

# **Statistical Analysis on Violence against women during the COVID-19 pandemic**

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Submitted by:

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### **CANDIDATE'S DECLARATION**

I, Shweta Singh, 2K21/MSCMAT/61, student of MSc(Mathematics), hereby, declare that the project Dissertation titled, "Statistical Analysis on Violence against women during the COVID-19 pandemic" which is submitted by us to the Department of Applied Mathematics, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of Master of Science, is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associateship, Fellowship, or other similar title or recognition.

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## **CERTIFICATE**

I hereby certify that the Project Dissertation titled “Statistical Analysis on Violence against women during the COVID-19 pandemic” which is submitted by Shweta Singh, 2K21/MSCMAT/61, [Department of Applied Mathematics], Delhi Technological University, Delhi, in partial fulfilment of the requirement for the award of the degree of Master of Science, is a record of the project work carried by the students under my supervision. To the best of my knowledge this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

Prof. Anjana Gupta

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## **ACKNOWLEDGEMENT**

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## **ABSTRACT**

Millions of women worldwide are impacted by violence against women, a problem of global public health and human rights. Despite efforts to prevent and address the problem, violence against women remains pervasive and is often underreported. This thesis uses statistical analysis to explore the prevalence of violence towards women, identify hazard elements for victimization and examine how violence affects the lives of women.

Data from the National Crime Records Bureau are used in the study which collects and compiles crime data from police departments across all of India's states and union territories, including data on related to crimes opposed to women. The data are analysed using descriptive statistics and correlation analysis.

The results indicate that abuse of women is a serious and pervasive issue. The analysis also identifies several risk factors for victimization, including younger age, lower education, and lower income. Additionally, the study finds that women who suffer violence are more likely to report having worsened physical and mental health outcomes, as well as having participated less in social and economic activities.

The findings have important implications for policy and practice, highlighting the requirement for specific actions to address risk factors for violence and to provide support for survivors. The study also underscores the need for continued research on violence against women, using rigorous methods and statistical analysis to ensure that policies and programs are evidence-based and effective. By shedding light regarding the prevalence and effects of violence opposed to women, this thesis contributes to efforts to prevent and address this pervasive problem.

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## **List of Abbreviations**

VAW : Violence against women

NCRB : National Crime Records Bureau

WHO : World Health Organisation

IPV : Intimate Partner Violence

RGAs : Rapid Gender Assessment surveys

NSO : National Statistical Offices

# **Chapter 1**

## **1.1 Introduction**

The abuse of women is a pervasive global issue which is unjustifiable and has far-reaching consequences for individuals, families, and communities. In addition to posing a serious threat to public health, the COVID-19 epidemic has highlighted the disturbing rise in violence opposed to women around the world. The COVID-19 epidemic and the associated containment measures have created an environment that increases the likelihood that women may experience various forms of violence in their homes and communities and exacerbates already existing gender disparities.

The pandemic has disrupted the social fabric of societies, leading to economic instability, increased stress, and social isolation. These factors, coupled with existing power dynamics and unequal gender norms, have contributed to a rise in intimate partner violence (IPV), domestic abuse and other forms of violence opposed to women. However, to effectively address and combat this issue, it is crucial to obtain a complete comprehension of the scope, nature and underlying factors of violence opposed to women during the COVID-19 epidemic.

In this thesis, a thorough statistical analysis is attempted to examine the patterns, trends, and the epidemic's effects on violence opposed to women. By using reliable data from NCRB and employing appropriate statistical techniques, this research seeks to offer important understandings regarding the prevalence, characteristics and consequences of VAW in context of the ongoing global health crisis. Additionally, the study will explore the elements connected to the perpetration and victimization of violence opposed to women, shedding light on beneath-surface social, economic and the effects of cultural dynamics on this occurrence.

## 1.2 Definitions

**Statistics:** A subset of mathematics is statistics and a scientific discipline that involves collection, analysing, interpreting, presenting and organising of numerical data. It encompasses methods and strategies for summarizing, describing, and drawing meaningful conclusions from data, as well as for creating informed decisions based on the information obtained. It is the art of learning from data.

**Statistical Analysis:** The process of collecting, organizing, examining and interpreting numerical values in order to find patterns, connections and insights. It involves use of statistical methods and strategies to draw meaningful outcomes and form informed decisions according to the data at hand.

**Population:** In statistical analysis, the population is the complete collection of people, things, or events that have something in common and are of interest to the researcher. It is the entire group of units used for data collection and analysis. The population can be finite or infinite, according to the context of the study. Like, the population could be all women in a specific country, all cars manufactured in a particular year, or all customers of a certain company.

**Sample:** It is a subset of the population that is chosen to represent and provide information about the larger population. It is a smaller, manageable group that is studied and analysed to come to a conclusion and make assumptions on the overall population. The process of selecting a sample is called sampling. Obtaining a sample that is typical of the population and enables the generalisation of findings is the aim of sampling.

The two main categories of statistics are:

- Descriptive statistics.
- Inferential statistics.

**Descriptive Statistics:** It is the branch of statistics that concentrates on outlining and characterising a dataset's key attributes or properties. It involves the use of numerical measurements and graphical illustrations to gain insights into data, understand its distribution and communicate its properties concisely and effectively.

The aim of descriptive statistics is to present a brief and understandable overview of the data, allowing researchers and analysts to easily grasp its central tendencies, variability, and shape. The key aspects of descriptive statistics include:

- Measures of central tendency
- Measures of Dispersion
- Measures of Position
- Frequency Distributions
- Graphical Representations

**Measures of central tendency:** It is sometimes referred to as measures of location, are statistical measures that represent the average or centre of a dataset. They give a solitary value that summarizes the overall characteristics of data distribution. The mean, median, and mode are the three often used central tendency measures.

- Mean
- Median
- Mode

**Mean:** The most widely used indicator of central tendency is the mean. It is determined by adding up each value in the dataset and dividing the result by the overall number of values. Extreme values affect the mean in a significant way and it is influenced by the distribution of the data. It is appropriate to use when the data is normally distributed or follows a symmetrical pattern.

**Median:** The middle value in an ordered dataset is known as the median. To find median, the data is first either sorted by descending or ascending order and then the middle value is identified. When a dataset contains an odd number of items, the median is the value in the middle. When a dataset contains an even number of values, the median is the average of the two middle values. The median is robust to extreme values and is useful when dealing with skewed data or datasets containing unusual data.

**Mode:** The value or values that are most frequently seen in the dataset are the mode. It represents the peak of frequency distribution and is useful for the data that are discrete or categorical. A dataset can have one mode (unimodal), two modes (bimodal), or more than two modes (multimodal). In some cases, there may be no mode if no value appears more frequently than others.

**Measures of Dispersion:** It is also referred as measures of variability, they are statistical measures that give information about the spread, variability, or dispersion of dataset. They quantify the distribution of the data points or clustered around the measures of central tendency. The most prevalent methods of dispersion include:

- Range
- Variance
- Standard deviation
- Interquartile range.

**Range:** The range is the most basic index of dispersion and it is calculated as the variation in a dataset between the highest and lowest values. It gives an outline of the overall distribution of the data, but it may not adequately capture the general variability and is sensitive to extreme levels.

**Variance:** The variance is a measure that quantifies the average squared deviation of each data point from the mean. It gives a more comprehensive understanding of the variability by considering the differences between individual data points and mean. Variance is determined by adding up the squared deviations, dividing by the quantity of observations, and is often denoted by  $\sigma^2$  (sigma squared).

**Standard Deviation:** The standard deviation is frequently used to characterise the dispersion of data is the square root of variance. It measures the how far apart on average each data point is from the mean. It is denoted by  $\sigma$  (sigma) and provides a common unit of measurement for dispersion. Since it is expressed in the same units as the original data, it is easier to interpret than the variance.

**Interquartile range (IQR):** It is a measure of dispersion that focuses on the measure of the data's middle 50% of the distribution.. It is estimated as the difference of 75th percentile (Q3) and the 25th percentile (Q1) of the dataset are used to calculate it. The IQR is resistant to maximum values and frequently used when dealing with skewed distributions or datasets with outliers.

**Measures of Position:** It is also referred to as quantiles or percentiles, are statistical measures to determine the relative position of a particular value in a dataset. They provide information about the distribution of the data and help analyze specific data points in relation to the rest of the dataset. Among the often measures of position are:

- percentiles
- quartiles

**Percentiles:** Percentiles represent the percentage of data points that fall below a particular value in a dataset. As an example, the 25th percentile (also known as the first quartile, denoted as Q1) is the value that 25% of the data points fall below. Similarly, the 50th percentile is the median (often known as the second quartile, denoted as Q2), and the 75th percentile (often known as the third quartile, denoted as Q3) reflects the value at which 75% of the data points are centred. By using percentiles, we may partition the dataset into equal portions and understand the distribution of values.

**Quartiles:** The dataset is divided into four equal portions called quartiles, each of which contains 25% of the data. The first quartile (Q1) indicates the value below which 25% of the data points fall, the median value is represented by the second quartile (Q2), and the value below which 75% of the data points fall by the third quartile (Q3). The interquartile range (IQR) is the difference between the third quartile and the first quartile, providing an indication of the distribution of the middle 50% of the data .

**Frequency distribution:** It is a statistical representation of how data values are distributed across different categories or intervals. It summarizes the data by showing the count or the frequency with which every value or set of values occurs in the dataset. It offers useful perceptions into the distribution pattern, central tendency, and variability of the data.

To create a frequency distribution, the following steps are typically followed:

- Define the categories or intervals: Determine the categories or intervals that will be used to group the data. These categories should be mutually exclusive and collectively exhaustive, meaning that each data point should fit into only one category.
- Tally the frequencies : Count the number of occurrences or frequencies of each data point falling within each category or interval. This can be done by examining the dataset and assigning tallies or using software tools for automated counting.
- Calculate cumulative frequencies (optional) : Cumulative frequencies represent the running total of frequencies as you move through the

categories. It can be helpful in analysing the relative proportions of data within certain ranges or in calculating percentiles.

