Introduction

In 2011-2012, nearly half federal offenders were in need of a psychological follow-up at admission (CMHA, 2023). According to the report from Public Safety Canada (2017), almost one in five persons accused of homicide were believed by the police to have a mental or developmental disorder in 2013. Research identifies the over-representation of mental health concerns within the Canadian Justice system, starting at the time of the arrest to correctional services (OJJDP, 2023**).** Many factors contribute to the increased risk of people with mental illness becoming involved with the criminal justice system. One of the most common misconceptions is the belief that mental illness is inherently linked to violence (CMHA, 2023). The perpetuation of this misbelief has several negative outcomes. There is no research to support the causal link between violent behaviour and mental disorder, and this misconception further stigmatizes and criminalizes individuals suffering from mental health problems. Some research suggests that time spent in custody may aggravate existing mental health conditions and impedes access to further support and services. Explicit and implicit bias from these misperceptions may lead to endorsements of forced legal actions for those individuals suffering from mental health conditions. Therefore, public misperceptions and fears surrounding mental illness may influence police response when in contact with individuals with mental health conditions and thus further contribute to the over-representation of mental health concerns in the justice system. In 2012, Canadians who suffered from mental health disorders were four times more likely to report having been arrested compared to those without a disorder. This pattern continues to increase from 2014 through 2016 (Public Safety Canada, 2017). It's imperative to gain a deeper understanding of police perception of mental instability at the time of the arrest. Previous studies demonstrated a link between mental illness and offenders and identified socio and economic marginalization, homelessness, and inadequate access to mental health support as factors correlated with this relationship (Public Safety Canada, 2017; Sapers & Zinger, 2016; Boyce, 2015). There is a large body of research suggesting an association between seasonality and mental health. However, few studies have examined the effect of seasonality on mental health in the context of criminal justice. The current study aims to further explore the relationship between the seasonality of the arrest month and police perception of mental instability at the time of arrest using the dataset published by Toronto Police Services.

Literature Review

Hansen and colleagues (2008) found that episodes of extreme heatwave negatively affect individuals with mental health conditions. Lacosta and colleagues (2019) also found a correlation between seasonality and suicide rates during spring and winter even after controlling for gender. Research also suggests a link between seasonality and aggressive behaviour in affective disorders with aggressive patterns also peaking in spring and winter (Fux et al., 1995). Other research also demonstrated the cognitive benefit of pleasant weather and longer photoperiods, consistent with findings of seasonal affective disorder that receiving less daylight (shorter photoperiods) negatively affects mental well-being and emotional stability (Keller et al., 2005; Morken et al., 2000; Mueller & Davies, 1986). Aggressive behaviour and violence are associated with increased irritability, which is found to be correlated with seasonality (Hsu et al., 2014). Additionally, research also demonstrated a link between youth, mental health disorders, and increased risk of violent behaviour. Youth aged 14-24 suffering from mental disorders are at more risk of becoming involved with the criminal justice system compared to those aged 45 and above (Public Safety Canada, 2017; Boyce, 2015). Building on this body of research, the current study will also consider the effect of age combined with seasonality. The following research questions were formed:

Research Question:

- What is the relationship between arrest month and the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of their arrest?
    - H0: There is no significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability at the time of their arrest based on arrest month
    - H1: There is a significant difference in the likelihood of an individual exhibiting signs of mental instability at the time of their arrest based on season

- What is the relationship between Season, age and the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of their arrest?
    - H0: There is no significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest based on arrest month and age
    - H1: There is a significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest based on arrest month and age

Methods

The present study explores the dataset published by Toronto Police Services on Arrests and Strip Searches. The current dataset contains 24 attributes including Arrest year, month, perceived race, sex, age group, youth at arrest, and actions at arrest. Based on the research question, several attributes in the data set were identified as the targets of interest: Arrest Month, Actions at arrest: Mental instability or possibly suicidal, Age group (at arrest), and Youth at arrest (under 18 years). Data cleaning, exploratory data analysis, and data visualization was conducted prior to examining the hypothesis using the data set. A one-way ANOVA was conducted to examine the effect of seasonality on Observed mental instability or possibly suicidal at the time of the arrest. A two-way ANOVA was conducted to examine the effect of seasonality combined with age on Observed mental instability or possibly suicidal at the time of the arrest.

