Research Article

CRIME AGAINST WOMEN IN INDIA – ANALYSIS OF NEWS AND OFFICIAL STATISTICS TO FIND FACTORS INFLUENCING TEMPORAL PATTERNS

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ABSTRACT

The environment we reside in can have a profound impact on our actions, particularly when it comes to criminal activity. The importance of studying the effects of surroundings on criminal behavior has become increasingly clear. There are three main types of environments, natural, physical and social. In this work, how the natural environment affects rate of crime against women in India has been discussed. India has four seasons namely winter, monsoon, summer, and autumn. News headlines come under the crime against women category with published date are extracted from Indian news websites like The Hindu, Times of India, etc. These news headlines are grouped under three different violent crime types, kidnap & abduction, rape and rape with murder. seasonality of crime was exposed with the help of extracted date and crime type. This study revealed that rate of three crime types were high in (monsoon) rainy season followed by winter and autumn respectively.

Keywords: - temporal patterns, seasonality, correlation coefficient, significance, association.

1. INTRODUCTION

The natural environment can have a reflective effect on human behavior and mental states, potentially leading to changes that increase the likelihood of criminal activity. The findings from previous studies suggest that natural forces can affect individuals both physically and emotionally, potentially leading to out-of-character behaviors that may result in criminal acts. Furthermore, changes in climate and temperature are expected to have even more significant impacts on crime rates in the future. A pattern of weather characteristic of a period of time, usually months, that recurs with regularity from year to year constitutes a season. No matter what one day's weather may be, or what the climate may be, in almost all locations the weather changes during the year, being hotter during one period and cooler during another.

According to the Indian meteorological department (IMD) India has four climatological seasons; Winter season from January to February, Summer or pre-monsoon season lasting from March to May, Monsoon or rainy season lasting from June to September and Post-monsoon or autumn season lasting from October to December. The fact that the changing seasons affect human behavior patterns is confirmed by data on almost all human activity, including crime.

Crimes against women in India are come under two categories Indian Penal Code (IPC) and Special Local Laws (SLL). Rape, kidnap & abduction and rape with murder are most affecting violent crimes which need immediate attention to prevent future crimes. In this proposed temporal analysis work only, the crimes under these three types are considered and analysed.

In this paper, we employed the periodic data extracted from India news websites to examine the temporal patterns in over 500 thousand violent crimes in India committed against women between 2001 and 2020, and determine the relationship, if any, to

- Season
- Day-of-week
- Week-of-month
- Month-of-year
- Holidays and public event days
- The climate variable that we examine is temperature and rainfall.

2. MATERIALS AND METHODS

2.1. DATASET

News headlines of all reported incidents of crime that have occurred in India from 2001 to 2020 are extracted from India news websites using keyword search, that is only crime against women are filtered from all kinds of news. The data include the headlines of the crime and date of crime incidents. The data from 2001 from 2020 consist over 500 thousand reported crimes. The number of crimes by type over the time period are shown in Fig.1. We only examine three types of violent crimes mentioned above to analyse the temporal factors on crimes.

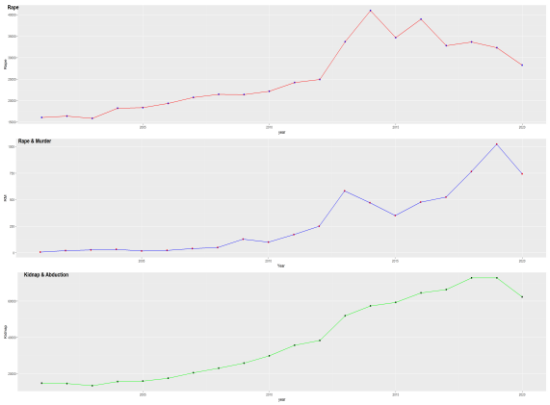


Fig.1. Annual crime incidents from 2001-2020

Monthly, annual and seasonal temperature and rainfall data of India are freely available in Indian meteorological department website. Rainfall dataset contains monthly average, annual total (sum of all months) and seasonal rainfall in all over India. Temperature dataset contains monthly average, annual total, and seasonal temperature in all over India. Rainfall was measured in mm (milli meter) and temperature was measured in Celsius scale. Sample rainfall and temperature data are shown in Table.1, and Table.2 respectively.

