Analysis of Possible Demographic Factors Influencing Report of Mental Health Act Apprehensions in Toronto Area*

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To have a general idea in terms of statistics of Mental Health Act (MHA) Apprehensions in the Toronto area, two of the datasets publically available from the Toronto Open Data Portal are speculated by using histograms and scatter plots. In general, the number of apprehensions increases by year and a decrease in the number starts in 2022, males in the age cohort 25-34 are more likely to have mental health-related apprehensions, and the total number of crimes and MHA apprehensions might also have indirect correlation within the same area. Although possible trends are detected, no relations are analyzed at this point. Even though various literatures have been published regarding mental health status, most of them lack a prespective in terms of law and crime: this report proposes to detect possible trends for future inspection and research regarding Mental health-related Apprehensions and possible contributing variables.

Table of contents

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*Code and data are available at: https://github.com/MjChen120/Mental_Health_Apprehensions_Toronto.

1 Introduction

By statistics, in any given year, 1 in 5 Canadians experiences a mental illness. By the time Canadians reach 40 years old of age, 1 in 2 have - or have had - a mental illness ("Mental Illness and Addiction: Facts and Statistics" 2023). Mental health issues are not uncommon and should be treated seriously just like other types of health issues. Toronto is one of the major cities in Canada, which is also the capital of Province Ontario. Toronto fields includes old 140 City of Toronto Neighborhoods structure as well as the new 158 City of Toronto Neighborhoods structure. Large cities are usually associated with fast pace of life, inflation, competition, and high pressure; this large city draws our attention regarding the mental health status of its residents. What are the demographic factors of the population that is being apprehended under the Mental Health Act (MHA) in Toronto city? This report is interested in possible factors that contributes to the numbers of apprehensions under MHA.

The MHA apprehensions and reports data set from Open Data Toronto Portal (Gelfand 2022) could be hinting the overall well-being of the residents in the area. This particular report thus examines the MHA Apprehensions data set ("Mental Health Act Apprehensions" 2024) provided by Toronto Public Data by using R language (R Core Team 2022) to provide a overview of the statistics both demographic and year-related in regards of the mental health apprehensions. Number of crimes and violence are usually associated with high testosterone level (Armstrong et al. 2022); men in young adulthood have significant positive association with impulsive and violent criminal behavior. Demographic factors such as age and gender could thus play a key role of Mental Health related apprehensions or crime reports in general. To elaborate, the relationships between number of reports and year, gender, and age are studied in this report.

To hypothesize, the demographic factors gender and age correlates with the number of MHA Apprehensions. In addition, the number of Mental Health Apprehensions could be in some way related to total number of reported crimes in the same neighborhood. Thus, a supplementary

data set called Police Annual Statistical Report ("About Police Annual Statistical Report - Arrested and Charged Persons" 2023) regarding arrested and charged persons from Open Data Toronto (Gelfand 2022) is loaded for comparing the number of crimes reported in total and number of MHA apprehensions in the same area division to see if there is any correlation between the two.

In result, potential trends in terms of relation between the demographic factors and crime rate in the same area division were detected. The relations were not statistically analyzed at this point of time, however, this report provides a foundation for research studies regarding the similar topics for Toronto area in the future. This report includes the introduction of the data sets in Data section, demographic analysis in Results section, and a Discussion section with limitations at the end.

2 Data

For the report, data used are retrieved from public online resource called Open Data Toronto Portal through the library `opendatatoronto` (Gelfand 2022).The data selected for the purpose of analysis are two package data sets called "Mental Health Act Apprehensions" ("Mental Health Act Apprehensions" 2024) and "Police Annual Statistical Report - Arrested and Charged Persons" ("About Police Annual Statistical Report - Arrested and Charged Persons" 2023). Both of the data sets are measured mainly based on reported made from facilities. We downloaded, cleaned and tidied the data set using the statistical programming language R (R Core Team 2022) including the `tidyverse` (Wickham et al. 2019), `janitor` (Firke 2023), `ggplot2` (Wickham 2016), `dplyr` (Wickham et al. 2022), `readr` (Wickham, Hester, and Bryan 2022), `tibble` (Muller and Wickham 2022), `kableExtra` (Zhu 2021), and `knitr` (Xie 2014).

