ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 7 | Issue: 1 |January 2021|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor: 7.032 ||ISI Value: 1.188

A STUDY OF ACCIDENTS OCCURS IN KOLHAPUR CITY USING STATISTICAL MEASURES

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ABSTRACT

The impact Globalization is shown on many developing countries across the world. India is one of the such country, which benefited the most. Increased number of economic activity raised the consumption levels of the people across the country. This created wide scope for increase in transportation and travel. The increase in the number vehicles since last 20 years has put lot of pressure on the existing roads and ultimately resulting in road accidents. there is an increase of the two wheeler and four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of death, disability and demand for emergency medical care.. In this study we study the pattern of various types road accidents in Kolhapur over a few years. 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, Z- Test, Level of Significance, ANOVA.***

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 20–50 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 38 lakh 76 thousand population with an area about 7686.54 sq.km. The Kolhapur city is having 4 police stations.

COLLECTION OF DATA

The data is collected from records of 4 units 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 & sex. Also we

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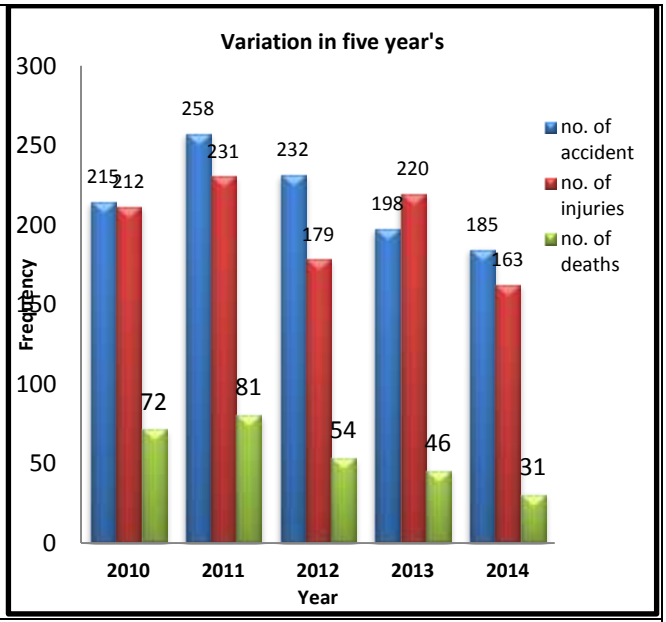
collect the information about the type of vehicles due to which accidents are taken place.

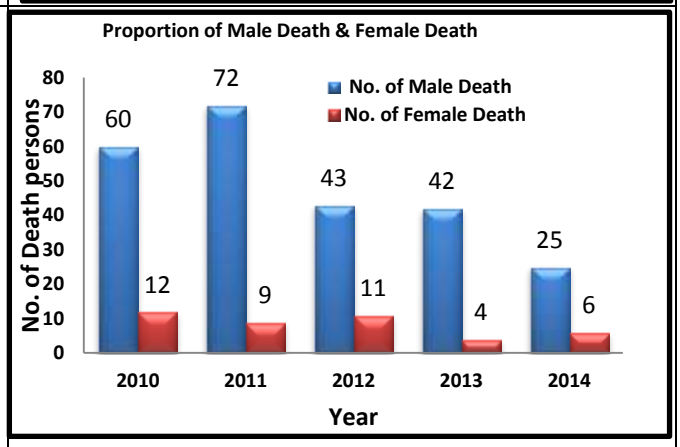
TECHNIQUES

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. ANOVA 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 2015 by using Time Series Analysis.