Table.1. Annual and Seasonal Rainfall (in mm) data

Year	Annual	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
2001	1083.3	17.5	128.1	815.4	122.2
2002	920.8	37.8	119.5	689.2	74.3
2003	1174.5	49.3	107.8	897.8	119.5
2004	1071.3	36.9	137	785.7	111.7
2005	1232.5	86.3	131.4	879.9	134.9

Table.2. Annual and Seasonal Temperature (Celsius or centigrade) data

Year	Annual	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
2001	25.6	20.78	27.73	27.92	23.61
2002	25.74	20.74	28.02	28.17	23.57
2003	25.61	20.71	27.83	28.1	23.33
2004	25.65	20.76	28.1	28.02	23.3
2005	25.58	20.8	27.7	28.25	23.1

2.2. ASSOCIATION BETWEEN SEASON AND CRIME

The total number of crime incidents occurred in each month over the time period 2001-2020 is shown in Fig. 2. As seen in this figure, Significant month-of-year effects appear to be evident for these three types of crime. The number of reported incidents under rape, rape with murder crimes are higher in month of January, July, August, September, October and December than in other months. The number of crimes reported under kidnap and abduction in January, February, July, August, September and October are greater than in other months. It clearly proves that these crimes are mostly occurred in monsoon and post-monsoon seasons followed by winter season.

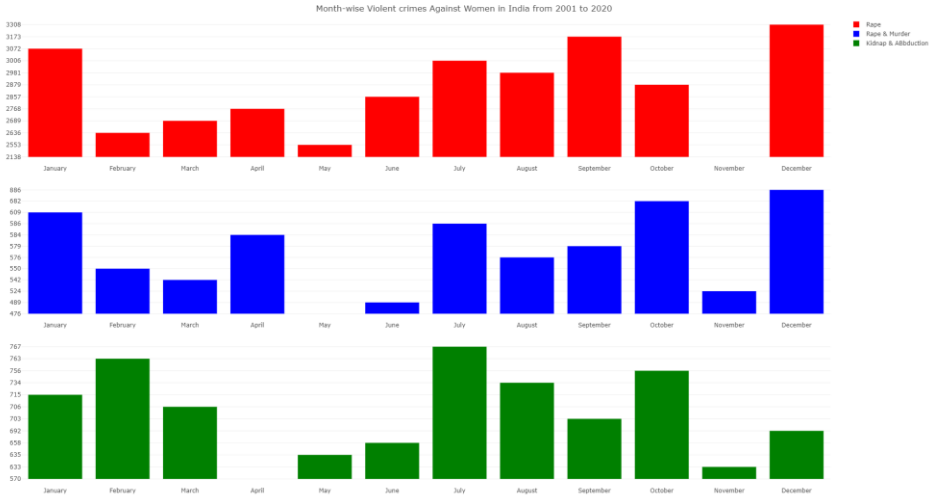


Fig.2. Monthly total crime incidents from 2001-2020

Season-wise total number of crime incidents recorded under the three violent crimes against women in India in shown in Fig.3. As seen in this figure, most of the rape, rape with murder, and kidnap offences are committed in monsoon and post-monsoon seasons.

