DATA401 assignment

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Does the type of crime and when crimes are occurring differ among regions in New Zealand between July 2021 and July 2022?

Introduction

With the number of reports of increasing crime showering news outlets, one wouldn't be faulted for thinking crime has increased in New Zealand in recent times, and in fact, they might be right (Block, 2022; Vitz, 2022). Reports of record inflation and increased food prices and cost of living have become familiar headlines in the modern new cycle. These reports are of course supported by StatsNZ data on Food Price Index increasing and coincide with reports on a decline on New Zealanders mental health (Stats NZ, 2022; Stats NZ 2022). These socio-economic factors affect all aspects of society, including crime. By understanding the commonly accepted root causes of crime, we may be able to better understand why crimes occur and why crimes can occur more frequently in certain situations. The causes of crime are myriad and no one factor is solely the cause of crime, rather it is a combination of socio-economic factors that contribute to crime and rates of crime (CS&CPC, 2005). The most common mentions include social and economic disadvantages, poverty, and geographic location (Ministry of Justice, 2009). When considering increased cost of living in New Zealand over the past year, this report is will assess how crime occurrence trends have changed over this period. Moreover, considering geographic location in New Zealand, this report aims to see whether crimes occurring differs among regions in New Zealand and whether these crimes occur at different times. To answer the question of whether the type of crime and when crimes are occurring differs among regions in New Zealand between July 2021 and July 2022, the Police data on Demand and Activity with respect to the Time and Place and Districts/Regions data sets will be used. The data taken between July 2021 and July 2022 will be used, being the most recent data collected, and will be used for the basis of this report.

Method

The dataset used in this report is taken from the New Zealand Police Dataset 'Demand and Activity 'with respect to the 'Time and Place' and 'Districts/Regions' data sets. The Demand and Activity data set was used as this includes reports of crime occurrence as reported to Police (New Zealand Police, n.d). The 'Time and Place' dataset herein includes reports of when the crime was reported to have occurred by day of the week and in three-hourly bands of any given day. The 'Districts/Regions' data also records the police district to which the crime was reported. For the data set included in this report, two main datasets were collected from the police datasets website. These include the 'total_crimes', Hour_Day_Region and 'crime_loc_data' datasets. The 'total_crimes' data set briefly outlines the total reported crime count in New Zealand between July 2021 and July 2022. The 'crime_loc_data' dataset describes the reported count of crimes occurring in each region in New Zealand per month between July 2021 and July 2022. The regions included in the dataset are Auckland, Bay of Plenty, Canterbury, Gisborne, Hawke's Bay, Manawatu-Wanganui, Marlborough, Nelson, Northland, Otago, Southland, Taranaki, Tasman, Waikato, Wellington, West Coast, and Special regions Chatham Islands and those regions outside territorial authority. The Hour_Day_Region datasets includes data pertaining to the crime division and regions in New Zealand, and also includes data for when the crime occurred (days of the week and hours bounded in 3 hour reported increments). To explore the dataset, the programming language R will be used to conduct exploratory descriptive statistical analyses and to visually explore the data. Aside from the base R package, I will also employ the use of packages tidyverse, ggplot2, readr, stringr and pals, plotly and ggmisc. Exploration of the datasets will begin by computing summary statistics in R for the basic dataset of 'total_crimes' and computing the total number of crimes across all crime divisions in New Zealand (July 2021- July 2022), to get an overview of the total crimes occurring in New Zealand. The number of crimes occurring in New Zealand by region, by day and by hour band

will be explored using summary statistics and visualisations. Crime occurrence per month will also be assessed to explore changes in crime occurrence over the past year in New Zealand. I will also produce visualisations of the data so that the results can be easy to interpret using graphs.

Results

From the total_crimes data set, the total number of reported crimes committed across all regions of New Zealand in the period between July 2021 and July 2022 is 1470942. The average (mean) number of all crimes committed between July 2021 and July 2022 in New Zealand is 91934. The total number of reported crime occurrences can be visualised in the graph 'Total Crime Occurrences in New Zealand between July 2021 and July 2022'. Theft and Related offences (theft) are the most commonly occurring division of crime, followed by Public order offences. Homicide and related offences is the least common division of crime.

