Showing Toronto's Traffic Safety Improvement Before and During the COVID-19 Pandemic*

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Abstract

Vehicle collisions are an unfortunate consequence of the amount of traffic flow that cities such as Toronto experience daily, and is an issue which every city seeks to mitigate. Using data from public Toronto databases, we obtain daily police reports on vehicle collisions and analyze the data using graphs. We observe that Toronto's prevention in dangerous collisions appears to be improving, but total collisions continue to increase and confounding factors resulting from the COVID-19 pandemic make it difficult to predict effectiveness of the city's pre-pandemic actions. The study has implications for continued planning and management while mindful of external factors.

1 Introduction

Every urban city must face numerous challenges daily in order for its residents and the region to function productively and encounter positive growth. As the most populated city in Canada, Toronto is no different from others in having to deal with the struggles of maintaining safety. One such issue is traffic and road safety, which only increases in severity as a city's population grows if steps are not taken to address the problem. As a result of a significant bump in traffic-related fatalities in 2016, with 78 KSI collisions resulting in death (Service 2022a), the city acted by implementing a five-year action plan from 2017 to 2021 dubbed the Vision Zero Road Safety Plan, with the goal of reducing fatal and serious collisions by 20% by 2026 (T. T. Services 2016).

Using reports of traffic collision data provided by the City of Toronto, the goal of this report was to analyze the effectiveness of the Vision Zero Safety Plan by comparison of the frequency and severity of collisions since the plan was introduced. Observations were also done on the most frequently endangered locations and the change in collision frequency in these regions over time. Results from this analysis showed that the safety plan began to show promise by the end of 2019, as evident by a significant decrease in serious collisions since the city's implementations at the beginning of 2017. Areas in the city which experienced serious incidents more often showed clear improvement in traffic safety as observed by police report data. Previously dangerous neighbourhoods for traffic activity had drastically reduced collisions reported by the end of 2019. However, the independent effectiveness of the city's planning becomes impossible to analyse beginning in 2020 with the occurrence of the COVID-19 pandemic, slowing city activities internationally and contributing to a massive decrease in general vehicle activity. As well, Toronto's general traffic safety has not shown any noticeable improvement with the number of non-serious traffic collisions continuing to rise, only stopped by the pandemic's effect on the city. It remains to be seen how the pandemic will continue to affect traffic volume in the future as countries are beginning to recover from the virus. Cities including Toronto may attempt to learn from unexpected situations such as the pandemic and adjust programming accordingly.

*Code and data are available at: https://github.com/Ivannoar/Showing-Toronto-s-Traffic-Safety-Improvement-Before-and-During-the-COVID-19-Pandemic.

Table 1: First five rows of a dataset showing traffic collisions in Toronto

Month	Day	Year	Hour	Divison	Neighbourhood ID	Neighbourhood	Fatalities	Injury	Fail to Remain	Property Damage
May	Monday	2020	2	D52	77	Waterfront Communities-The Island (77)	0	NO	NO	YES
May	Monday	2020	5	D22	18	New Toronto (18)	0	NO	YES	YES
May	Thursday	2020	22	D51	74	North St.James Town (74)	0	NO	NO	YES
January	Tuesday	2020	21	D52	76	Bay Street Corridor (76)	0	NO	YES	NO
May	Monday	2020	9	D52	76	Bay Street Corridor (76)	0	YES	NO	NO

2 Data

In order to analyze the effectiveness of the city of Toronto's traffic safety plan, this report uses the data gathered from the Police Annual Statistical Report on Traffic Collisions (T. P. Services 2021). This annual report is updated by the Toronto Police Service and transparently shares information related to police-related statistics, which is available for the public to see. The dataset containing information on collisions was obtained from the Toronto Open Data Portal Home and downloaded as a .csv file.

The data in this report is collected by the Toronto Police Service and contains traffic collision incidents recorded by the police from 2014-2020. Police will arrive at a collision according to a number of criteria, including factors such as fatalities, damage to government property, or any incidents involving pedestrians or cyclists (Service 2022b). If the collision does not meet these criteria, but the damage resulting from the crash exceeds a value of 2000 dollars, citizens are required to self-report their collisions which are recorded into the database. If the damage does not exceed 2000 dollars and criteria for police presence are not met, incidents are not required to be reported and thus may not appear in the database. Therefore, it is unknown how many unrecorded traffic collisions have occurred in the city and thus under-represent the total number of incidents. It may also be the case that incidents which do not require police presence are also not reported, either accidentally or purposefully by the collision's participants, leading to nonresponse bias. Bias is also heavily present in the year 2020, where the COVID-19 pandemic paralyzed cities and countries internationally. This event left the world unprepared for handling it and as of this report's finalization continues to have its impact on global affairs. The result is that most statistical data from 2020 onwards must take into account the global pandemic in all cases, likely leading to a massive headache for those conducting chronological analyses. The effects of the pandemic, and the resulting Ontario lockdown are apparent in the Toronto Police Service's data which will be discussed soon.

