How did the pandemic influence crime in the City of Toronto?*

Analysis of Neighbourhood Crime Rate data of the City of Toronto from 2019 & 2020

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Abstract

In this report, the Neighbourhood Crime Rate data was pulled from the City of Toronto Open Portal to analyze neighbourhoods that were most affected by crime in 2019 and 2020. Upon analysis of the data, there is a significant decline in crime in the city of Toronto during the pandemic especially in communities with the highest crime rates. This is an important result as it can help policymakers in the government to take appropriate steps to reduce the crime rate post-pandemic.

1 Introduction

COVID-19 has crippled the city of Toronto with lockdowns. These lockdowns have reportedly negatively impacted our mental & physical health (Kumar and Nayar 2021) After going through 2020, we can now observe the data that shows us how the city has done. The Toronto Police Services uses this data to fight crime strategically. In this paper, we look at how the pandemic impacted crime in the City of Toronto to understand better if the suffering from the 2020 lockdown had a silver lining.

I conducted the analysis by looking at all the crime statistics in 2019 and 2020. This was done by bar graphs showing us visually a significant drop in case of counts and case rate for the 140 neighbourhoods of Toronto. Furthermore, I created a table that confirmed our graphs. Lastly, I ran a paired sample t-test on the difference in crime rates between 2018-19 & 2019-20 and found a high significance between the drop rates. Further, I explained how the data is acquired and biases associated with the data, and also looked in greater depth into potentially why there is a decline in crime in Toronto during the pandemic.

2 Data

To get better insights on crime in Toronto and find what neighbourhoods were most affected, I utilized the Neighbourhood Crime Rates data from the Toronto Open Data portal(*Neighbourhood Crime Rates* 2021). The raw dataset includes the data from 140 neighbourhoods of Toronto, population estimates of each neighbourhood provided by Environics Analytics, crime count, and crime rate. The crime count and crime rate included in the dataset are for Assault, Auto Theft, Break and Enter, Robbery, Theft Over, Homicide and Shooting & Firearm Discharges from the year 2014 to 2020. The crime rate is calculated per 100,000 population per year and the population figure reflects only the resident population of a region.

While this dataset contains all reported crimes in the City of Toronto, it isn't an accurate representation of actual crime rates in the city as there are biases in the data. The temporary population such as commuters, homeless people, and business patrons are not included in the neighbourhood population count. The data is collected and maintained by the Toronto police services themselves, which is a bias that should also be considered when examining this data, as there is a history of racial bias in policing (Goff and Kahn 2012). Furthermore, the dataset does not include racial data, nor does it includes crimes such as sexual assault

*Code and data are available at: https://github.com/isfandyar/How-did-the-pandemic-influence-crime-in-the-City-of-Toronto

Table 1: Toronto Neighbourhood Crime Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Population Projection (2020)	140	21728.871	11839.46	7130	13227.25	26598.25	87808
Crime Count (2019)	140	284.221	248.797	52	134.75	326.25	1471
Crime Rate (2019)	140	1294.641	711.203	493.078	820.836	1446.977	4676.352
Crime Count (2020)	140	249.114	216.445	54	124	292.5	1326
Crime Rate (2020)	140	1116.631	599.593	386.459	735.707	1285.054	4810.709

which is among one of the most under-reported criminal offences, due to the stigma and history of women not believed by police (McQueen et al. 2021)

The data analysis in this paper was done using `R` (R Core Team 2020). The raw data was obtained in csv format from the City of Toronto Open Data Portal using R package `opendatatoronto` (Gelfand 2020). This dataset was last updated on May 6, 2021. Using the R package `tidyverse` (Wickham et al. 2019), and `dplyr` (Wickham et al. 2021), I was able to clean and perform exploratory data analysis on the dataset. I first excluded ID, OBJECTID, Hood_ID, and geometry points from the dataset and decided to only analyze data from 2019 and 2020 as I am most interested in the newest data available and I want to look at how the city crime differs in the pandemic year compared to the year before the pandemic. However, the COVID-19 pandemic lockdown measures begin in March of 2020 (Rodrigues 2020), therefore the analysis of 2020 includes a few months that weren't influenced by the pandemic.