2.1 Demographics of Mental Health Act Apprehensions

The primary data from "Mental Health Act Apprehensions" captures all Mental Health Act (MHA) Apprehensions pursuant to the MHA ("Mental Health Act Apprehensions" 2024). The data consists 25 variables, including the gender, age cohort, and year of the MHA apprehension reports. This particular data is chosen for the interest of the paper and no similar data sets are available from Open Data Toronto. Those three variables in particular and with the counting of the number of the cases will be used for demographic analysis. Each event number in the data set is a distinct MHA Apprehension and the data is queried based on report dates (Table 1).

Table 1: Sample of cleaned Mental Health Act Apprehensions Data

ID	Report-Year	Division	Gender	Age-Cohort
1	2014	D42	Male	55 to 64
2	2014	D22	Female	35 to 44
3	2014	D13	Male	25 to 34
4	2014	D23	Female	25 to 34
5	2014	D32	Male	25 to 34

2.2 Police Annual Statistical Report

The supplementary data set "Police Annual Statistical Report - Arrested and Charged Persons" is used for further inspection of the MHA apprehension data. The data set is chosen for the purpose of the study not only because there are no other similar data sets in the Open Data Toronto Portal, it is also updated by the same publisher as the MHA apprehension data set; thus, the format is consistent with the primary data. The data provides the aggregate count of people who have been arrested and charged by police station division, neighborhood, sex (or gender), age, crime category, and crime sub-type ("About Police Annual Statistical Report - Arrested and Charged Persons" 2023). The data set contains 11 variables in total. The variables unique data id, year of arrest, division of police station, and number of arrests are thus included for this purpose (Table 2).

Table 2: Sample of cleaned Police Annual Statistical Report Data

ID	Arrest-Year	Division	Arrest-Count
1	2019	D14	1
2	2022	D12	2
3	2018	D14	1
4	2015	D22	3
5	2014	D52	46

2.3 Combining Datasets

By assumption, areas with more crime reports should have more mental health related apprehensions due to the fact that MHA apprehensions are part of the crime reports; however, mediators and moderators might take place to impact the relationship between these two variables. For instance, residents in an area that has high crime rate could be violating the laws due to mental pressures, which could potentially trigger mental health issues. Crimes around an individual might negatively affect their mental health, thus influencing them into committing mental health apprehensions. As explained, this particular data package is thus

included in this report for finding possible factors that affect the mental health apprehension in one area.

The Annual Police Report data ("About Police Annual Statistical Report - Arrested and Charged Persons" 2023) is thus combined with the MHA Apprehension data ("Mental Health Act Apprehensions" 2024) to compare the number of apprehensions under MHA and number of arrests within the same year and same police station division to study a possible pattern. Table 3 presents a snapshot of the finalized combined data.

Table 3: Sample of Summerized data combining the above two datasets

ID	Arrest-Year	Division	Counts	Type
1	2014	D11	433	MHA
2	2014	D12	393	MHA
3	2014	D13	310	MHA
4	2014	D14	688	MHA
5	2014	D22	452	MHA
6	2014	D23	369	MHA
7	2014	D31	441	MHA
8	2014	D32	577	MHA
9	2014	D33	357	MHA
10	2014	D41	404	MHA

3 Results

3.1 Number of Reports by Years

The year of the reports and numbers of reports recorded in a year is being visualized by a histogram. The data is cleaned again for this purpose specifically to remove parts of the data that lack gender and age cohort reports. As we can see, the number increases as the year increases until 2022. After 2022, the number of apprehensions decreases (Figure 1). This might be an indicator where residents' mental healthy generally becomes better after 2022. The differences between year categories might not necessarily be significant at this point of analysis. In comparison, the total of number of arrests in general decreases through the years with a increase until the year of 2020. Although the trend of the data both changed, no scientific evidence supports the theory that the number of reports might be influenced by Covid-19 pandemic; however, the difference in the trends of the data over the years might hints the insight that the number of MHA apprehensions might not be directly correlated to the number of total arrests.
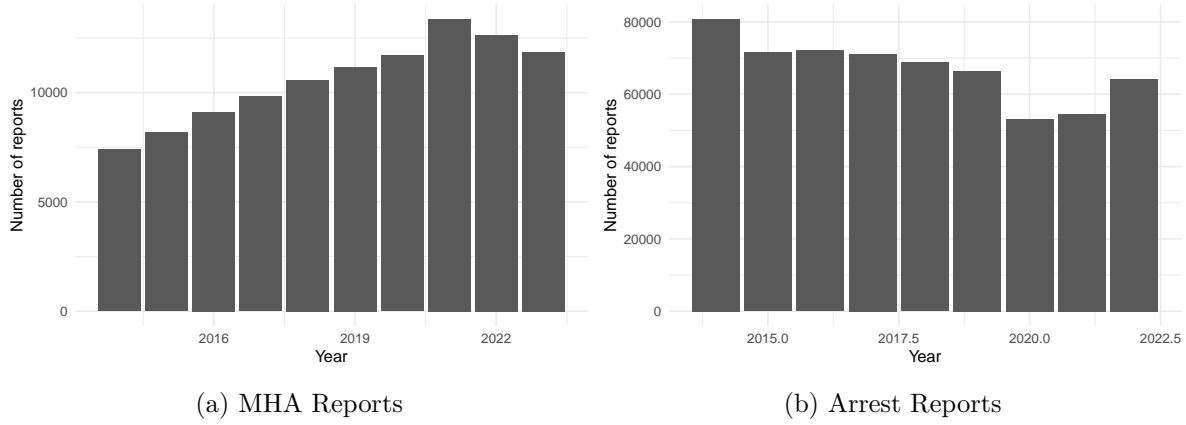
(a) MHA Reports

