Understanding Vulnerability: An Analysis of Toronto Police Service's Annual Statistical Report on Crimes Against the Person(2014-2022)

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This study analyzes the trends in the dataset of all identified victims of crimes against the person reported to the Toronto Police. The dataset, obtained from OpenDataToronto, includes data from 2014–2022. When studied on a year-to-year basis, the data show relatively minor fluctuations in the total number of victims of crimes against the person each year. However, when analyzed over the period 2014-2022, there appears to be no significant shift in the number victims of crimes committed against individuals annually. Nonetheless, upon delving deeper into the data, we uncover changes in the underlying trends on victims of crimes against the person. This research is significant as it provides insights into understanding the factors that may contribute in making an individual vulnerable to such crimes.

Introduction

Canada, often listed as one of the safest countries in the world attracts hundreds of thousands of immigrants every year in search of a better lifestyle. A huge chunk of these immigrants resides in major Canadian cities like Toronto, Vancouver, Montreal, or Calgary making them some of the most populous cities in Canada. Crime is one of the pressing issues in majority of the big cities worldwide and the City of Toronto is no exception. In the scope of this paper, "crimes" specifically refers to "crimes against the person". The study of victims of crime is critical in ensuring public safety and creating an informed society. This paper presents an analysis of the victims of crimes against the person reported to the Toronto Police from 2014–2022. The analysis is driven by the need to develop an understanding of the factors that contributes towards one becoming more vulnerable to such crimes and examine how the trends in the type of crimes committed against the person has changed over time.

The dataset for this study was obtained from OpenDataToronto (Gelfand 2022), specifically the "Police Annual Statistical Report - Victims of Crimes" published by the Toronto Police Services. The dataset includes all identified victims of crimes against the person reported to the Toronto Police and the type of crime that was committed along with the sex and age group details of the victim. Here, "crimes against the person" is referring to CCJS level 1 crimes only (*About Police Annual Statistical Report - Victims of Crimes* 2023). As per statistics Canada, examples of CCJS level 1 includes crimes such as assault and sexual violence ("Canadian Community Crime Tracker: About the Data" 2018). Our research offers an examination of the trends in the number of reported victims of crimes each year over the span of nine years from 2014-2022, the type of crimes committed (assault, sexual assault, robbery or other) against them and factors that make them vulnerable to these crimes. The examination was executed using the R programming language (R Core Team 2022) and enhanced with diverse analytical tools, including Tidyverse (Wickham et al. 2019), Janitor (Firke 2023), and Knitr (Xie 2014).

The results of this research revealed some interesting trends. Upon examination, the number of victims reported over the study period revealed no noteworthy increase or decrease in the number of reported victims of such crimes. Upon delving deeper, we found that although the number of reported victims of crimes remained almost constant the underlying trends such as the nature of the crime and the profile of the potential victim has changed over the years. Where, victims of robbery and other crimes shows a descending pattern, an increase in women victims and victims of assault and sexual assault calls for actions by the authority to ensure women and public safety. Among the victims, adults (18+) constitute the majority, followed by youths (12-17 years of age).

These findings are crucial to guide the development of efficient policy and law enforcement strategies. The paper is organized as follows: Section 2 details the techniques used to process the data followed by a brief discussion of the dataset and variable of interests. Section 3 presents the findings of the paper including yearly trends on victims of crimes followed by addition of factors such as age and sex. The concluding section brings together these insights and help us draw conclusions on what factors contribute in the vulnerability of individuals towards these crimes along with the broader societal understanding of crimes in Toronto.

Code and data supporting this analysis is available.[1]

2 Data

The data being used in this paper was obtained from City of Toronto's Open data portal using the opendatatoronto package [@opendatatoronto]. The dataset used in the analysis is " Police Annual Statistical Report - Victims of Crimes" published by the Toronto Police Services.

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[1]https://github.com/Jagpreet5ingh # Data

The data was cleaned and analyzed using the R programming language [@citeR] and the following packages were used: Tidyverse [@tidyverse], Janitor [@janitor], and Knitr [@knitr].

Details of the data extraction and cleaning processes are discussed in the subsections below.

