



ANALYSIS OF HOMICIDES IN TORONTO AREA FOR THE YEARS
BETWEEN 2004 - 2019

November 2020

INTRODUCTION

Data Analysis is a process of inspecting, cleansing, transforming and modelling data with the goal of discovering useful information in order to draw conclusion and support decision making.

Under this brief definition, we will use different statistical tools that will help us to identify some important facts in order to figure out Reasons or Patterns that creates actionable insights about what happened and what is likely to occur in the future.

SUMMARY

As many big cities around the World, Toronto can not escape from the Homicides. “*Crime in [Toronto](#) has been relatively average as in comparison to other major cities, but recently, it has seen a record number of shootings in 2019, and is now on track to see even more in 2020. In 2017, a ranking of 60 cities by [The Economist](#) ranked [Toronto](#) as the 24th safest major city in the world, behind Tokyo, London, Paris, and Seoul, but one of the safest major cities in North America.*^{[1][2]} A CEOWORLD magazine ranked Toronto as the 95th safest cities in the world for 2018, running behind several other major cities like Tokyo, London, Osaka, Singapore, Hong Kong, and Taipei but safer than most cities in North America “ (Wikipedia, 2020)

OBJECTIVES

- Identify the places where the Homicides occur more frequently.
- Determine the Type of Homicides and its proportion.
- Analyze under which season of the year the Homicides occur more.
- Prepare a forecast of Homicides for the year 2020

METHODOLOGY

For the present analysis we are going to use a secondary data that was extrapolated from Toronto Open Data website update until 2019. In order to reach the objectives of this analysis, we will apply Descriptive Statistics to draw conclusions based on the historical data .

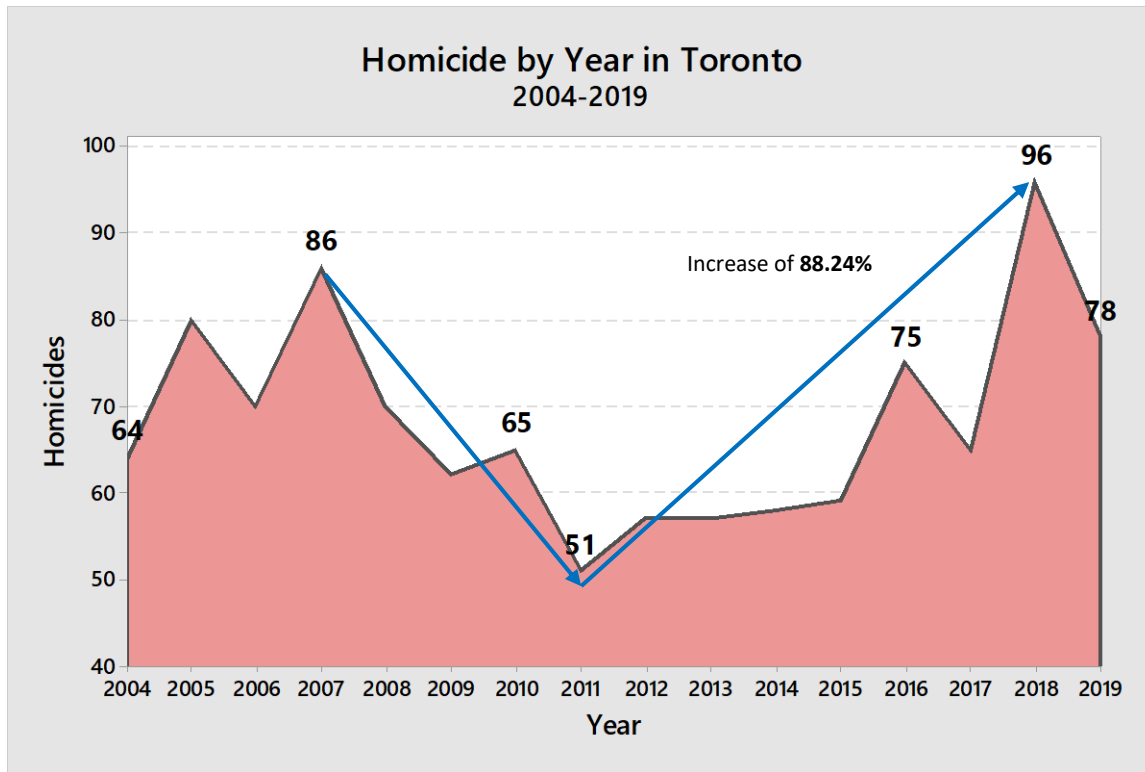
We are going to separate the Analysis section in four main areas for a better understanding of the Data.

- 1) Calendar (Including Year, Month and Day of the week when the homicide occurs).
- 2) Type of Homicide