Year	No. of Accidents	No. of Injuries	No. of Deaths
2010	215	212	72
2011	258	231	81
2012	232	179	54
2013	198	220	46
2014	185	163	31



Year	No. of Deaths	
	Male	Female
2010	60	12
2011	72	9
2012	43	11
2013	42	4
2014	25	6



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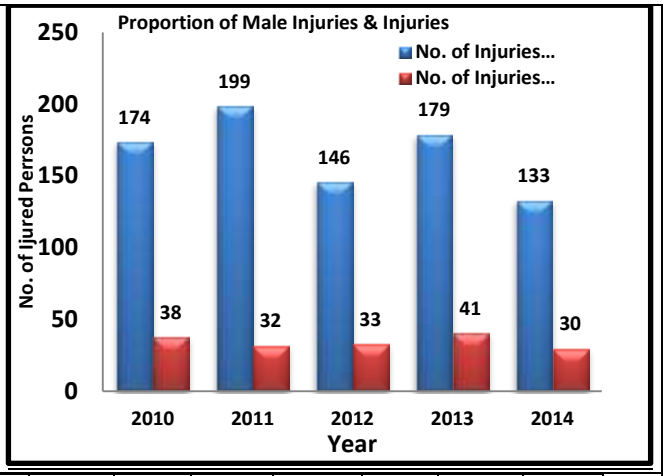
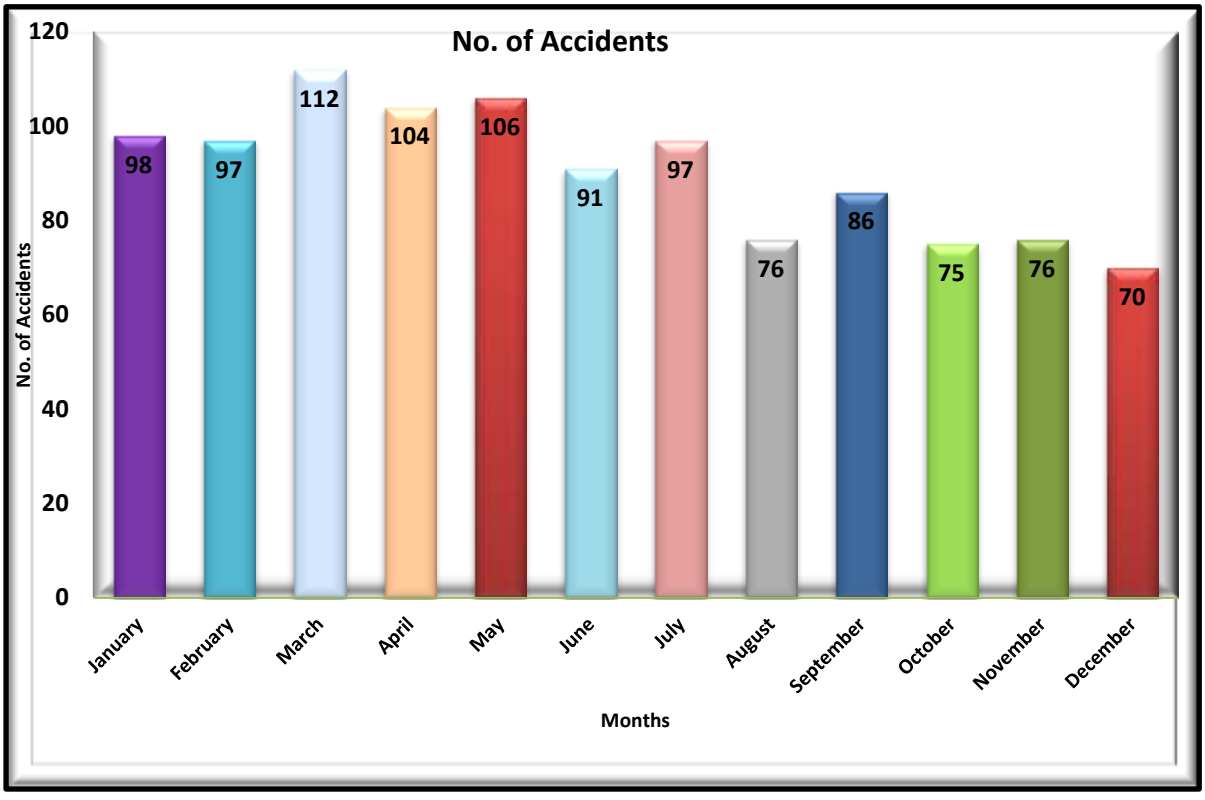
Year	No. of Injuries	
	Male	Female
2010	174	38
2011	199	32
2012	146	33
2013	179	41
2014	133	30



Months	Jan	Feb	March	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. of Accidents	98	97	112	104	106	91	97	76	86	75	76	70



DATA ANALYSIS

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,

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

Therefore, χ^2 =23.4572,
At the level of significance 1%,
χ^2 0.01(11)=24.725 and $\chi^2 0 < \chi^2 0.01(11)$

b) Test for equality of mean age of male & female driver who made the accidents.