- Create a frequency table : Present the collected frequencies in a tabular format. The table typically consists of two columns: one column for the categories or intervals and another column for the corresponding frequencies.
- Display the distribution graphically (optional): To visualize the frequency distribution, it is common to represent it graphically using histograms, bar charts, or frequency polygons. These visualizations provide a clearer understanding of the shape, central tendency, and variability of the data distribution.

**Graphical Representations:** Graphical representations are data visualisation tools . They provide a visual summary of the data, improving its patterns, relationships, and trends. Graphical representations are widely used in data analysis, research, presentations, and reports to communicate information effectively. There are several common types of graphical representations:

- Bar chart
- Histogram
- Line Graph
- Scatter Plot
- Pie Chart
- Box Plot

**Bar chart:** A bar chart uses rectangular bars of various widths to represent categorical data. The frequency or value of each bar is indicated as its height. Bar charts are effective in comparing data across different categories.

**Histogram:** A histogram represents the distribution of numerical data by dividing it into intervals (bins) and displaying the frequencies or relative frequencies of data points within each bin. Histograms offer perceptions into central tendency, variability of the data distribution and the shape.

**Line graph:** A line graph connects data points with line segments to depict the relationship between two variables. It is commonly used to depict trends, changes over

time or continuous data. Line graphs are particularly useful for visualizing data with a time component.

**Scatter Plot:** A scatter plot displays the relationship between two variables as individual data points on a Cartesian plane. Each point represents the values of the variables, and the scatter plot helps identify patterns or correlations between them.

**Pie Chart:** A pie chart represents categorical data as slices of a circle, with each slice corresponding to a specific category. The size of each slice is proportional to the frequency or percentage of that category within the dataset. Pie charts are effective in displaying the relative proportions of different categories.

**Box Plot:** A box plot (also called as a box-and-whisker plot) provides a visual summary of the distribution of numerical data. It displays the minimum and maximum values, quartiles, and outliers, giving details about the range, median, and distribution of the data.

**Summary statistics:** Summary statistics are numerical measurements that offer a brief outline of a dataset's essential features. They help describe the central tendency, variability, and shape of the data distribution. Summary statistics are widely used in data analysis and research to gain insights and draw conclusions from the data.

Some common summary statistics include:

- Mean
- Median
- Mode
- Variance
- Standard Deviation
- Range
- Interquartile range
- Skewness
- Kurtosis

**Mean:** The average is calculated by dividing the sum of all values in the dataset by the total number of values. It represents the dataset's usual or core value.



**Median:** When a dataset is ordered in either ascending or descending order, the median is the midway value. With 50% of the numbers below and 50% above, it divides the dataset into two equal halves. The median is a measure of central tendency for skewed distributions and is less impacted by extreme values.

**Mode:** The value or values that appear in the dataset the most frequently are the mode. It displays the most typical or prevalent value(s) in the data.

**Variance:** The spread or variability of the data distribution is measured by variance. It measures how far away from the mean each value in the dataset is. A bigger variance suggests that the data points are more dispersed.

**Standard deviation:** The square root of the variance yields the standard deviation. It gives an indication of how far apart on average each data point is from the mean. An increased standard deviation denotes a wider range of data values.

**Range:** The range represents the difference between the dataset's highest and lowest values. It gives a sense of how evenly distributed the full dataset is.

**Interquartile Range (IQR):** The IQR is the variation between the third quartile (Q3) and the first quartile (Q1). It represents the spread of the middle 50% of the data and is useful for identifying outliers and assessing the variability within that range.

**Skewness:** Skewness measures the asymmetry of the data distribution. A longer tail on the right side is indicated by positive skewness, whereas a longer tail on the left side is indicated by negative skewness.

**Kurtosis:** Kurtosis measures the shape of the data distribution, specifically the presence of heavy tails or outliers. Higher kurtosis indicates more extreme values in the dataset.

**Inferential Statistics:** Inferential statistics is a branch of statistics that involves drawing conclusions and using a sample of data to draw inferences about a group. It allows researchers to make generalizations and predictions about a larger population by analysing a smaller subset of data. Inferential statistics relies on the principles of probability theory and sampling.

It involves a range of statistical techniques, such as hypothesis testing, confidence intervals, regression analysis, analysis of variance (ANOVA), and correlation analysis. These techniques help researchers assess the reliability and validity of their findings and provide insights into the broader population.

**Correlation analysis:** It is applied to investigate the connection between two or more variables. Researchers can learn how changes in one variable affect changes in another by measuring the degree and direction of the linear connection between variables.

The key concept in correlation analysis is the correlation coefficient, which is a numerical value that quantifies the degree of association between variables. The correlation coefficient ranges from -1 to +1, with a value of -1 indicating a perfect negative correlation, +1 indicating a perfect positive correlation, and 0 indicating no correlation.

## **Chapter 2**

### **2.1 Literature Review**

The COVID-19 pandemic, resulting from the emergence of the novel corona virus SARS-CoV-2, has severely disturbed people's life worldwide. In light of the fast-paced dissemination of the virus and the escalating community transmission in multiple nations, several social containment measures have been put into effect. These recommendations are from the World Health Organisation (WHO) to combat the pandemic, include the isolation of suspected cases and the practice of social distancing. Governments and authorities all over the world rapidly enacted or increased restrictive social distancing measures to stop the spread of the virus after the World Health Organisation (WHO) declared the COVID-19 outbreak a pandemic on March 11, 2020. While steps like this are necessary for global transmission, the "Hobson's option" has some negative consequences. These closed lockdown policies increased the tension in the family as a person is left alone economically and psychologically. The problems created by the epidemic increased the risk of poor health and well-being for people who were already living in poor conditions prior to the COVID-19 outbreak. Abuse affects men and women differently. In particular, "outbreaks are increasing gender inequality for women and girls and will affect the way they receive health and care" .

Human rights are violated when violence against women occurs. It is a widespread problem with severe consequences for people, families, and communities. Intimate partner violence primarily refers to a type of VAW that takes place in the context of a familial or romantic relationship involving cohabitation. The WHO acknowledges that IPV can take many different forms, including physical violence (including assault, torture, and even murder), sexual violence (including unwanted sexual contact and harassment), psychological violence (involving manipulation, threats, humiliation, or intimidation), economic violence (involving obsessive control over money or financial exploitation), and stalking (including persistent surveillance). In Indian society, women have traditionally held a significant and revered position. The Vedas portrayed women as mothers, creators, and embodiments of life, often worshipping them as 'Devi' or Goddess. However, this glorification of women existed alongside a harsh reality, where women in India were subjected to complete suppression and subjugation within a patriarchal society. Throughout the country, Indian women endured subjugation and oppression, as society clung to orthodox beliefs that perpetuated various forms of violence, both domestic and public, encompassing physical, emotional, and mental abuse.

Women's lives have been profoundly impacted by the COVID-19 epidemic in a number of ways. Women have faced heightened health risks due to their roles as frontline healthcare workers and caregivers, with potential disruptions to reproductive healthcare services. The economic impact of women have been disproportionately affected by the epidemic, which has resulted in job losses, reduced working hours, and unstable income, exacerbating existing gender inequalities. Additionally, women have shouldered a heavier burden of care giving responsibilities, as school closures and limited childcare options have increased their workloads and impacted their ability to balance work and family obligations. The pandemic has also witnessed a concerning rise in gender-based violence, with lockdown measures trapping some women in abusive environments. Due to social isolation, financial stress, and the burden of many obligations, women's mental health has deteriorated. Furthermore, school closures and remote learning have disproportionately affected women and girls' access to education. Efforts to address these impacts must prioritize gender-responsive policies and interventions that promote women's empowerment, protect their rights, and mitigate the disproportionate challenges they face.

By UN report "Measuring the shadow pandemic: Violence against women during COVID-19". UN Women took the initiative in April 2020 to start gathering information that would help with a gender-sensitive response to the COVID-19 pandemic. Rapid Gender Assessment surveys (RGAs) were put into place in 58 countries thanks to partnerships with national statistics offices, governmental organisations, and outside partners. These studies aimed to evaluate the socioeconomic impacts of COVID-19 with an emphasis on the effects on different genders. The RGAs examined issues like employment, income, unpaid domestic work and care giving, access to products and services, as well as measures for relief and social protection. The comprehensive data obtained through these surveys played a pivotal role in informing policies and interventions that recognize and address the unique challenges faced by women during the pandemic. The national statistical offices (NSOs), national women's machines, and a technical advisory group of experts in VAW statistics and organisations that have carried out comparable initiatives all provided general support for the implementation of the VAW RGAs in Albania, Bangladesh, Cameroon, Colombia, Côte d'Ivoire, Egypt, Jordan, Kenya, Kyrgyzstan, Morocco, Nigeria, Paraguay, Thailand, and Ukraine. A type of VAW has been reported by 45 percent of women, or a woman they know, since COVID, and 65 percent of women say they have experienced it at some point in their lifetime.

The following data has also been observed that every fourth woman claims that domestic disputes have increased in frequency and that she feels more dangerous at home. One in five women and one in two feel uneasy walking alone in the daytime and at night, respectively. One-third of women, or 7 out of 10, believe that domestic violence—either verbal or physical has increased over time. 3 out of 10 women and 6 out of 10 women, respectively, believe that violence against women has increased in their communities and that sexual harassment has gotten worse in public. Amidst all

this younger women are the most affected one and the data for the same also shows the same. According to the data we observed that since the epidemic, 1 in 2 women have reported seeing or knowing a woman who had been violent,, and 48 percent of the women were between the ages of 18 and 49, compared to 42 percent between the ages of 50 and 59 and 34 percent between the ages of 60 and more. When women with children are taken into account, it has been observed that every second woman with children experienced, compared to 37% of partnered women without children and 41% of unpartnered women without children. Now out of unemployed and employed women, the unemployed are the most affected which can be clearly observed by the data. According to the report it was observed that in unemployed women 52 percent of them reported violence against women experiences, 33 percent believe they are less secure at their home and 50 percent feeling less secure when out alone at night whereas in employed women 43 percent of them reported violence against women experiences, 26 percent believe they are less secure at their home and 37 percent feeling less secure when out alone at night. In comparison to women living in urban areas (39 percent), women in rural areas (44 percent) reported feeling more unsafe while travelling alone at night since COVID-19, and women in rural regions (62 percent) reported feeling more likely to experience sexual harassment in public..

