Visualizing Neighbourhood Crime rates in Toronto*

Is toronto getting more dangerous?

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January 23, 2024

Toronto consistently secures high positions in studies evaluating urban safety. In The Econimist (2021), Toronto earned the distinction of being the second safest city globally, surpassed only by Copenhagen in the Netherlands. Despite the rankings, crime rates in Toronto are increasing in 2023. This paper aims to identify neighbourhoods with consistently high crime rates across different crime categories and analyzes the relationship between population density and crime rates, conducting an in-depth investigation into whether Toronto is experiencing an escalation in danger.

1 Introduction

Toronto has maintained a comparatively low crime rate in contrast to other major cities, yet it witnessed an unprecedented surge in shootings in 2019. In 2017 Except for homicide, all major crime offences are experiencing an increase in numbers reported by this time last year The remainder of this paper is structured as follows. Section 2....

2 Data

2.1 Data Sourcing

Data used in this paper are retrieved from Open Data Toronto Portal using the library `opendatatoronto` Gelfand (2022). The dataset is provided by Toronto Police Service (2023).

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*Code and data are available at: LINK.

2.2 Variable of interest

The neighbourhood investigated in this paper is based on the new 158 City of Toronto Neighbourhoods structure. We collected each neighbourhood's population and its respective crime rates across 9 different crime categories, including assault, auto theft, bike theft, break and enter, homicide, robbery, shooting, theft from motor vehicle and theft over $5000. We analyzed the crime rate data from 2014 to 2023.

2.3 Data Preprocessing

Data was cleaned and analyzed using the open source statistically programming language R (R Core Team (2022)) , using functionalities from tidyverse (Wickham et al. 2019), ggplot2 (Wickham 2016), dplyr (Wickham et al. 2022), readr (Wickham, Hester, and Bryan 2022), tibble (Müller and Wickham 2022), janitor (Firke 2021), kableExtra (Zhu 2021) and knitr (Xie 2014). Details of the data extraction and cleaning processes are discussed in the subsections below.

Table 1: Sample of Clean Neighbourhood Crime Rate Data in 2023

Neighbourhood	Population	Assault Rate	Auto Theft Rate	Shooting Rate	Homicide Rate	Robbery Rate
Yonge Bay Corridor	14731	3.6864	1.5478	0.0136	0.0068	0.4209
Fenside-Parkwoods	22909	0.5674	0.1746	0.0044	0.0044	0.0611
North Toronto	15077	0.6964	0.1194	0.0072	0.0012	0.0929
Dorset Park	26286	0.8293	0.3728	0.0076	0.0152	0.1141
North Riverdale	12168	0.6575	0.2219	0.0164	0.0082	0.0740

3 Results

3.1 Overall trend of crime rates

Based on the crime rate data spanning from 2014 to 2023, the majority of crime rate categories have remained relatively stable, with the notable exceptions of assault and auto theft crimes, see Figure 1. The data reveals a significant uptick in both categories post-2020 and into 2021. Specifically, from 2014 to 2023, the assault crime rate exhibited a 34% increase, rising from

0.6104 to 0.8063. Concurrently, the auto theft crime rate experienced a substantial surge of 211%, escalating from 0.1229 to 0.3822. Both categories reached its highest levels in 2023.

Furthermore, the analysis underscores assault as the predominant crime in Toronto, recording nearly three times the occurrence of other crime categories. This observation emphasizes the significance of addressing and understanding the dynamics of assault-related incidents within the city.
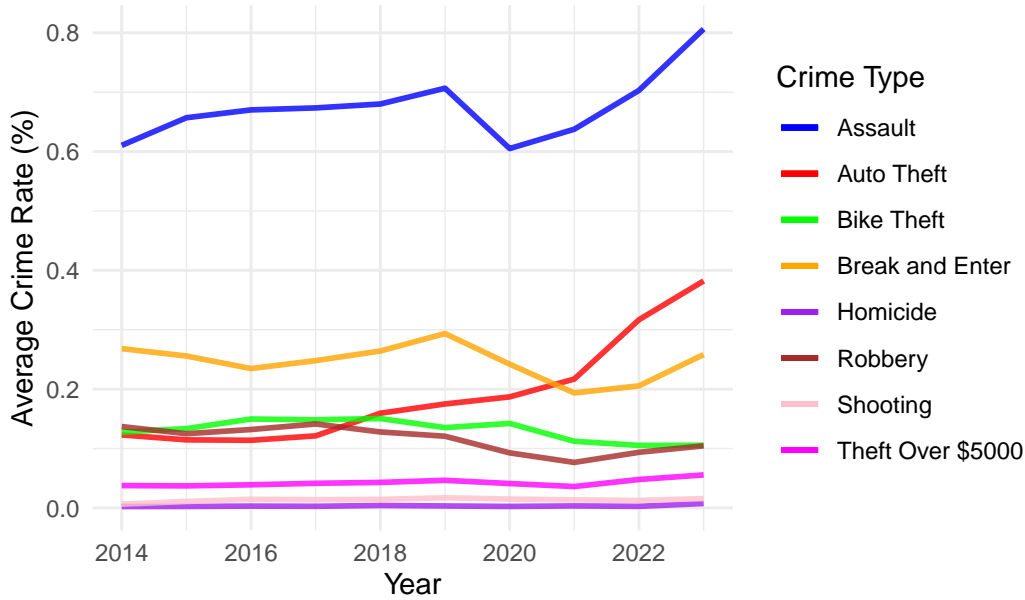

