Data Analysis of Mental Health Trends from 2014 to 2023 in Toronto*

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In today's society, acknowledging the importance of mental health and the growing awareness surrounding it has increased more and more. This paper explores the 'Mental Health Act (MHA) Apprehension' data from opendatatoronto. The study analyzes trends in mental health situations and their correlation with those factors. Findings illustrate that number of MHA apprehensions is at its highest in 2021. It also indicates there are higher MHA apprehensions among males. The age group '25 to 34' shows the highest occurrences of MHA apprehensions. Additionally, individuals living in apartments are more likely to face MHA apprehension. The paper provides insights into the relationships among mental health conditions, age, gender, and living arrangements, offering a concise overview of the situation.

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*Code and data are avaliable at:https://github.com/marycx/Analysis-of-Mental-Health-Situation-from-2014-to-2023-in-Toronto.git

1 Introduction

Mental health is an essential aspect of an individual's well-being. It plays a key role in shaping individuals' lives and decisions. Good mental health of the community also has a significant influence on the development and safety of society. (Ahmedani 2011) states that approximately 25% of the worldwide population is affected by mental health issues at some point in their life. However, a study has estimated that less than 40 percent of individuals with mental health illnesses have received consistent mental health support and treatment throughout the years in the United States(Bagby 1987). In recent years, there has been a growing recognition of the importance of mental health (Reavley NJ 2018); individuals have higher mental health literacy and understanding about the importance and necessity of mental health treatment.

In Ontario, Mental Health Act (MHA)(Ontario 2015), which was established in 1967 (current version published in 2015), provides assistance to people with mental health concerns. It governs the involuntary admission and treatment of people with mental health disorders. It aims to provide mental health services and protect individuals' rights. It guarantees the access to care for individuals who may be at risk of harm to themselves or others due to their mental health conditions. All of these upsides that MHA brings strongly help the people in need: this paper(Bagby 1987) discusses how MHA helps creating a trend toward an increasing rate of civil commitments in taking the treatment for mental health conditions.

In this paper, we use R(R Core Team 2020) to analyze a dataset from opendatatoronto(*Opendatatoronto: Access the City of Toronto Open Data Portal* 2020) on the occurrences of MHA apprehension in Toronto from 2014 to 2023(Data 2024) in order to get a better idea on the development of mental health situation and what factors are influencing individuals' mental health. This report first looks at the overall trend of mental health situation across 2014 to 2023 after conducting data cleaning and pre-processing. It then attempts to analyze the intricate relationships between mental health conditions and demographic factors such as age, sex, and premise type, using graphs and tables. It is shown that the occurrences of male MHA apprehension are higher than female MHA apprehension in each year between 2014 to 2023. Also, age group "25 to 34" has the highest occurrences of MHA apprehensions compared to other age groups. Moreover, it is found that the number of individuals living in "Apartment" has a higher percentage of getting MHA apprehension compared to people living in other places. However, this may be slightly biased since majority of people in Toronto lives in apartments due to the packed city.

The remainder of this paper is structured as follows: Section 2 first discusses the data including data pre-processing and data overview, then presents the results, showing the relationships between mental health and demographic factors such as age, sex, and premise type.

2 Data

The data used in this paper has been sourced from the City of Toronto's open data portal (*Opendatatoronto: Access the City of Toronto Open Data Portal* 2020). Specifically, the dataset is named "Mental Health Act Apprehensions," including all Mental Health Act (MHA) Apprehensions pursuant to the Mental Health Act (Data 2024). This report incorporates information related to different gender categories, diverse age groups, and types of premises. The objective is to employ these data for examining the correlations among these variables and the occurrences of MHA apprehensions. One limitation worth noting is that each unique data entry should not be interpreted as the apprehension of a distinct individual, as an individual may be apprehended multiple times. However, this does not impact the analysis because the focus of the report is on the occurrences rather than the unique individuals involved.