- 3) Neighbourhood (What neighbourhoods have the most Homicides)
- 4) Forecast

ANALYSIS

1) Calendar

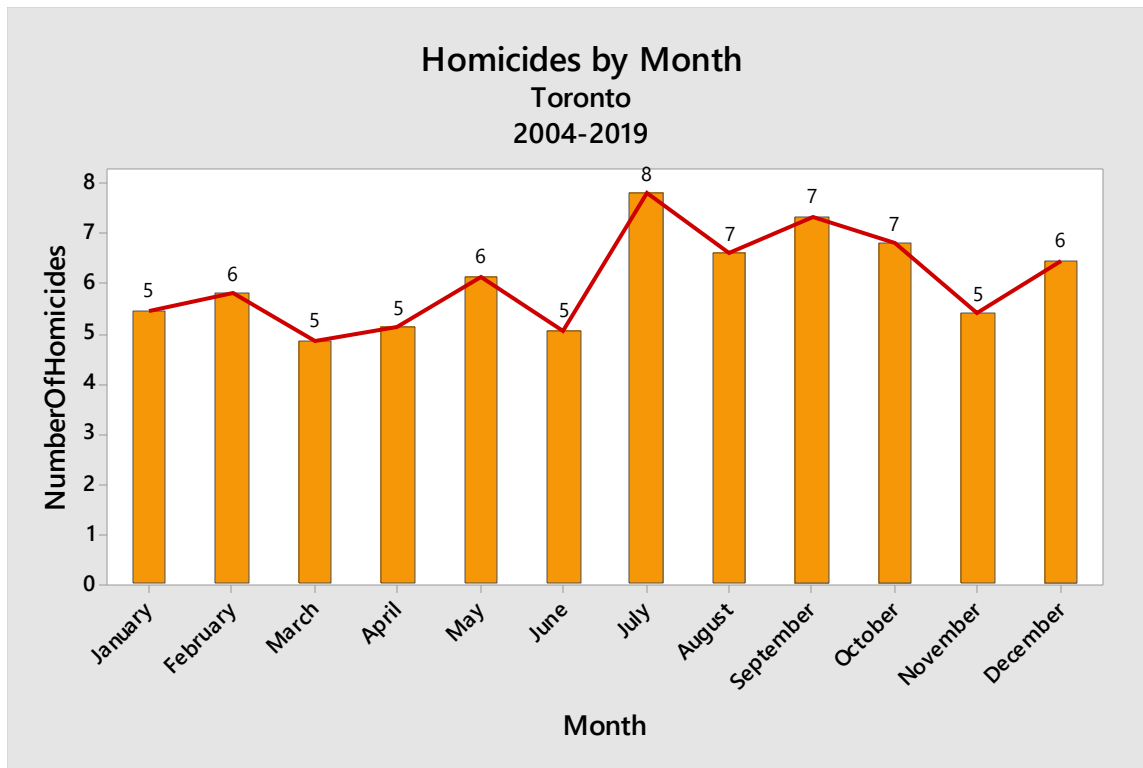


Statistics

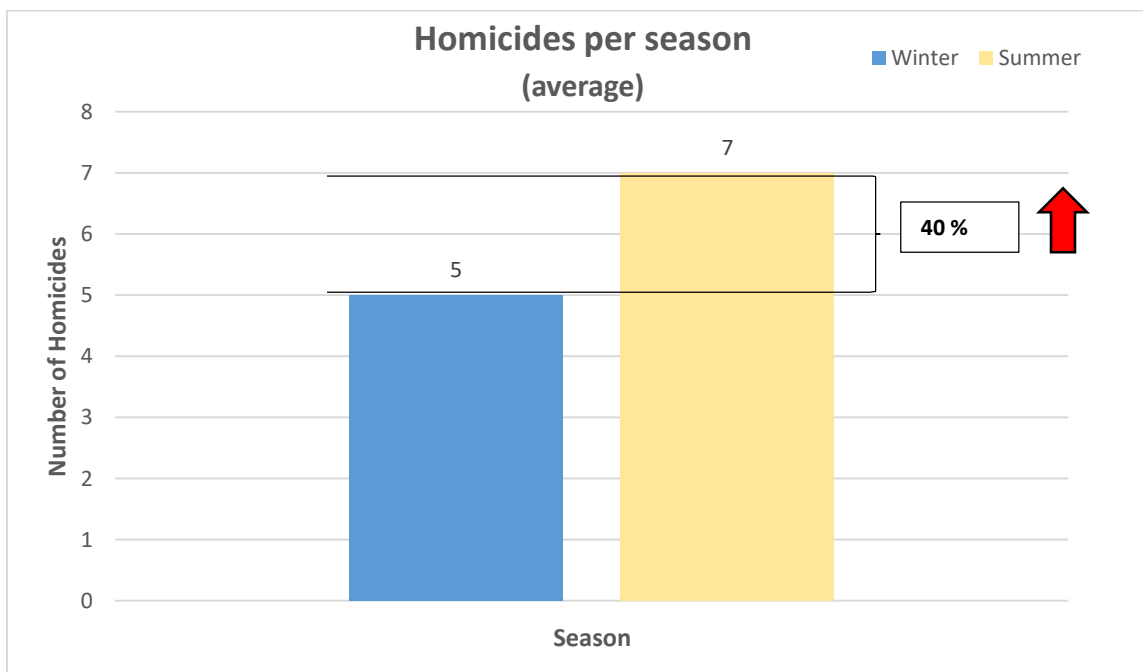
Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Homicides	16	0	68.31	3.02	12.08	51.00	58.25	65.00	77.25	96.00

2011 was a pivot year where the number of homicides touched its low number but at the same time, start a new wave of homicides with an increasing rate of 88.24 % until 2018. We can say that in average , every year was an increment of 12.6% in homicides .

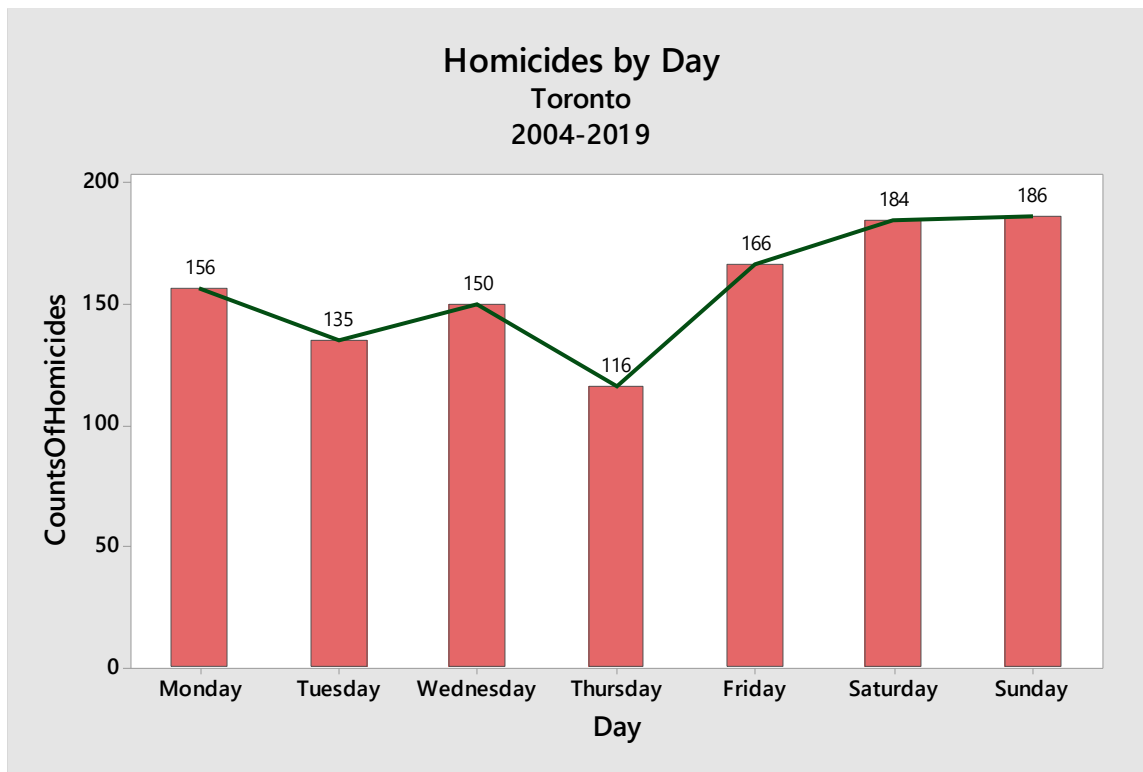
Only in one year, from 2017 to 2018 the number of homicides had an increment of 47.69%.