Data Cleaning:

Before conducting analysis, the dataset was cleaned to ensure the quality and validity of the analysis results. A dictionary of key value pairs were created to replace categorical variables of object data type in pandas to a numerical data type in order to make quantifying easier for the later analysis. In the dataset, the arrest months were coded as four categorical variables: Jan-Mar, Apr – June, July – Sept, Oct – December. These four categories were recoded into numerical data type from 1 to 4 respectively to assist quantitative analysis. The current study identifies January to March as Winter, April to June as Spring, July to September as Summer, and October to December as Autumn. Other variables such as Sex, Perceived Race and Crime occurrence

category were also recorded into numerical values for better analysis, ranging from 1 – 30. Note the main variable of interest Mental instability or possibly suicidal were already coded as numerical in the dataset, no additional changes were completed in this study.

Exploratory Data Analysis

	Arrest_Month	Perceived_Race	Sex	Age Group at Arrest	Youth at Arrest	Actions at Arrest: Mental Instability or possibly suicidal
count	65276.00	65276.00	65276.00	65276.00	3042	65276.00
mean	2.468319	5.120856	1.806851	3.570424		0.033381
std	1.126876	3.037227	0.395121	1.333958		0.179632

Figure 1: Descriptive Analysis

To better understand the dataset, we conducted descriptive analysis and displayed some of the important variables of interest in the table above. The dataset included information on 65276 arrests between 2020 and 2021. The average arrest month was between April and June (M = 2.47, SD = 1.13). This finding is interesting and worthy of further analysis given the correlation between hotter weather and negative influence on individuals suggested by Lacosta and colleagues (2019), as well as the finding of aggressive patterns in spring (Fux et al., 1995). Of the 65,276 arrests examined, 3042 of the individuals belong to the youth age group at time of arrest.

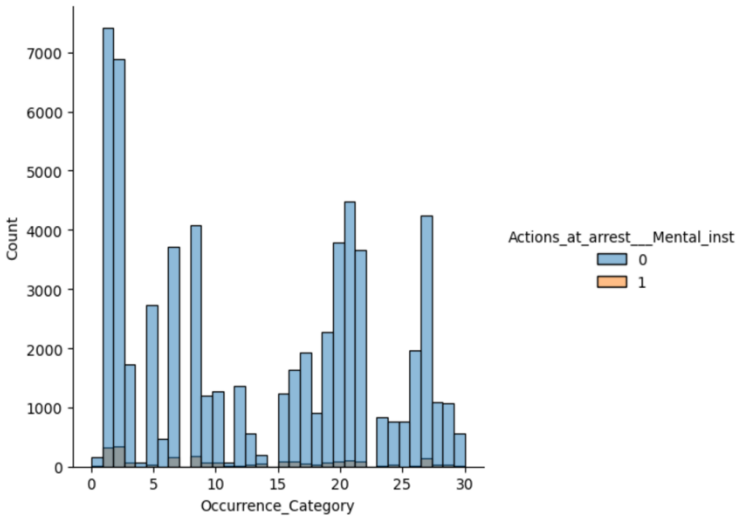

Figure 2

Out of all the arrests examined, 3.3% involved the individual exhibiting signs of mental instability or possibly suicidal. Individual exhibiting sings of mental instability or possibly suicidal at time of arrest were suspected of a wide range of crimes ranging from assault to harassment (figure 2). We further visualize the variable arrest month and different occurrence categories (figure 3).

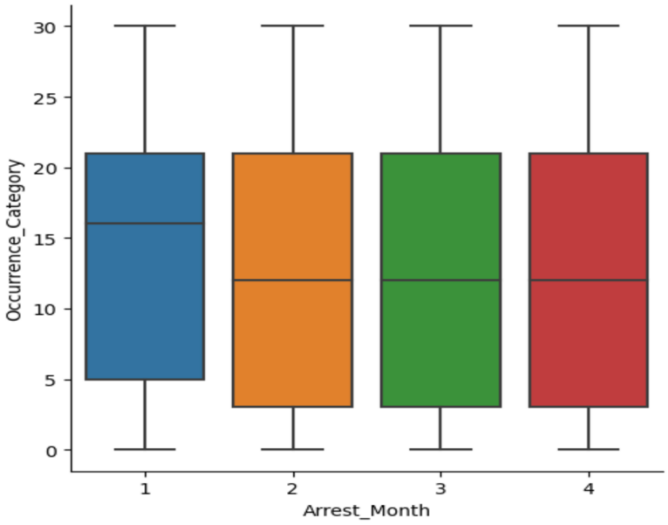

Figure 3

A correlation heatmap was also generated as part of our exploratory analysis to examine the variables of interest. A weak correlation (<0.5) was found across the variables of interest such as

arrest month, age group and observed mental instability or possibly suicidal at time of arrest (Figure 4).