Data is cleaned and analyzed using open-source statistically programming language R(R Core Team 2020), using packages from tidyverse(Wickham et al. 2019), dplyr(Wickham et al. 2021), knitr(Xie 2014), kableExtra(Zhu 2021), tibble(Müller and Wickham 2022), and janitor(Firke 2021).

2.1 Data Pre-processing

Raw data downloaded from City of Toronto's open data includes 25 data features (see Table 1 for each data feature and its content), many of which are not important in this analysis. Therefore, this report will not explain each of the data feature; details can be found (Data 2024). The raw dataset includes 105821 data entries. Some data cleaning is performed. First, relevant data features are selected for analysis (OCC_YEAR: occurred year, SEX: sex, AGE_COHORT: age group, and PREMISES_TYPE: premise types). Then data is cleaned by renaming the variables, so that their names are obvious. The variable names are as follows:

1. occurred_year: the year that the MHA apprehension occurred.
2. sex: sex of the person apprehended
3. age_group: age category of the person apprehended
4. premises_type: the premise that the person lives in

Moreover, there are certain entries containing the value "Not Recorded," which are removed to ensure the reliability and accuracy of the dataset. After data pre-processing, there are 104530 data entries, each with 4 features described above. A data overview is provided in the next section to further display the data.

2.2 Data Overview

This section presents an overview of the dataset following the selection of relevant variables and the cleaning process.

Table 1: Preview of the uncleaned MHA apprehension dataset

(a)

X_id	EVENT_UNIQUE_ID	REPORT_DATE	REPORT_YEAR	REPORT_MONTH	REPORT_DOW	REPORT_DOY	REPORT_DAY
1	GO-20141263946	NA	2014	January	Wednesday	1	1
2	GO-20141264197	NA	2014	January	Wednesday	1	1
3	GO-20141262056	NA	2014	January	Wednesday	1	1

(b)

REPORT_HOUR	OCC_DATE	OCC_YEAR	OCC_MONTH	OCC_DOY	OCC_DAY	OCC_DOW	OCC_HOUR	DIVISION	PREMISES_TYPE
19	NA	2014	January	1	1	Wednesday	19	D42	House
20	NA	2014	January	1	1	Wednesday	20	D22	Apartment
11	NA	2014	January	1	1	Wednesday	11	D13	House

(c)

APPREHENSION_TYPE	SEX	AGE_COHORT	HOOD_158	NEIGHBOURHOOD_158	HOOD_140	NEIGHBOURHOOD_140
Mha Sec 17 (Power Of App)	Male	55 to 64	144	Morningside Heights	131	Rouge (131)
Mha Sec 17 (Power Of App)	Female	35 to 44	16	Stonegate-Queensway	16	Stonegate-Queensway (16)
Mha Sec 17 (Power Of App)	Male	25 to 34	92	Corso Italia-Davenport	92	Corso Italia-Davenport (92)

Table 2: Sample of cleaned mental health data

Occurred Year	Sex	Age Group	Premises Type
2014	Male	55 to 64	House
2014	Female	35 to 44	Apartment
2014	Male	25 to 34	House
2014	Female	25 to 34	Apartment
2014	Male	25 to 34	Apartment
2014	Female	45 to 54	House

Table 2 provides some sample data entries in the refined dataset. It can be observed that the post-processing data comprises four columns: “Occurred Year,” “Sex,” “Age Group,” and “Premises Type”.

Table 3 shows the total number of MHA apprehensions across 2014 to 2023. A bar plot is created to better visualize the general trend of the dataset. It can be seen in Figure 1 which illustrates a gradual rise in the occurrences of MHA apprehensions from 2014 to 2021, peaking in 2021 (13219 occurrences). Moreover, a slight decrease is observed from 2021 to 2023. Some implications can be inferred from this trend. The reason why 2021 has the most cases of MHA apprehensions might be due to COVID-19 pandemic which was prevailing at that time. COVID-19 brought multifaceted challenges to people, for example, the economic uncertainty, lose of loved ones, prolonged social isolation, and so on. To some extent, these challenges all contributed to the increasing number of mental health problems (Matt Boden 2021).