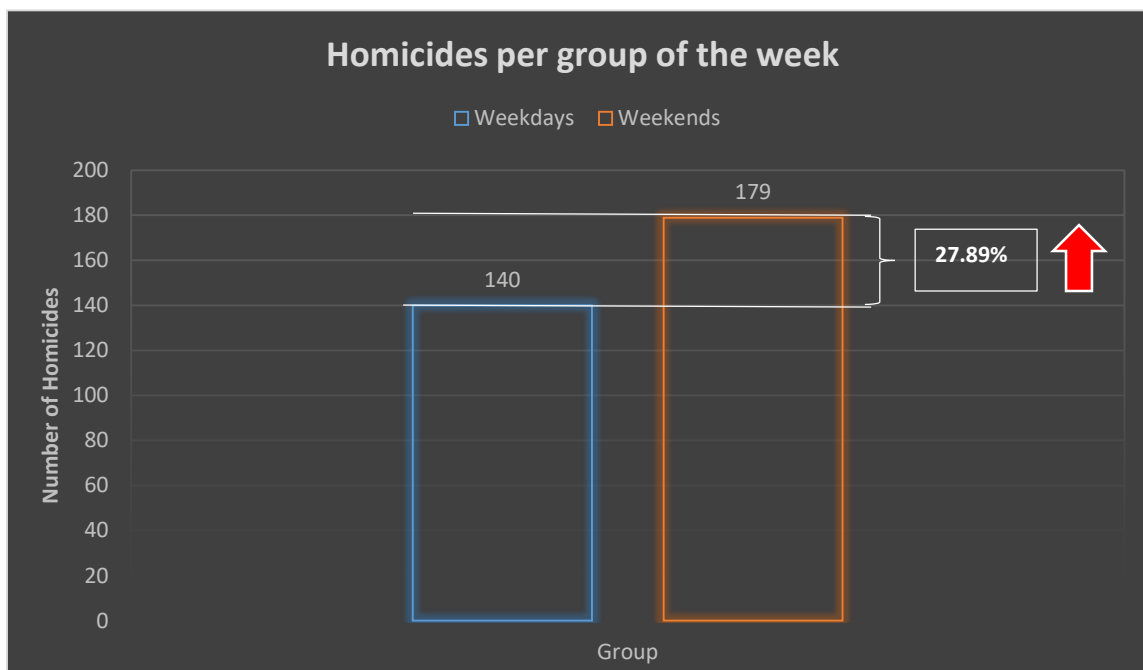
We can split the graph in two groups: Winter and Summer



From Winter to Summer the number of homicides increase in 40 %. An average of 2 more cases , from that, we can say that the increment represent almost one or two homicide per week more .



We are using accumulate values for 15 years of this study in order to show the bias clearly. We can appreciate on the graph the increasing trend of the homicides to the weekend.

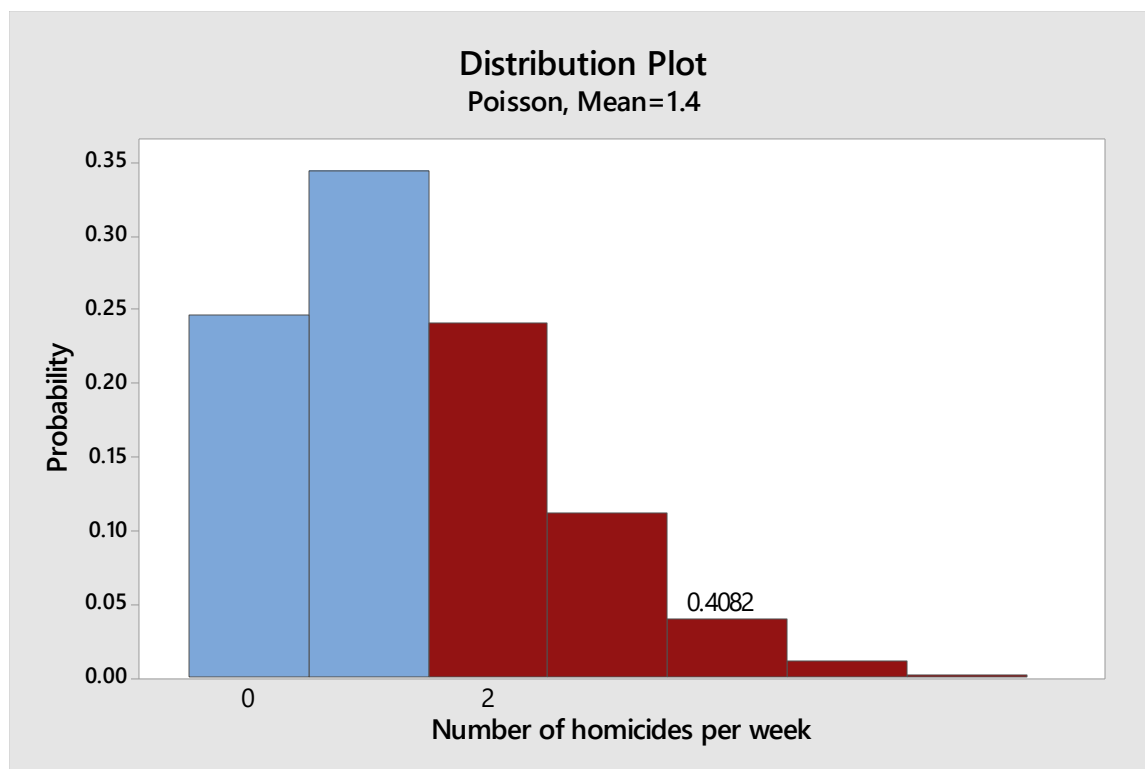


Splitting the graph in two groups between Weekdays and Weekends, the majority of Homicides occur during the weekend with an increment of 27.89% being Saturday and Sunday the most fatality days.

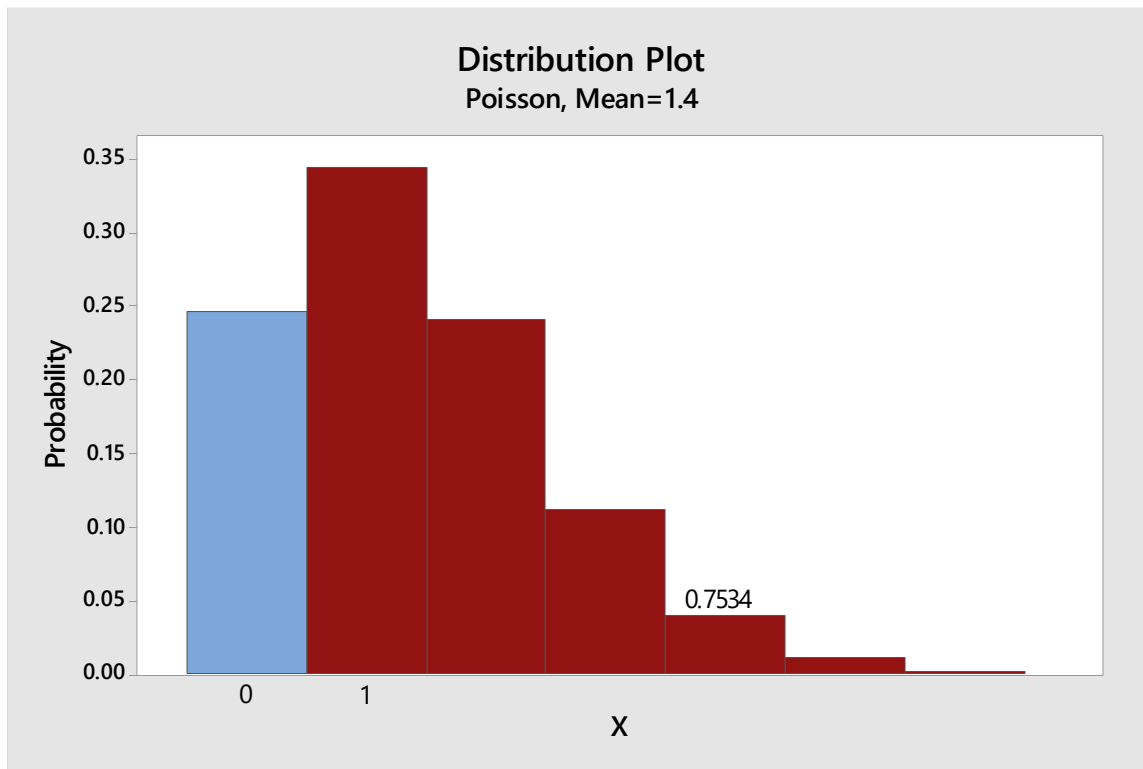
To summarize the present section, we can say the year 2011 is the turning point between the lowest cases and the beginning of a gallopant homicide rate increase of 88.24% until 2018.

