Although the Number of Crimes Commited in 2019 Increased with Population, Crime Rates Stayed Relatively Constant Across Toronto Neighbourhoods

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Abstract

The goal of this paper was to determine if some Toronto neighbourhoods were safer than others. Data was drawn from Toronto's Open Data Portal and was analyzed using multiple packages in R Studio. It was found that although the volume of crime increased with neighbourhood population, the crime rate for each neighbourhood was relatively constant. Therefore, it can be determined that each Toronto neighbourhood is roughly equal in terms of safety.

Introduction

It is well documented that population growth leads to an increase in the number of crimes committed (McArdle (2011); Nolan (2004); Chang et al. (2013); Watts (1931)). This rise in crime could occur for multiple reasons. First, there are more opportunities for crime as population increases – more cars to steal, more houses to rob, and more people to attack (Braithwaite (1975)). Second, the criminal will have the opportunity to surround themselves with like-minded individuals, justifying their actions and increasing their likelihood of committing a crime (Braithwaite (1975)). Finally, and perhaps most importantly, there is an increased feeling of anonymity as population density increases (McArdle (2011); Braithwaite (1975)). People believe they will not be recognized or caught.

Although the volume of crime increases with population, it is debated whether population has a direct impact on the crime rate (Chang, Kim, and Jeon (2019); Steinmetz (2016)). Crime rate is a measure of crimes committed while accounting for population. Crime rate allows for the comparison of crime across geographical areas with different populations, and in the same area over time. Crime rate is defined as the number of crimes committed per 100,000 people, and can be represented by the following formula (Wallace et al. (2009)).

$$\text{Crime Rate} = \frac{\text{Number of Crimes Commited}}{\text{Population}} \times 100,000$$

This paper looks to investigate the relationship between population, the number of crimes committed, and crime rate. The study will be focussing on 140 distinct Toronto neighbourhoods in 2019. This paper attempts to determine if some areas of Toronto are "safer" than others. Although the general trend for volume of crimes did increase with population, crime rates held relatively constant across neighbourhoods. There may

be more crime in "Waterfront Communities-The Island" than in "Beechborough-Greenbrook", but the ratio of crime per 100,000 inhabitants is similar. Regardless of neighbourhood, inhabitants will be exposed to roughly the same rate of crime.

Data

This data was pulled from Toronto's Open Data Portal – Neighbourhood Crime Rates (Toronto (2019)). Toronto's Open Data Portal gives users the ability to "generate insights, analyses, and/or... develop web/mobile applications" (Toronto (2021)). The data was analyzed using R(R Core Team (2020)). Many packages were used to study the data. Opendatatoronto (Gelfand (2020)) and sf (Pebesma (2018)) were used to pull the data from the open data portal. Here (Müller (2020)) aided in saving and locating files. Knitr (Xie (2020)) was used to create tables. Tidyverse (Wickham et al. (2019)) was used for general analysis. Ggplot2 (Wickham (2016)) and gridExtra (Auguie (2017)) were used to create plots and figures. Tinytex (Xie (2021)) was used to help write the output to PDF. Finally, bibtex (Francois (2020)) was used for citations. Files of importance have been uploaded to GitHub for future use or for interest sake.[1]

The dataset does have some biases. First, not all crimes are reported. If people are not confident in their local police force, they may fail to report robberies, breaking and entering, and assault. It is also possible that homicides can go unreported if they are successfully hidden from the police. Additionally, there are many low populated Toronto neighbourhoods, but just a few highly populated ones. Therefore, the trend is relying heavily on just a few datapoints in the high population section of the dataset. To further investigate the trend between crime and population, it could be wise to compare cities and towns within (or between) provinces.

Figure 1 shows a plot comparing the number of major crimes committed to the population of different Toronto neighbourhoods. Each point on the graph represents a different neighbourhood. There is a positive trend for assault, breaking-and-entering, robbery, and total crime. However, car-theft and homicide appear to not be affected by population. Although these two crimes do not participate in the trend, the total number of major crimes does increase with population.

