Researching the possible explanatory predictors of the Domestic Violence Cases in New South Wales.

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Abstract

This research investigates the factors contributing to the domestic violence rate in Local Government Areas (LGAs) of New South Wales (NSW). The initial hypothesis proposed that domestic violence would decline over time due to decreasing unemployment rates despite increasing population density [1]. However, the analysis of data refuted this hypothesis and revealed new predictors. The findings demonstrate that drug abuse, along with population density, have a significant influence on domestic violence cases. Specifically, a strong positive correlation between population density and domestic violence suggests that higher population density leads to increased incidents of domestic violence. Furthermore, we already have multiple research articles on the relationship of alcohol and domestic violence. In contrast, employment and income were found to have no direct impact on domestic violence. Consequently, a new hypothesis is proposed, emphasizing the role of population density and substance abuse in domestic violence rates. Even though the initial hypothesis was falsified, more data is required to further analyze the variables of income and employment as they are quite significant variables in real life.

The study also identifies potential confounding factors, such as cultural background and educational qualifications, that require further examination. Higher education is suggested to enhance empathy and decrease the likelihood of domestic violence, while certain cultural contexts with oppressive practices and religious beliefs may exhibit higher domestic violence rates.

Linear regression models were employed to establish a proportional relationship between total domestic violence offenses and predictors, including drug cases, and population density. However, the study acknowledges limitations regarding assumptions of linearity, independence of errors, and homoscedasticity, which could affect result validity.

In conclusion, this research provides initial insights into the relationship between predictors and domestic violence through data analysis. Further investigations are necessary to comprehensively understand and quantify the impact of these predictors by considering additional factors and addressing data limitations. The findings contribute to a deeper understanding of domestic violence in NSW, facilitating future research endeavors in this field.

Introduction

What is Domestic Violence?

Domestic violence is a complex pattern of behaviors which ranges from physical acts of violence to sexual abuse and even emotional abuse [3][4][6]. Domestic Violence takes place among all ethnic groups, cultures, age groups, faiths, income levels, education levels, etc. Women are more likely to be abused in the relationship, but men may also be survivors. Abuse may also take place between same sex couples. [5] Domestic violence is categorized into 2 types: Intimate Partner Violence (IPV - violence over partners) and Non-Intimate Partner Violence (NIPV - violence over familial relationships) [6].

IPV and NIPV has no boundaries and occurs regardless of culture, race, religion, or socioeconomic status [7]. For this research both IPV and NIPV will be considered as Domestic Violence (DMV). There are different types of DMV such as physical, emotional, financial, sexual. Social, verbal, spiritual and elder or child abuse [8].

Initial Hypothesis and Working Theory

The main question this research is meant to answer is what explains the domestic violence rate in NSW Local Government Areas. Using this question, the hypothesis formed was that even though domestic violence is prevalent in New South Wales; it has decreased over the years considering the decrease of this unemployment rate despite the increase in population density [2]. The reason for this hypothesis was simple, a higher population density may lead to increased stress levels as there is more competition for the jobs. This stress is caused due to the fear of unemployment and unemployment can lead to financial strain which causes financial stress and insecurity that can lead to increased tension and conflict in relationships, and a sense of social isolation, which in all can contribute to domestic violence. Based on the initial hypothesis we have the following graphs to demonstrate the trends in Unemployment, Population Density, and Domestic Violence.

The Research, Bias, and Confounding Factors

It is important to recognize and address potential biases that may impact the findings of this research paper. There are several potential biases that can influence the findings of this project such as:

- Selection Bias – As the years covered spans from only 2016 to 2020. The limited time range may not capture the full picture and could lead to skewed results. While comparing data from the recent 5 years can provide valuable insights. It is important to acknowledge that patterns and trends may be hidden or not fully captured within this limited timeframe. Future studies could benefit from analyzing a more extensive range of years
- Sampling bias – If the data is collected using non-random sampling methods, there is a risk of sampling bias wherein some type of cases might be over or underrepresented. Another important point to remember is that it is crucial to recognize that domestic violence cases are often under reported. This under reporting can be attributed to various factors such as fear, stigma, and lack of trust in the criminal justice system. Therefore, the dataset may not fully represent the true prevalence and characteristics of domestic violence incidents, introducing a sampling bias.

Some confounding factors for the project might be Socioeconomic factors such as employment rates, education levels, cultural factors, access to support services, substance abuse, etc. While this project considers the Employment rates, and substance abuse in the form of drug and alcohol into consideration when analyzing, Education levels can also be a confounding factor, but due to the lack of sufficient data, it has been excluded from the research. It is important to acknowledge that these omitted variables may interact with the predictors being examined and could potentially impact the relationship between the predictors and dependent variable.