Summer and Weekends shows the most fatality season and time for homicides.

The probability that two or more homicides occur in one week is **40.82 %**



The probability that one or more homicides occur in one week is **75.34 %**



The forecast for the year 2020 will be in the range of 62 – 75 Homicides.

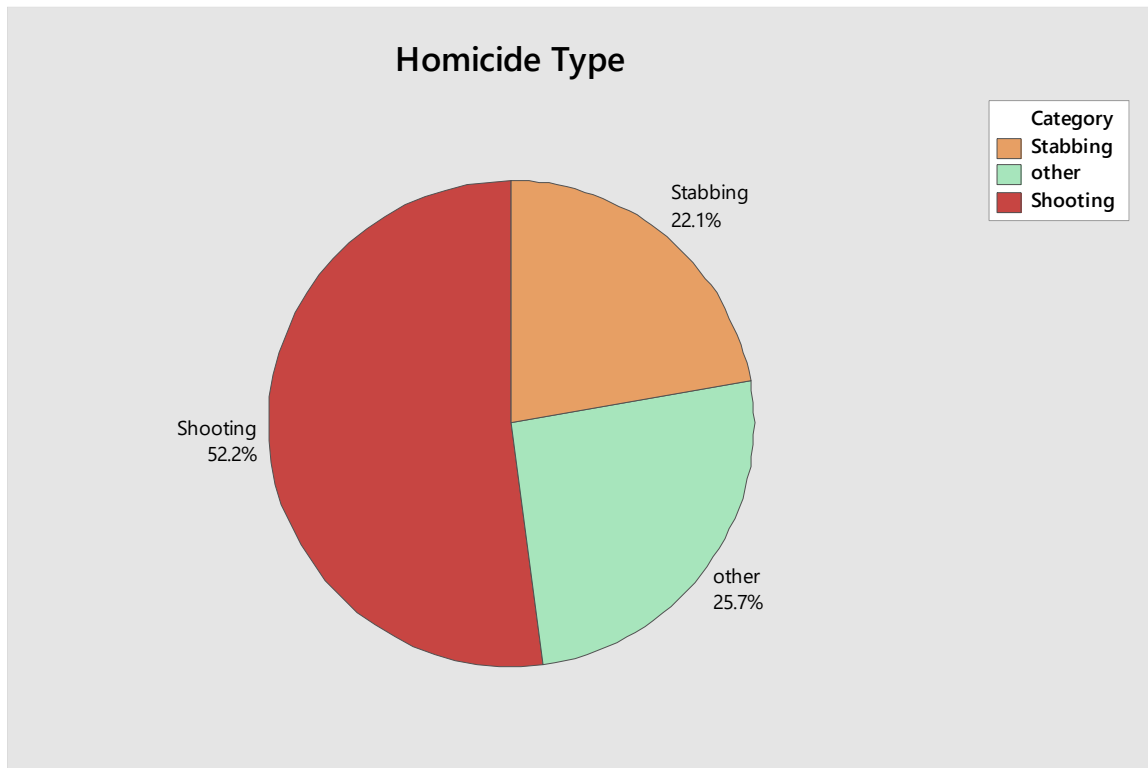
Descriptive Statistics

N	Mean	StDev	SE Mean	95% CI for μ
16	68.31	12.08	3.02	(61.87, 74.75)

μ : mean of Homicides

2) Type Homicide

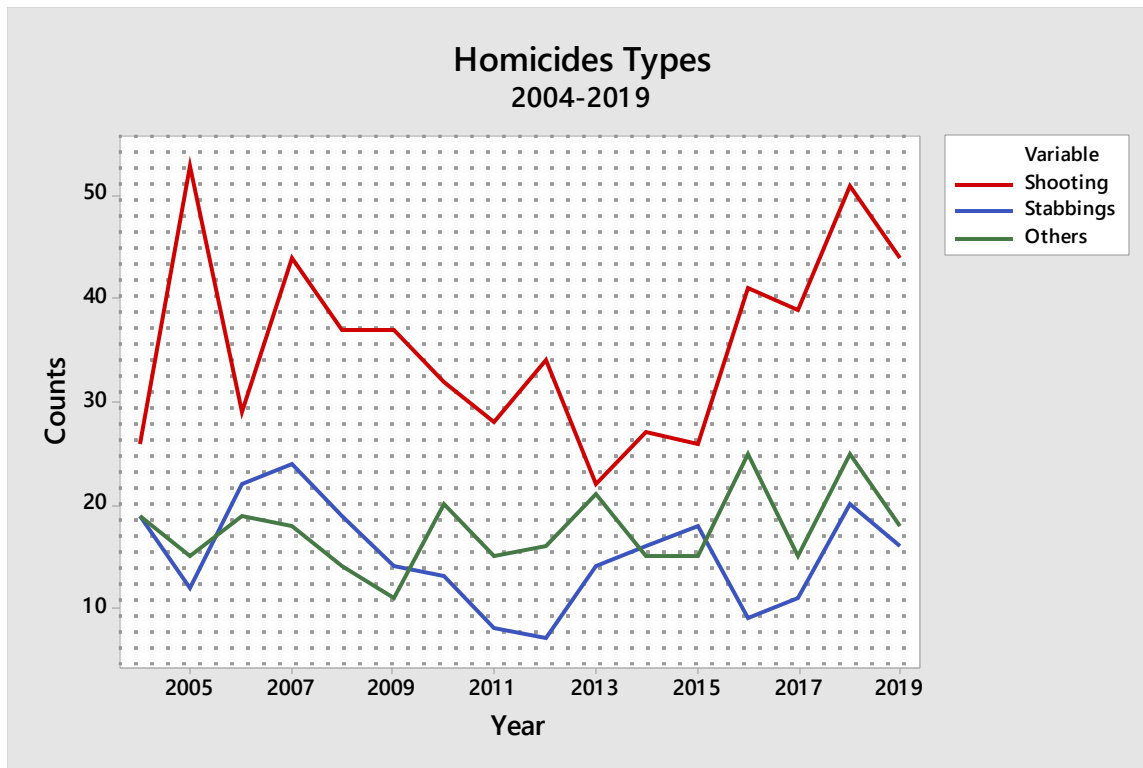
There are two kind of homicides that are the most common: Homicide by shooting and stabbing