## **Chapter 3**

### **3.1 Data Sources**

The National Crime Records Bureau (NCRB) in India is an important data source for studying violence against women. The NCRB gathers and compiles crime information from police agencies in all Indian states and union territories, including information on crimes opposed to women.

The NCRB's "Crime in India" report provides insights into many types of violence against women, include sexual assault and domestic violence, dowry deaths and rape. The report presents statistical information on the number of reported cases, the nature of the offenses, the age group of victims, the relationship of the offender to the victim, and the outcomes of police investigations and prosecutions.

Researchers and policymakers rely on NCRB data to comprehend the prevalence and patterns of assaults on women across different regions and over time. It helps identify trends, hotspots, and areas where interventions are needed. The data from the NCRB can also contribute to the evaluation of policies, programs, and initiatives aimed at addressing violence opposed to women.

However, it is significant to remember that NCRB data on violence against women may have some limitations. These include underreporting of cases due to societal stigma, lack of awareness, and distrust in the criminal justice system. Additionally, variations in data recording practices and definitions of crimes across jurisdictions can affect the comparability and accuracy of the data.

Researchers using NCRB data on violence against women should exercise caution, acknowledge these limitations, and consider triangulating the findings with other sources of data, such as surveys, studies, and qualitative research. Such comprehensive approaches can offer a more nuanced view of the issue and contribute to the evidence-based policies and interventions to combat violence against women effectively.

## 3.2 Results and Analysis

Crime against women in India is a significant issue that has garnered national and international attention. Different types of cruelty and discrimination, for instance rape, sexual assault, dowry-related crimes, domestic violence, and harassment, are prevalent in Indian society. While it is important to recognise that crime statistics can be influenced by several factors, including reporting rates and societal attitudes, I tried to provide an overview of the statistical trends based on available information. I have used data collected by National Crime Records Bureau (NCRB).

The NCRB is in charge of compiling and examining crime data in India. The NCRB reports women's rights violations under many aspects of the Indian Penal Code, like rape (Section 376), assault on women with intent to outrage her modesty (Section 354), dowry deaths (Section 304B), cruelty by husband or relatives (Section 498A), and others. In this report we get stats of Incidence (I), Victims(V) & Rate (R) of Cognizable Crimes (IPC) under Different Crime Heads in which I have used the victim data for Dowry Deaths, Abetment to Suicide of Women, Cruelty by Husband or his relatives, Rape, Assault on Women with intent to Outrage her Modesty and Total Crime against Women. I have done Statistical Analysis of the above data to with the correlation within crimes and comparison of specific crime within different states.

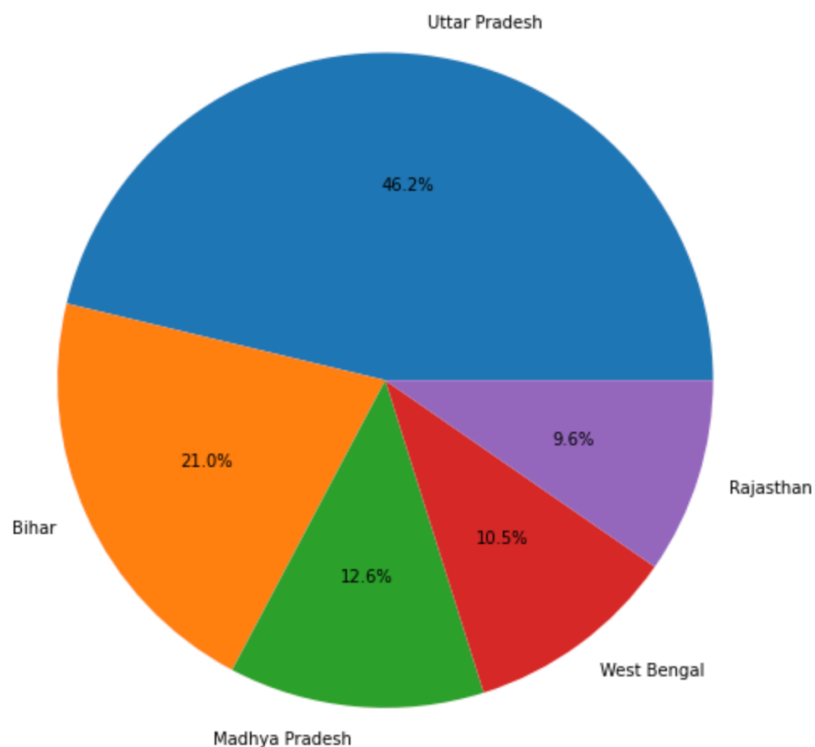
We have data of total 36 states and Union Territories with the variety of crimes against women that are done. The statistical description of the data having means, Standard deviation, minimum and maximum with quartiles are shown in the Table3.1.

	Dowry Deaths (Sec. 304B)IPC	Abetment to Suicide of Women (Sec. 305/306 IPC)	Cruelty by Husband or his relatives (Sec. 498 A IPC)	Rape	Assault on Women with Intent to Outrage her Modesty	Total Crime against Women
count	36.000000	36.000000	36.000000	36.000000	36.000000	36.000000
mean	195.694444	142.555556	3119.222222	788.305556	2409.583333	10469.083333
std	424.991685	214.090294	4871.084526	1072.216285	3356.878758	13012.303335
min	0.000000	0.000000	0.000000	2.000000	3.000000	9.000000
25%	1.000000	1.000000	8.750000	53.500000	56.500000	245.750000
50%	31.500000	29.000000	688.000000	490.000000	792.000000	5881.500000
75%	182.750000	215.500000	3774.750000	1157.750000	4141.750000	15897.500000
max	2302.000000	844.000000	19966.000000	5345.000000	12641.000000	49761.000000

Table 3.1 Description of the data

## Analysis on Dowry-Related Crimes:

Dowry-related crimes are a subset of violence against women in India that involve the mistreatment and harassment of women due to dowry disputes. The custom of asking or accepting significant gifts or valuables from the bride's family to be given to the groom and his family at the time of marriage is known as dowry. Although being illegal since the enactment of the Dowry Prohibition Act in 1961, the dowry system continues to persist in some sections of Indian society. Dowry-related crimes, including dowry deaths and harassment for dowry, continue to be a concern in India. These crimes occur when a woman's family fails to meet the demands for dowry made by her husband or in-laws. The NCRB report tells that there are 7,045 dowry deaths in 2020. Uttar Pradesh has maximum number of dowry deaths which is more than 30% of totals dowry deaths happened in India in 2020. On the second place, the neighbour state of Uttar Pradesh, Bihar is placed with around 15% of totals dowry deaths. Madhya Pradesh, West Bengal and Rajasthan are placed at 3rd, 4th and 5th placed. More than 70% of total dowry death in 2020 are happened in these 5 states. Taking only these 5 states in account the comparison between these is shown in fig-3.1 as pie chart.



*Fig-3.1 Comparison between top 5 states in dowry deaths*



The Dowry Prohibition Act, 1961, explicitly forbids the transfer of dowries. Additionally, Section 498A of the Indian Penal Code provides legal recourse for women subjected to dowry harassment. However, challenges persist in the effective implementation of these laws, including inadequate awareness, social and familial pressures, and delays in legal processes, which can hinder justice for victims. The distribution of the Dowry deaths between different states are shown in the fig-3.2 bar chart. Addressing dowry-related crimes requires a multi-faceted approach. Efforts should focus on raising awareness about the illegality and harmful consequences of dowry, in support of empowering women and gender equality, providing support services for victims, and strengthening the enforcement of existing laws. Education, economic empowerment, and changing societal attitudes are crucial in combating this deeply entrenched issue.

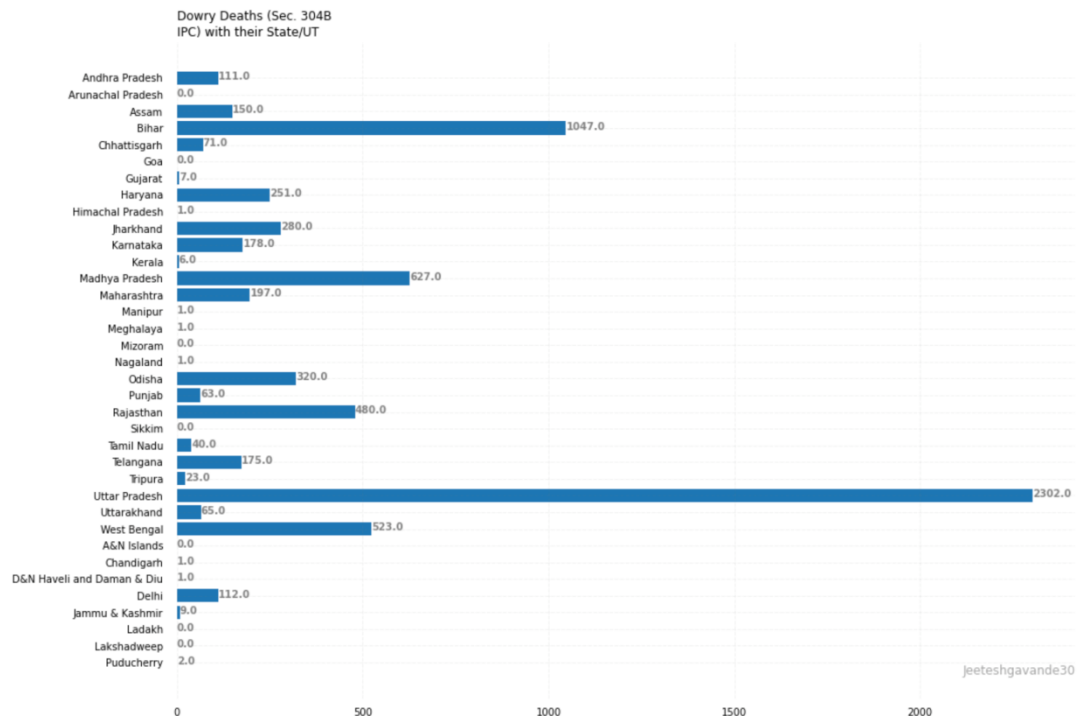
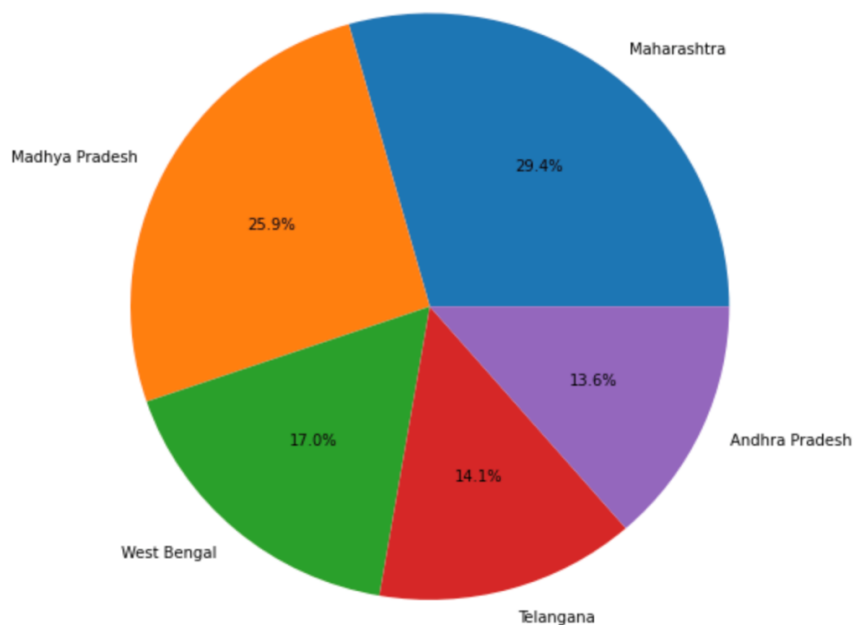