To focus on the main goals of this report, `R` (R Core Team 2020) was used to open the dataset and begin the analysis. The `tidyverse` (Wickham et al. 2019) package was used to process and clean the data for our purposes. `kableExtra` (Zhu 2020), `dplyr` (Wickham et al. 2021) and `ggplot2` (Wickham 2016) were used to generate figures and graphs for analysis. `knitr` (Xie 2021) allows this report to be accessed via PDF.

The original dataset contained 415918 collision observations and 17 variables, which contained information such as collision identification numbers, date and time of the incident, geographical information, and severity of the crash, such as if there was injury, death, or property damage. To begin with cleaning the data, indicator columns related to index and identifier numbers were removed due to lack of usefulness. Some geographical and chronological data were also left unused as they were not needed for the focus of the analysis, and were excluded over data existing in the report. As similar variables already existed, only a few categorical terms were chosen on the basis that they would be easier to manipulate and analyse. Lastly, only incidents from 2016 to the most recent updated year, 2020, was included. This was in order to conduct analysis of the effects of the city's safety plan from 2016 and onward. After the data was cleaned, the report contained 300108 observations and 11 variables. A separate data table was then created totalling statistics of incidents by year. 1) shows a sample of the cleaned data, containing some recorded incidents.

Toronto's Vision Zero Safety Plan aimed to decrease fatal and serious traffic collisions in the city by 20% by 2026, and has attempted to do so through initiatives such as red light cameras, improvements to cycling accessibility and safety, and speed limit reductions (T. T. Services 2022). The city's statistical report includes figures on whether traffic collisions are fatal, cause injury, result in a Fail to Remain case, or cause damage to property. We will consider a fatal or serious collision as one that results in death or injury. (Figure 1) shows the frequency of traffic collisions in Toronto since Vision Zero was implemented.