By acknowledging these biases and limitations, this research paper strives to provide valuable insights using the available data and establish a foundation for further investigation in this field. It is essential for future studies to address these biases and consider a broader range of factors to enhance the understanding of the factors affecting domestic violence.

Dataset	Columns_Used	Description
Provided data	LGA, Year, Offence Category, Sub-Category, Total Offences	The provided data had a count of all cases registered by the police for Domestic Violence related assault which became our dependent variable. Along with which, we have also used Drug Offences data.
NSW Shapefile	LGA, Geometry	These shapefiles helped to create the geographic visualizations of the Research.
Employment data	LGA, 2016 to 2020	The data had the actual surveyed data from 2016 to 2022 followed by predictions until 2066.
Income Data	LGA, 2016 to 2020	This data had the median salary based on LGA for every year from 2016 to 2020.
Population Data	LGA, Population Density	This data has the population statistics based on gender and the overall population and population density by LGA.

Data Methodology

About the Data

For this research, multiple datasets were used. Links to these datasets have been provided in the Appendix. Following is a table representing the datasets used, the specific data used from it, the description of the data.

Data Manipulations

The data provided to us had LGA, Category of Offences and Sub-Category of Offences followed by multiple columns each representing a month of a year starting from 1995 until September 2020. This data was cleaned and presented in a way wherein we had LGA, Offence Category, Sub-category, and Year (a sum of all months of the year) as the columns of the dataset.

Furthermore, multiple Drug possession offences were combined to have one common Drug Offence for the research. From the NSW shapefiles only 2 columns, LGA and Geometry, were used and all other dropped to minimise the run time of the functions. The Employed data was trimmed and only the actual surveyed data of 2016 to 2020 was taken into consideration. Similarly, Labour data was trimmed and only a few columns were kept. Alcohol related data was not taken into consideration as the data which was found were either Liquor offences which did not have any correlation to the research or had data of domestic violence caused due to Alcohol consumption. On further analysis, Income and Population data was also found and merged with the main dataset. The regression models were built on the merged data (without Labour data) for the period of 2016 to 2020 which provided us with 5 years of recent data. Through this method, we might be able to analyse the recent trends or be looking at microscopic events, ignoring the macroscopic details. The research has been conducted with keeping this detail in mind.

As mentioned in the table above, the columns from each of the dataset used was merged into one dataset called Main_Data on the basis of the common columns LGA and Year. This dataset had all the columns used for the analysis. Each variable was converted to its specific variable data type and values of years from 2016 to 2020 were only taken.

Data Analysis

After the necessary data manipulations, an exploratory data analysis was conducted to know more about the data. The following map shows that Domestic Violence is prevalent in the state of NSW:

Variable	Total_DMV_Cases	Total_Drug_Offences	Total_Unemployed	Population_Density	Median_Salary
Total DMV Offences	1.0000000	0.6754243	0.4883757	0.8783281	0.1707115
Total Drug Offences	0.6754243	1.0000000	0.4237379	0.6659191	0.1269837
Total Unemployed people	0.4883757	0.4237379	1.0000000	0.5021195	0.1845971
Population Density	0.8783281	0.6659191	0.5021195	1.0000000	0.3470221
Median Salary	0.1707115	0.1269837	0.1845971	0.3470221	1.0000000

Total_Drug_Offences	Total_Unemployed	Population_Density	Median_Salary
2.531006	1.384489	4.064990	1.197540