2.1 Dataset

As mentioned above, the dataset utilized is this paper is " Police Annual Statistical Report - Victims of Crimes" published by the Toronto Police Services. The dataset includes all identified victims of crimes against the person, including, but not limited to, those that may have been deemed unfounded after investigation, those that may have occurred outside the City of Toronto limits, or have no verified location. The dataset includes data from 2014-2022 with 1110 samples each with 9 variables. Some samples in variables such as "Sex" and "Age Group" have unknown values. But the number of such samples is relatively and consistently small for each year and hence doesn't lead to a huge deviation in the data. Another potential concern is the number of unidentified or unreported victims of these crimes. However, since the data is only considering the CCSJ level 1 crimes, it limits the number of unreported CCSJ level 1 crimes to a small number. As per statistics Canada, examples of CCSJ level 1 crimes are assault, sexual assault etc. ("Canadian Community Crime Tracker: About the Data" 2018). Moreover, crimes like assault, sexual assault, and robbery usually do not go unreported. Finally, the variable "Subtype" has "other" as one of the options which does not provide enough insight into what the other subtypes of crime are apart from assault, sexual assault, and robbery, thereby limiting the connection that can be drawn between different variables. No other datasets were considered because this data is directly published by Toronto Police Services, the original owner of the data. Additionally, the dataset was rated highly in data quality as below (*About Police Annual Statistical Report - Victims of Crimes* 2023):

- As of 23 January, 2024, the dataset was last refreshed on 14 January, 2024 with an overall data quality score of 99% and with a gold rating.

- The dataset has a score of 100% for freshness which means the data set is up-to-date and refreshed on schedule.

- The dataset has a score of 100% for metadata and completeness which means the data is well described and complete.

- The dataset has a score of 93% for Usability due to one column "Category" having constant values.

In order to make the dataset manageable, unnecessary variables such as ID (served no purpose in our analysis) and Category (all samples had the same value, "Crimes Against the Person) were excluded. The cleaning of data involved using the select function (Wickham et al. 2019) to select the six out of nine variables that was required for the analysis. No other change was made to the obtained dataset.

2.2 Variable of Interest

The data includes the year the victim of the crime was reported, the subtype of the crime committed against the victim which was broken into four sub-categories "assault", "sexual violence", "robbery" and "other".

The victim is then identified as "Male", "Female" or "Unknown" under the sex variable. This is followed by the variables age group and age cohort which are connected in the sense that ages "<12" relates to age group "Child", ages "12-17" relates to age group "Youth" and all other ages relates to age group "Adult". Apart from these, if age group is "Unknown", age cohort is "Unknown" as well and vice versa. Finally, there is a variable to count the number of victims reported per year per subtype per sex per age group per age cohort which together makes one sample on the dataset. This variable is an important aspect of measurement as it represents the number of occurrences for each combination of all other variables hence allowing a quantitative analysis of those variables.

3 Analysis and Data Visualization

Our analysis examines the trends about victims of crimes against the person reported to the Toronto Police from 2014-2022 revealing insights about the nature of crime and help us understand the factors contributing to vulnerability towards such crimes.

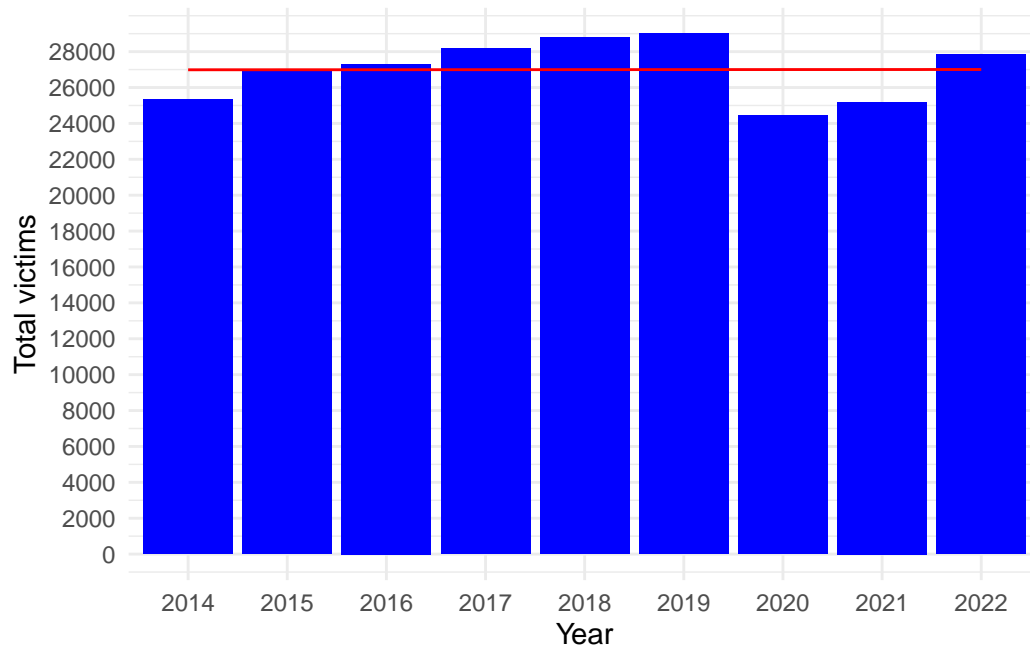## 3.1 Victims of Crimes - Yearly Trend (2014-2022)

