Toronto Bicycle Theft Rates Pre- and Post-COVID-19*

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3 February 2023

This paper investigates bicycle theft trends in Toronto in the years before, during, and after the COVID-19 pandemic of 2020 (specifically, 2014-2021) using data from Open Data Toronto. Overall, bicycle thefts increased during the pandemic and decreased afterwards. This paper aims to address major bicycle theft trends to make bicycle-owning in Toronto a safer experience.

1 Introduction

With the growing conscious effort to be more environmentally sustainable, cities around the world have been encouraging their residents to use bicycles as an alternative and more sustainable form of transit, as opposed to cars (Fernandez-Heredia, Monzon, and Jara-Diaz 2014). Bicycle-riding has also been promoted as part of an effort to encourage people to engage in more active lifestyles at a time in which jobs are increasingly becoming more sedentary (Fernandez-Heredia, Monzon, and Jara-Diaz 2014). However, factors such as risk of injury, cost, and fear of bicycle thefts serve as key obstacles to this growing initiative (Fernandez-Heredia, Monzon, and Jara-Diaz 2014). Of these obstacles, bicycle theft is especially of concern, as it could also serve as a reflection of neighbourhood safety.

This paper investigates major trends in bicycle thefts in Toronto over the past 8 years, from 2014 to 2021. Studies have investigated bicycle-riding safety and attitudes towards bicycle-riding (Habib et al. 2014), and there is considerable attention to major crime rates in Toronto, however there is a gap in the literature regarding bicycle theft rates in particular. This paper aims to address this gap by comparing overall bicycle theft rates over time, across neighbourhoods, and across premises from which they were stolen. This paper finds that overall bicycle theft rates in Toronto since 2014 peaked in 2018 and in 2020 and that bicycles were mostly stolen when stored outside as opposed to other premises. Of the 140 neighbourhoods in Toronto, the Waterfront Communities-The Island neighbourhood saw the highest overall

*Code and data are available at: https://github.com/sakura-ariga/bicycle_thefts_toronto.git.

bicycle theft rates, while the Maple Leaf neighbourhood saw the lowest overall bicycle theft rates. This data is worth investigating because it could contribute to existing literature regarding attitudes towards bicycle-riding and could help improve the safety of bicycle-riding in Toronto.

This paper will first examine and explain the Open Data Toronto dataset that the report draws upon. It will then investigate the overall bicycle theft trends over time, with a particular focus on the years just before, during, and after the COVID-19 pandemic. Thirdly, it will compare bicycle thefts across neighbourhoods to determine which neighbourhoods experience the most and least bicycle theft rates. Fourthly, the premise types in which these bicycle thefts occurred will be investigated for overall trends to determine what premises are the most and least safe to store one's bicycles. Finally, this paper will consider the limitations of this dataset and subsequent findings.

2 Data

To investigate bicycle theft trends in Toronto, the Bicycle Theft dataset (Services 2022) from the Open Data Toronto portal (Gelfand 2022) was used. The R statistical programming language (R Core Team 2021) was used to clean and analyze this data, along with the R packages tidyverse (Wickham et al. 2019) to import and visualize data, dplyr (Wickham et al. 2022) to manipulate data, ggplot2 (Wickham 2016) to create graphs, RColorBrewer to change graph colours (Neuwirth 2022), and kableExtra (Zhu 2021) to create tables. The variables Report_Year, NeighbourhoodName, and Premises_Type were extracted from the original Open Data Toronto dataset. While the original Bicycle Theft data included both a Report_Year and Occurrence_Year variable, Report_Year was chosen as it better took into account the fact that this dataset is comprised of bicycle thefts reported to the Toronto Police Service.

Table 1 displays the 8 years that the cleaned dataset contains bicycle theft data for, and shows the total number of bicycle thefts that occurred in each year. Figure 1 graphs this as a bar graph to better visualize the trends. Table 1 and Figure 1 show that bicycle thefts steadily increased from 2014 to 2018, decreased in 2019, rose again in 2020, and dropped in 2021. From this, we can conclude that bicycle thefts increased during the COVID-19 pandemic year of 2020 but decreased post-pandemic in 2021. Most interestingly, the two years with the most bicycle thefts were 2018 and 2020. The latter could be explained by the COVID-19 pandemic that occurred that year and that led to increased unemployment levels (Canada 2022), which is an indicator for theft crimes (Maddah 2013). Furthermore, overall thefts in 2021 were much lower compared to the previous year and is the year with the second least amount of thefts over the 8-year period, second only to 2014. This aligns with decreased unemployment levels following the pandemic (Canada 2022).

