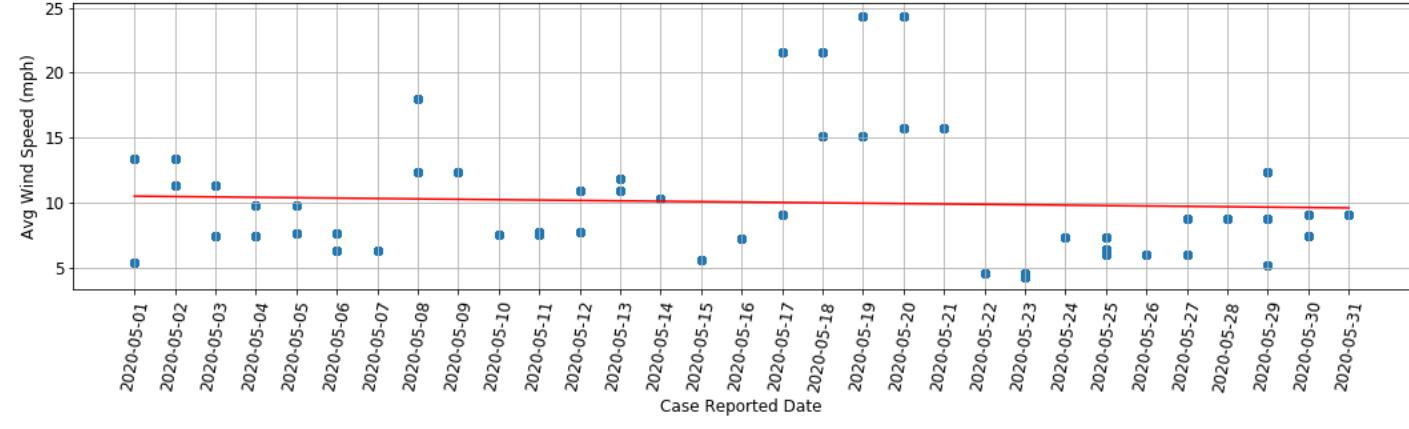
Case Reported Date vs Avg Wind Speed (mph)-March



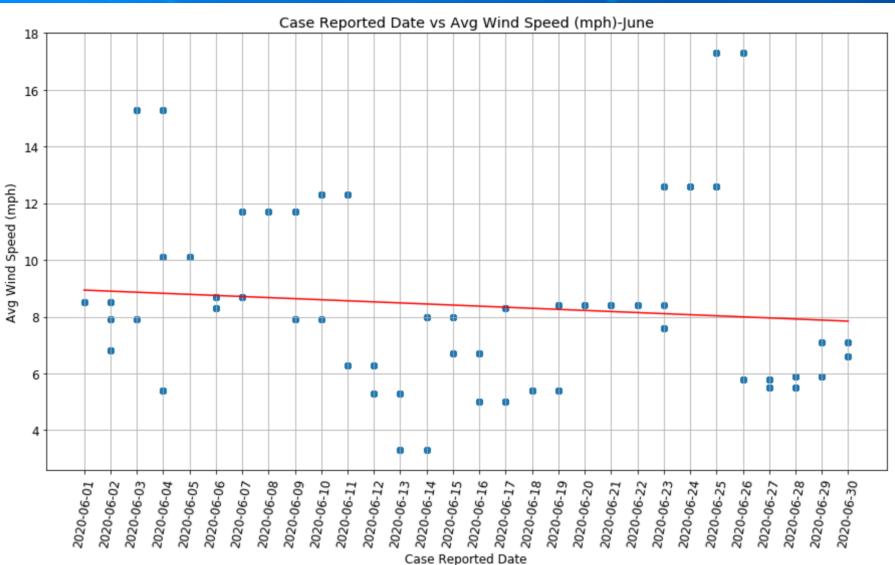
Case Reported Date vs Avg Wind Speed (mph)-April



Case Reported Date vs Avg Wind Speed (mph)-May

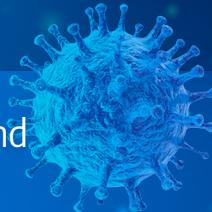


Case Reported Date vs Avg Wind Speed (mph)-June



Conclusions

- ▶ In Ontario, major cities were severely impacted including Toronto (largest numbers) and GTA.
- ▶ April 2020 was the peak spread of the virus as it had the most cases in Ontario.
- ▶ Females had a higher mortality rate but also a higher recovery rate than males.
- ▶ Females were mostly contracting the virus through outbreak, while males were mostly contracting the virus through close contact.
- ▶ Majority of the data shows as the temperature increases over time; total reported cases reduces.
- ▶ Windspeed does not seem to be a driver that impacts the number of cases in Toronto.



Implications of Findings

- ▶ Some of the reported cases in Ontario occurred in cities closer to the US borders, suggesting this might have added to the spread.
- ▶ The most common means of contracting the virus was due to lack of proper precautions.
- ▶ Largely populated cities are responsible for most of the spread in Ontario.
- ▶ In February, population was not reporting symptoms as virus was not classified as severe at that time. In March, the virus was considered a pandemic and reported cases increased significantly but started reducing by the end of May and June.
- ▶ Temperature played a significant role in the decrease of total cases.



Thanks to the datasets discovered, we were able to create interesting correlations which represents how the Coronavirus pandemic has affected all of us. The current weather has certainly been a factor in the decrease of total cases, so continue to enjoy the summer with caution.