Table 3: Number of MHA apprehensions in Toronto each year from 2014-2023

Occurred Year	Count
2014	7156
2015	8055
2016	9005
2017	9710
2018	10482
2019	11024
2020	11596
2021	13219
2022	12512
2023	11759

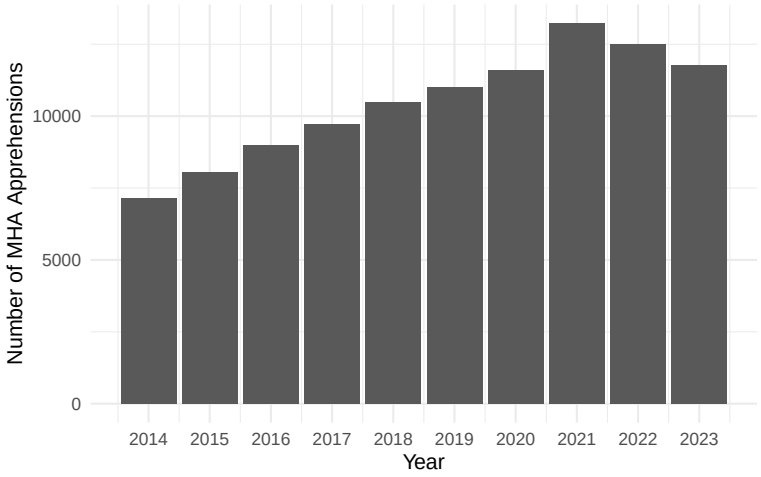

Figure 1: Total number of MHA apprehensions in each year

2.3 Relationship between Sex and Mental Health

In this section, the relationship between sex and the number of MHA apprehensions will be analyzed.

Table 4 shows the number of male and female MHA apprehensions in Toronto from 2014 to 2023. It can be observed that the percentage of male MHA apprehension is generally higher than the female MHA apprehensions.

The scatter plot Figure 2 is used to make it easier to see the trend between the year and the number of MHA apprehensions in different sex. As depecited in Figure 2, it can be clearly observed that the number of male MHA apprehensions consistently surpasses that of female MHA apprehensions across the years 2014 to 2023. Futhermore, an observation can be made that in the year of 2020, the male MHA apprehension attained the highest percentage (58.55%), while in the year of 2015, the female MHA apprehension attained the highest percentage (44.26%) across 2014 to 2023. There is also a decrease in the number of MHA apprehensions in both sexes in 2017 compared to 2015 and 2016. It is also worth noting that in the year of 2020, while the number of male MHA apprehensions reaches its peak, the number of female MHA apprehensions is at its lowest (differs by 17.1%). Also, in 2015, the reverse happens: while the number of female MHA apprehensions reaches its peak, the number of male MHA apprehensions is at its lowest (differs by 11.48%). This phenomenon is something worth analyzing in depth, and can be better understood by researching.

Overall, it can be concluded that males have a higher number of MHA apprehensions than females.

Figure 2: Percentage of male and female MHA apprehension percentage from 2014 to 2023

Table 4: Percentage of Male and Female MHA apprehensions in each year

occurred_year	sex	count	percentage
2014	Female	3113	43.50
2014	Male	4043	56.50
2015	Female	3565	44.26
2015	Male	4490	55.74
2016	Female	3907	43.39
2016	Male	5098	56.61
2017	Female	4147	42.71
2017	Male	5563	57.29
2018	Female	4497	42.90
2018	Male	5985	57.10
2019	Female	4686	42.51
2019	Male	6338	57.49
2020	Female	4806	41.45
2020	Male	6790	58.55
2021	Female	5699	43.11
2021	Male	7520	56.89
2022	Female	5464	43.67
2022	Male	7048	56.33
2023	Female	5074	43.15
2023	Male	6685	56.85

Table 5: Total number of MHA apprenhension in age groups in Toronto from 2014 - 2023

Age Group	Count
18 to 24	20425
25 to 34	30186
35 to 44	20092
45 to 54	14563
55 to 64	10907
65+	8345

2.4 Relationship between Age and Mental Health

In this section, the relationship between age and the number of MHA apprehensions will be analyzed.