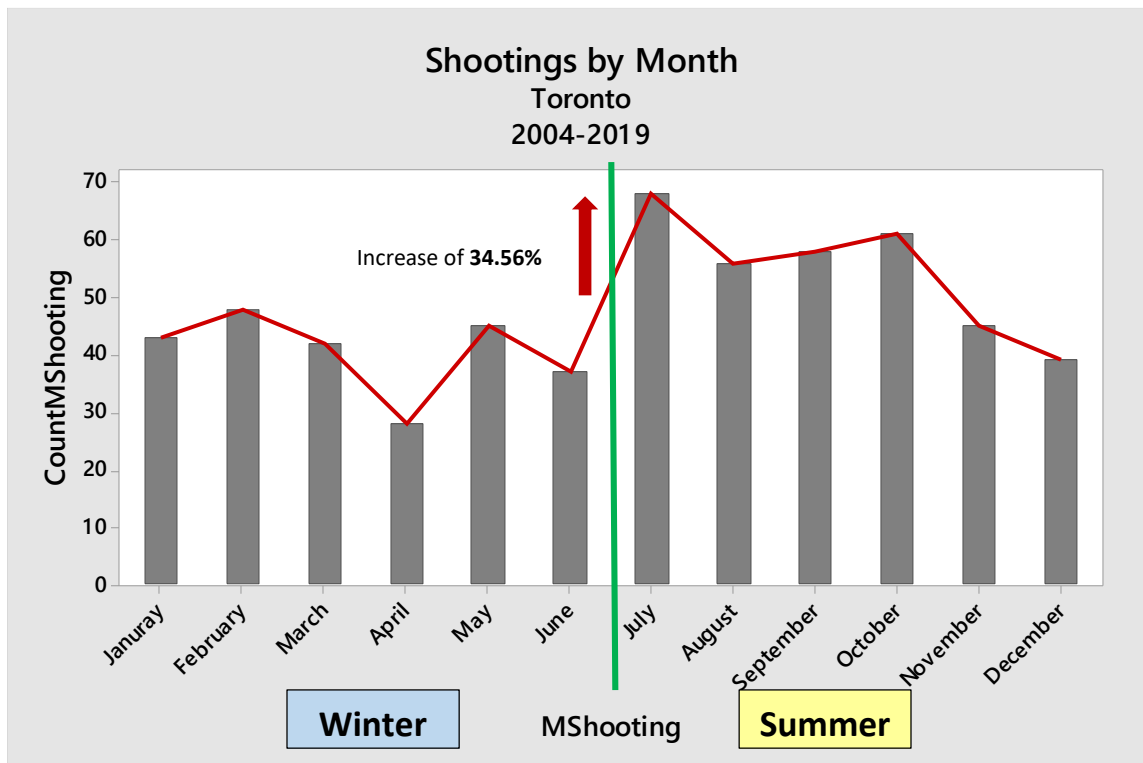
Shooting represent more than 50% and stabbing 22.1%. The rest of homicides is spread in "other" category with 25.7%.

The next graph we can appreciate the evolution of the homicides in 15 years of study. Between the years 2007 – 2013 the trend for shooting is decreasing 58.5% . We can say that every year the decreasing rate is in average 9.75%. In numbers that percentaje represent around five shootings less every year.

On the other hand, for the years 2014 – 2018 the increasing rate was 131.82%, more than twice of decreasing, around seven shootings more every year.

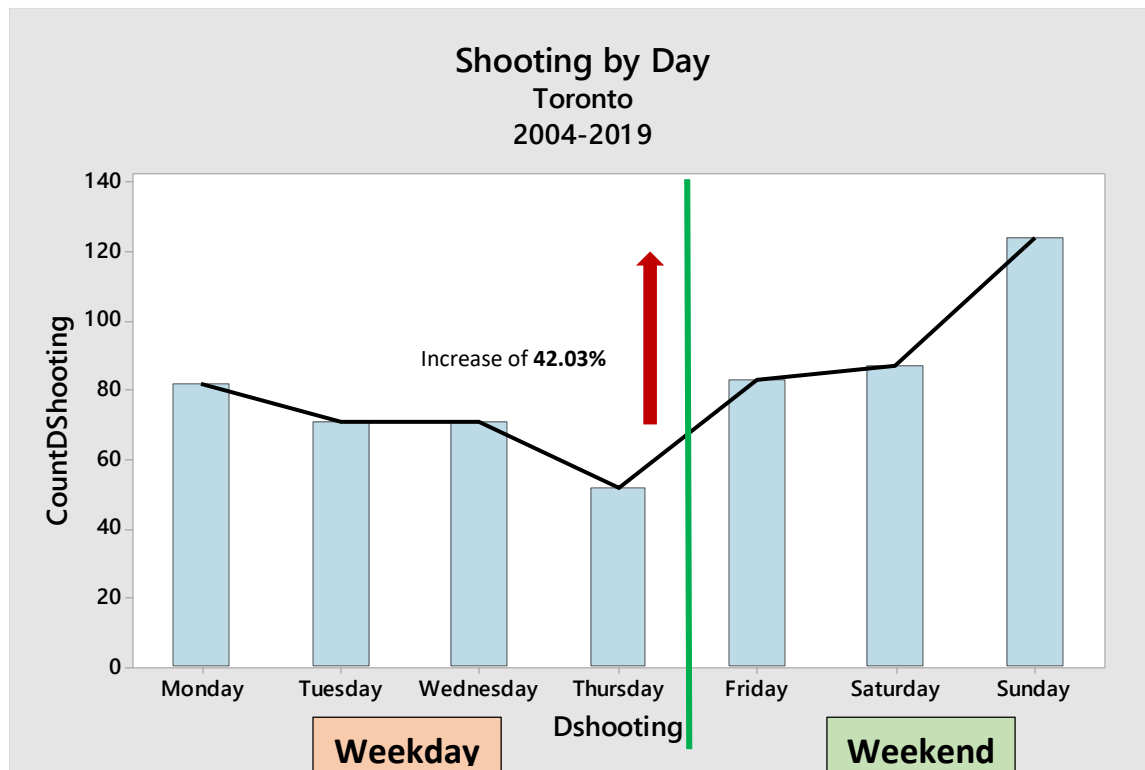


Shootings by month



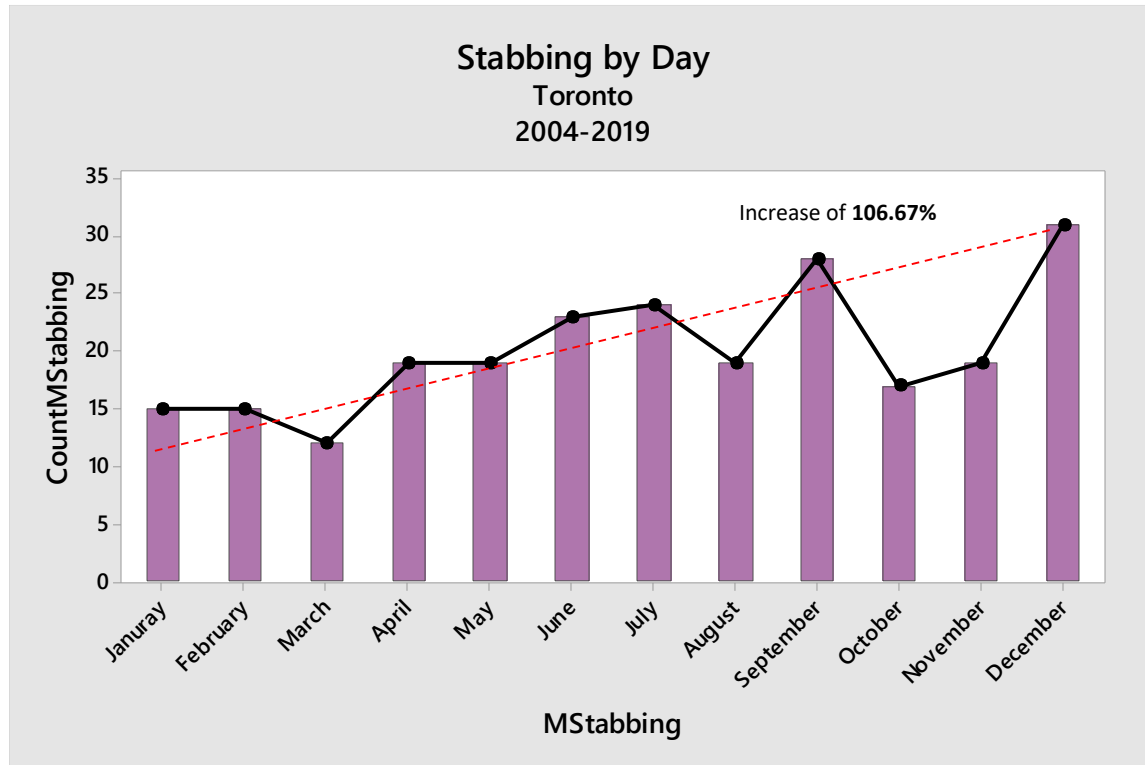
The monthly shootings graph shows two different situations during a year. From Winter to Summer the Shootings increase in 34.56%. Maybe it is happening due to more social activities.