Fig-3.2 Bar Chart showing State wise Dowry Deaths

## Analysis on Abetment to Suicide of Women

Abetment to suicide of women refers to situations where a woman takes her own life, and someone else is found to have instigated, aided, or encouraged the act. Analysing the statistics on abetment to suicide of women in India provides insight into the prevalence and underlying factors associated with such cases. Suicide cases, including abetment to suicide, can be challenging to document accurately due to various reasons such as stigma, social pressure, and underreporting. Therefore, there is a chance for the actual number of cases could increase than what is officially recorded. India has a complex cultural and social landscape where women often face various forms of discrimination and oppression. Factors like dowry disputes, domestic violence, marital discord, and societal expectations can contribute to abetment to suicide cases among women.

The NCRB report tells that there are 5,132 victims of Abetment to suicide of women in 2020. Maharashtra has maximum number of victims of Abetment to suicide of women which is more than 17% of totals victims of Abetment to suicide of women in 2020. On the second place, Madhya Pradesh is placed with around 14% of totals victims of Abetment to suicide of women. West Bengal, Telangana and Andhra Pradesh are placed at 3rd, 4th and 5th placed. Around 57% of totals victims of Abetment to suicide of women in 2020 are from these 5 states. Taking only these 5 states in account the comparison between these is shown in Fig 3.3 as pie chart.



*Fig-3.3 pie chart showing victims of Abetment to suicide of women for top 5 states*

India has laws in place to address abetment to suicide, including Section 306 of the Indian Penal Code. But effectiveness of implementation and the speed of justice can vary, which may impact the deterrence of such crimes. The distribution of the victims of Abetment to suicide of women between different states are shown in the Fig 3.4 bar chart. To address the issue of abetment to suicide of women, it is crucial to focus on comprehensive strategies that include legal reforms, raising awareness, empowering women, promoting mental health support services, and tackling societal norms that perpetuate gender inequality and discrimination.

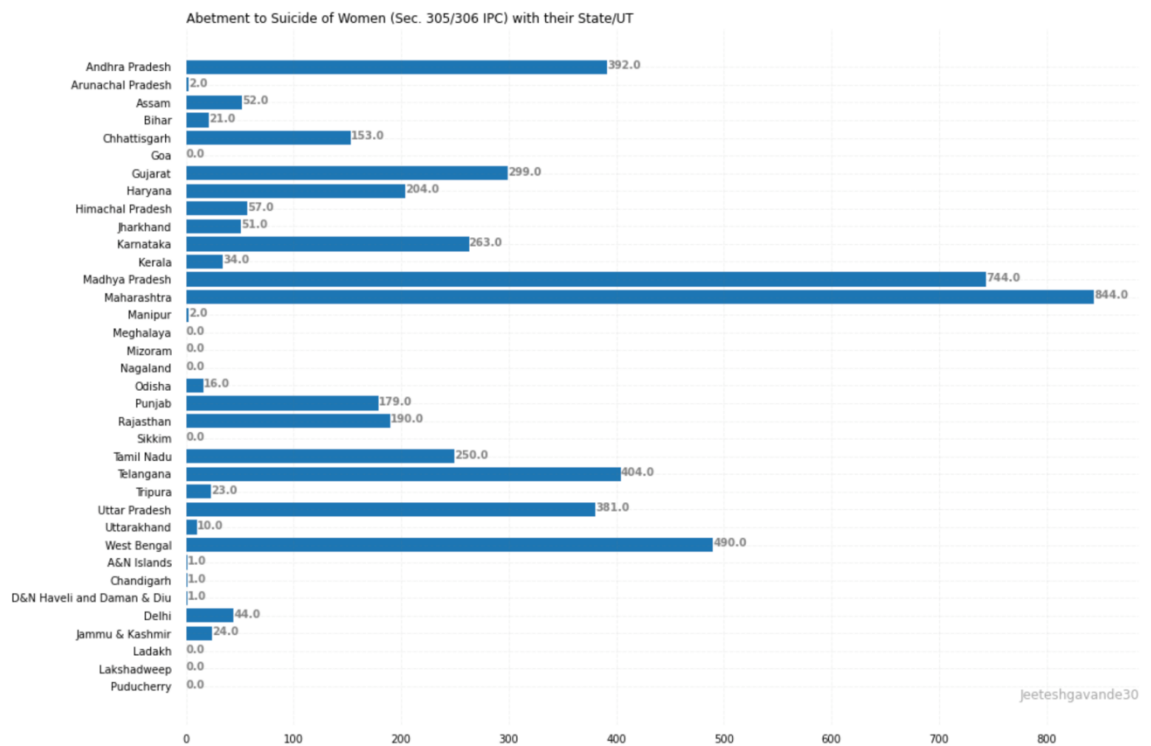


Fig-3.4 Bar chart showing state wise Abetment to suicide of women

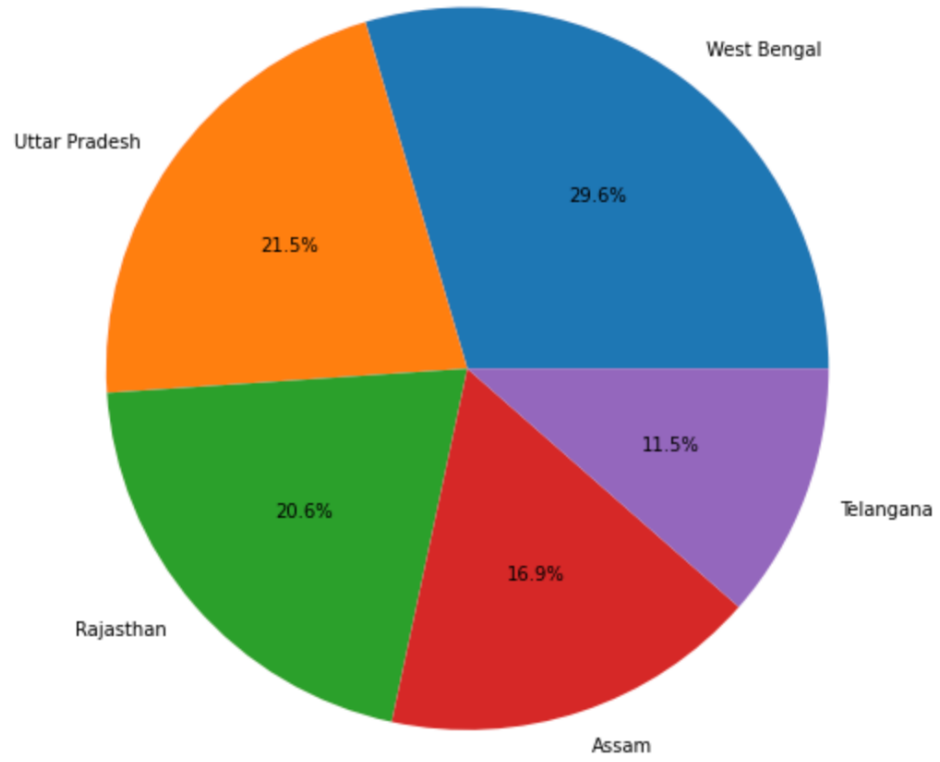
## **Analysis on Cruelty by Husband or his relatives**

An instance of domestic violence where a woman is physically, mentally, or emotionally abused by her spouse or members of his family is cruelty by a husband or his relatives. Analysing this issue provides insight into the prevalence, dynamics, and impact of such cruelty on women in India. Cruelty can take many different forms, such as physical harm, verbal abuse, mental control, economic exploitation, and social isolation. These acts of cruelty can lead to severe physical and psychological harm, affecting a woman's overall well-being and quality of life. The cruelty by husband or relatives often arises from deeply ingrained gender inequalities and patriarchal norms in Indian society. Traditional gender roles, economic dependency, and unequal power dynamics contribute to the vulnerability of women and perpetuate cycles of abuse.