To better understand how the crime count, crime rate, and the population varies, I created a summary statistic table (Table 1) that showcases the Mean, Std. Dev, Min, Max, Pctl. 25 & Pctl. 75 of data from 2019 & 2020 by using `st` function from R package `vtable` (Huntington-Klein 2021) and `kable` (Zhu 2021) function from knitr package. Furthermore, using the knitr package again to create table (Table 2) to show neighbourhoods with the most number of crimes and crime rates in Toronto in 2019 & 2020 (Table 2).

Also, by using the selected neighbourhoods in Table 2 & Table 3, I created a graphs ((Figure 1) & (Figure 2)) using ggplot (Wickham 2016) library to further understand how the neighbourhood population may factor higher crime in the city.

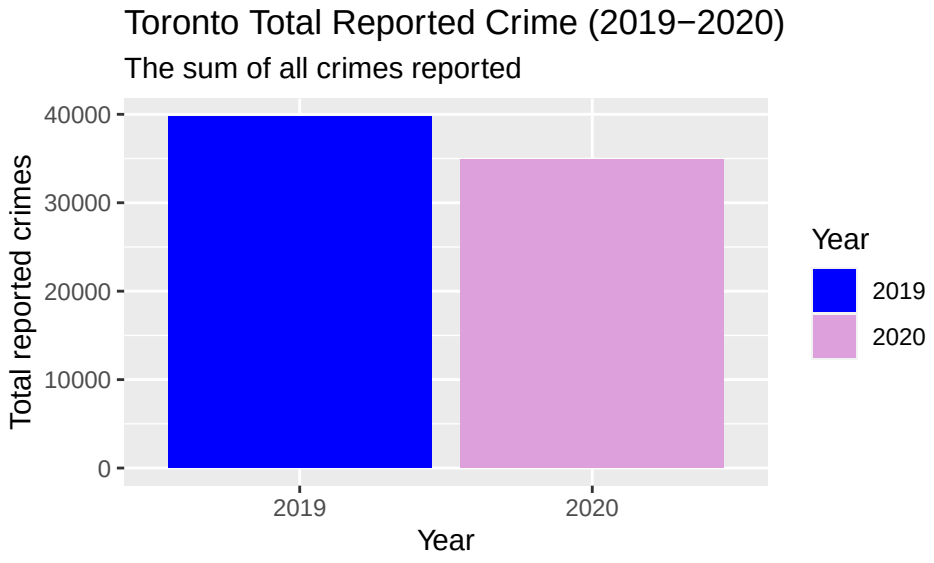

Figure 1: Toronto Total Reported Crime (2019-2020)

3 Results & Discussion

From (Figure 1), we can observe that there is a drop in the total number of crimes in the city of Toronto. This drop is by 4915 (12.4%) counts of reported crime. Further, looking at (Figure 2), (Figure 3), (Figure 4), & (Figure 5), we can observe that the number of crimes counts and rates have dropped when we compare 2019 to 2020. Also, by looking at Table 1, we can observe that there is a difference of 178.01 between crime rates of 2019 & 2020.

A paired-sampled t-test was conduced to compare the difference in crime rate of Toronto neighbourhoods between 2018-19 & 2019-20. There was a significant difference in crime-rate for 2018-19 (M = 561.82, SD = 835.67) and 2019-20 (M = -178.01, SD = 251.97);t(`parameter_ttest`) = -8.8903431, p = 2.859257×10^{-15}

The drop in crime rates can be linked to the government providing money to assist the population, known as CERB (Johnson and Roberto 2020). As CERB was helping people in poverty, the reason to do crime will be reduced as basic needs were being met. (Segal, Banting, and Forget 2021) It can also be linked to lockdowns making it so fewer people were outside, resulting in fewer crimes. (Hodgkinson et al. 2022)

However, even though the number of crimes reported seems lower, there have been numerous reports that during the pandemic, there has been a rise in domestic abuse ("National Survey Finds Domestic Violence During Pandemic Was More Frequent and Severe | CBC News" 2020) & hate crimes which this data doesn't cover (Gray and Hansen 2021).