Shootings by day

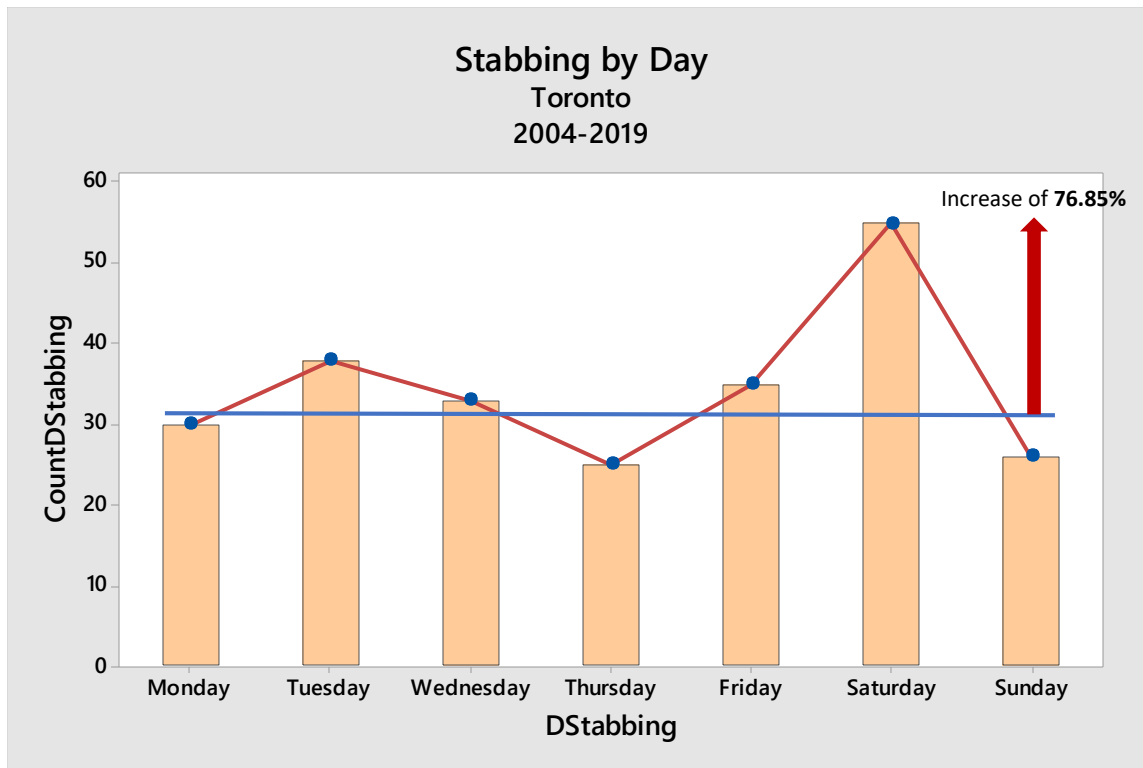


From Weekday to Weekend the Shootings increase in 42.03% and special case for Sundays that Register the most of the cases. As we made a presumption for Summer, the social activities increase during the Weekends, that could trigger an increment of the number of shootings.

Stabbings by Month



From January to December the number of Stabbings increase in 106.67%. An Average, we can say that there is one case per month at the beginning of the year, at the end of the year this number is almost twice.



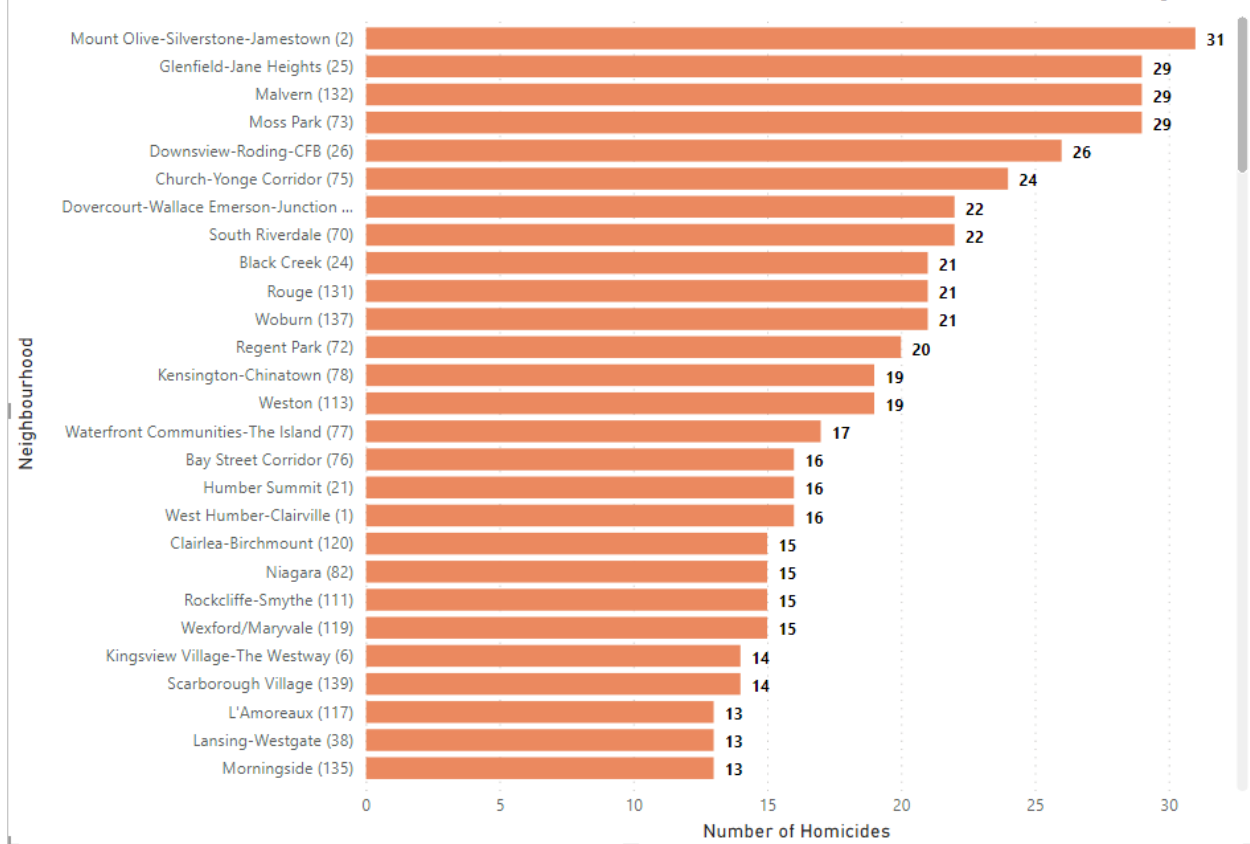
The number of Stabbings increase in 76.85% Saturdays comparing with the rest of the week.