Table 5 displays the total occurrences of MHA apprehensions in different age groups in Toronto from 2014 to 2023. It can be observed that the age group "25 to 34" has the highest number of MHA apprehensions (30186 occurrences). Then the number of MHA apprehensions gradually decreases as the age group becomes older. Age group "18 to 24" and age group "35 to 44" have similar number of MHA apprehensions, which only differs by 333 occurrences.

Figure 3 illustrates the relationship between the age group and the number of MHA apprehension in each year more clearly. It can be observed that the number of MHA apprehensions in age group "25 to 34" is always at the highest compared to in other age groups. This is possibly due to various societal and economic pressure for people in this age group. Also, age group "65+" always has the lowest number of MHA apprehensions. For age group "18 to 24", "25 to 34", "35 to 44" and "45 to 54", the number of MHA apprehensions increases from 2014 to 2021, reaching its peak at 2021, and then gradually decreases from 2021 to 2023. For age group "65+", the number of MHA apprehensions has a consistent increasing trend from 2014 to 2023.

Overall, it can be implied that individuals in age group "25 to 34" have the highest number of MHA apprehensions compared to other age groups.

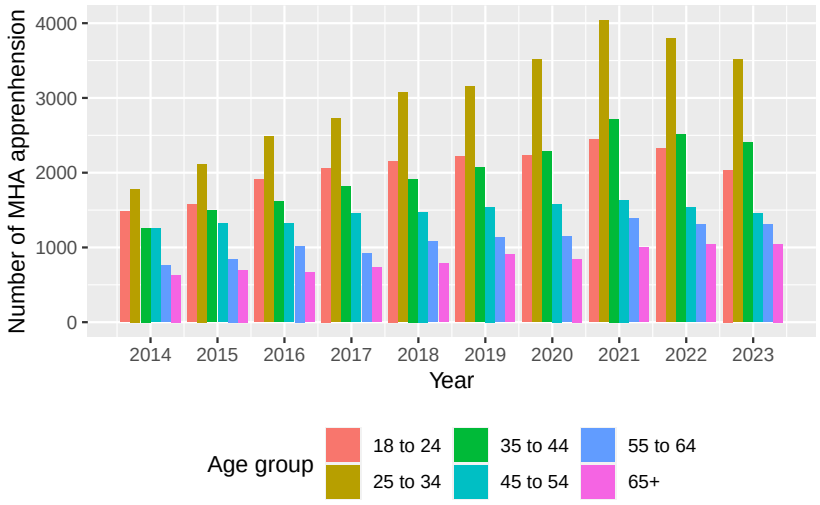

Figure 3: Number of MHA apprenhension in age groups in each year

2.4 Relationship between Premise Types and Mental Health

In this section, the relationship between premises type and the number of MHA apprehensions will be analyzed.

As illustrated in Figure 4, the distribution of the number of MHA apprehensions across various premise types is presented as percentages. It can be seen that "Apartment" emerges as the predominant category in premise types. In total, 40.9% of MHA apprehension of individuals live in "Apartment". This might be due to the fact that many people are renting apartments alone or still stranger. Therefore, they have very few people to talk to if they do not feel mentally well. MHA apprehensions of individuals living in "House" has the second largest percentage (17.8%) compared to others. The number of MHA apprehensions of individuals living in "Outside" and "Other" are approximately the same, which are 16.4% and 16.7% respectively. The remaining 8.2% includes individuals living in "Commercial", "Transit", "Educational" buildings, which do not have significant effects in the context of mental health situation analysis.