4 Conclusion

In this paper, we looked at crime cases and crime rates of 140 neighbourhoods of Toronto and found that there has been a significant drop in crime in Toronto. We determined that the pandemic has an effect on violent crimes, but also noted that the dataset by the Toronto police department doesn't look at all crimes, such as domestic abuse, sexual assault, and hate crimes.

Appendix

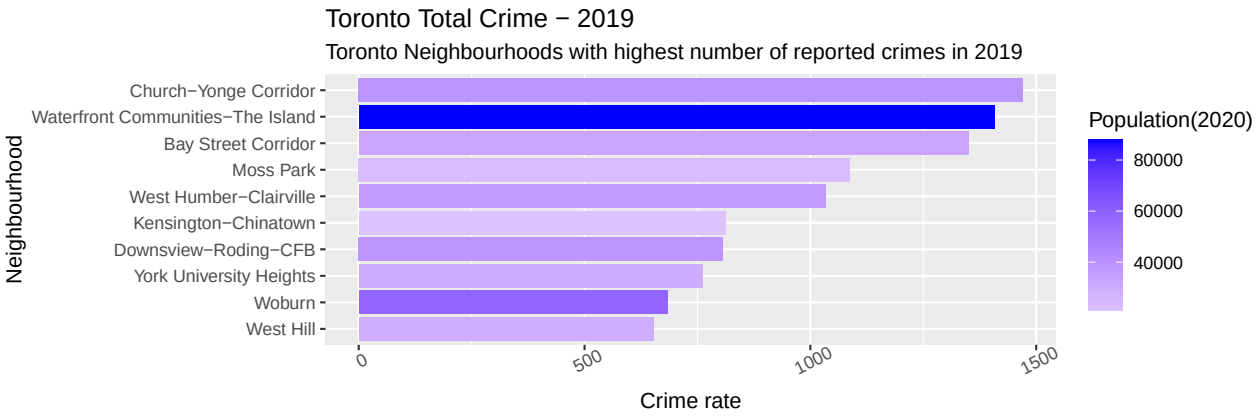

Figure 2: Top 10 Toronto Neighbourhoods with highest number of reported crimes in 2019

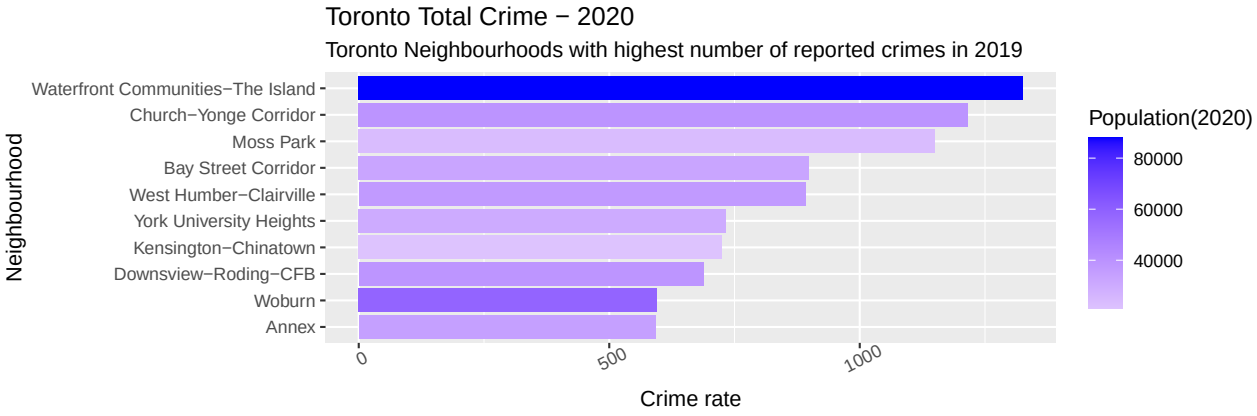

Figure 3: Top 10 Toronto Neighbourhoods with highest number of reported crimes in 2019