Figure 1: Graph of total number of victims per year (2014-2022)

The yearly trends on the total number of victims of crimes against the person reported to Toronto Police every year from 2014-2022 is represented with the help of the bar graph in Figure 1. On examining the bars, we see minor fluctuations from year-to-year with no strict patterns as such. A red regression line [2] can be seen parallel to the x axis. The regression line depicts the relationship between the year and total number of victims of crime against the person. The horizontal regression line represents no correlation between the two variables. The number of victims of crimes reported yearly over the period of the data has no significant change. However, it's important to note that population change is not one of the factors taken into account for this analysis.

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[2]A regression line is a linear relationship between the dependent and the independent variables on the y and x-axis respectively. The correlation is established by analyzing the data pattern formed by the variables.

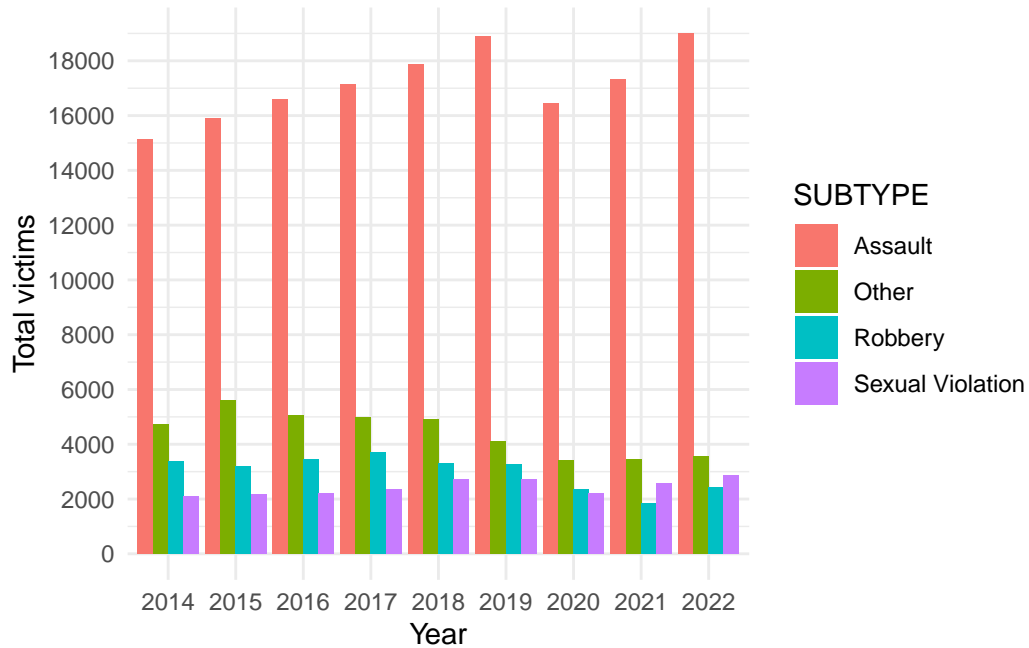## 3.2 Assaults and Sexual Violations on a Rise

Figure 2: Graph of total number of victims per year by type of crime (2014-2022)

When analyzing the total number of victims every year from 2014-2022 with respect to the sub type of the crime, it is evident from Figure 2 that there has been an overall increase in the number of victims of assault. Additionally, it can be noticed that the number of victims of sexual violation is also following an upward trend. Both assault and sexual violation crime victims peaked in 2022 with 18995 and 2873 reported victims respectively. On the other hand, a declining trend can be observed in the number of victims of robbery and other types of CCSJ level 1 crime. The rise in cases of assault and sexual violation is a rather concerning trend as these crimes usually consist of bodily harm or threats of harm to the victims.