[1] https://github.com/tim-stephens/INF2178H_A1_Crime_in_Toronto_2019

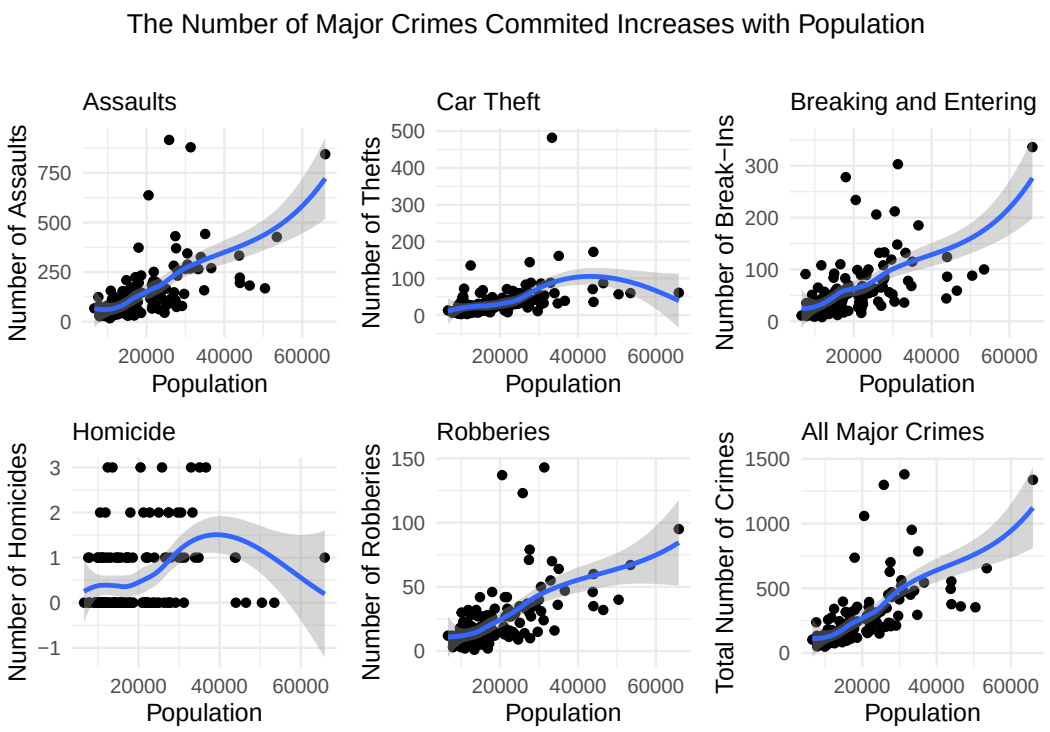

Figure 1: *Comparing the number of major crimes commited to the population of 140 Toronto neighbourhoods.*

There is a clear outlier on the "Car Theft" plot. To investigate, Table 1 was constructed. In Table 1, the top 5 neighbourhoods for car theft are shown (along with their populations).

Table 1: *Toronto Neighbourhoods with the Highest Number of Car Thefts*

Neighbourhood	Population	Number of Car Thefts
West Humber-Clairville	33312	482
Islington-City Centre West	43965	172
Downsview-Roding-CFB	35052	161
York University Heights	27593	144
Humber Summit	12416	135

Table 1 shows that the top neighbourood for car theft is West Humber-Clairville. After doing some research on Toronto.com (https://www.toronto.com/community-static/4544796-west-humber-clairville/), it was found that this neighbourhood is located very close to Toronto Pearson International Airport (Figure 2). Due to long-term overnight parking, unattended vehicles, and the sheer abundance of automobiles, it is likely that proximity to the airport is giving rise to an increase in auto theft.