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##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     216   18340   62442   91934  101396  425280
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## [1] 1470942
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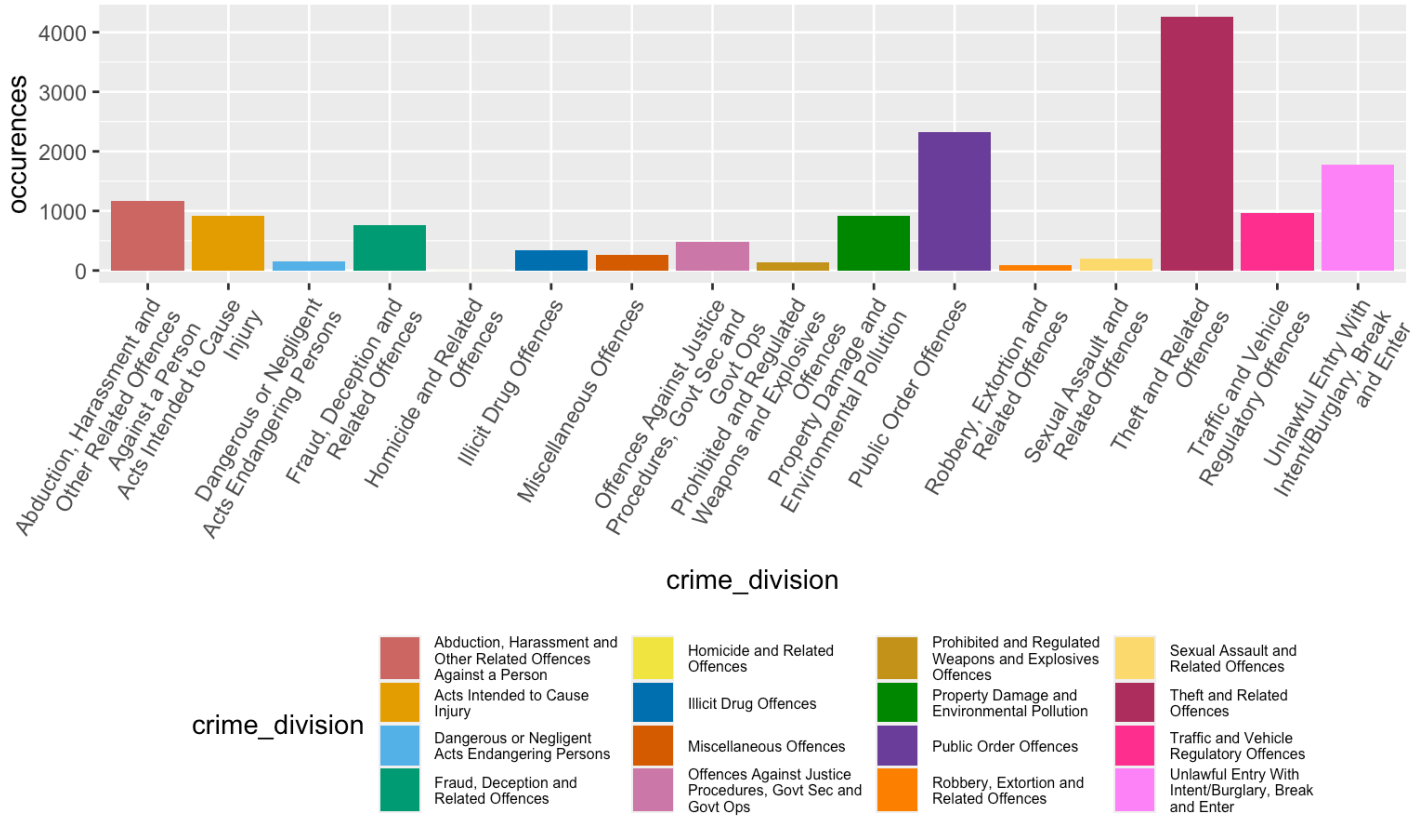
Fig. 1: Total Crime Occurences in New Zealand (July 2021 - July 2022)



Further exploration of the data is conducted using the crime_loc_data, assessing crime division by region. The table below shows the mean number of crimes occurring and the standard deviation, for each region in New Zealand. The region with the highest average reported crime occurrence is Auckland Region. Appendix 2, 'Side-by-side Bar chart, by Crime Division', shows the sum of crimes in each region in New Zealand, illustrating the number of reported crime occurrences in Auckland is considerably greater compared with other regions in New Zealand. The crime division 'theft' is also seen to be the most commonly reported crime in Auckland Region. The graph '100% stacked bar chart, by Region', illustrates how 'theft' makes up the highest proportion of all crimes reported in most regions.