3.3 Females - The More Vulnerable Sex to be a Victim of Crime in the recent times
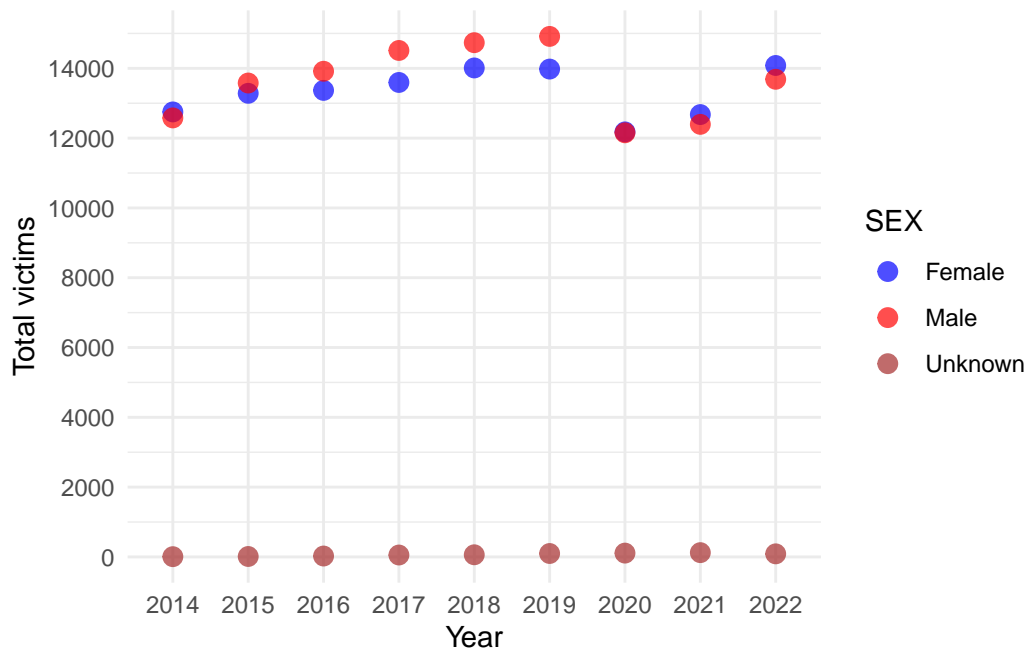

Figure 3: Graph of total number of victims per year by sex (2014-2022)

Figure 3 represents a very interesting pattern when observed on a year-to-year basis. Beginning from 2014, individuals of both sex, male and female became victims of crime with 172 more female victims reported than male victims. However, from 2015 – 2019, number of male victims increased at a higher rate than females. In 2020, both sexes became victims to almost the same number of crimes. 2020 onward, the number of female victims increased at a higher rate than males showing a complete opposite trend when compared to 2015-2019. Surprisingly, this trend is synonymous to the pattern seen in Figure 2. The cases of sexual violation showed an increasing trend in the same period the crime against women increased.

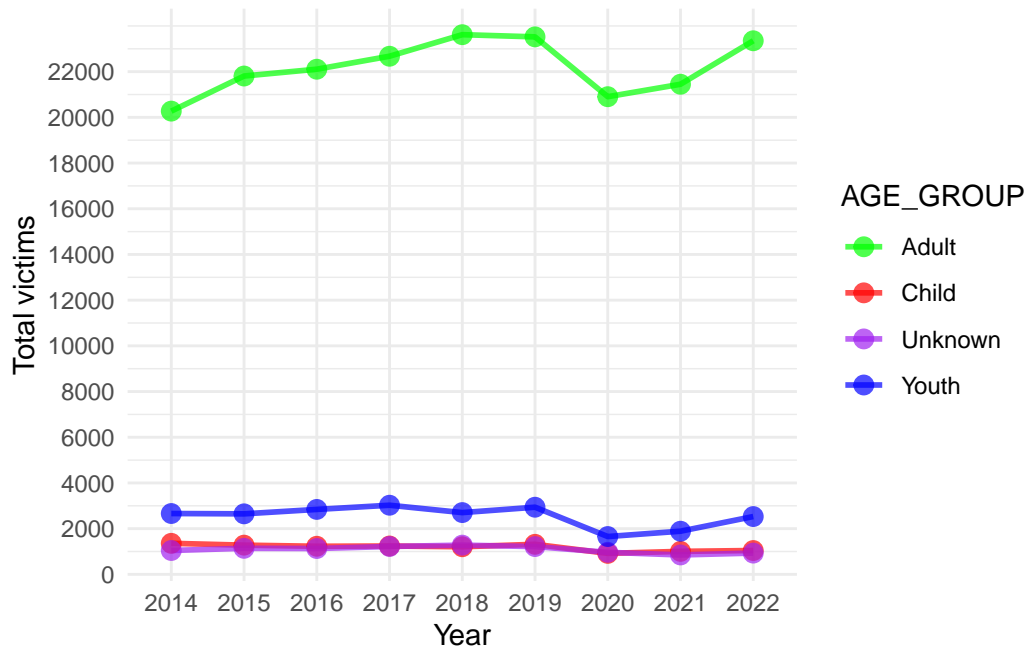## 3.4 Adults - Most Vulnerable Age Group to be a Victim of Crime