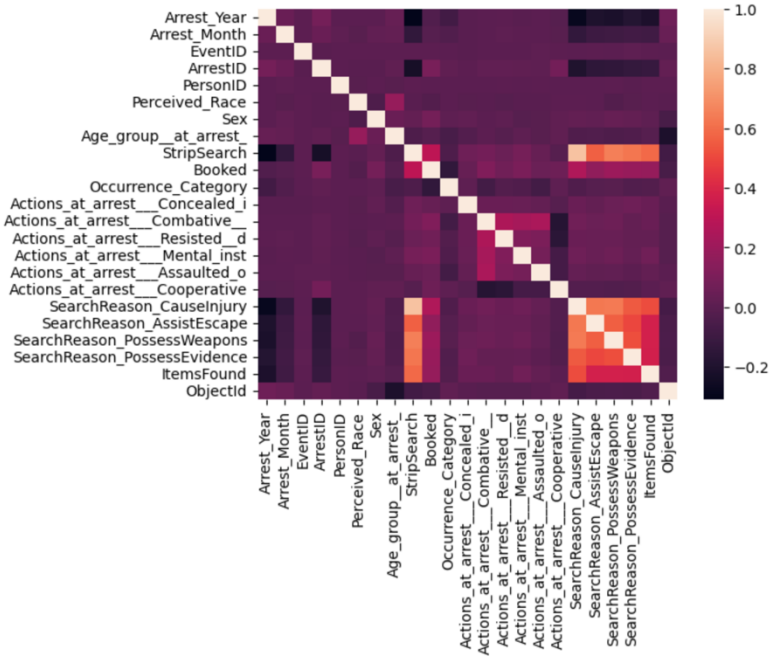

Figure 4

However, a weak correlation does not mean that there is no relationship between these variables. Cases reported mental instability or possibly suicidal accounts for a relatively small percentage of the total cases. Age group at arrest also includes the age range from 17 and under to 65 and older. The wide range of age considerations may mask the effect of some age group on observed mental instability at time of arrest. As mentioned above, previous research identified an association between youth suffering mental disorders and increased risk of criminal offense (Boyce, 2015), and youth arrest cases also account for a relatively small percentage of the cases in this dataset. Five One Sample Tests were conducted for the variables of interest. Analysis include the effect of arrest month, age group, Sex, Perceived race and occurrence category were conducted against the dependent variable of observed mental instability or possibly suicidal at time of arrest. All one-sample tests found significant effect of arrest month ($t = 552.06$, $p < .001$), age group($t = 677.45$, $p < .001$), sex ($t = 1146$, $p < .001$), perceived race ($t = 427.96$, $p < .001$), occurrence category ($t = 358.17$, $p < .001$) on the dependent variable with a large t statistics, indicating a strong evidence against the null hypothesis that the variables of interest have no impact on the dependent variable. Therefore, the findings warrant further analysis to explore the relationship between the variables of interest.

One-Way ANOVA, Tukey's HSD

- **RQ1**: What is the relationship between arrest month and the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of their arrest?
    - H0: There is no significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability at the time of their arrest based on season
    - H1: There is a significant difference in the likelihood of an individual exhibiting signs of mental instability at the time of their arrest based on season

A one-way ANOVA was conducted to compare the means of Arrest Month (Group 1) and Observed mental instability or possibly suicidal at time of arrest (Group 2). The F-statistic was not significant, $F(2, 57) = 2.15$, $p = .092$, indicating that there were no significant differences among the groups. Post-hoc analysis was performed using Tukey's Honestly Significant Difference (HSD) test with a family-wise error rate (FWER) of 0.05 to further validate the results. The results of the Tukey's HSD showed that there was no significant difference in the mean between group 1 and group 2 (mean difference = 0.0164, $p = 0.5043$). Based on the results above, we fail to reject the null hypothesis.

Two-Way ANOVA, Shapiro-Wilk test, QQ-Plot

RQ2: What is the relationship between Season, age and the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of their arrest?

- H0: There is no significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest base on arrest month and age
- H1: There is a significant difference in the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest base on arrest month and age

A two-way ANOVA was conducted to investigate the effects of arrest month (four levels: [Jan-Mar, Apr-June, July-Sept, Oct-Dec]) and whether the arrested is youth (two levels: under 18 years or 18 years and above) on reported mental instability or possibly suicidal at time of arrest. The main effect of age was significant, $F(2, 65264) = 38.48$, $p<.001$, indicating that the

likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest significantly differed between age under 18 years old and those 18 years and above.