Figure 1: Average Crime Rates over time in Toronto's new 158 neighbourhood

3.2 Relationship between population density and crime rates

To comprehensively explore the relationship between population density and crime rates on a geographic scale, we generated a heatmap illustrating crime rates across different neighborhoods. This analysis specifically focused on population data from the year 2023 for simplicity. Notably, areas with heightened population density, particularly in downtown and northeast Toronto, were identified as depicted in Figure 2.

Upon scrutinizing the heatmap across various crime categories, there is no clear correlation between population density and specific crime rates, except in the case of bike theft. However, notable patterns are observed in the northwest area, including neighborhoods such as West Humber-Clairville, York University Heights, Downsview, and Oakdale-Beverley Heights, all of which are characterized by high population density. In this region, an elevated occurrence of crime is observed across seven out of nine crime categories. Moreover, bike theft crimes

were concentrated in downtown Toronto, aligning with the primary location of the city's bike-sharing program.
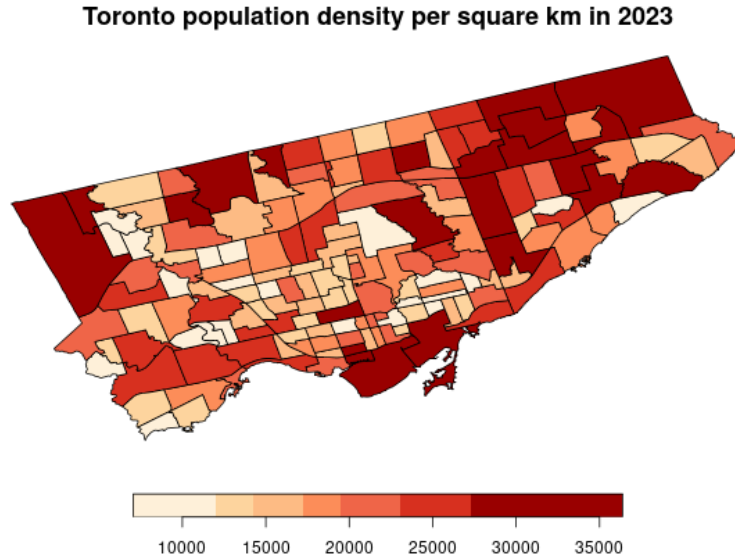
See Figure 3.

Toronto population density per square km in 2023

Figure 2: Toronto Population Density in 2023

3.3 Neighbourhood with the highest crime rate

After analyzing the distribution of crime across various neighborhoods, our focus shifted towards identifying the neighborhood with the highest crime rate in Toronto. The chart in Figure 4 illustrates the average crime rates across the nine categories utilized in this study for the top 20 neighborhoods. This analysis specifically concentrates on crime rate data from the year 2023, aligning with the rationale mentioned earlier.