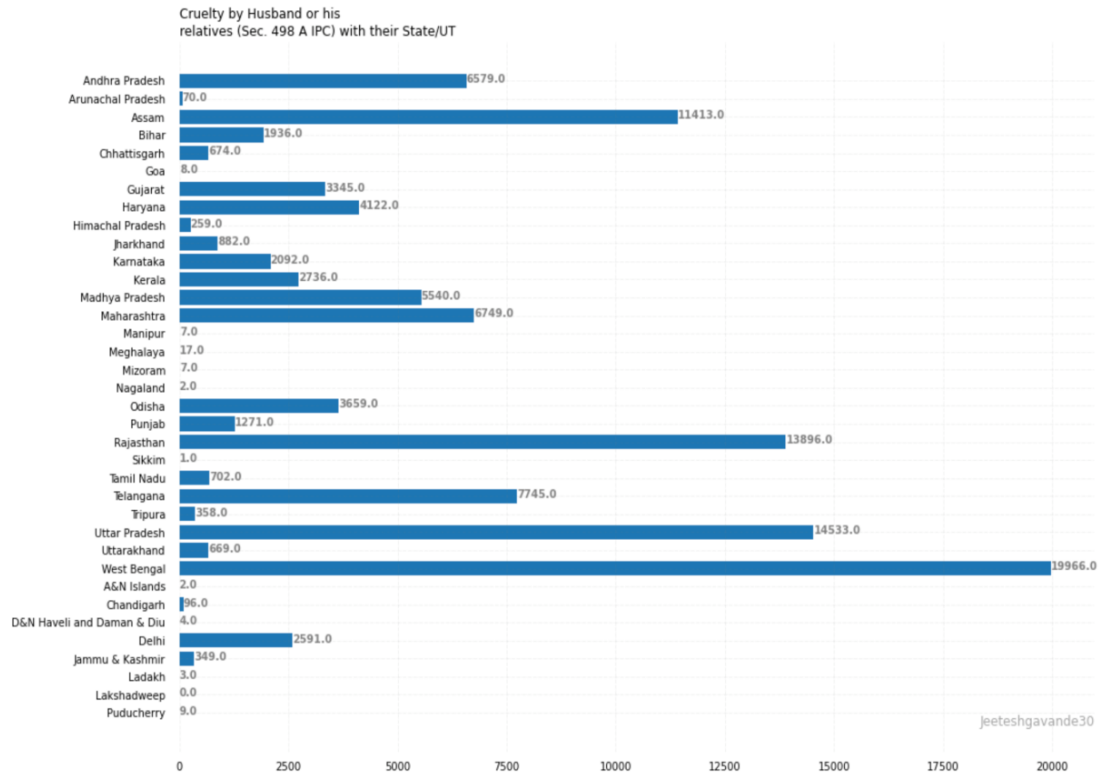
Women subjected to cruelty by husband or relatives face multiple challenges, involving physical harm, emotional distress, and loss of self-worth and social isolation. The long-lasting effects can extend to their physical health, mental well-being, and ability to participate fully in society.

Cruelty by husband or relatives is a significant problem affecting women in India. The National Crime Records Bureau (NCRB) records these cases under Section 498A of the Indian Penal Code. In 2020, the NCRB reported 1,12,292 cases of cruelty by husband or relatives. West Bengal has maximum number of victims of Cruelty by Husband or his relatives. Out of 1,12,292 cases 19,966 are happened in West Bengal. On the second place with more than 13% of cases Uttar Pradesh has reported 14,533 cases in 2020. Rajasthan, Assam and Telangana are placed at 3rd, 4th and 5th placed with 13896, 11413 and 7745 cases respectively. Around 60% of cases related to Cruelty by Husband or his relatives in 2020 are from these 5 states. Taking only these 5 states in account the comparison between these is shown in fig-3.5 as pie chart.

It is significant to remember that statistical data represents reported cases, and many incidents of cruelty by husband or relatives may go unreported due to societal barriers, fear, or lack of awareness. Therefore, the actual prevalence of this issue may be higher than official records indicate. The distribution of the victims of Cruelty by Husband or his relatives between different states are shown in the Fig-3.6 bar chart. Addressing cruelty by husband or relatives requires a multi-pronged approach. It involves promoting gender equality and increasing awareness of women's rights, providing legal aid and counselling services, establishing safe shelters, and strengthening the implementation of existing laws. Community support and engagement, along with effective enforcement mechanisms, are essential for protecting and empowering women.



*Fig-3.5 Pie chart showing cases related to Cruelty by Husband or his relatives in 2020 in top 5 states*



*Fig-3.6 Bar Chart showing state wise victims of Cruelty by Husband or his relatives*

## Analysis on Rape

A horrific crime known as rape involves non-consensual sexual contact or penetration, typically perpetrated against women. Analysing rape statistics provides insight into the prevalence, trends, and impact of this form of crime against women in India. Rape is a pervasive issue affecting women in India. Rape affects women across different age groups, but a significant proportion of victims are children and young girls. The NCRB data shows that a large number of rape victims are below the age of 18, highlighting the vulnerability of minors to this crime. Rape cases occur in both urban and rural areas, but there may be disparities in reporting and access to support services. Factors such as social infrastructure, awareness, and education levels can influence reporting rates and support available to survivors.

The National Crime Records Bureau (NCRB) records rape cases under Section 376 of the Indian Penal Code. In 2020, the NCRB reported 28,379 rape cases across the country. However, it is crucial to recognize that rape is widely considered to be underreported and the number of cases could perhaps be far greater. Rajasthan has maximum number of victims of Rapes in 2020. Out of 28,379 cases 5,345 cases are happened in Rajasthan. On the second place with 2827 cases Uttar Pradesh has reported around 10% cases in 2020. Madhya Pradesh, Maharashtra and Assam are placed at 3rd, 4th and 5th placed with 2368, 2088 and 1684 cases respectively. Around 50% of cases related to Rapes in 2020 are from these 5 states. Taking only these 5 states in account the comparison between these is shown in fig-3.7 as pie chart.

India has enacted stringent laws to address sexual offenses, including rape, such as the Criminal Law (Amendment) Act, 2013. However, challenges remain in the effective implementation of these laws and ensuring swift justice. Conviction rates for rape cases in India have historically been low, which can impact survivors' trust in the legal system. Rape prevention efforts focus on creating awareness, promoting gender equality, and educating the public about consent and respect. Initiatives such as self-defence training, community engagement, and gender-sensitive education are crucial in combating the culture of violence and addressing the rape's underlying causes. The distribution of the victims of Rapes between different stated are shown in the Fig-3.8 bar chart.

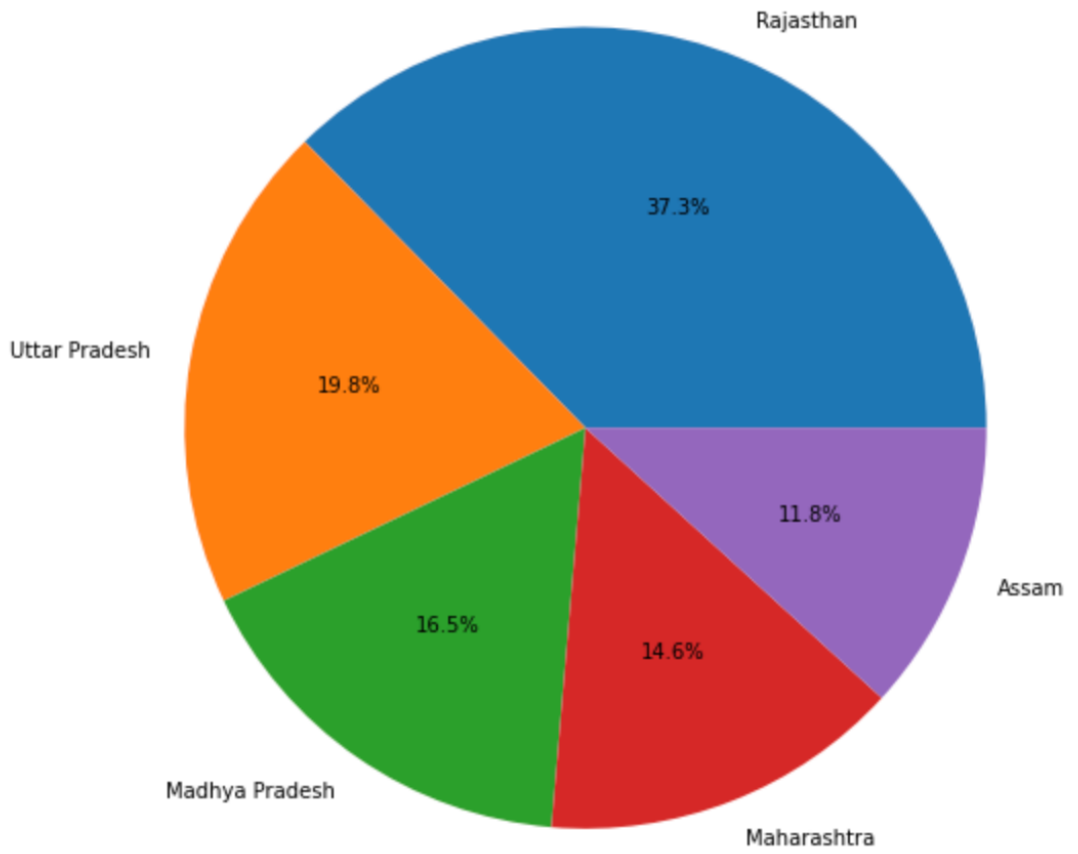


Fig-3.7 Pie chart showing comparison between top 5 states for cases related to Rape