The main effect of arrest month was not significant, $F(3,65264) = 1.71$, $p = .162$, suggesting that the likelihood of police reporting an individual exhibiting signs of mental instability or possibly suicidal at the time of arrest did not significantly differ across different arrest months. The interaction between arrest month and age at arrest was not significant, $F(6, 65264) = 0.66$, $p = .678$, indicating that age did not affect the month of arrest. To validate the results of this study, the Shapiro-Wilk test was conducted to test the normality of the data set, and a quartile-quartile plot was generated to visualize the normality of our dependent variable (figure 5). The Shapiro-Wilk test revealed a significant deviation from normality ($W = 0.188$, $p < .001$). We fail to reject the null hypothesis that the data are normally distributed. Even though significant differences were found for age on our dependent variable, non-normality of the data set could potentially bias the results of the study. Using the quartile-quartile plot we identify an abnormality of data distribution. A significant portion of data deviating from the center distribution disrupts the normality of the data. This may be due to responses to our dependent variable being categorical coded in 0 and 1 representing Yes or No. Therefore, it's worth exploring the data set with alternative analysis methods.

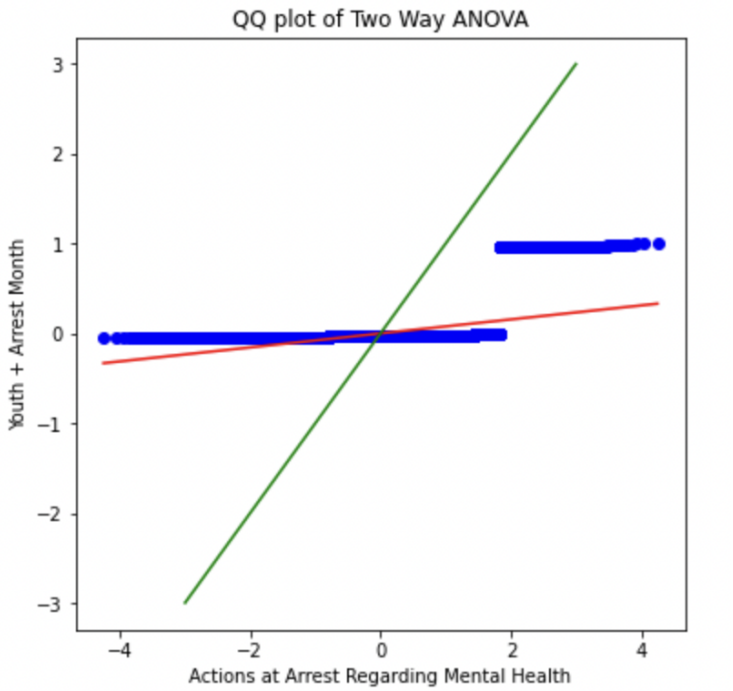

Figure 5

Discussion

We fail to reject the null hypothesis for research question one on the effects of seasonality on the likelihood of police report observed mental instability and possibly suicidal at the time of the arrest. However, this result does not necessarily mean that seasonality does not have an effect on the mental well-being of offenders. While the present study recognizes the arrest month quarters as discrete seasons, the actual date range of seasonality depends on multiple factors such as daylight duration, temperature, humidity, and more. Additionally, the non-normality of the data distribution could also be a potential factor for the non-significant results. We also found significant results to our research question two such that being a youth under 18 at the time of arrest have an effect on the likelihood of reported mental instability or possibly suicidal. This result is consistent with the literature reviewed above. The non-normality of the dataset also hinders the ability to generalize the results of research question two to the broader generation. Future studies should explore the seasonal effects on arrest decisions using a more specific monthly dataset and control for factors such as photoperiod and time spent outside in nature.

There is more than one factor that may play a role in the relationship between seasonality and mental well-being. It would also be important to explore other factors such as gender on reported mental instability, and the interaction with age.

Conclusion

The current study draws from a body of research studying the effect of age and seasonality on reported mental instability at the time of arrest using data published by Toronto Police Services. Exploratory data analysis, One-Way ANOVA, and Two-Way ANOVA were conducted. Significant effects were found for age on the likelihood of police-reported observed mental instability or possibly suicidal trends of the individual arrested. Some limitations to the current study and future directions were discussed.

Citation

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