Analysis of shooting incidents trend in Toronto from 2004 to 2023*

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The research analyzes the trends of firearm shooting incidents by firearm in Toronto from 2004 to 2023, and the used dataset from Opendatatoronto provides all shooting incidents that happened in Toronto throughout the period. In addition, this study also shows the urban violence in Toronto and area in danger. The trend of firearm incident cases increased significantly from 2015. It decreased from 2020, the year the lockdown started, because of COVID-19, but the City of Toronto should consider stricter laws and rules since the decreasing trend might be because of the COVID-19 lockdown.

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*https://github.com/kakaomonk/toronto_shooting_incidents

1 Introduction

Owning firearms by individuals has become a major social issue in Toronto and other urban areas in North America. However, possessing a firearm by an individual cannot be illegalized since some citizens need the firearm inevitably. The urban violence by firearm in Toronto has become an object of public concern and is becoming more serious. Beyond the controversy, the study mainly focuses on the trend of firearm shooting incidents in Toronto from 2004 to 2023. There were significant changes in the trend, and the change was enough to make the issue more controversial (Opinion 2018).

Firearm violence affects several social communities, and it is directly related to social safety in all communities in Toronto. In addition, Toronto is a large city that is multicultural and full of diversity. However, they might cause hate because of the differences between the cultures.

The trends of firearm shooting incidents in Toronto throughout the period depended on many factors from the society, but the purpose of the study is to explore the general trends of firearm shooting incidents in Toronto. Analyzing the incident trends will significantly decrease firearm incidents in Toronto and derive better laws and rules for the society for the citizens' safety.

2 Data

The dataset used contains all firearm incidents that caused death and injuries in Toronto from 2004 to 2023, and the dataset is from the 'opendatatoronto' 'R' package (Gelfand 2022). The dataset can be found on 'opendatatoronto' website named "About Shootings & Firearm Discharges" (Services 2023). All used technologies are done by 'R' (R Core Team 2022), 'ggplot2' (Wickham 2016), 'knitr'(Xie 2023), 'tidyverse' (Wickham et al. 2019), and 'here' (Muller 2020).

2.1 Data Cleaning

The purpose of the study is to analyze the trends of firearm incidents in Toronto from 2004 to 2023, and the dataset is obtained from 'opendatatoronto' (Gelfand 2022). The preserved columns are related to the date of occurrence and the area code. All columns that are not related to the future analysis were removed. For accurate results, every invalid data that contains uncertain data was omitted, and it was not used for the study.

2.2 Data

Table 1: Number of firearm shooting incidents by year

OCC_YEAR	Incidents
2004	191
2005	262
2006	215
2007	207
2008	238
2009	252
2010	259
2011	227
2012	219
2013	204
2014	177
2015	288
2016	407
2017	392
2018	427
2019	492
2020	462
2021	409
2022	380
2023	343

The Table 1 shows the number of firearm incident cases by each year, and trend of firearm incident cases had been increased from 2015 significantly. Furthermore, the following visualized graph Figure 1 shows the trend more intuitively.

The visualized graph shows that there was a significant increase in firearm shooting incidents in Toronto from 2015. The line on the graph directly shows that the trend intuitively. In addition, the horizontal line is the average number of cases that is 302.55 times per a year.

Table 2: Number of firearm shooting incidents by division

DIVISION	Incidents
D11	168
D12	495
D13	204
D14	330
D22	230
D23	657
D31	1043

DIVISION	Incidents
D32	357
D33	202
D41	362
D42	511
D43	480
D51	345
D52	151
D53	99
D54	169
D55	248

Now, some specific divisions/region that are exposed to the firearm shooting incidents, and divisions/regions need more attention from the City of Toronto.