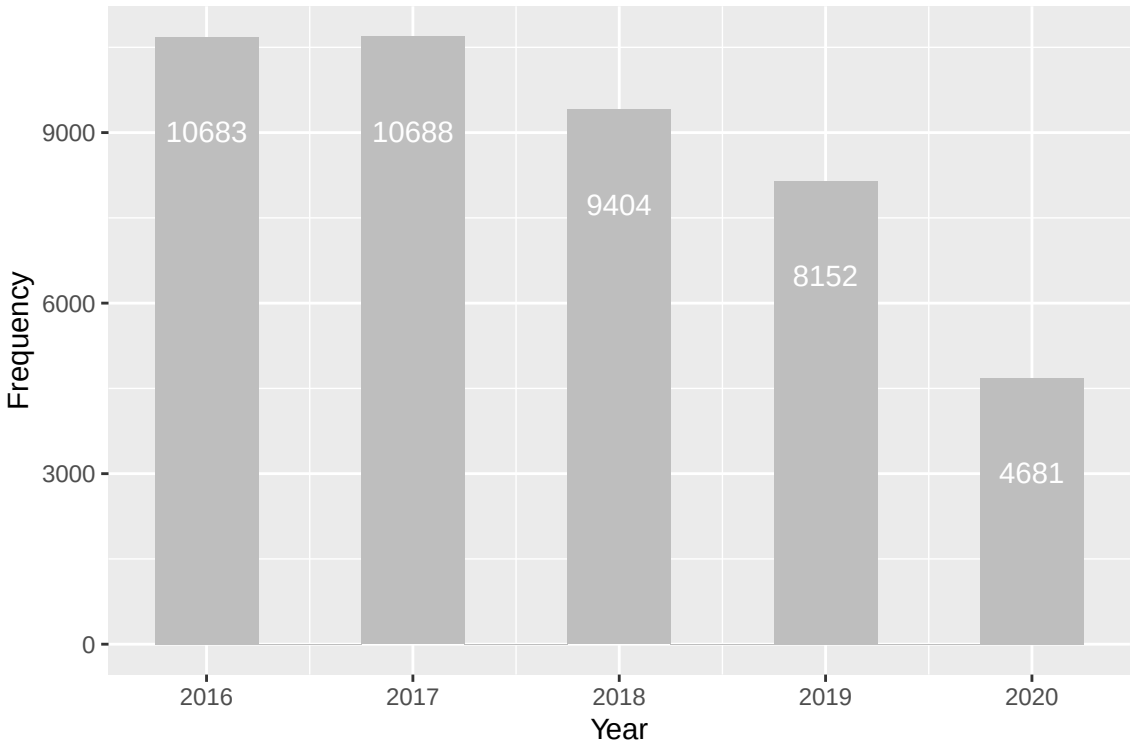

Figure 1: Number of Fatal or Injurous Traffic Collisions in Toronto

According to the graph, the number of serious incidents began to drop in 2018, with a sharp decrease in serious traffic-related incidents in 2020. As a result of the COVID-19 global pandemic, Toronto declared a state of emergency on March 23 2020, resulting in closure of businesses and reduced traffic activity for the entire year (Ranger 2021). This makes analysis of Toronto's traffic safety measures difficult as the extent to which the pandemic had an effect on traffic collisions is unknown. Most likely, the city's closures and resultant lockdowns were a large factor in the drop of serious accidents, and the ongoing pandemic may affect continued statistical analysis for years to come.

In a large city such as Toronto, it is understood that some areas of the city may experience higher activity, larger volume during rush hours, or relatively worse safety measures, thus creating regions where serious accidents are more likely to occur than others. (Figure 2) shows the top 10 neighbourhoods in serious collision count in 2016, and the relative change over time recorded by the Toronto Police Service dataset. The graph was produced from code by (Lam 2021).

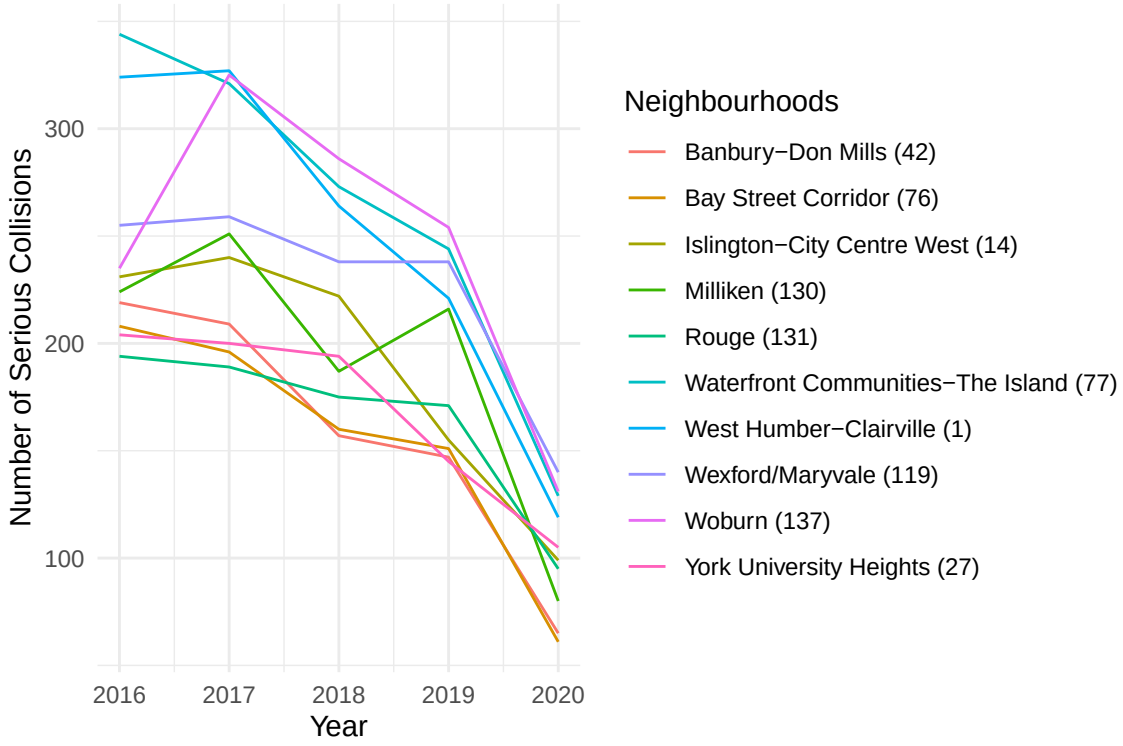

Figure 2: Improvement in yearly serious collision count from 2016 top neighbourhoods