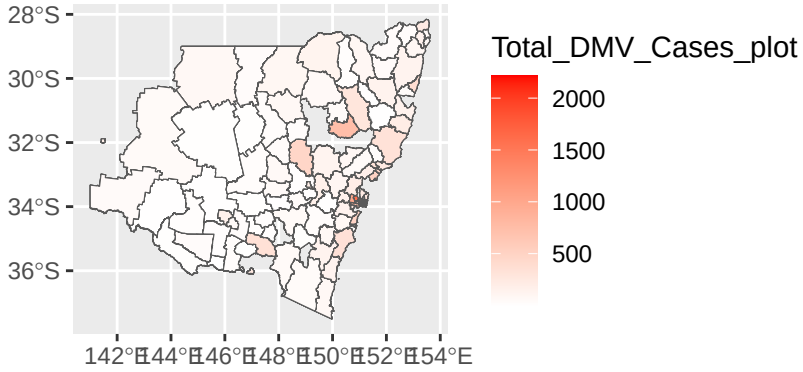


Fig 1. Total Domestic Violence cases by LGA in NSW

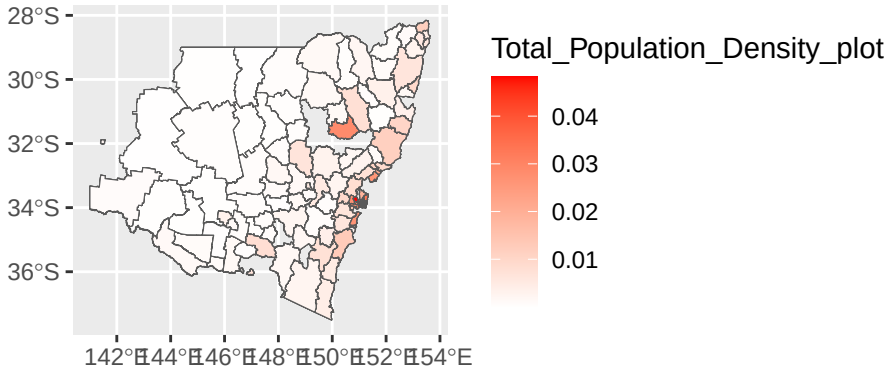


Fig 2. Total Population Density by LGA in NSW

According to the research conducted by ABC Broken Hill, Domestic Violence decreases towards the west of NSW whereas the Domestic Violence rate increases. Figure 1 displays the total number of cases by LGA in NSW till date. This is consistent with the research conducted by ABC Broken Hill [1]. Looking at Figure 2, we can see how the population density decreases towards the west. This hints that the Population Density and Domestic Violence Cases are related.

The predictors used for this research are Total Employed people, Total drug offences, Alcohol induced DMV offences, and non-Alcohol based DMV offences. This research uses a linear regression model to check the relationship between the number of DMV cases and Employment while also having other predictors which are confounding factors [10]. Linear Regression is possible on the assumption of 4 criteria: Linearity, Independence, Homoscedasticity, and Normality.

Based on the dataset, the correlation matrix and Variance Inflation Factor is checked for the predictors. The output is as seen in the tables displayed above:

The Final Model results

The statistical significance of the predictors were also calculated and surprisingly, the following were the results.

```
## lm(formula = Sub_Data$Total_DMV_Offences ~ Sub_Data$Total_Drug_Offences +
##     Sub_Data$Total_Unemployed + Sub_Data$Population.Density +
##     Sub_Data$Median_Salary, data = Sub_Data)
##                               coef.est coef.se
## (Intercept)                     224.39    30.81
## Sub_Data$Total_Drug_Offences      0.07     0.01
## Sub_Data$Total_Unemployed         0.00     0.00
## Sub_Data$Population.Density   24517.70   812.49
## Sub_Data$Median_Salary            0.00     0.00
## ---
## n = 610, k = 5
## residual sd = 129.76, R-Squared = 0.80
```

Results of Initial Hypothesis

Based on the analysis of the data, the original hypothesis of this research was falsified. Employment and Income does not affect the Domestic Violence Cases. Further analysis was then conducted, and more predictors were discovered. It was noticed that drug influence, and population density were great predictors for the number of domestic violence cases. In fact, Domestic violence and Population density are related to a very high extent as seen through the statistical significance table. This means that if Population density increases then there is an increase in the number of domestic violence cases. Furthermore, considering that Employment and Income is not a factor of influence, other factors are involved with the rate of Domestic Violence in NSW.

Modified Hypothesis and Working Theory

Considering the falsification of the original hypothesis, a new hypothesis can be put forward. The Domestic Violence Cases increases with the increase in population density. Drug abuse and Alcohol abuse would be more in areas of high population density and as seen, could be a factor in the rate of Domestic violence in New South Wales [9]. Furthermore, due to the lack of data, more confounding factors could be used. Some confounding factors are cultural background, and educational qualification. If a person is highly educated, they would be more empathetic and would not engage in Domestic Violence. In contrast to educational qualifications, there are certain cultures wherein women are oppressed. Such cultures have certain religious beliefs which may lead to the rise in Domestic Violence rates in NSW.

Further Literature Review

Domestic violence is a significant issue in New South Wales (NSW), involving various forms of abuse in intimate relationships [12]. Understanding the factors contributing to domestic violence rates is crucial for effective intervention. Studies have examined the relationship between population density and domestic violence rates, with some finding a positive correlation in urban areas, while others show no clear relationship [13][14].

Substance abuse, particularly drug and alcohol misuse, is consistently linked to domestic violence. Individuals involved in substance abuse are more likely to perpetrate or experience domestic violence incidents [17]. Areas with high population density may have increased substance abuse rates, making them more prone to

domestic violence. However, substance abuse is not the sole determinant, as it interacts with socio-cultural and individual factors [18].

Cultural background plays a complex role in domestic violence rates, influenced by religious beliefs and gender norms [15]. Cultural beliefs shape attitudes towards gender roles and power dynamics, impacting the occurrence of domestic violence. Higher levels of education are associated with increased awareness of gender equality, contributing to more respectful relationships.