Looking at the total reported crime occurrences between July 2021 and July 2022 on each day of the week in each region in New Zealand, Table 1 (Appendix 3) shows a contingency table of the total number of crime occurrences for each day of the week in each region. We can visualize this using a stacked Bar Chart to illustrate the total number of crimes in days of the week for each region. 'Stacked bar chart, by Day' shows the reported sum of all crimes by day of the week, for each region. By using a proportion table, it is possible to show the relative proportion of crimes occurring in each region for each day of the week. Appendix 4 illustrates this proportion contingency table. We can visualize this using the '100% stacked Bar Chart, by Day' to illustrate the proportions of crimes in days of the week for each region. The graph illustrates no significant proportional difference between days of the week for reported crimes. Notably, Thursday is suggested to be a big crime day in the Chatham Islands Territory.

Fig. 2: 100% Stacked Bar chat, by Region

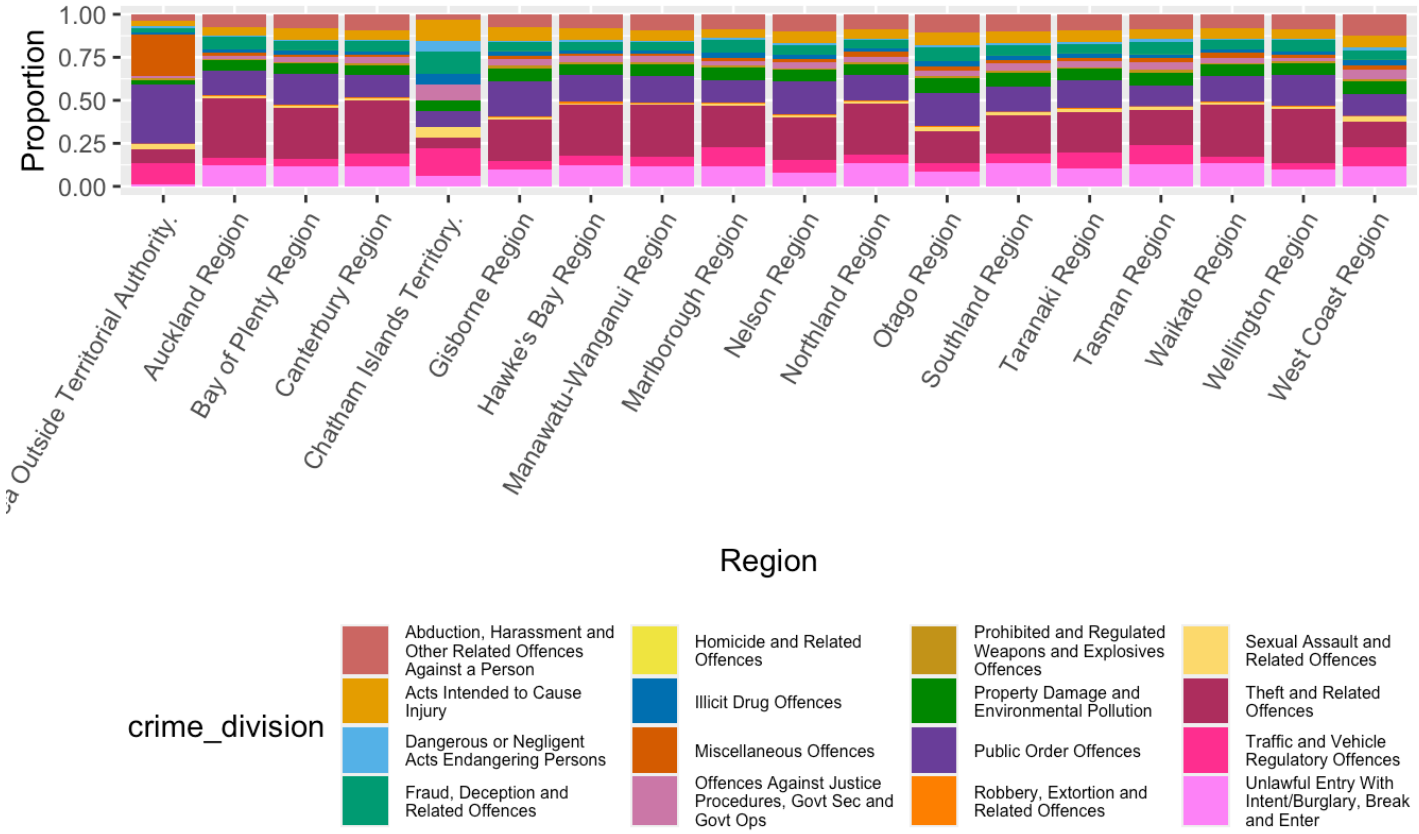


Fig. 3: 100% Stacked Bar chat, by Day

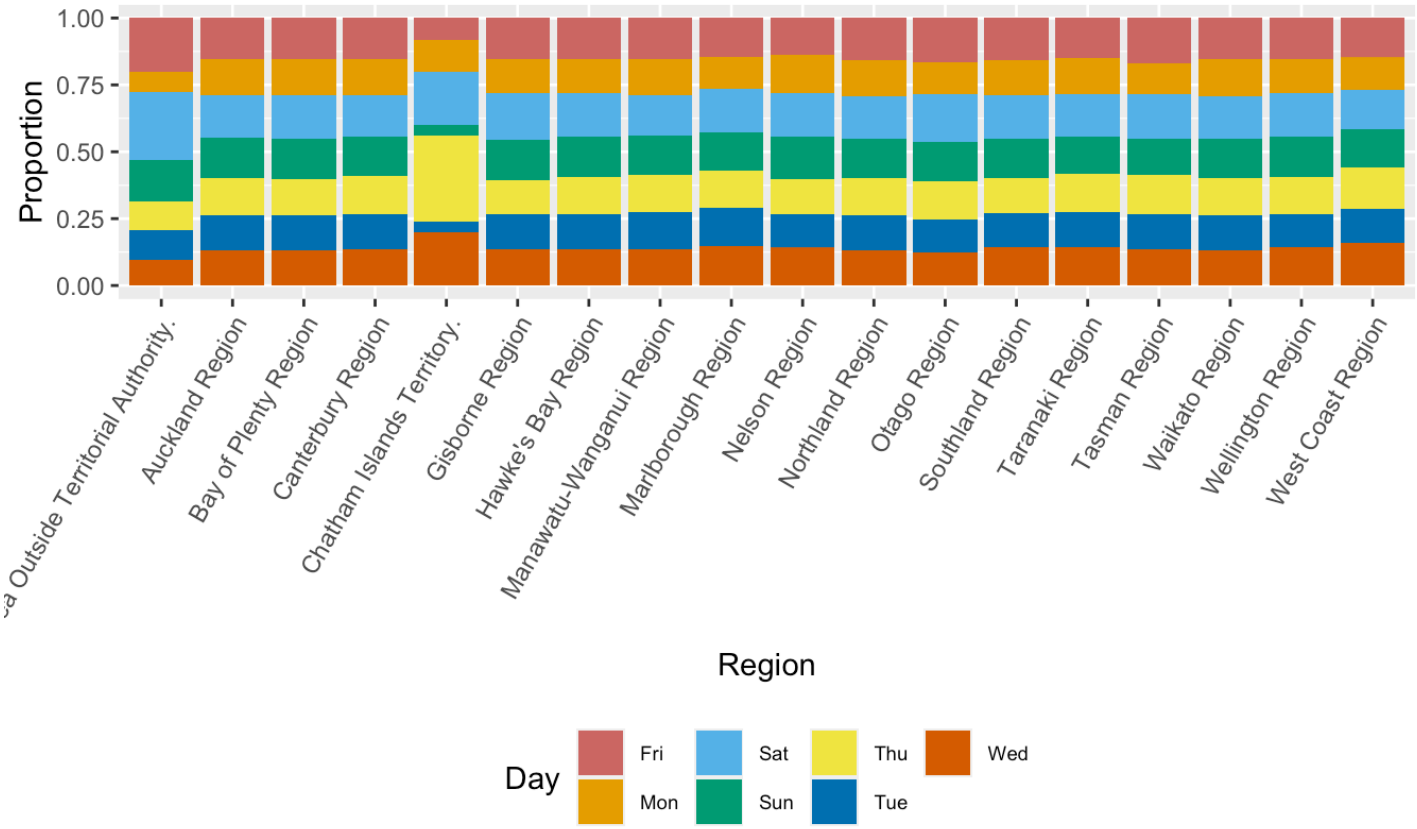
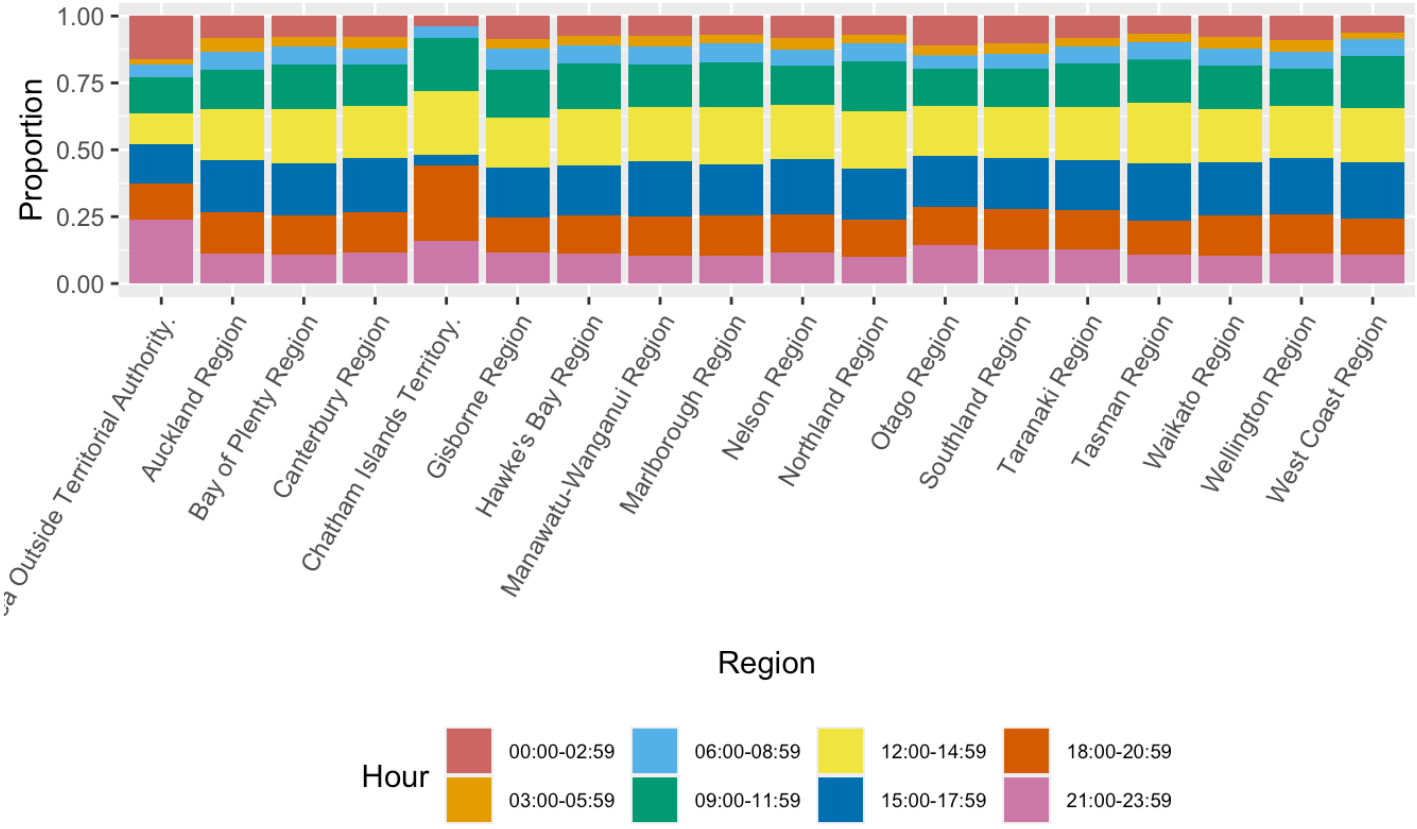
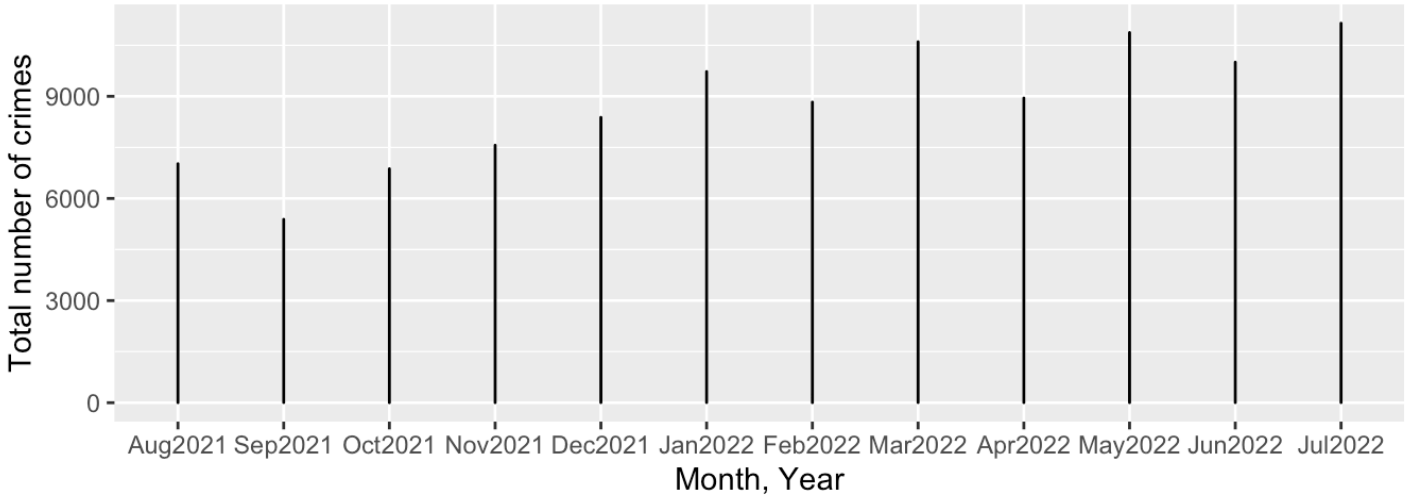