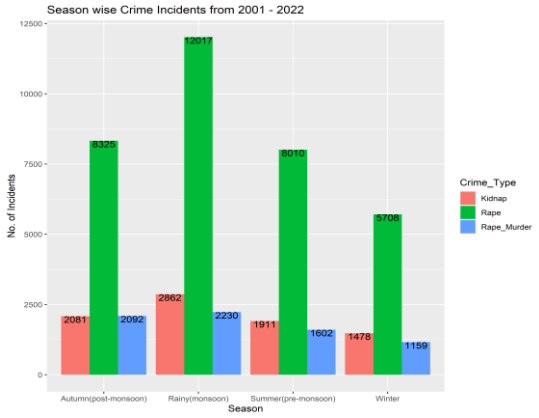


Fig.3. Season-wise total crime incidents from 2001-2020

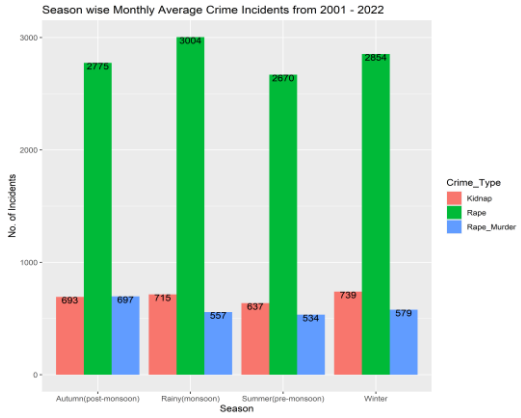
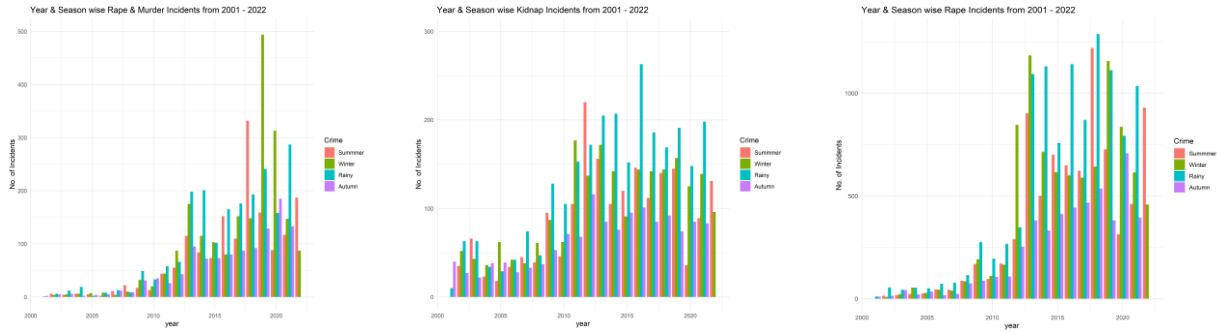


Fig.4. Season-wise monthly average crime incidents from 2001-2020

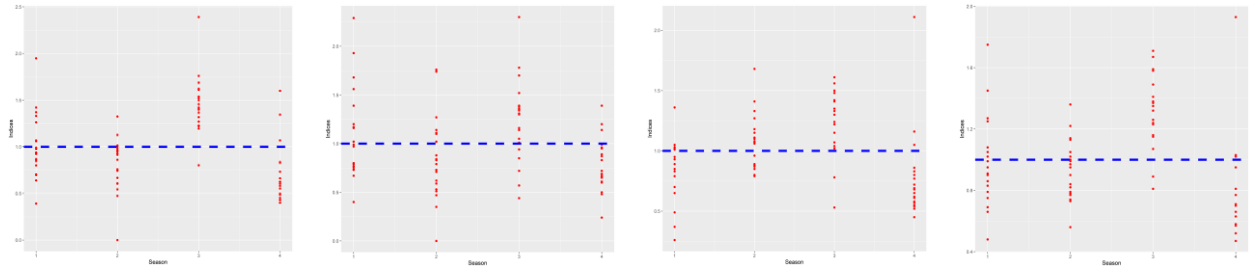
season-wise monthly average number of crime incidents recorded under the three violent crimes against women in India is shown in Fig.4. As seen in Fig.4, average number of offences per month in monsoon and winter seasons is greater than in other season's months. There are only two months in winter season, hence the monthly average becomes higher than other months. In Fig.5 (a), (b) and (c), year (2001-2020) and season-wise rape with murder, kidnap and rape offences recorded in India are shown. As seen in these figures, year and season-wise number of offences in monsoon and post-monsoon seasons is greater than in other seasons.



a. Rape and murder b. Kidnap & abduction c. Rape

Fig.5. Year and season-wise number of offences recorded.