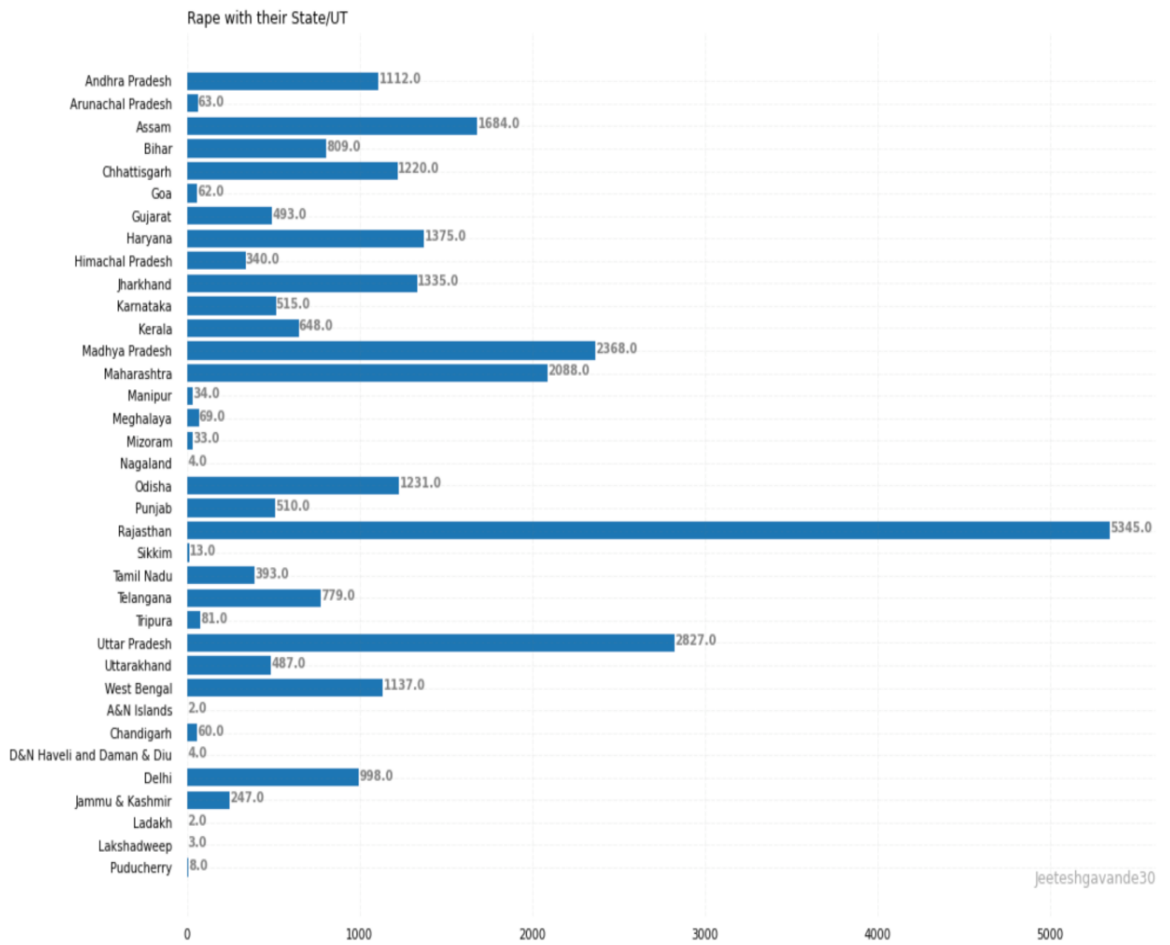


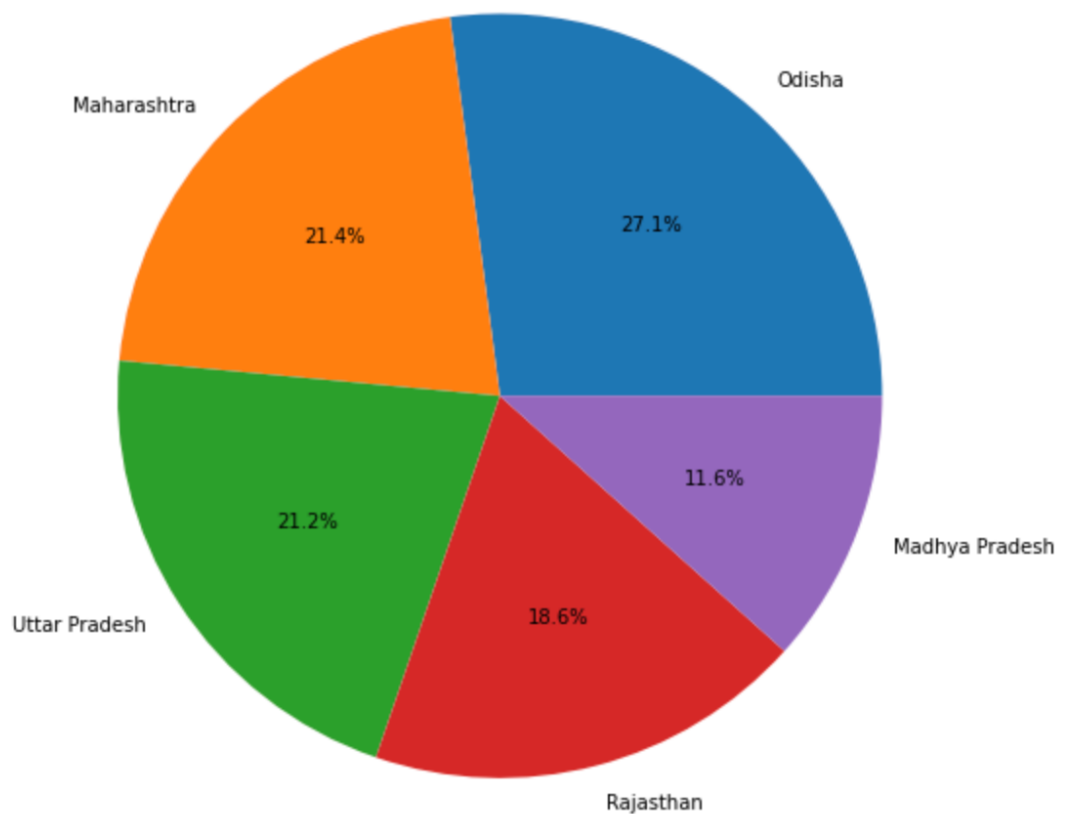
Fig-3.8 Bar Chart showing state wise Rape Victims

## **Assault on Women with Intent to Outrage her Modesty**

Assaulting women with the intention of offending their modesty is a crime that involves any act of physical or verbal assault targeting a woman's modesty, dignity, or sense of decency. This offense is defined under Section 354 of the Indian Penal Code. Assaulting women with the intention of offending their modesty is a common form of crime opposed to women in India. It includes a variety of behaviours like sexual harassment, molestation, and eve-teasing (street harassment). Due to social and cultural factors, many incidents go unreported, making it challenging to ascertain the exact prevalence of this crime.

The term "modesty" is subjective and can vary based on cultural and societal norms. Acts that fall under this offense include unwelcome physical contact, making sexually explicit remarks, gestures, or displaying pornography without consent. The intention is to violate a woman's modesty or cause her distress. Reporting rates for assaulting women with the intention of offending their modesty are relatively low due to various factors, including fear, social stigma and a lack of faith in the legal system. Encouraging reporting, raising awareness, and creating safe spaces for women to come forward are essential in addressing this crime. Assaulting women with the intention of offending their modesty often occurs in public spaces. Eve-teasing, in particular, refers to the harassment of women in public areas through verbal comments, gestures, or stalking. Initiatives to improve safety in public spaces, such as increased police presence, public awareness campaigns, and stricter law enforcement, can help combat eve-teasing and related offenses.

In 2020, the NCRB reported 86,745 cases related to assaulting women with the intention of offending their modesty across the country. Odisha has maximum number of cases related to Assault on women with intent to outrage her modesty in 2020. Out of 86,745 cases 12,641 cases are happened in Odisha. Maharashtra stand on the second place with 10,007 cases related to assaulting women with the intention of offending their modesty in 2020. Uttar Pradesh, Rajasthan and Madhya Pradesh are placed at 3rd, 4th and 5th placed with 9907, 8690 and 5431 cases respectively. More than 50% of cases related to Assault on women with intent to outrage her modesty in 2020 are from these 5 states. Taking only these 5 states in account the comparison between these is shown in Fig-3.9 as pie chart.



*Fig-3.9 Pie chart showing comparison between top 5 states for cases related to Assault on women with intent to outrage her modesty*

The Indian Penal Code's Section 354 makes it unlawful to assault a woman with the aim to offend her modesty. The law aims to provide legal recourse for victims and establish consequences for offenders. However, challenges exist in ensuring effective implementation, timely justice, and addressing societal attitudes that perpetuate such offenses. Prevention efforts focus on creating awareness, promoting gender equality, and fostering respect for women's autonomy and dignity. Educational initiatives, public campaigns, and community engagement can help challenge regressive attitudes and contribute to a safer and more inclusive society. The distribution of the victims of assaulting women with the intention of offending their modesty between different states are shown in the Fig-3.10 bar chart. It's important to approach the analysis of assaulting women with the intention of offending their modesty with sensitivity and consider the experiences and perspectives of survivors.