Downtown Yonge East and Yonge-Bay Corridor emerge prominently as the two areas with the highest crime rates, both recording nearly 0.8% of the population involved in some form of criminal activity. Surprisingly, a noteworthy finding surfaces as four out of the top five neighborhoods with the highest crime rates are located in downtown Toronto, namely Downtown Yonge East, Yonge-Bay Corridor, Moss Park, and Kensington-Chinatown. This observation underscores that downtown Toronto carries the highest crime rate within the city.
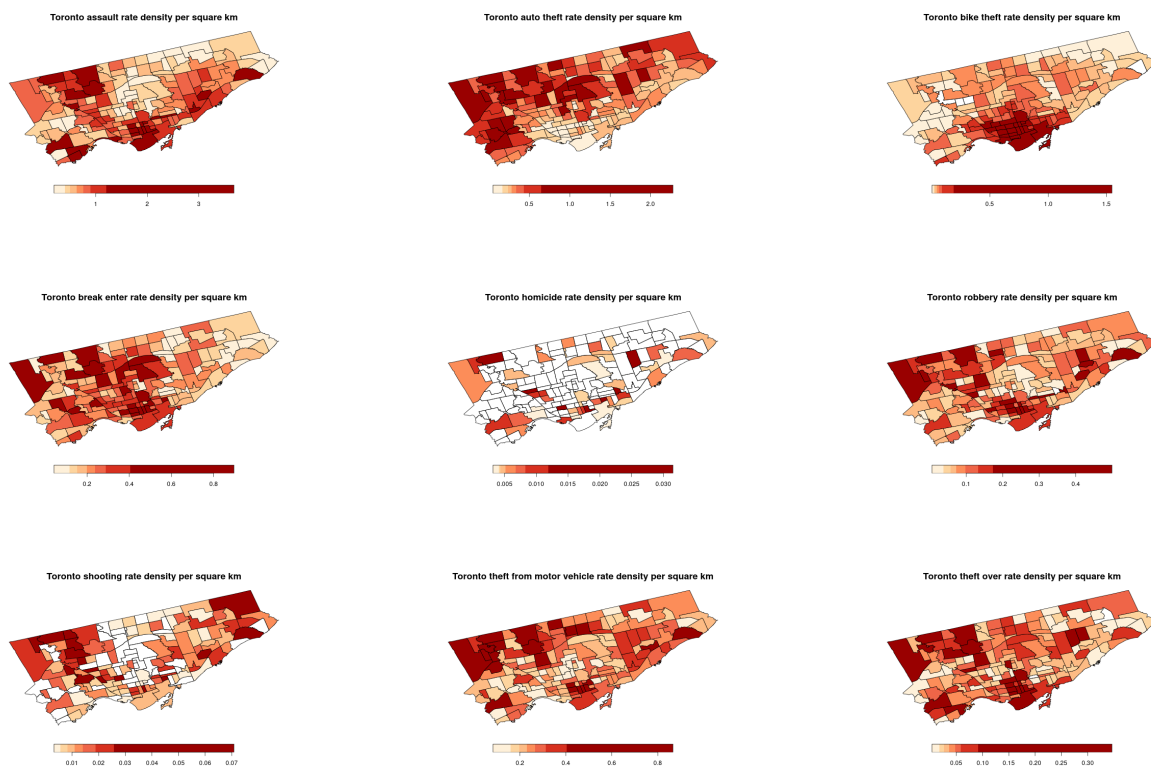
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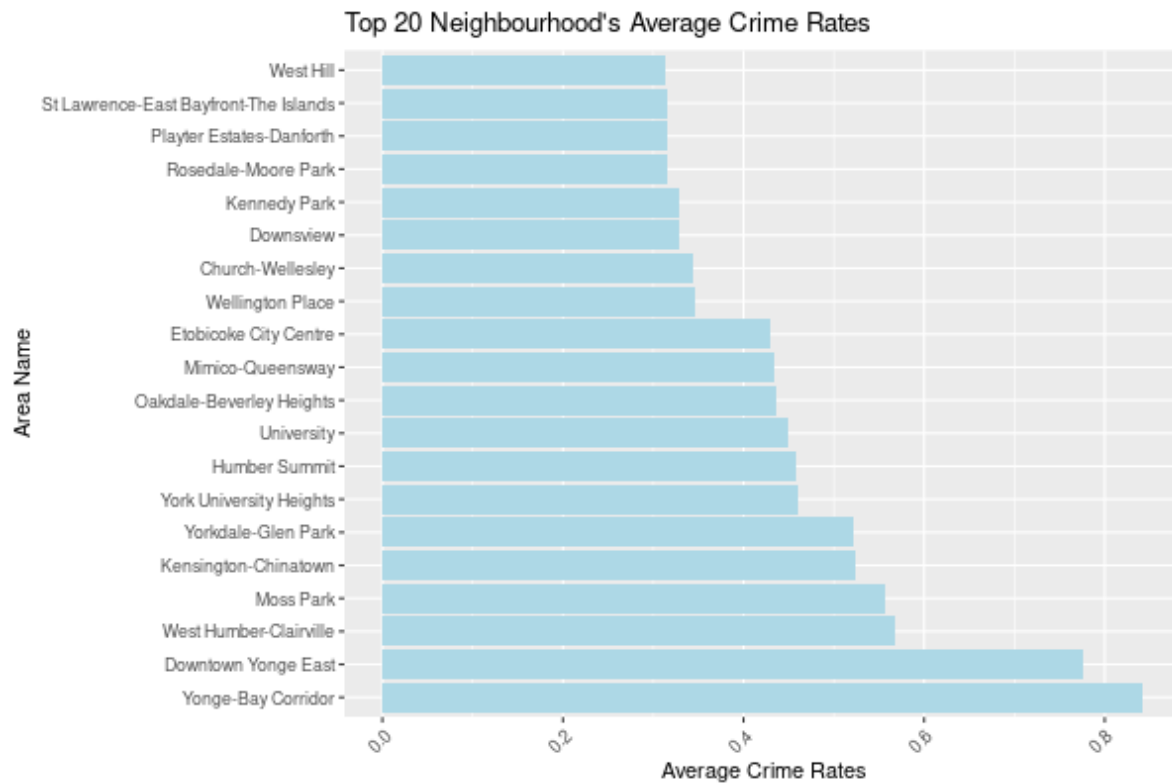Figure 3: Crime Rate Heat Maps in Toronto

Figure 4: Top 20 Neighbourhood's Average Crime Rates

References

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Toronto Police Service. 2023. *Neighbourhood Crime Rates*. https://open.toronto.ca/dataset/ neighbourhood-crime-rates/.