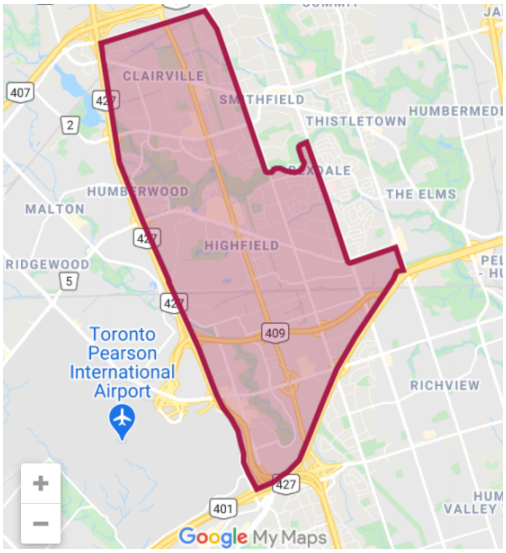

Figure 2: *The geographical location of Humber West-Clairville.*

Although the number of crimes committed was proportional to the population, further analysis was conducted to see if crime rates also differed due to population. If the crime rate is positively correlated to population, then it can be inferred that as population density increases, a higher percentage of people will commit crimes. If crime rate stays constant, then we can infer that even with an increase in population, the same proportion of people will commit crimes. Figure 3 compares crime rates for different major crimes against neighbourhood populations.

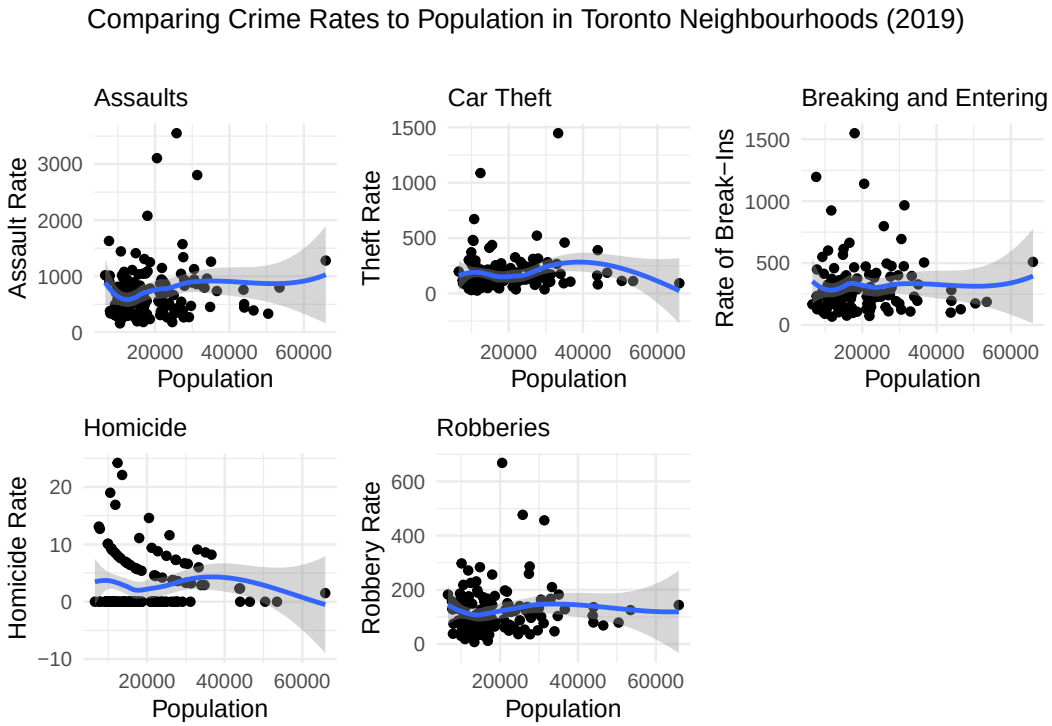

Figure 3: *Comparing the rate of major crimes committed to the population of 140 Toronto neighbourhoods.*

Figure 3 shows that there is a relatively constant rate of crime across Toronto neighbourhoods, regardless of population. An increase in population does not lead to an increase in the proportion of people committing crime - at least in Canada's largest city.

Conclusion

To determine if one Toronto neighbourhood was safer than the others, a comparison of the number of crimes committed was compared across neighbourhoods. It was apparent that with an increase in population, there was an increase in crime. However, the rate of crimes committed did not change much across different neighbourhoods. Although someone living in a highly populated area may see more reports of crime in the news, the actual crime rate between neighbourhoods is relatively constant. No matter where one lives in Toronto, they will experience a similar rate of crime – one neighbourhood is not much safer than any other. However, if you are hoping to keep your car... stay away from West Humber-Clairville and take a taxi to the airport!

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