Figure 4: Graph of total number of victims per year by age group (2014-2022)
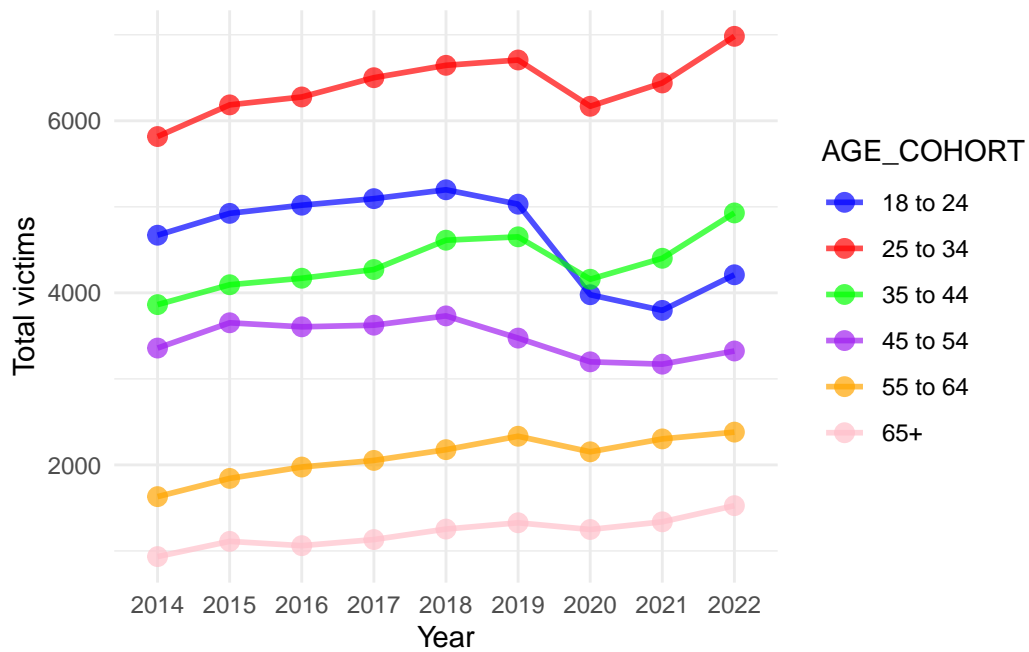

Figure 5: Graph of total number of adult victims per year by age cohort (2014-2022)

Age is another variable that makes certain groups more vulnerable than others towards crimes that are on the rise such as assault and sexual violation, as established from Figure 2. When examining the total number of victims every year from 2014-2022 with respect to the age group of the victim in Figure 4, it is clear that the adult age group is the most prone to crimes against them. The dataset defines adult as anyone who is older than 17 years of age. It is therefore necessary to drill down into which specific age cohort of adults is most vulnerable to crimes. Figure 5 does exactly that by graphing the total number of victims over the years with respect to the adult age cohort. The graph reveals that the most vulnerable victims are adults that are 25-34 years of age represented by the red line.

CONCLUSION

The analysis of Toronto's victims of crime yearly trends and the shifts in the types of crimes committed in the recent years in conjunction with factors like sex, age group and age cohort help us better understand vulnerability of individuals towards these crimes. As per our study, a vulnerable individual is more likely to become a victim of assault than any other type of CCSJ level 1 crime. Sexual violation is also on the rise in the recent times. An increasing trend in both types of crimes can be observed in @fig2. Additionally, our study shoes that individuals vulnerable towards these crimes are likely adults that are 25-34 years of age. In the more recent times, as evident from @fig-3, Graph of total number of victims per year by sex (2014-2022), females are at a higher risk than males. Hence, we can conclude that the most vulnerable group of individuals that can be a victim of assault or sexual violence are female adults that are 25-34 years of age. These results stresses upon the importance of taking measures to improve public safety as well as woman safety in the city of Toronto. As the city continues to welcome more individuals every year, a analytical approach to study the trends and utilizing the results when making policy decisions can set us towards the right track.

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