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A Study of Pattern of Road Accidents Using Statistical Methods in Kolhapur

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ABSTRACT:
The impact Globalization is shown on several developing countries across the world. India is one of the such country, which benefited the most. Increases the number of business activity raised the consumption levels of the people across the country. This created wide scope for increase in travel and transportation. The increase in the number vehicles since last 15 years has put lot of pressure on the existing roads and ultimately resulting in road accidents. there is an rise of the two wheeler and four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of disability, death and demand for emergency medical care. In this study we study the pattern of various types road accidents in Kolhapur. Our study shows the number of accidents, proportion of injuries and deaths as well as the proportion of the male and female are same and the accidents are distributed uniformly throughout the year.
KEYWORDS:- *Graphical Representation, Nonparametric- Test, Level of Significance*

I. INTRODUCTION:

The process of rapid and unplanned urbanization has resulted in an unprecedented revolution in the growth of motor vehicles world-wide. The alarming increase in morbidity and mortality owing to road traffic incidents (RTI) over the past few decades is a matter of great concern globally [1, 2, 4, 5]. Currently motor vehicle accidents rank ninth in order of disease burden and are projected to be ranked third in the year 2020 [7-9, 11-13, 15-16]. In India, more than 70,000 people get killed due to RTI every year, and this needs to be recognized as an important public health issue[3,14,17]. Very few studies have attempted to understand the epidemiology of risk factors associated with RTI in Indian cities [10, 18]. Globally, more than 1 million people die each year from traffic crashes and about 20–40 million are injured or permanently disabled

The death rates due to various diseases are decreased due to the scientific development. But the death rates due to accidents are increasing rapidly. The accidents couse loss of human lievs, injuries and huge loss of vehicles. The accidents are not purely random .There are several causes for the accidents namely rough road, increase in population, narrow roads, increase in number of vehicles & their poor maintenance and improper knowledge of driving. In this study we have collected the information regarding the accidents in the kolhapur city area from last five years. The collected data is analysed for studying the various characteristicks. The Kolhapur is a city having about 5 lakh 64 thousand population with an area about 7686.54 sq.km. The Kolhapur city is having four police stations.

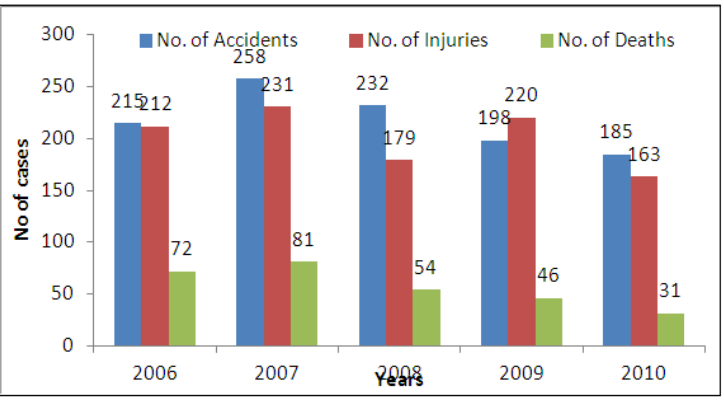
II. COLLECTION OF DATA:

The data is collected from records of four different of police station in kolhapur city which are " Laxmipuri police station ", "Rajarampuri Police station", "Karveer Police station " and " Shahupuri Police station". We collect the information about the date of accidents also about the number of deaths and injuries in accidents and their age and sex. Also we collect the information about the type of vehicles due to which accidents are taken place.

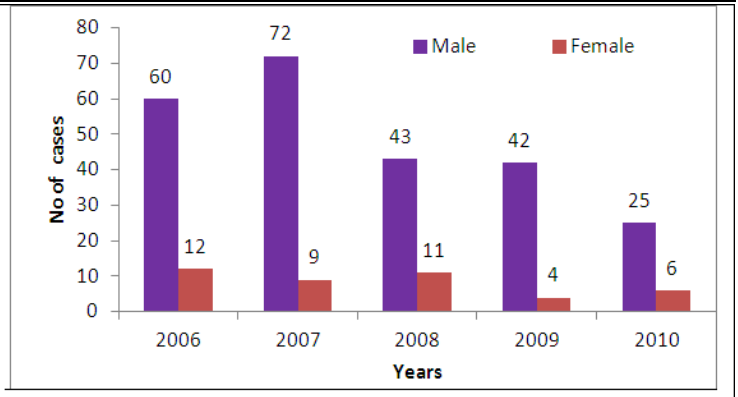
III. METHODOLOGY:

The data is classified according to many characteristics and prepared the contingency tables. Various charts have been drawn in order to understand the factors affecting the couses of accidents. The Chi-square test of uniformity of accidents during the years , type of vahicles of accidents. The equality of age of drivers is also tested. Nonparametric technique is used to test the equality of accidents made by various types of vehicles. The nature of age distribution of various characteristics involved in the accidents is considered. Predicted value of no. of accidents for Year 2012 by using Time Series Analysis.