Table 2: Top 10 neighbourhoods with the most number of crimes in Toronto in 2019

Neighbourhood - 2019	Crime - 2019	Neighbourhood - 2020	Crime - 2020
Church-Yonge Corridor	1471	Waterfront Communities-The Island	1326
Waterfront Communities-The Island	1408	Church-Yonge Corridor	1216
Bay Street Corridor	1350	Moss Park	1150
Moss Park	1088	Bay Street Corridor	899
West Humber-Clairville	1033	West Humber-Clairville	892
Kensington-Chinatown	812	York University Heights	733
Downsview-Roding-CFB	807	Kensington-Chinatown	725
York University Heights	761	Downsview-Roding-CFB	688
Woburn	684	Woburn	595
West Hill	653	Annex	592

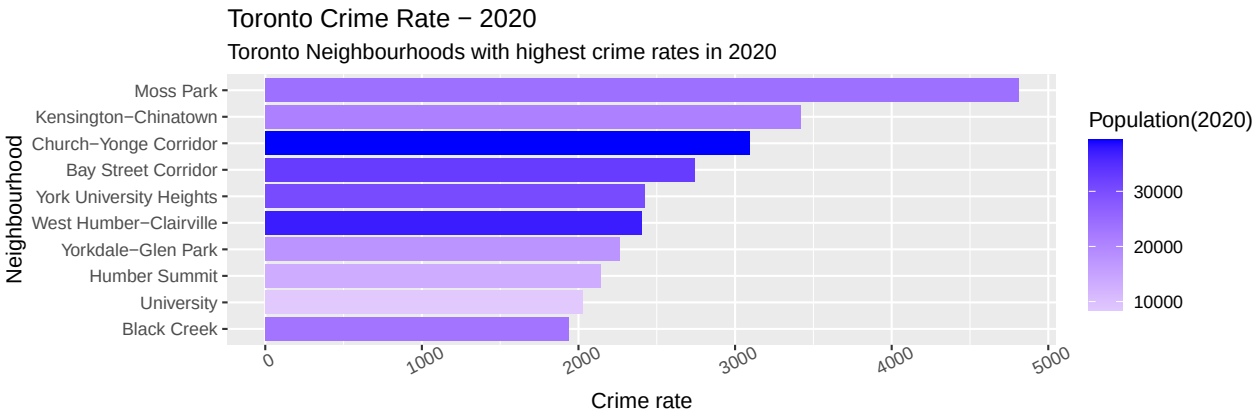

Figure 4: Top 10 Toronto Neighbourhoods with highest crime rates in 2020

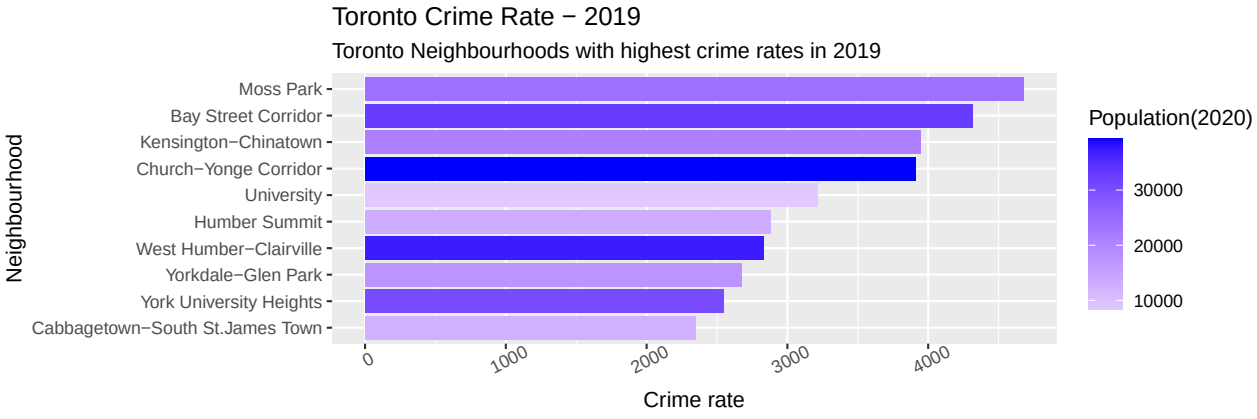

Figure 5: Top 10 Toronto Neighbourhoods with highest crime rates in 2019

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