As seen in these figures, number of offences in monsoon season is greater than in other seasons. According to the seasonal indices, average percentage of total crime incidents is increased by 33%, rape incidents is increased by 47% and kidnap incidents is increased by 26% in monsoon season, average percentage of rape with murder incidents is increased by 12% in winter season, 23% in monsoon season. Hence, monsoon and winter season has higher chances of crime occurrence.



(a) (b) (c) (d)

Fig.6. Seasonal indices of crime

2.3. ASSOCIATION BETWEEN CRIME AND DAY-OF-MONTH

In order to examine how crime incidents are associated with weekdays, day of month, week of month and month of year, A total of seven weekdays, twelve months and three types of crime are assessed, leading to tests of significance.

Among twelve months seven of them January, March, May, July, August, October, and December comprise 31 days, April, June, September and November comprise 30 days, and February comprises 28 days in common year and 29 days in leap year. To analyze the prevalence of crime on day of month, total number of crime incidents occurred on each day is summed up and plotted. As shown in Fig.6, crimes are prevalent on the fourth, seventh, twenty first and twenty fourth day of the month. Crime are less prevalent at the start, middle and end of the month.

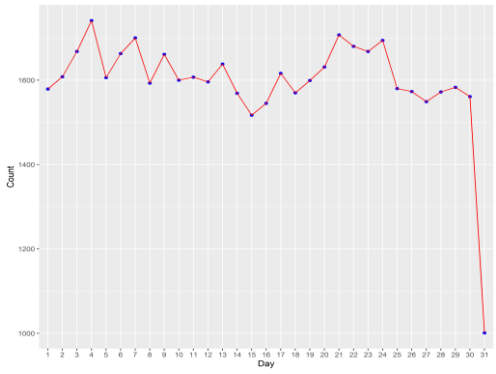


Fig.7. Number of offences in day-of-month

2.4. ASSOCIATION BETWEEN CRIME AND PART-OF-MONTH

As we all know that a week comprises seven days, months cannot be divided into weeks as it comprises 4 weeks and 2 or 3 days extra except month of February in non-leap year. So, for this study purpose we divided each month into three parts 1-start of the month, 2-middle of the month, and 3 – end of the month (1-10 days, 11-20 days and 21-30 or 31 days). Total number of crime incidents recorded in India are calculated as part-wise total of all months. As shown in Fig.8, Rape incidents and kidnap incidents are more prevalent on third part of the month, rape with murder incidents are more prevalent on first part of the month. Rape with murder, kidnap and rape offences are less prevalent on second part of the month.

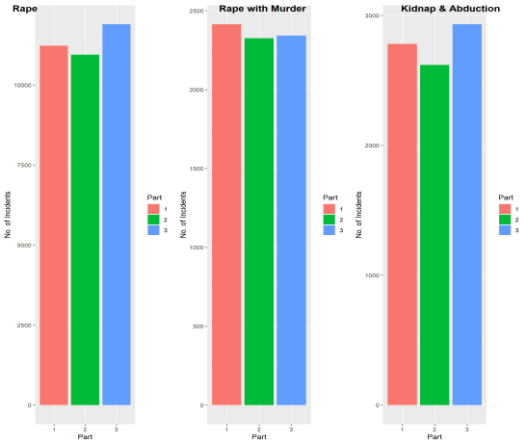


Fig.8. Number of offences in parts-of-month

2.5. ASSOCIATION BETWEEN CRIME AND DAY-OF-WEEK

One common year has 365 days and leap year has 366 days. A common year has 52 weeks plus one day, a leap year has 52 weeks plus two days. As we wanted to find crime prevalence on the day-of-week, we found the day of the week by using the date of crime in MS-Excel. Total number of crimes in each day are calculated for year 2001-2020. Rape incidents are more prevalent on Wednesdays, kidnap and abduction incidents are more prevalent on Thursdays, rape with murder incidents are more prevalent on Wednesday, Thursday and Fridays and rape with murder and kidnap types of crime are less prevalent on Sundays and rape incidents are less prevalent on Tuesdays.