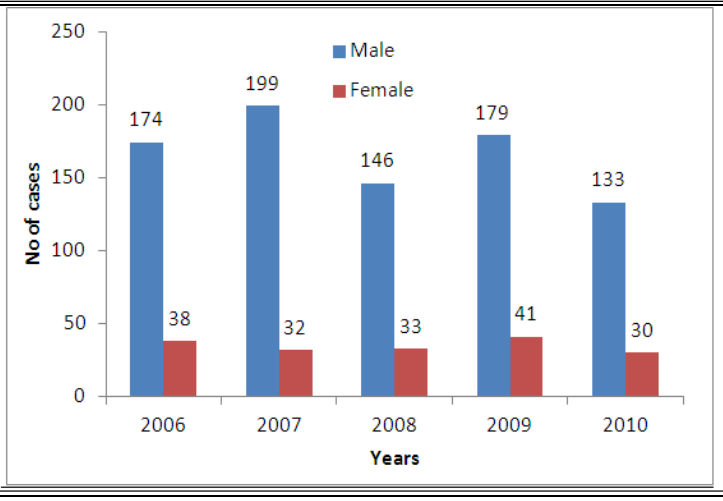
Year	No. of Accidents	No. of Injuries	No. of Deaths
2006	215	212	72
2007	258	231	81
2008	232	179	54
2009	198	220	46
2010	185	163	31



Year	No. of Deaths	
	Male	Female
2006	60	12
2007	72	9
2008	43	11
2009	42	4
2010	25	6



Year	No. of Injuries	
	Male	Female
2006	174	38
2007	199	32
2008	146	33
2009	179	41
2010	133	30



Testing of Hypothesis:

a) Chi-Square Test for the uniform of number of accidents:

Hypothesis are stated as ;

H0 : Accidents are distributed uniformly over the year.v/s

H1: Accidents are not distributed uniformly over the year.

Calculation:

The test statistic is,

$$\chi^2 = \sum_{i=0}^{n} (Oi - Ei)^2 / Ei \sim \chi^2 (n - k - 1)$$

Therefore, $\chi^2 = 23.4572$,

At the level of significance 1%,

$\chi^2 0.01(11) = 24.725$ and $\chi^2 0 < \chi^2 0.01(11)$

b) Kruskal wallis test fortesing equality of types of vehicles which made the accidents in different years.

Years	Accidents made by the wheelers		
	2	4	6
2006	73	36	24
2007	79	47	42
2008	72	47	29
2009	71	32	27
2010	84	31	12

Hypothesis:- H_0 : Average number of accidents made by different wheelers are not same.
H_1 : Average numbers of accidents are same in different years are same.

Calculation

From table, n = $n_1 + n_2 + n_3$ = 5+ 5+ 5=15 and $H = \sum_{i=1}^{n}\left(\frac{T_i^2}{n_i}\right) = 1055.6$

Test Statistic: Under Ho,

$H = \frac{12}{n(n+1)}\sum_{i=1}^{n}\left(\frac{T_i^2}{n_i}\right) - 3(n+1)$

$H = \frac{12}{15(15+1)}(1055.6) - 3(15+1) = 52.78 - 48 = 4.78$

$\chi^2_{table} = \chi^2_{table}(0.05, 3\text{-}1) = 7.81$ and $H < \chi^2_{table}$,

c) Kruskal wallis test fortesing equality of number accidents in different years : .

Kruskal wallis test fortesing equality of number accidents in different years are equal .

H_0 : Average number of number accidents in different years are not equal .

H_1 : Average number of number accidents in different years are equal

From table, n = $n_1 + n_2 + n_3 + n_4 + n_5$ = 15 and $H = \sum_{i=1}^{n}\left(\frac{T_i^2}{n_i}\right) = 1006.5$

Test Statistic: Under Ho,

$H = \frac{12}{n(n+1)}\sum_{i=1}^{n}\left(\frac{T_i^2}{n_i}\right) - 3(n+1)$

$H = \frac{12}{15(15+1)}(1006.5) - 3(15+1) = 50.325 - 48 = 2.325$

$\chi^2_{table} = \chi^2_{table}(0.05, 5\text{-}1) = 9.49$ and $H < \chi^2_{table}$,

d) TIME SERIES ANALYSIS:

Years	2006	2007	2008	2009	2010
No. of Accidents	215	258	232	198	185

Fit a linear trend for a data by using least squares method

Let, X=Year, Y=No. of Accidents.

$\therefore \overline{\mathbf{X}} = \frac{\Sigma X_i}{n} = \frac{10060}{5} = 2012$,

$\widehat{Y} = \beta_0 + \beta_1 X$

$\widehat{\boldsymbol{\beta_0}} = \frac{\Sigma Y_i}{n} = \frac{1088}{5} = 217.6$,

$\widehat{\beta}_1 = \frac{\Sigma U_{iY_i}}{\Sigma U_i^2} = \frac{-120}{10} = -12$

Y= $\widehat{\boldsymbol{\beta_0}} + \widehat{\beta}_1 U$

$\therefore$ For year 2015 U=3, $\hat{\mathbf{a}}$=217.6, $\hat{\mathbf{b}}$=-12

Y= $\widehat{\boldsymbol{\beta_0}} + \widehat{\beta}_1 U$=217.6+(-12)*3

Y=181.6

Y$\cong$ 182

For year 2015 Estimated no. of accidents is182

Overall Finding

The number of accidents, proportion of injuries and deaths as well as the proportion of the male and female are same in five years.The accidents are distributed uniformly throughout the year.and average age of male drivers is almost equal to average age of female drivers.There is significant difference in the average number of accidents made by different types of vehicles.as well as the average number of accidents made by different types of vehicles are significantly different.The age distribution of male who injured in accidents is positively skewed whereas female is negatively skewed & both are platykurtic. The variation in female age is higher than male age.The age distribution of male who suffered in accidents is positively skewedwhereas female is negatively skewed & both are platykurtic. Regression Coefficient of Y on X i.e. (β) for the given sample is insignificant. For year 2015 Estimated trend value (No. of Accidents) is 182

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