(b) Arrest Reports

Figure 1: Counts of Reports in Each Year

3.2 Demographic Factors

With sketching histograms, the number of reports in different groups of population are compared to each other based on gender and age. In addition, the four histograms are drawn to visualize the difference between those groups (Figure 2 and Figure 3). As result, males with age from 25 to 34 are more likely to report mental health apprehensions (56.99% males, 28.88% with age cohort from 25 to 34). The differences between gender and age group are not tested in terms of significance even though it could be significant with high power level due to large sample size. The analysis has limitations such as it only includes binary gender (i.e., female vs. male); further limitations will be discussed after in the discussion section.
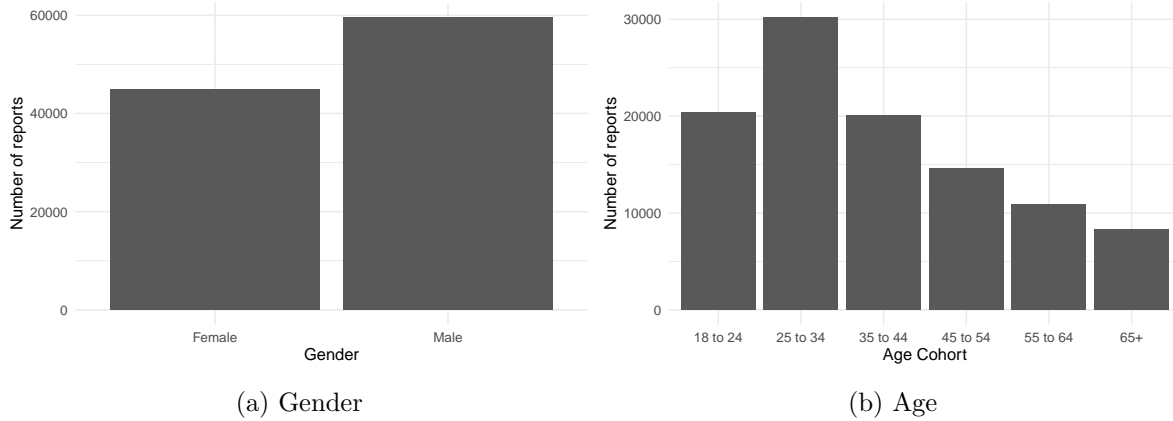

(a) Gender

(b) Age

Figure 2: Gender and Age of People Apprehended
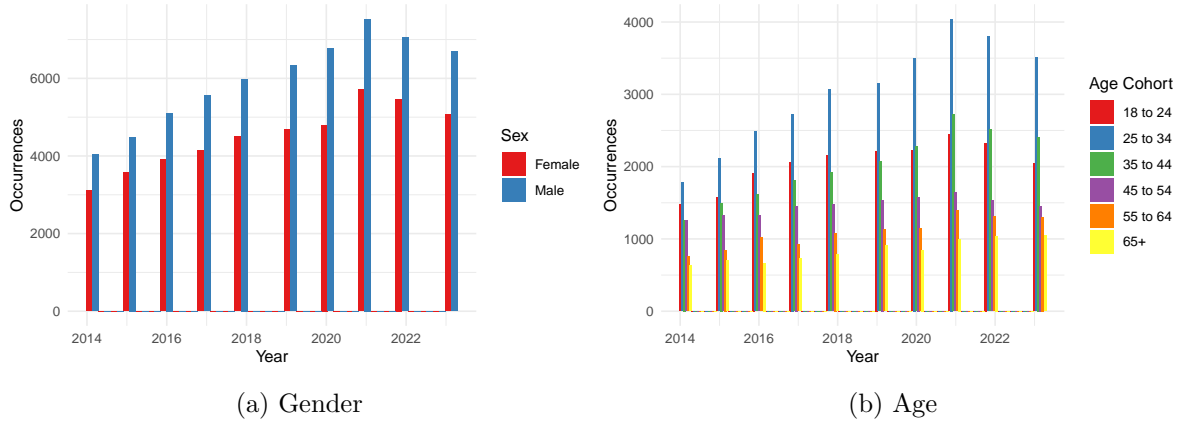
6