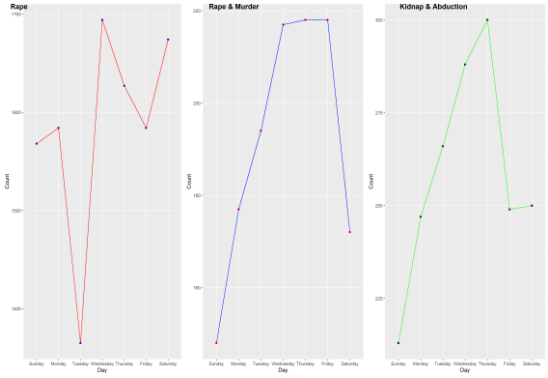


Fig.9. Number of offences in day-of-week

2.6. Association Between Crime and Month-Of-Year

A year comprises 12 months starting from January to December. These twelve months are divided into four seasons according to the climate of India. Each month has a specific weather condition. Here, how the crimes are prevalent on months of the year is analyzed. As shown in Fig.9, All types of crime are more prevalent on month of December and October. Kidnap and abduction crimes are less prevalent on May month, Rape with murder incidents are less prevalent on February month and rape incidents are less prevalent on November month. As discussed earlier crimes are more prevalent on months of winter and monsoon seasons.

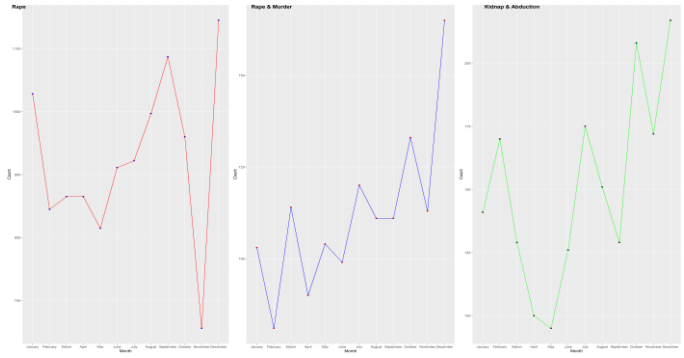


Fig.10. Number of offences in month-of-year

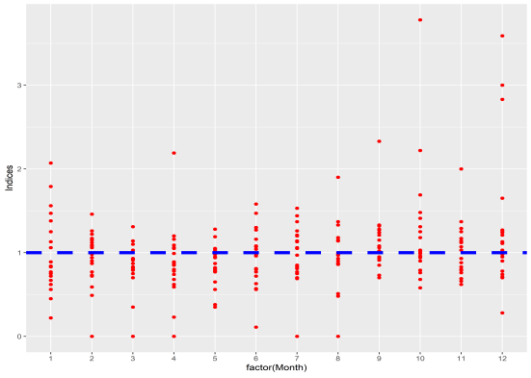


Fig.11. Month-wise seasonal indices

Seasonal indices were calculated to find month-wise seasonality of crime incidents for twenty years from 2001 to 2020. Twelve months of calendar are represented in number format from 1 to 12 in x-axis in Fig.11 and y-axis represents seasonal indices. This figure represents month-wise seasonality of total crime incidents. As seen in

Fig.11, the average percentage of crime incidents is increased by 11%, 23%, 3% and 30 % in September, October, November and December months respectively. Obviously, these months are come under monsoon and post-monsoon seasons. The other months of monsoon season had no decreasing trend in average percentage. Hence, it is found that months of monsoon and post-monsoon has higher probability of crime occurrence.

2.7. ASSOCIATION BETWEEN CRIME TYPES

The three types of crime assessed in this study are rape & murder, rape, and kidnap. Relationships between these crime types are statistically analyzed using linear model.