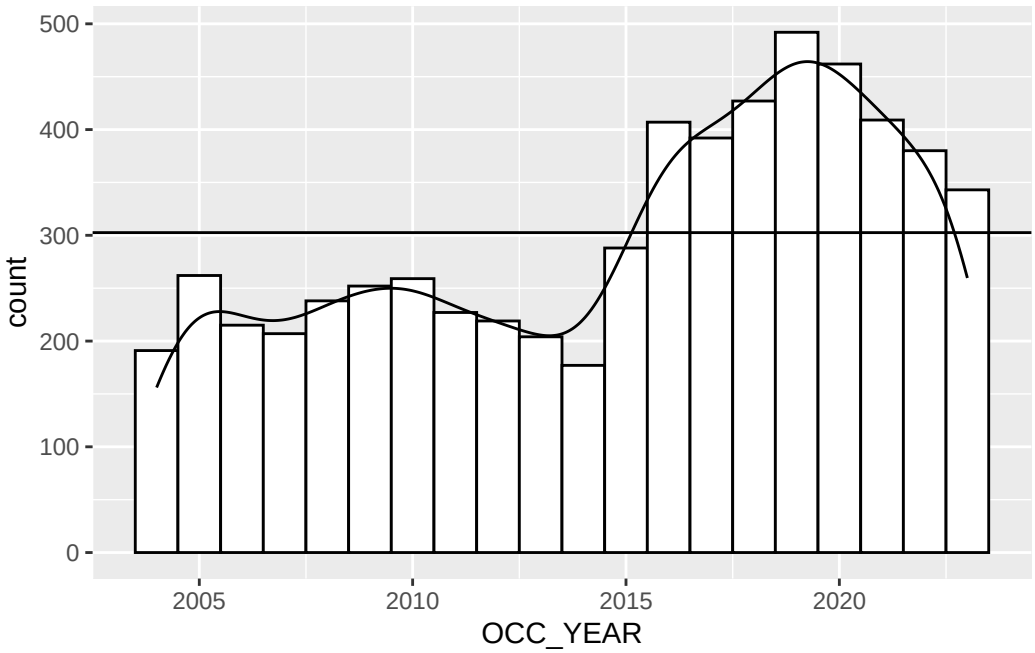

Figure 1: **?(caption)**

According to the table, division 31 (York University Heights, Humber Summit, Humbermede, Glenfield-Jane Heights, Oakdale Beverley Heights, Black Creek, Pelmo Park-Humberlea) has had the most shooting incidents in the past 20 years. On the other hand, division 53 (Yonge-St.Clair, Thorncliffe Park, Broadview North, Forest Hill North, Casa Loma, Forest Hill South, Annex, Rosedale-Moore Park, Mount Pleasant East, Mount Pleasant West, Bedford Park-Nortown, Bridle Path-Sunnybrook-York Mills, Lawrence Park South, Yonge-Eglinton, Leaside-Bennington) has the least firearm incidents in the past 20 years.

3 Results

3.1 Trends in firearm incidents

According to Figure 1, there were significant changes in the trend of firearm shooting incidents in the City of Toronto. Even if firearm incident cases have decreased since 2019, the City of Toronto and Toronto police need to be aware of the future trend since the lockdown because of COVID-19 and almost all citizens stayed at home during the pandemic.

3.2 Area in danger

On the other hand, Division 31 is the area most exposed to firearm shooting incidents, and 17% of all firearm shooting incidents in Toronto have occurred in Division 31. Therefore, police in the division should pay more attention to firearm incidents to protect the citizens and reinforce the patrol of crime-prone areas in Division 31.

4 Conclusion

Based on the analysis, the 'City of Toronto' and the 'Toronto Police Service' could operate an enhanced protection system for citizens from gunfire violence in Toronto. The trends in gunfire shooting incidents in Toronto have improved since 2019, but they still need to strengthen the laws and rules about gunfire in Toronto for the citizens. The police in Division 53 especially need to improve patrol in the area. If the current trend continues, gunfire incidents will gradually decrease in Toronto.

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