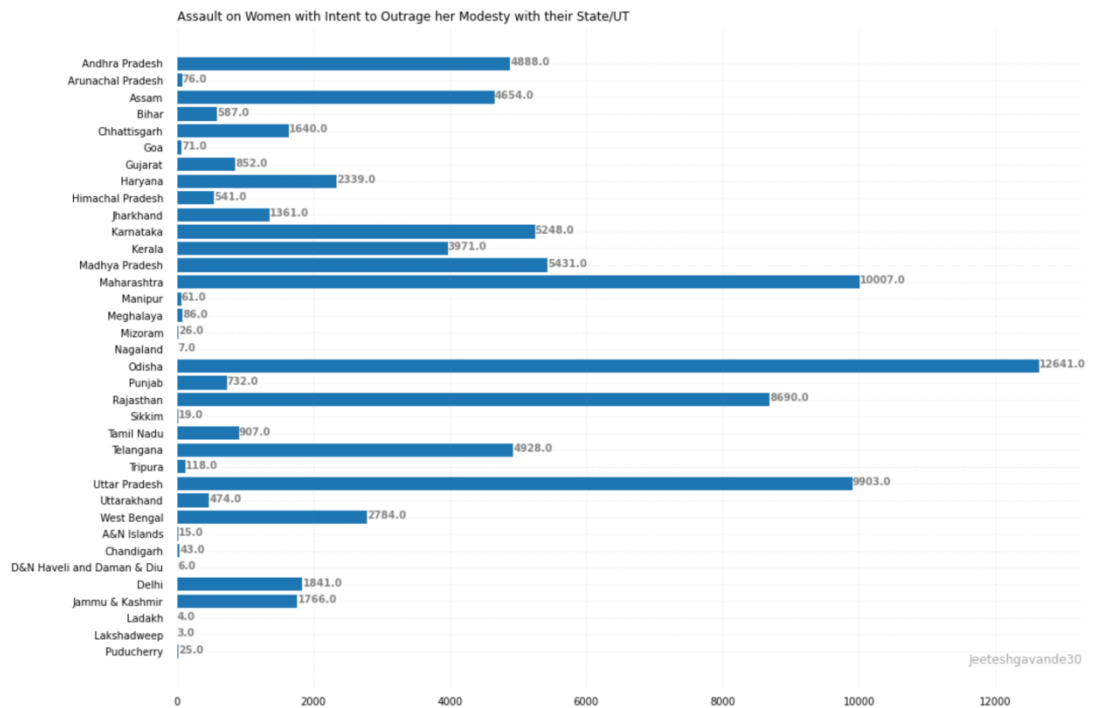
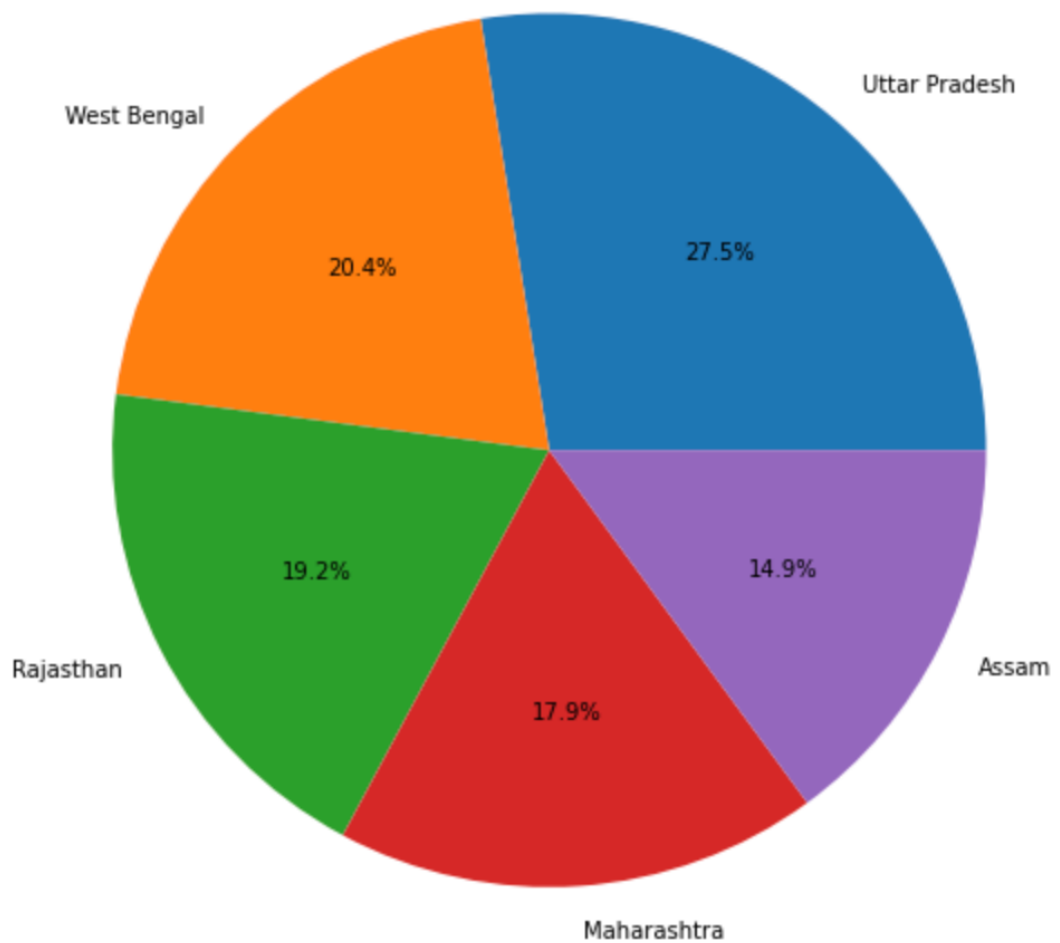


Fig-3.10 Bar Chart showing state wise victims of assault on women with intent to outrage her modesty.

According to NCRB data, in 2020, there were 3,76,887 reported cases of violence opposed to women in India. This includes crimes like rape, assault, harassment, dowry-related offenses, and others. Noteworthy is the fact that crimes against women are often underreported due to various reasons, including societal pressure, fear of retaliation, a lack of belief in the criminal justice system and the shame attached to reporting such crimes in society. The actual number of crimes against women may be much higher than what is officially recorded. Uttar Pradesh stands First in case of total crimes against women with 49,761 victims out of 3,76,887 victims. Uttar Pradesh stands in top 5 positions in all the above crimes explained. After Uttar Pradesh, West Bengal lie on second position with 36,975 victims in which victims related to Cruelty by Husband or his relatives are most.

Rajasthan, Maharashtra and Assam stand on 3rd, 4th and 5th position with 34763, 32363 and 27028 victims respectively. Cases related to Rape is highest in Rajasthan which is very concerning and whereas Abetment to Suicide of Women victims are highest in Maharashtra. Taking only these 5 states in account the comparison between these is shown in fig-3.11 as pie chart.



*Fig-3.11 pie chart showing top 5 states with highest number of total crimes against Women*

Arunachal Pradesh, Goa, Manipur, Meghalaya, Mizoram, Nagaland and UTs have less number of crimes against women but Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra and Rajasthan are the states where these are so many cases happened in 2020. Fig-3.12 shows Bar Chart Comparison for different states with respect to the total crimes against Women.

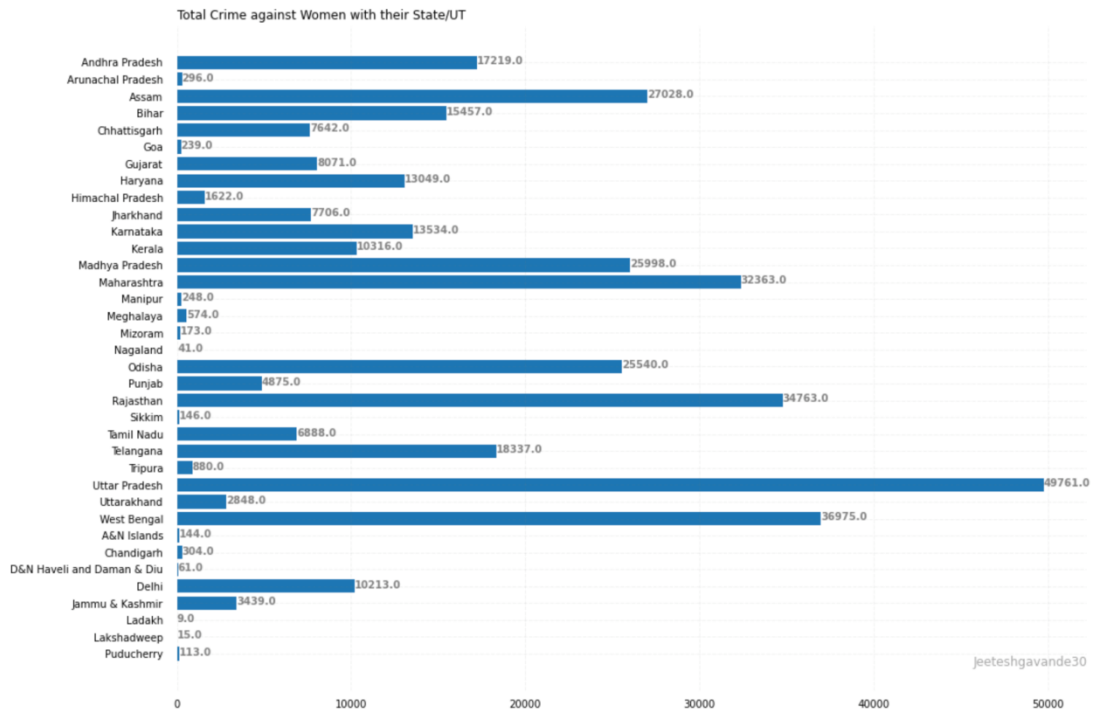


Fig-3.12 bar chart showing state wise comparison of crimes against women

# Correlation Test

## 1. Pearson Correlation Test:

The Pearson correlation test, also known as Pearson's correlation coefficient, an evaluation of the strength and direction of the linear relationship between two continuous variables is made using this statistical measure. It quantifies the strength of the correlation between the variables, ranging from -1 to +1. It is significant to note that the Pearson correlation test only assesses the linear relationship between variables. It doesn't give any specifics regarding the presence of other types of relationships, such as nonlinear or curvilinear relationships.

When I applied Pearson Correlation on the data then it is clear that “Cases related to Cruelty by Husband or his relatives” are to most correlated to total crimes against Women with 0.9057. On the second Place Assault on Women with Intent to Outrage her Modesty Crime is most correlated to total crimes against Women with Pearson's correlation coefficient 0.838. Crimes related to Rape is stand third with Pearson's correlation coefficient of 0.813. Fig-3.13 shows the correlation matrix with Pearson's correlation test.



Fig-3.13 Heat Map showing Pearson's Correlation Test Matrix

## 2. Kendall correlation Test:

The Kendall correlation test, also known as Kendall's rank correlation coefficient, is a non-parametric statistical test used to measure the strength and direction of the monotonic relationship between two variables. It assesses the ordinal association between variables, making it suitable for analysing data with ranked or ordinal variables. The Kendall correlation coefficient is denoted as " $\tau$ " (tau).