Table 1: The total number of bicycle thefts that occurred in each year, from 2014 to 2021.

Year	Number of Thefts
2014	3058
2015	3318
2016	3846
2017	3900
2018	4004
2019	3732
2020	3951
2021	3189

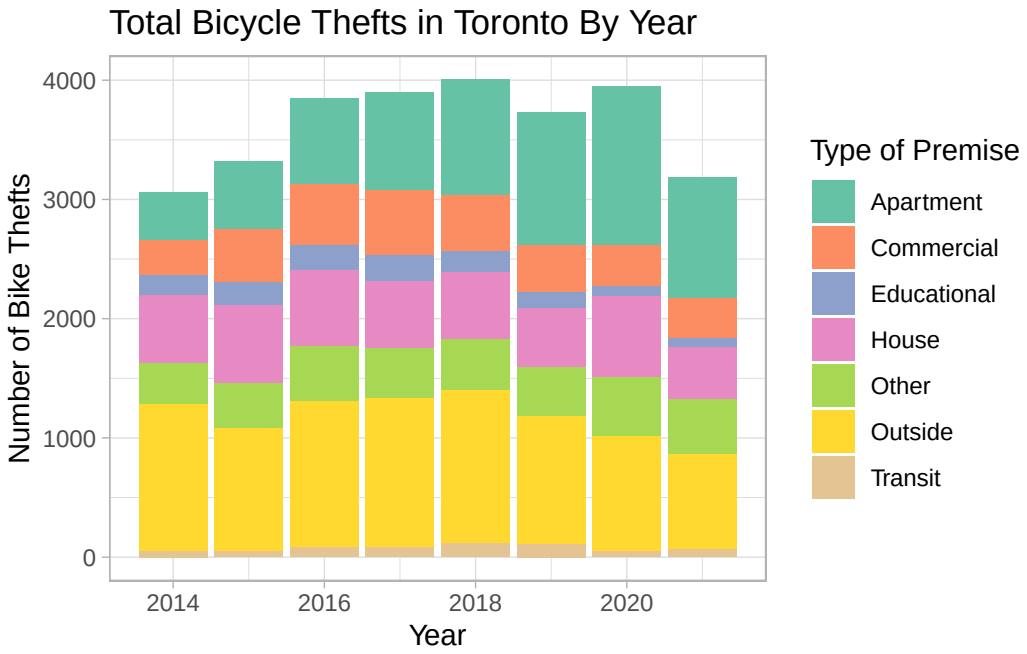

Figure 1: Total Bicycle Thefts in Toronto By Year (2014-2021)

Table 2: The Toronto neighbourhoods with the most and least total bicycle thefts in the 8-year period of 2014-2021.

	Neighbourhood	Total Thefts
Most Thefts	Waterfront Communities-The Island	2898
Least Thefts	Maple Leaf	7

Table 2 displays the neighbourhood with the highest number of total bicycle thefts and lowest number of total bicycle thefts over the 8-year period. The Waterfront Communities-The Island neighbourhood was the neighbourhood with the most bicycle thefts overall. Figure 2 graphs this neighbourhood's annual bicycle thefts over the 8-year period. As with the overall bicycle theft trends displayed in Figure 1, 2018 was the year with the most thefts, however Figure 2 differs from the overall bicycle theft trends in that the bicycle thefts during and post-pandemic remain similar, as the bars for 2020 and 2021 respectively are of similar height. Furthermore, pre-pandemic bicycle thefts in the Waterfront Communities-The Island neighbourhood, as seen in the bars for 2016 to 2019, are much higher than those during or post-pandemic, differing slightly from the Toronto overall trends displayed in Figure 1.