Table.3. Correlation coefficient between crimes

	Kidnap / Abduction (Coefficient, *P* - value)
Rape	0.91, 0.00 (< 0.05)
Rape with Murder	0.93, 0.00 (< 0.05)

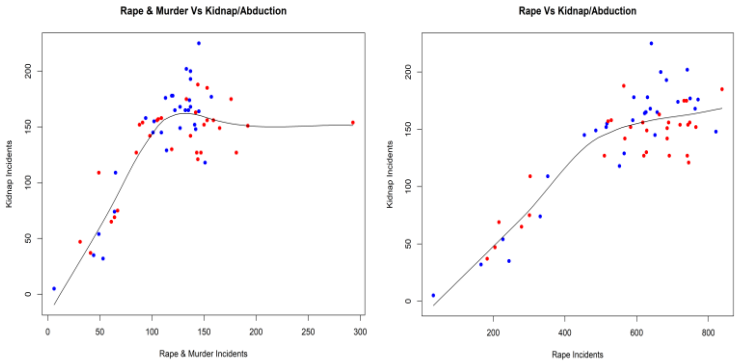


Fig.12. Association between crimes

Correlation coefficient and p-value are calculated between annual statistics from 2001 to 2020 of each crime using linear regression model. Correlation coefficient between kidnap/abduction and rape crimes is 0.91 and *p*-value is nearest to 0.00 which is less than 0.05, coefficient between kidnap/abduction and rape & murder crimes is 0.93 and *p*-value is nearest to 0.00 which is less than 0.05. In both the cases the relationships are statistically significant positive correlation between these crime types.

As the crime of kidnapping and abduction increases, so does the crime of rape, rape with murder. Fig.12 represents correlation between kidnap and other crimes. Table.3 shows correlation coefficient and p-value obtained from linear model.

2.8. CRIME ON HOLIDAYS

15.5 percentage of total crimes against women reported in India occurred in holidays or in public events. 3% of total crime occurred in valentine's day, Christmas evening, Christmas day, new year evening and new year day. 20% of holiday crimes are occurred in valentine's day, new year day.

2.9. ASSOCIATION BETWEEN CRIME AND TEMPERATURE - RAINFALL

Pearson's correlation coefficient was calculated to examine the relationship between temperature and crimes, rainfall and crimes. There was statistically significant positive correlation between temperature and crimes r=0.55, p-value < 0.05. There was no statistically significant positive correlation between rainfall and crimes p-value > 0.05.

In 2008, the rate of above noted crimes escalated. The increase in these three crimes continued through the 2010s and, like crime in other places, declined in 2020. Over time, the majority of the positive association between temperature and crime in India is driven by the trend in temperature and crime from about 2001 to 2020.

The long-term historical association also shows periods during which the temperature–violent crime relationship is inconsistent, suggesting that other factors are important for predicting the outcome. Even though number of

crime incidents occurred in monsoon was greater than other seasons there is no impact of rainfall on crime incidents.

3. DISCUSSION

In this analysis, we examined a sample of 500 thousand news headlines of India over the period 2001 to 2020 to find the temporal patterns of crime incidents in India. The outcomes of this analysis revealed some interesting points on crime temporal patterns.

- Month of January, February, July, July, August, September, October and December has higher prevalence of crime.
- All three types of crime are more prevalent on end of the month and less prevalent on middle of the month.
- All these crimes are more prevalent on middle of the week from Wednesday to Friday and less prevalent on weekends.
- These crimes are more prevalent on monsoon and winter seasons than post-monsoon and summer season.
- There was a statistically significant positive relationship between temperature and crime, there was no correlation between rainfall and crimes.
- Rape and rape with murder crimes are strongly correlated with kidnap and abduction crimes.
- 15.5 percentage of total crimes are occurred in holidays and public events. Valentine's day and new year day has highest of 20% of holiday crimes.

4. CONCLUSION

This empirical study is conducted to examine the dependence of crime on time and environmental conditions like temperature and rainfall. The crime dataset contained date wise news headlines extracted from Indian news websites from year 2001 to 2020, temperature and rainfall data for same time period downloaded from Indian meteorological department website was used for analysis. The study reveals that the number of crimes reported in India in monsoon and winter seasons is greater than in other months. Pearson's correlation coefficient was calculated to find if there is a relationship between environmental factors and crime incidents. A positive and statistically significant correlation found between temperature and number of crime incidents and there was no statistically significant positive correlation found between rainfall level and number of crime incidents. Among total crime incidents reported in India, 15% of them are occurred in holidays or public event days and 20% of these holiday crimes are reported in valentine's day and new year day.

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