Results show that these neighbourhoods which experienced the most collisions in 2016 had less serious accidents occur in the following years. Once again, a significant drop in traffic accidents is noticeable in the year 2020 as a consequence of the international pandemic. While the resulting data may suggest that Toronto's overall traffic safety is improving, (Figure 3) shows a surprising result; while overall, serious collision rates are dropping, the amount of vecicle collisions in general have been steadily increasing since 2016, and have only dropped in 2020 as a result of the pandemic. This is not extremely surprising, since as Toronto's population grows and the city expands, more traffic accidents are likely to happen. However, it is of interest that while collisions are increasing, they are on average less likely to be serious or result in death. While the goal of the Vision Zero plan to reduce serious accidents seems to be proving effective, the city should further its efforts in reducing accidents in general as a next step, in order to mitigate the amount of collisions and therefore dangerous collisions in the city.

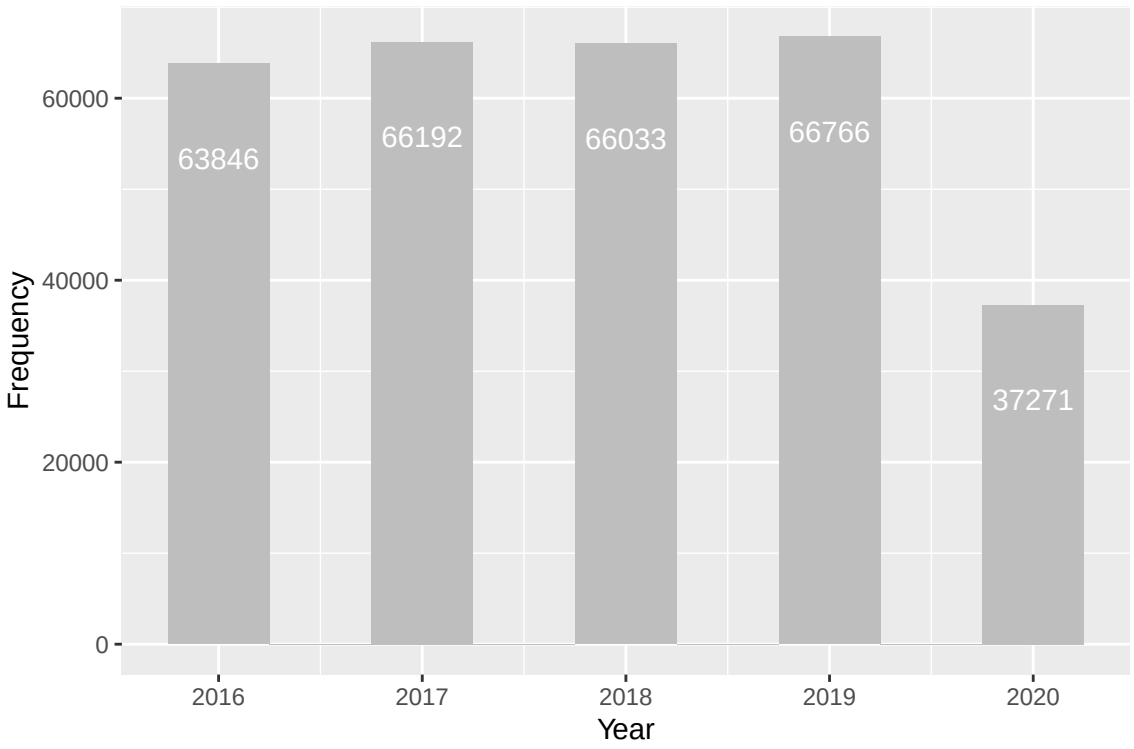

Figure 3: Yearly number of traffic collisions in Toronto

3 Conclusion

Ultimately, Toronto's Vision Zero Safety Plan was able to show its potential by playing a factor in the reduction of serious traffic accidents since the city's deadliest year for drivers in 2016, but the program was made less effective due to international factors creating an artificial halt in traffic activity in the years following. As well, data shows that the overall frequency in collisions has risen since 2016 in spite of the city's efforts otherwise. As the world begins to recover from the pandemic and citizens return to work and normal activities, Toronto should expect that the sudden drop in accidents will not last, and as the city returns to normal, the likelihood of a vehicle collision will begin to return to and increase beyond pre-pandemic levels. While this means that the city should continue to strive for active prevention of accidents through its government programs, there may also be worth in researching how future city-stopping events can be used in order to allocate government resources where they are required the most in these circumstances. In the event of another lockdown-causing situation, hopefully in the far future, we hope that Toronto is able to learn from the unexpectedness of the present pandemic and react appropriately in the future in order to keep the city operating as much as possible while also using some potential consequences of the event to their advantage.

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