Fig. 4: 100% Stacked Bar chat, by Hour Boundary



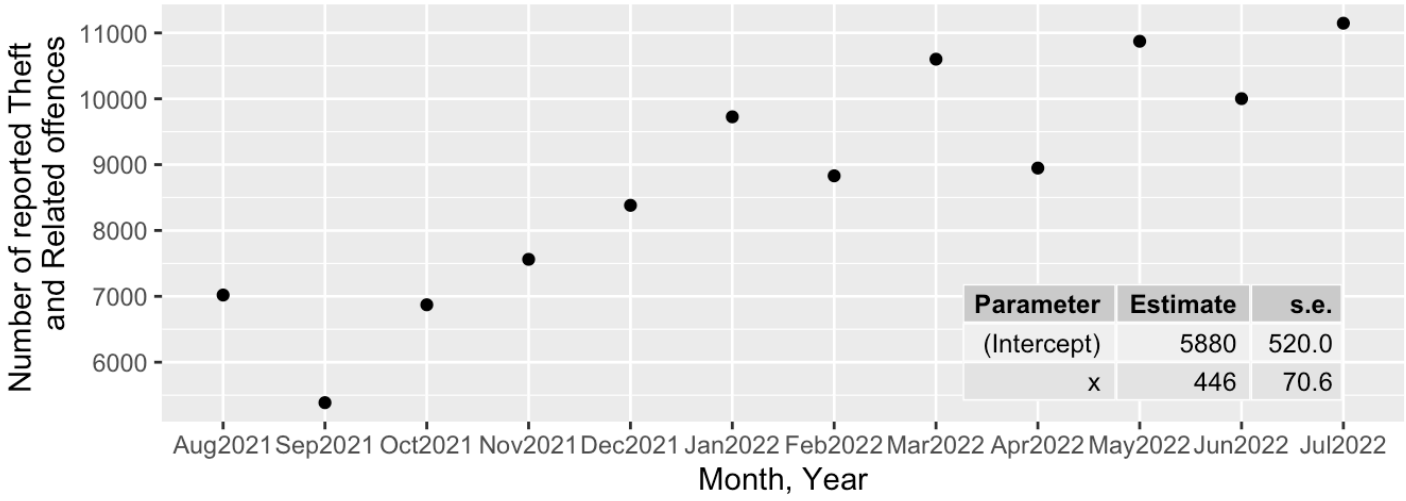
Also explored is the possible difference in reported crime occurring by hour boundary. Table2 (appendix 4) shows the contingency table by hour boundary in each region. The contingency table suggests the hour boundary of 12:00 - 14:59 accounts for the highest reported crime occurrences. The '100% stacked bar chart, by hour boundary' illustrates the proportion of crimes occurring in different regions by their hour band. This suggests that proportionally, there does not appear to be much difference between regions with respect to the time of day in which crimes occur. Using a proportion contingency table, it is also possible to show the relative proportion of crimes occurring in each region for each Hour band. The results of the proportion contingency table (appendix 5) show that the highest proportion of all crimes occur in the Auckland region. Finally, to look at whether there has been a change in crime occurrences over the past year, a line graph was used to produce a time series plot of total crimes occurring in New Zealand. The data used here encompasses August 2021 to July 2022.