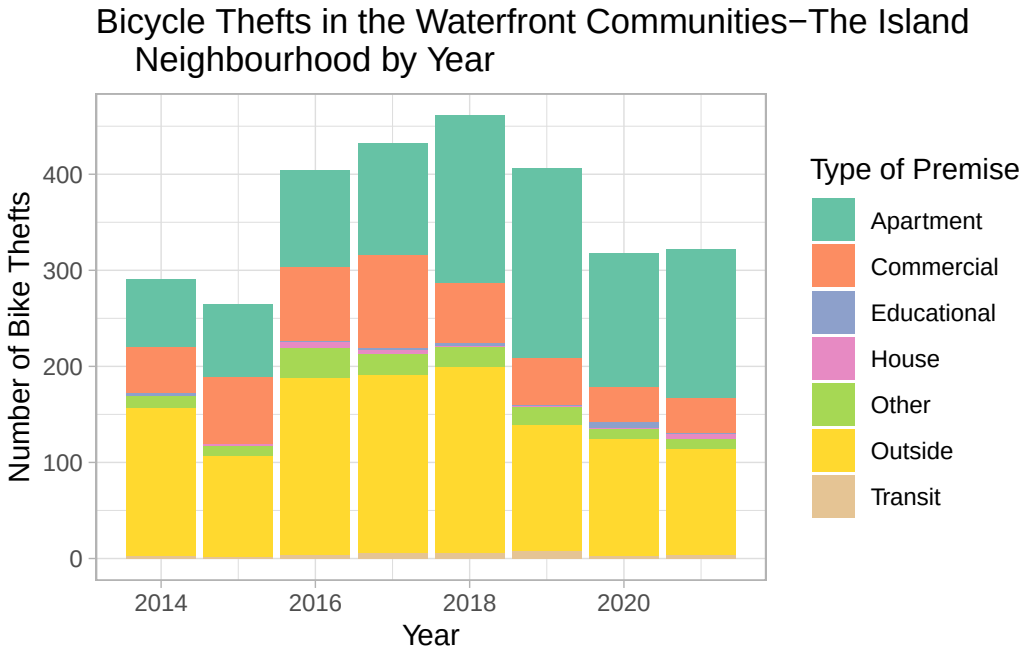

Figure 2: Total Bicycle Thefts in the Waterfront Communities-The Island Neighbourhood By Year (2014-2021), the Toronto neighbourhood with the most bicycle thefts total

The neighbourhood with the least overall bicycle thefts was the Maple Leaf neighbourhood. Figure 3 graphs this neighbourhood's annual bicycle thefts over the 8-year period. Unlike the overall bicycle theft trends in Figure 1, 2017 and 2020 were the years with the most thefts for this neighbourhood. However, the values for bicycle thefts during these years is only 2 thefts (as seen on the y-axis of Figure 3), such that comparing it to overall bicycle theft trends is not very significant as these numbers are so small compared to the overall bicycle theft numbers. The same can be said about this neighbourhood's bicycle theft trends regarding the pre-, during, and post-COVID-19 pandemic years.

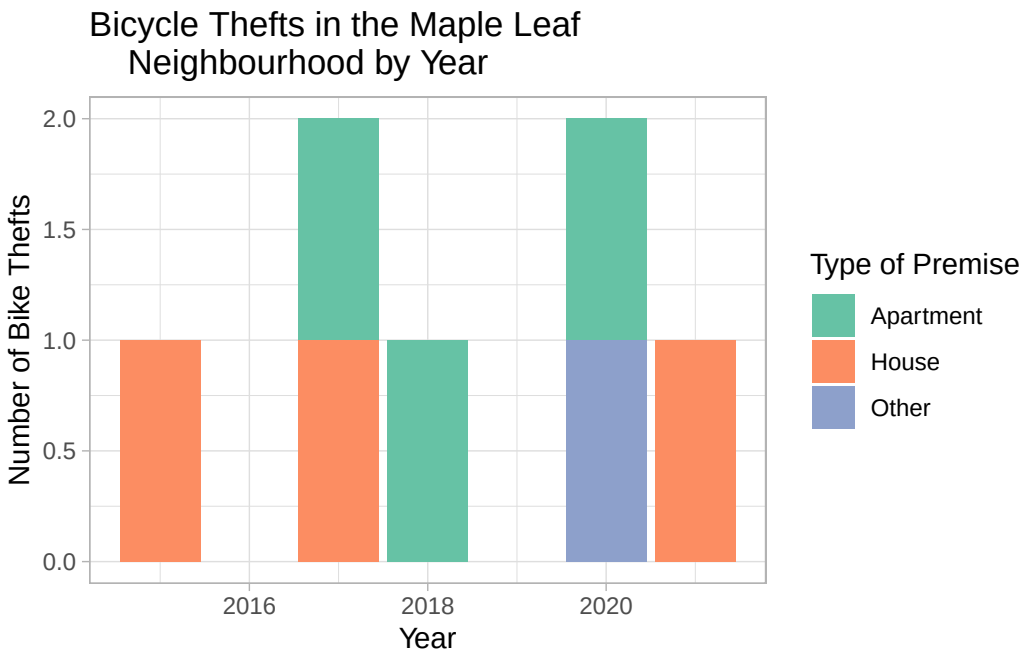

Figure 3: Total Bicycle Thefts in the Maple Leaf Neighbourhood By Year (2014-2021), the Toronto neighbourhood with the least bicycle thefts total