(a) Gender	(b) Age

Figure 3: Gender and Age of People Apprehended Visulization Year-Depended

3.3 Number of MHA versus Total Reports per Division

To visualize the number of reports and arrests in an area, average counts of MHA apprehensions and Police Reports over the years for each division is compared against each other. Again, as mentioned, MHA reports will always be less than total reports since it is a part of the reports at the first place; however, as demonstrated in Figure 4, the percentage of MHA reports among total reports are different from each other. For instance, larger numbers of police reports are intuitively associated with larger numbers of MHA reports (i.e., Division 13 versus Division 14). Results, however, shows that in some cases where one division has larger numbers of police reports but smaller numbers of MHA reports compared to others (i.e., Division 14 versus Division 51). The percentages of average MHA reports out of average police reports of the years are not consistent across the divisions as well. The report does not test the significance of the difference and lacks enough information for detecting possible moderators and mediators, thus, we can only state that there could be an indirect correlation between the number of total crimes and MHA reports within the same division in the same area.
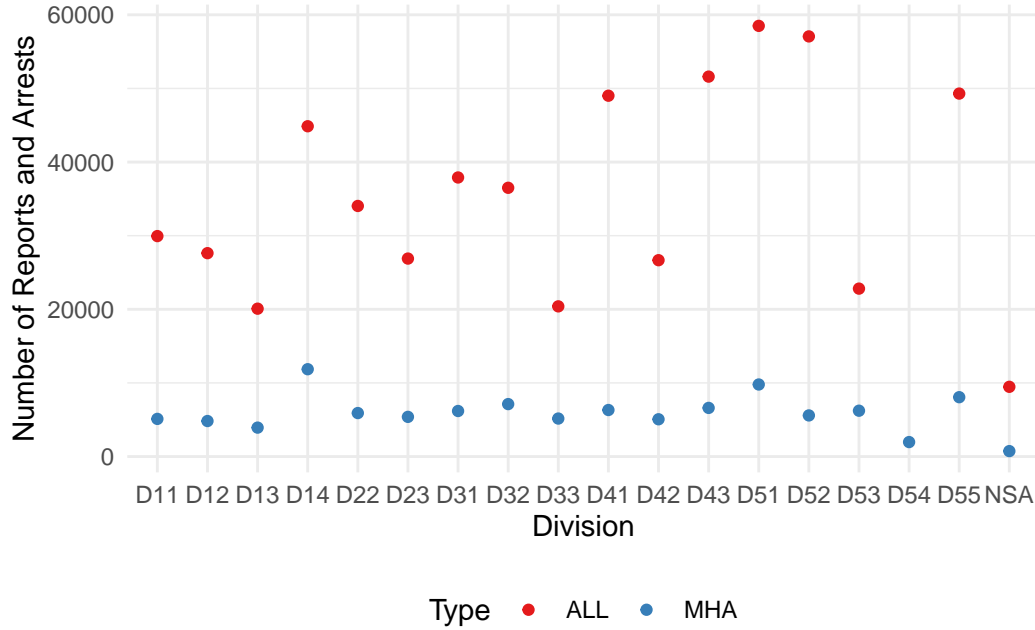
Figure 4: Gender and Age of People Apprehended

4 Discussion and Conclusion

Overall, the data reveals relationships between demographic factors (age, gender, and area or neighborhood) and number of MHA apprehensions reports. By conducting histogram graphs, We found that the number of MHA reports increases each year until 2022: in comparison, the total crime reports in Toronto decreases until 2020 (Figure 1). This trend of data could be a result of Covid-19 Pandemic due to the fact that many people encounter mental health issues while staying mostly at homes. The difference of the patterns in MHA and total crime reports also hints a potential indirect correlation with each other. Demographically, males in age cohort from 25 to 34 are more likely to be reported as MHA apprehensions(56.99% males, 28.88% with age cohort from 25 to 34) as shown in Figure 2. The difference between gender and age groups are not necessarily significant though are most likely to be since the large sample size. Closer studies such as model and power analysis should be conducted for better statistical understanding of the data sets.