3) Neighbourhood

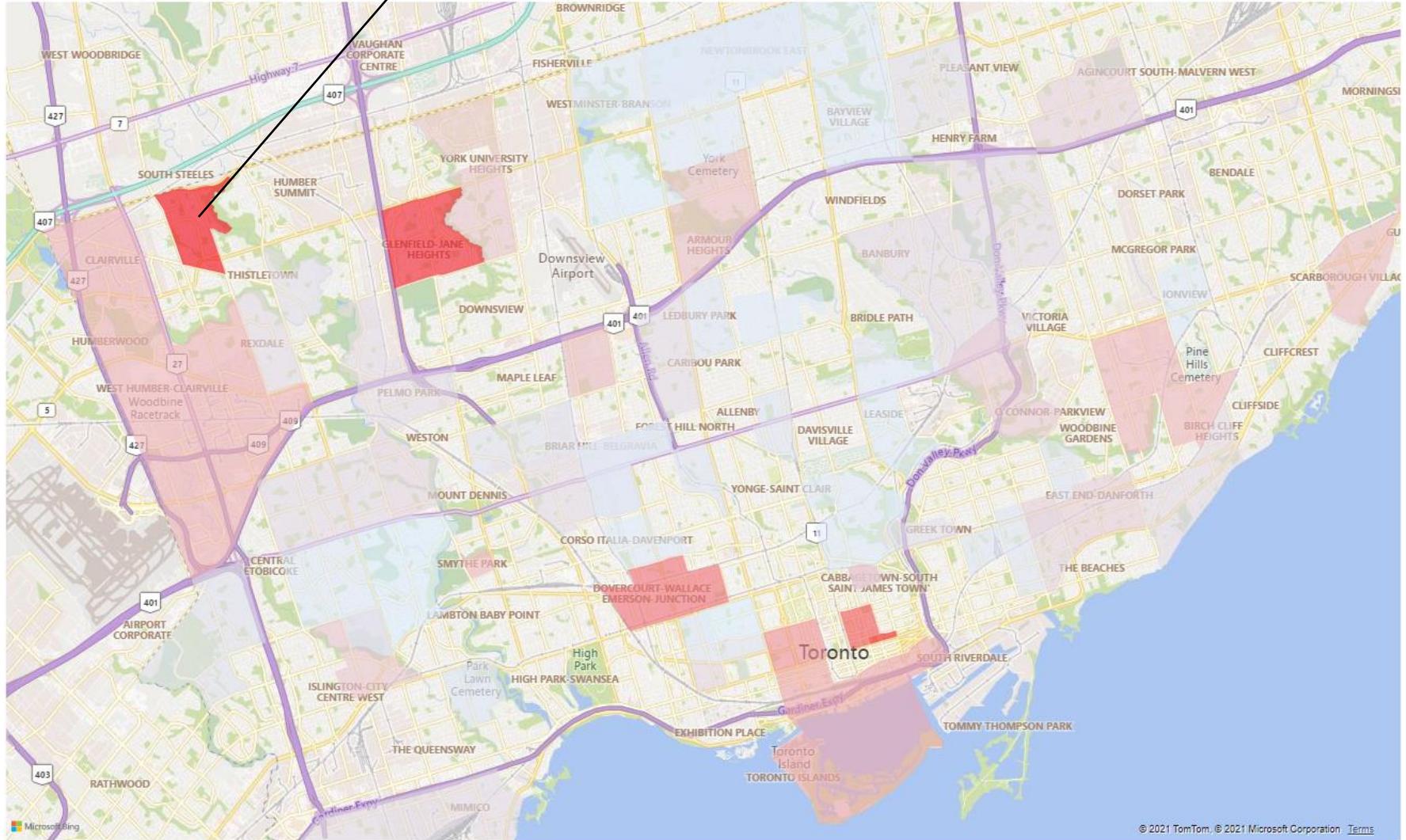
Toronto's existing 140 social planning neighbourhoods. We are counting the accumulate number of homicides for 15 years since 2004 to 2019 for each neighbourhood.

The next graph shows the first 27 neighbourhoods with the most homicides cases in 15 years of analysis. Mount Olive – Silverstone – Jamestown neighbourhood is the place where the majority of homicides occurred with an accumulate of 31 cases.

Homicides by Neighbourhood (2004 - 2019)



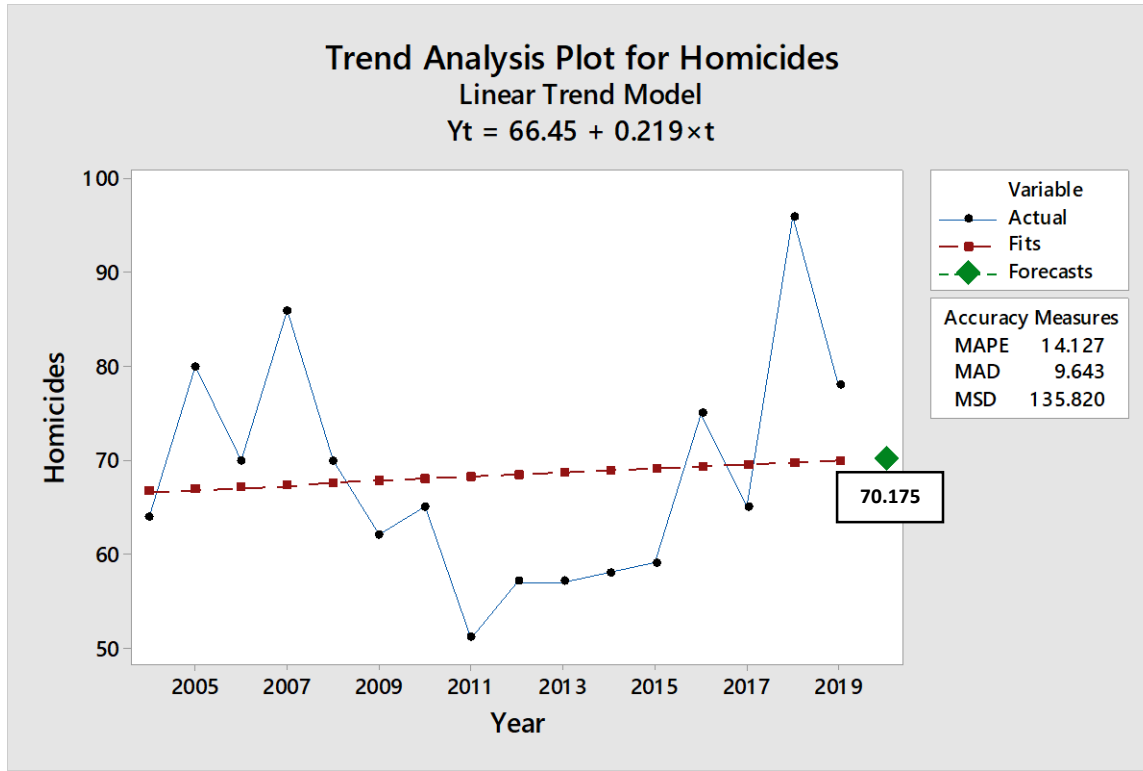
**Mount Olive – Silverstone
– Jamestown**



4) Forecast

The forecast for homicides in 2020 is developed using a Linear Trend Model as we can see on the present graph.