The difference between the amount of bicycle thefts reported in the neighbourhood with the most thefts, Waterfront Communities-The Island, versus the least thefts, Maple Leaf, could partly be explained by the type of premises where the bicycle thefts occurred. Figure 4 shows the total bicycle thefts reported in Toronto by premises type between 2014-2021. This graph shows that bicycle thefts occurred the most outside, followed by at apartments, and then at houses. The fill values of Figure 2 show that most thefts in the Waterfront Communities-The Island neighbourhood occurred outside and at apartments, the top two premise locations that overall bicycle thefts took place at. The fill values of Figure 3 show that most thefts in the Maple Leaf neighbourhood occurred at houses and at apartments, and not outside. One potential explanation for the difference in bicycle theft rates between these two neighbourhoods is that perhaps the Waterfront Communities-The Island neighbourhood is comprised of majority apartment buildings and outdoor bicycle parking areas, while the Maple Leaf neighbourhood is perhaps majority houses and therefore has a smaller chance of bicycle theft overall.

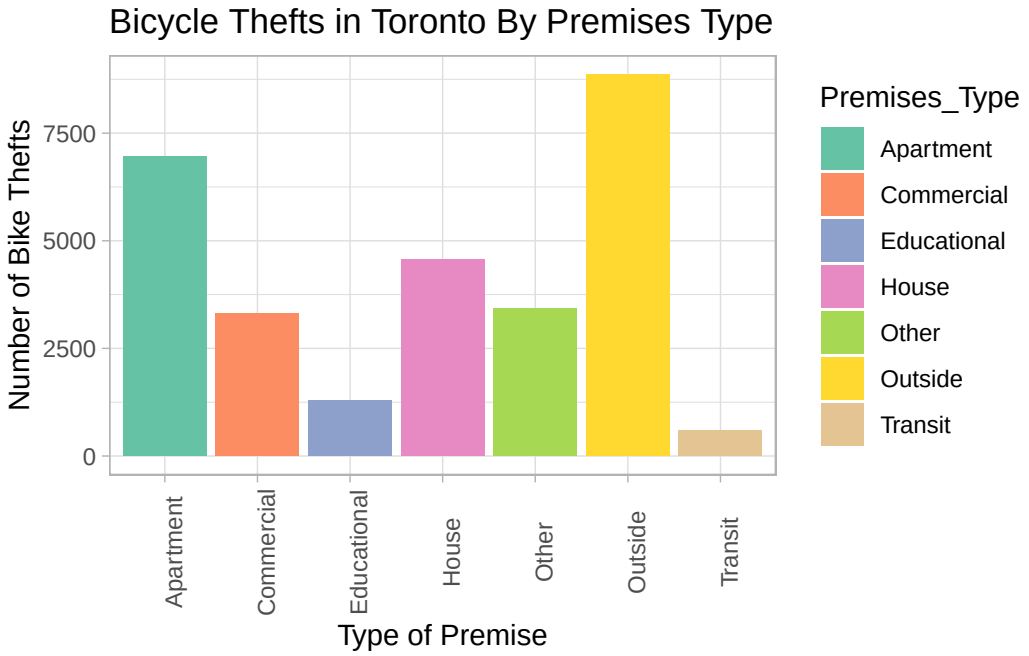

Figure 4: Total Bicycle Thefts in Toronto By Type of Premise Where Theft Occurred (2014-2021)

A key limitation of this data is that the location of the data is not entirely accurate, as identified by Open Data Toronto themselves. The portal stated that the exact location of bicycle theft occurrences were generalized to the nearest intersection for privacy reasons (Services 2022). Thus, the variable for neighbourhood in which bicycle thefts occurred may not be accurate (Services 2022). As such, this data cannot be reliably compared to other crime-related datasets, preventing meaningful comparison with overall crime rates or with crime victim profiles (Services 2022). Another limitation is that the data was collected by reports made to the Toronto Police, and is a reflection of the bicycle thefts that occurred to victims who feel comfortable interacting with Toronto Police. Thus, it may exclude bicycle thefts that occurred to people who are not as comfortable with the municipal police, such as racialized communities.

3 Conclusion

Overall, bicycle thefts in Toronto were higher during COVID-19 (2020) when compared to post-COVID-19 (2021), but the most thefts occurred in 2018. The neighbourhood with the most overall bicycle thefts was Waterfront Communities-The Island, while the neighbourhood with the least overall bicycle thefts was Maple Leaf. This could perhaps be due to differences in locations where bicycles were stolen from, in which outdoors was the location from which bicycles were stolen from the most. However, it is important to keep in mind that these findings

are not entirely accurate due to the offsetting of the location data to the nearest intersection (Services 2022).

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