Additionally, an possible indirect relation between the number of MHA apprehension and corresponding area division is detected: increase in number of total crime in one division does not correlates to higher number of MHA apprehensions with the same degree within areas (Figure 4). The percentages of average MHA reports out of average police reports of the years are not consistent across the divisions. In other words, possible bias, mediating, or moderating factors could take place in the correlation equation such as Equation 1. Although the paper

does not create and testify the validity of the equations and models, it provides a potential future direction for the research field.

$$NumberOfMHA = r * (TotalNumberOfCrimes) + Otherfactors + Bias \qquad (1)$$

4.1 Weaknesses and Next Steps

There are many weaknesses and limitation of the research. For MHA apprehension data, a unique event recorded in the data does not represent as an apprehension of a distinct individual: an individual may have been apprehended multiple times under the Mental Health Act, with those apprehensions recorded each with a unique event number in the data set. This fact probably applies to the Police Annual report data set as well, even though not mentioned in its description. This fact indicates that the visualization in the report does not represent number of people who are apprehended or arrested, but rather how many times those events happened. That could potentially affect the data and how to interpret data as one individual is responsible for a large amount of the apprehensions and crimes. For instance, the reason why males from 25 to 34 years old are generally apprehended more in the data (Figure 2) could be due to one male being apprehended multiple times. Furthermore, MHA Apprehensions data recorded events from year 2014 to 2022, whereas the crime data set only has events from year 2014 to 2023. The lack of one year data could dramatically change the outlook of the data visualizations due to the fact that only averaged number of reports over the years per division from MHA and crime data sets were used (Figure 1).

Other than limitations, the exact relationships are not evaluated statistically in this report; thus, in terms of future directions, actual correlations and relations can be analyzed by conducting proper statistical analysis such as Power or Model analysis. Better way of tidying and cleaning data could be done for current data limitations. Additional data sets and field studies could as well be conducted and used for supplementing the statistical analysis regarding the topic.

Appendix

.1 Additional data details

This appendix includes the snapshots of the data sets cleaned, tidied, and used for the purpose of the research. The script for data cleaning and the actual raw and cleaned data sets are available at https://github.com/MjChen120/Mental_Health_Apprehensions_Toronto

.1.1 Overview of Data Mental Health Apprehsions

ID	Report-Year	Division	Gender	Age cohort
1	2014	D42	Male	55 to 64
2	2014	D22	Female	35 to 44
3	2014	D13	Male	25 to 34
4	2014	D23	Female	25 to 34
5	2014	D32	Male	25 to 34
6	2014	D23	Female	45 to 54
7	2014	D53	Male	35 to 44
8	2014	D31	Male	25 to 34
9	2014	D12	Male	18 to 24
10	2014	D11	Male	25 to 34
11	2014	D51	Male	45 to 54
12	2014	D14	Female	25 to 34
13	2014	NSA	Female	55 to 64
14	2014	D22	Male	18 to 24
15	2014	D32	Female	35 to 44

.1.2 Overview of Data Police Annual Report

ID	Arrest-Year	Division	Counts
1	2019	D14	1
2	2022	D12	2
3	2018	D14	1
4	2015	D22	3
5	2014	D52	46
6	2015	D14	2
7	2019	D43	2
8	2018	D43	1

ID	Arrest-Year	Division	Counts
9	2020	D22	5
10	2020	D31	1
11	2021	D52	9
12	2016	D43	1
13	2020	D33	3
14	2021	D55	1
15	2021	D32	18

.1.3 Overview of Data Sets Summerized and Combined

The additional data set used for analysis is combined by R. All the number of MHA reports in the year for the same division is counted as the variable "counts" in MHA Apprehension data set; whereas all the reported numbers of the crimes for same division in the same year are summed as a column of "counts" as well in Police annual reports. The two data sets are then combined together with an extra column indicating the type of the reports they are from to differentiate (for example, "ALL" indicates the counts is for general police report, and "MHA" indicates the counts is for MHA report.

ID	Arrest-Year	Division	Counts	Type
1	2014	D11	433	MHA
2	2014	D12	393	MHA
3	2014	D13	310	MHA
4	2014	D14	688	MHA
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9	2014	D33	357	MHA
10	2014	D41	404	MHA
11	2014	D42	373	MHA
12	2014	D43	463	MHA
13	2014	D51	616	MHA
14	2014	D52	365	MHA
15	2014	D53	376	MHA

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