Overall, a conclusion can be reached that individuals living in "Apartment" have the highest occurrences of MHA apprehension.

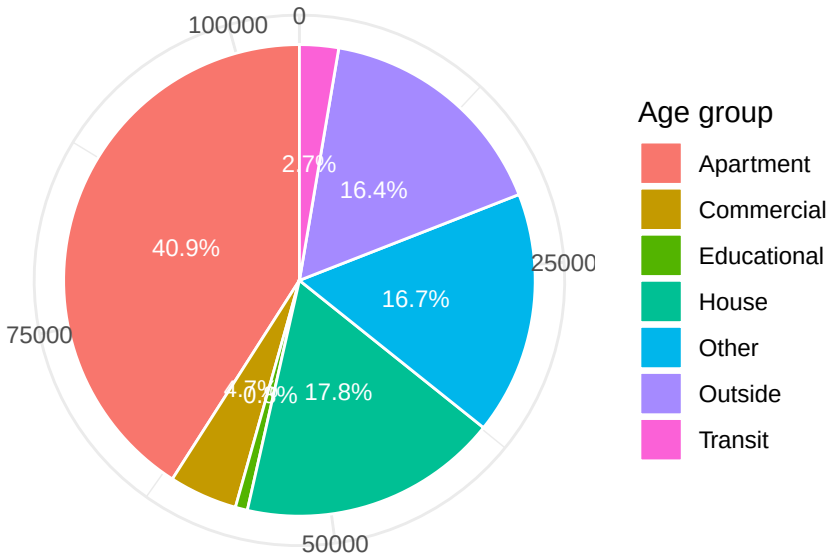

Figure 4: Percentage of MHA apprehensions by premise types

3 Reference

Ahmedani, Brian K. 2011. "Mental Health Stigma: Society, Individuals, and the Profession." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3248273/.

Bagby, Silverman, R. M. 1987. "Effects of Mental Health Legislative Reform in Ontario." https://psycnet.apa.org/record/1987-32403-001.

Data, Toronto Open. 2024. *Mental Health Act Apprehensions*. Toronto Police Services. https://open.toronto.ca/dataset/mental-health-apprehensions/.

Firke, Sam. 2021. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

Matt Boden, Kathryn J. Azevedo, Lindsey Zimmerman. 2021. "Addressing the Mental Health Impact of COVID-19 Through Population Health." https://www.sciencedirect.com/science/article/pii/S0272735821000490.

Müller, Kirill, and Hadley Wickham. 2022. *Tibble: Simple Data Frames*. https://CRAN.R-project.org/package=tibble.

Ontario, The Revised Statutes of. 2015. "Mental Health Act." https://www.ontario.ca/laws/statute/90m07.

Opendatatoronto: Access the City of Toronto Open Data Portal. 2020.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Reavley NJ, Jorm AF. 2018. "Public Recognition of Mental Disorders and Beliefs about Treat-

ment: Changes in Australia over 16 Years." https://doi.org/10.1192/bjp.bp.111.104208.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Wickham, Hadley, Romain François, Lionel Henry, and Kirill Müller. 2021. *Dplyr: A Grammar of Data Manipulation*. https://CRAN.R-project.org/package=dplyr.

Xie, Yihui. 2014. "Knitr: A Comprehensive Tool for Reproducible Research in R." In *Implementing Reproducible Computational Research*, edited by Victoria Stodden, Friedrich Leisch, and Roger D. Peng. Chapman; Hall/CRC. http://www.crcpress.com/product/isbn/9781466561595.

Zhu, Hao. 2021. *kableExtra: Construct Complex Table with 'Kable' and Pipe Syntax*. https://CRAN.R-project.org/package=kableExtra.