The Output of the Model is 70.175 homicides; we can round to **71 homicides** for 2020.

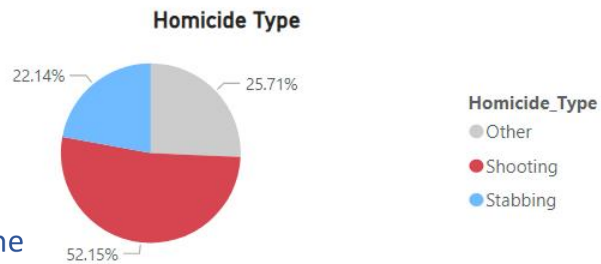
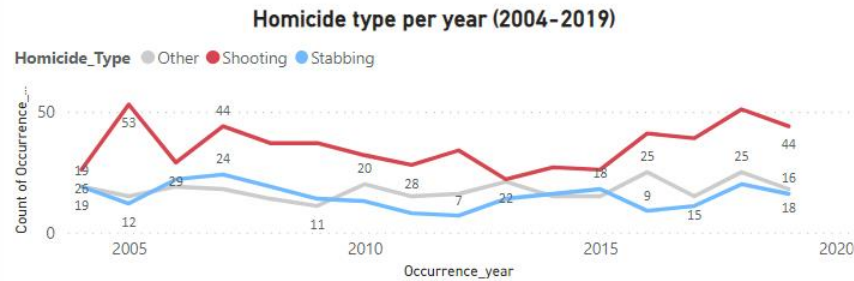
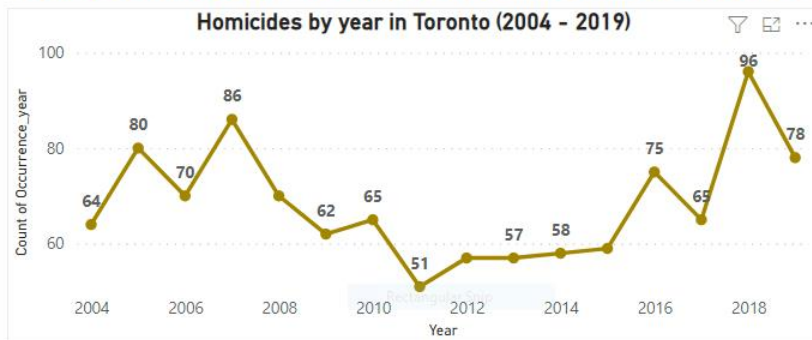


CONCLUSIONS

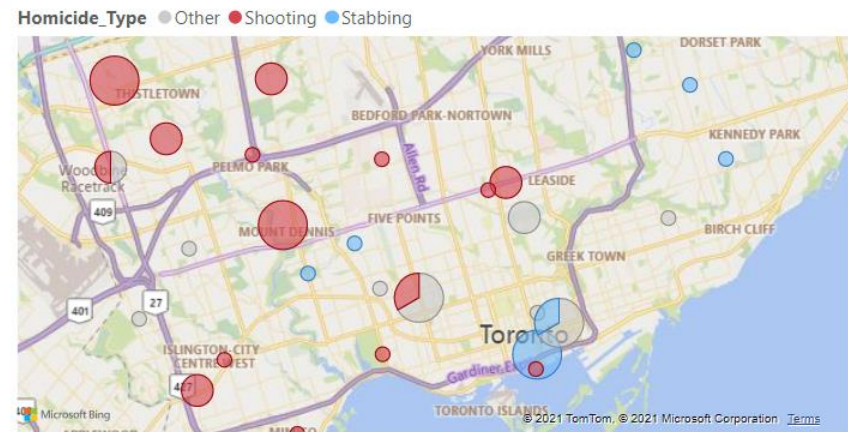
1. 2018 was the year where the number of homicides reach the maximum in 15 years with an increment of 47.69% in only one year.
2. Summer is the season where the number of homicides increase in average of 40%. That represents one or two more cases per week.
3. The most of the cases happen during the weekends with an increase of 27.89% comparing with the cases occurred in Weekdays.
4. The probability of one or more cases occurred in one week is 75.34%.
5. Shooting and Stabbing represent the most common cases for homicides with 52.2% and 22.1% respectively.

6. Shootings occurred more in Summer than Winter with an increment of 34.56%.
7. Saturdays to Sundays nights shows a rise on Shootings (42.03% more than the weekdays). A first hypothesis could be the Weekends' Social Activities could trigger these increment.
8. The trend for Stabbings increase from January to December in 106.67% doubling the number of cases at the end of the year.
9. Saturdays is the atypical day where the number of stabbings rocket in 76.85% comparing with the rest of the days.
10. Mount Olive – Silverstone – Jamestown neighbourhood is the place where the majority of homicides occurred with an accumulate of 31 cases.
11. The forecast model for 2020 shows 71 homicides.

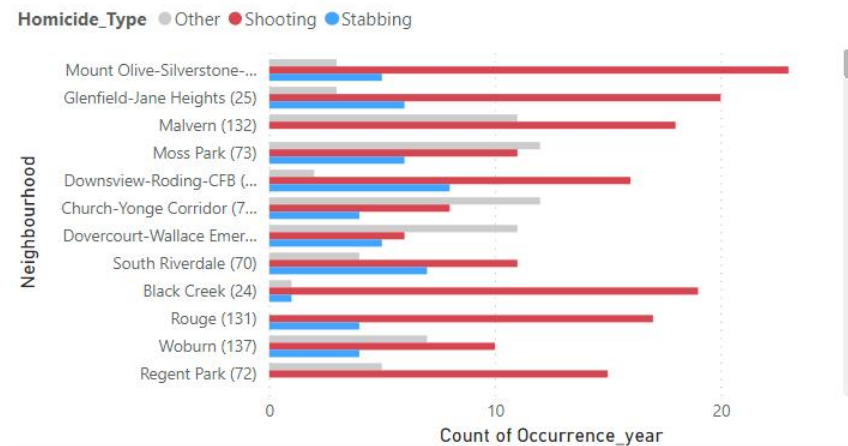
HOMICIDES IN TORONTO AREA FOR THE YEARS BETWEEN 2004 - 2019



Type of Homicide by Neighbourhood (2019)



Type of Homicide by Neighbourhood



REFERENCE

- *Toronto Open Data*: <https://open.toronto.ca/dataset/bicycle-thefts/>
- *An Introduction to Management Science*: Anderson, Sweeney.
- *The Analytics Life Cycle Tool Kit*: Gregory S. Nelson.
- *Managerial Statistics*: Gerald Keller



Jaime Alvarado
Data Analyst