Fig. 5: Line graph of total crime occurences in New Zealand between August 2021 and July 2022



Looking at the above line graph, we can observe an overall increase in total number of crime occurrences between August 2021 and July 2022. The '100% stacked bar chart, by region' (appendix 6), visualizes the proportion of crimes occurring in each region over time. Auckland consistently has the highest proportion of crime occurrences reported, however over this period, no great difference in crime per region can be seen from this graph. The proportion table (Appendix 7) also shows the relative proportion of crimes occurring in each region for each month between August 2021 and July 2022. From the research completed previously, it was shown that the most common crime is the "Theft and Related Offences" (Theft) division. As such, a more in depth analysis can be conducted into the occurrence of 'Theft'. Using a scatterplot graph, it is possible to visualize the total occurrences of 'Theft' per month over the past year.

Fig. 6: Scatterplot graph of Theft and Related Offences in New Zealand between August 2021 and July 2022



From the scatterplot of Theft and Related Offences in New Zealand between August 2021 and July 2022, we can observe a general trend of increasing number of reported Theft per month over the past year, suggesting the number of reported Thefts has increased. The difference between the total reported theft occurrences in August 2021 and July 2022 can also be calculated to be (11147 - 7020) = 4127, or an increase in reported theft occurrences by 4127, up 58.79% between August 2021 to July 2022.

Discussion

The exploratory analysis of the New Zealand Police data on Demand and Activity with respect to the 'Time and Place' and 'Districts/Regions' data sets shows that overall, no real difference between New Zealand regions in the type of crime and when crimes are occurring has been found in this report. These findings are supported in Figures 2, 4 and 5, showing the proportion of crimes occurring in regions, by day and hour boundary respectively. These findings suggest general crime trends throughout New Zealand to include the most commonly occurring crime being theft (Fig. 2), the day with the most reported crimes being Saturday (Fig. 3) and the most common hour boundary of reported crimes on any day of the week being 12:00-14:59 (Fig. 4). The findings also suggest the highest number of reported crimes occurs in the Auckland region (Appendix 1. This finding is, however, unsurprising as the Auckland region consists of around 1/3 of the entire New Zealand population, and consequently the Auckland region will be overrepresented in most samples taken simply due to this factor. One way to remedy this in further investigations would be to adjust for this using relative proportions of crime occurring in regions.

Occurrences of crime have been found to increase in New Zealand between 2021 and 2022 (Fig. 5). As the results show that the most commonly occurring crime in New Zealand, regardless of region, is theft and related offences (theft), is it also shown that theft has largely increased between August 2021 and July 2022 in New Zealand (Fig. 6). When comparing the values of total reported thefts between August 2021 and July 2022, an increase of 58.79 can be observed. This is consistent with other reports, mainly news articles (Vitz, 2022; Block, 2022) that also advise of a general trend of increasing crime and theft in New Zealand in recent times.

It is possible that some of the data reported during these months has been affected by extrinsic circumstances, namely the Auckland 2021 lockdown which occurred between August and December 2021. It is possible that due to this lockdown, fewer thefts were being committed (as more people were in their homes during this time) or reporting to police of crimes during this period lessened resulting in fewer reported crimes. Further investigations could be made here to include crime data over a longer period, for example over the past two or three years to gain a broader perspective of general crime trends in New Zealand. The study herein also does not consider a possible confounding factor of overall population change between in the period between August 2021 and July 2022. In further studies, it would be appropriate to consider statistical analyses on regional population data alongside crime statistics. To further investigate the causes of increased crime, it would be pertinent to analyse cost of living data, such as the consumer price index or food price index, so as to explore any possible relationship between these two factors. To conclude, the results of the statistical exploration taken on the New Zealand Police data of Demand and Activity show that, in general, the type of crime and when crimes are occurring in does not differ greatly between regions in New Zealand. However, when considering the overall crime trend in New Zealand between 2021 and 2022, an increase in crime occurrences is revealed.