The Kendall correlation coefficient provides information about the strength and direction of the monotonic relationship. The magnitude of the coefficient represents the strength of the monotonic relationship, with values closer to -1 or +1 indicating a stronger association. A positive value indicates a positive monotonic relationship, meaning that the other variable tends to rise in rank as the rank of the first variable rises. The Kendall correlation test is robust to outliers and does not rely on assumptions of normality or linearity, making it a suitable choice for analysing data with non-normally distributed or ranked variables. However, it may be less sensitive to detecting linear relationships compared to the Pearson correlation test.

When I applied Kendall correlation Test on the data then it is clear that “Cases related to Cruelty by Husband or his relatives” are to most correlated to total crimes against Women with 0.87. On the second Place Crimes related to Rape is most correlated to total crimes against Women with Kendall correlation coefficient 0.84. Crimes related to Assault on Women with Intent to Outrage her Modesty is stand third with Kendall correlation coefficient of 0.838. Table-3.2 shows the correlation matrix with Pearson's correlation test.

	Dowry Deaths (Sec. 304B)IPC	Abetment to Suicide of Women (Sec. 305/306 IPC)	Cruelty by Husband or his relatives (Sec. 498 A IPC)	Rape	Assault on Women with Intent to Outrage her Modesty	Total Crime against Women
Dowry Deaths (Sec. 304B)IPC	1.000000	0.580540	0.704037	0.723684	0.666955	0.732343
Abetment to Suicide of Women (Sec. 305/306 IPC)	0.580540	1.000000	0.688624	0.620088	0.661462	0.677755
Cruelty by Husband or his relatives (Sec. 498 A IPC)	0.704037	0.688624	1.000000	0.780255	0.759937	0.864866
Rape	0.723684	0.620088	0.780255	1.000000	0.782195	0.839429
Assault on Women with Intent to Outrage her Modesty	0.666955	0.661462	0.759937	0.782195	1.000000	0.838095
Total Crime against Women	0.732343	0.677755	0.864866	0.839429	0.838095	1.000000

Table- 3.2 Kendall correlation Test Matrix



### 3. Spearman Correlation Test:

The Spearman correlation test, also known as Spearman's rank correlation coefficient, is a non-parametric statistical test used to measure the strength and direction of the monotonic relationship between two variables. It assesses the ordinal association between variables, making it suitable for analysing data with ranked or ordinal variables. The Spearman correlation coefficient is denoted as " $\rho$ " (rho).

The Spearman correlation coefficient provides information about the strength and direction of the monotonic relationship. The magnitude of the coefficient represents the strength of the monotonic relationship, with values closer to -1 or +1 indicating a stronger association. A positive value indicates a positive monotonic relationship, meaning that the other variable tends to rise in rank as the rank of the first variable rises. The Spearman correlation test is a non-parametric alternative to the Pearson correlation test and is particularly useful when the data violate the assumptions of normality or linearity. It is robust to outliers and can handle both ranked and continuous variables.

When I applied Spearman correlation Test on the data then it is clear that "Cases related to Cruelty by Husband or his relatives" are to most correlated to total crimes against Women with 0.97 . On the second Place Assault on Women with Intent to Outrage her Modesty Crime is most correlated to total crimes against Women with Spearman correlation coefficient 0.954. Crimes related to Rape is stand third with Spearman correlation coefficient of 0.948. Table-3.3 shows the correlation matrix with Pearson's correlation test.

	Dowry Deaths (Sec. 304B)(n)IPC)	Abetment to Suicide of(n)Women (Sec. 305/306 IPC)	Cruelty by Husband or his(n)relatives (Sec. 498 A IPC)	Rape	Assault on Women with Intent to Outrage her Modesty	Total Crime against Women
Dowry Deaths (Sec. 304B)(n)IPC)	1.000000	0.766471	0.874618	0.901031	0.843435	0.899103
Abetment to Suicide of(n)Women (Sec. 305/306 IPC)	0.766471	1.000000	0.870038	0.806667	0.835170	0.854457
Cruelty by Husband or his(n)relatives (Sec. 498 A IPC)	0.874618	0.870038	1.000000	0.924047	0.926889	0.973227
Rape	0.901031	0.806667	0.924047	1.000000	0.925473	0.948127
Assault on Women with Intent to Outrage her Modesty	0.843435	0.835170	0.926889	0.925473	1.000000	0.954183
Total Crime against Women	0.899103	0.854457	0.973227	0.948127	0.954183	1.000000

Table 3.3 Spearman correlation Test Matrix

I have also done the statistical analysis on each type of crimes to calculate different statistical values like standard deviation, variance, IQR, range,

Skewness, Kurtosis, Mean and Median etc. Fig-3.14 shows the different statistical values for each type of crimes.

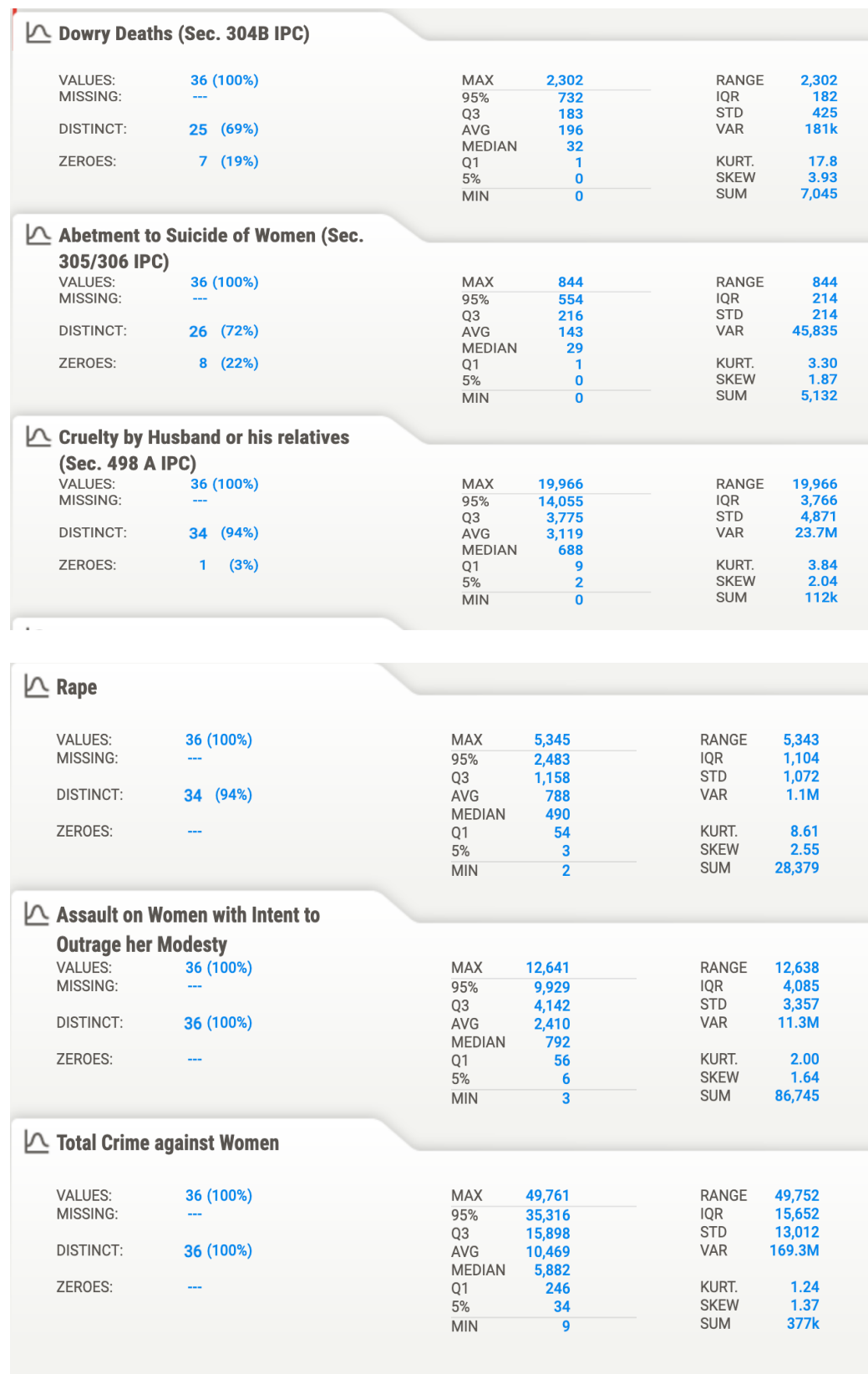


Fig-3.14 Statistical analysis for each type of crimes

## **Conclusion**

This study aimed to conduct a statistical analysis on violence against women during the COVID-19 pandemic, shedding light on the prevalence, patterns, and impacts of such violence. This study revealed alarming trends regarding the pandemic's aggression against women. It became evident that the global health crisis exacerbated existing gender inequalities and increased the vulnerability of women to different types of violence, such as abuse at home and intimate partner violence and sexual assault. The restrictive measures implemented to curb the spread of the virus, such as lockdowns and social isolation, inadvertently created an environment conducive to increased violence within households. According to the analysis, Uttar Pradesh reported the maximum rate of violence against women. As we know the violence against women are due to some of reasons mentioned here i.e gender inequality, male dominant society, drug intake and due to lack of awareness of the fundamental rights in women. Moreover, economic factor also plays an important role here. However, The limitations of this investigation must be considered. The data obtained from the NCRB and they have their own inherent biases and limitations, and the statistical analysis represents a snapshot of a particular period (2020).

Further research is needed to capture the long-term impacts and to explore specific factors influencing to the pandemic's period of violence towards women. Prevention efforts focus on creating awareness, promoting gender equality, and fostering respect for women's autonomy and dignity and setting up several support services or counselling for women as this violence against women increased majorly in the lockdown time and Educational initiatives, public campaigns, and promote the active involvement of men and boys as allies in preventing VAW. Encourage them to challenge harmful gender norms, foster positive masculinity, and actively participate in community efforts to address gender-based violence. By implementing these prevention measures, we can work towards creating a society free from violence against women. It is imperative for governments, policymakers, civil society organizations, and individuals to collaborate and prioritize the prevention of VAW in order to build a safer and more equitable world for all.

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