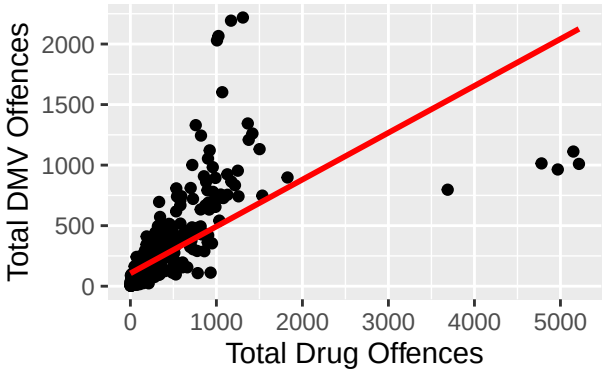
Existing research on domestic violence in NSW has limitations, including a lack of comprehensive data capturing the full scope of incidents, including unreported cases. Further research is needed to address these knowledge gaps and gain a more accurate understanding of prevalence and underlying factors.

Factors like socio-economic status, access to support services, and community resources also influence domestic violence rates. Domestic violence is a complex issue influenced by various factors. Additional research is needed to comprehend the dynamics between population density, substance abuse, and domestic violence rates, aiding the development of targeted prevention strategies, especially in densely populated areas [16].

In conclusion, cultural background, educational qualification, and other factors like population density and substance abuse contribute to domestic violence rates. However, further research considering additional factors is necessary to understand the complexities of domestic violence in NSW fully. A comprehensive approach is needed to develop targeted interventions that address the root causes and promote safer communities.

Model based on new Predictors

Linear Regression Models



3. Linear Regression for Drug Offences vs DMV Offences

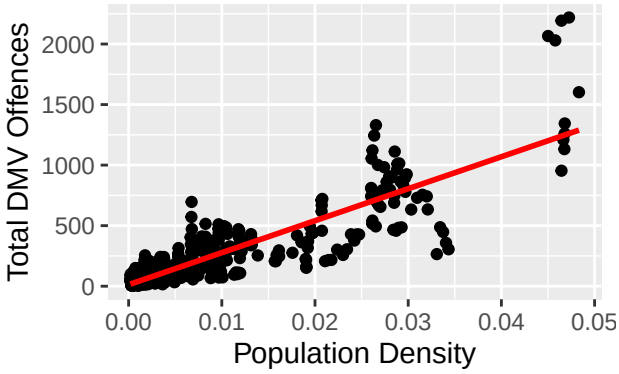
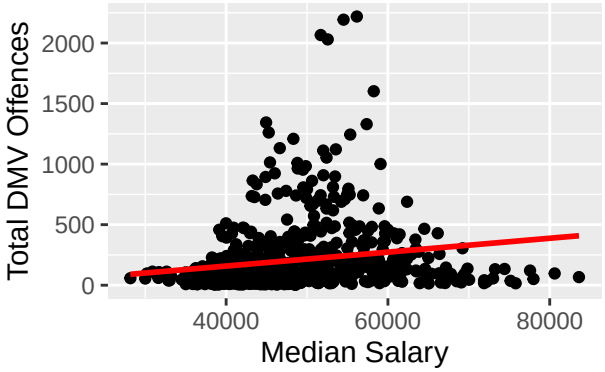


Figure 4: Linear Regression for Population Density vs DMV Offences



5. Linear Regression for Median Salary vs DMV Offences

The linear regression models prove that there is a direct proportional relationship between the Total DMV offences and the predictors, Drug cases, Median Salary, and Population density. The variables used in the linear regression model account for the potential confounding factors. However, it is important to acknowledge the limitations of this analysis. The interpretation of the results should be cautious, as the linear regression model assumes certain assumptions such as linearity, independence of errors, and homoscedasticity. Violations of these assumptions may affect the validity of the results. The graphs produced by the data analysis proves the new hypothesis and is supported by the literature review.

Conclusion

In conclusion, the scatter plots and the associated linear regression line provide initial insights into the relationship between the predictors and the target variable, Total DMV Offences. Further analysis and consideration of other factors are necessary to fully understand and quantify the impact of the predictors. There is a lot of scope for the improvement of the model. Due to the lack of data before 2016, only records from 2016 to 2020 was used to create a model. The data from the previous years may lead to some different results considering it would be more macroscopic in nature. Several confounding factors do not have existent data or is difficult to search for. When these confounding factors and variables are accounted for, there might be a huge change in the model and the results of the research.

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Appendix

Datasets used

[1] Provided Data

[2] NSW Shapefile

[3] Employment Data

[4] Income Data

[5] Population Data