Hypothesis:

H0 :μx=μy

i.e. Mean age of male driver is equal to mean age of female drivers.

H1 :μx≠μy

i.e. Mean age of male driver is not equal to mean age of female drivers.

We have,

$\bar{x}$ =37.1039, $\bar{y}$=38.7662,
S_1^2=194.0634, S_2^2=245.6852,
n_1=1073, n_2=216

Under Ho, $|Z0| = \left| \frac{\bar{x}-\bar{y}}{\sqrt{(\frac{S1^2}{n1}+\frac{S2^2}{n2})}} \right| \sim N(0,1)$

|Z0|=1.4477

At the level of significance 5% ,Zα/2=1.96 .

ANOVA Technique

c) Test for equality of average accidents made by various types of vehicle during different year.

Years	Wheelers to Wheelers					
	2×2	2×4	2×6	4×4	4×6	Total
2010	75	71	32	21	16	215
2011	72	85	44	18	39	258
2012	65	78	27	31	31	232
2013	67	55	35	23	18	198
2014	78	43	15	40	9	185
Total	357	332	153	133	113	1088

Hypothesis:- H01: Average numbers of accidents due to Wheeler to Wheeler are same.
H02 : Average numbers of accidents are same in different years.

Calculation :

G=Grand Total= 1088, Total S.S.= 13618.24,
S.S.dueto vehicle= 10958.24,
S.S.due to year = 658.64,
S.S.due to error=2001.36,
MSY=164.66, MSV=2739.56, MSE=125.085

ANOVA Table

S.V.	d.f.	S.S.	M.S.S.	F	Fα
Between Vehicle	4	10958.24	2739.56	21.90	3.01
Between Year (block)	4	658.64	164.66	1.316	3.01
Error	16	2001.36	125.085	-	-
Total	24	13618.24	-	-	-

d) Test for equality of types of vehicles which made the accidents in different years.

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Years	Accidents made by the wheelers			
	2	4	6	Total
2010	73	36	24	133
2011	79	47	42	168
2012	72	47	29	148
2013	71	32	27	130
2014	84	31	12	127
Total	379	193	134	706

Hypothesis:- H01: Average number of accidents made by different wheelers are same.
H02: Average numbers of accidents are same in different years.

Calculation :G=Grand Total=706, Total S.S.=S^2T=7374.94,S.S.due to vehicle=S^2v=6540.14, S.S.due to year =S^2y=386.27,S.S.due to error=S^2E=448.53, MSY=96.56, MSV=3270.07,MSE=56.06

S.V.	d.f.	S.S.	M.S.S.	F	Fα
Between Vehicle	2	6540.14	3270.07	58.33	19.37
Between Year (block)	4	386.27	96.56	1.72	6.04
Error	8	448.53	56.06	-	-
Total	14	7374.94	-	-	-

e)Nature of Distributions

Age distribution of male who died in the accidents.	Age distribution of female who died in the accidents
Mean =$\bar{x}$ =38.7644 Variance=185.6378 C.V.=35.1477 Central moments : μ2=185.6378 μ3=-113685.43 μ4=61387.5976 Skewness:- $\beta 1$=-2020.2747 $\gamma 1$ = 44.9474 Kurtosis :- $\beta 2$= 1.7813 $\gamma 2$=-1.2187	Mean =$\bar{x}$ =33.7976 Variance =211.17 C.V.=42.9959 Central moments : μ2=211.17 μ3=-895.007 μ4= 95325.61 Skewness:- $\beta 1$=-0.0850 $\gamma 1$ = 0.2915 Kurtosis :- $\beta 2$=2.1376 $\gamma 2$=-0.8624

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Age distribution of male who injuried in the accidents	ii) Age distribution of female who injuried in the accidents.
Mean =$\overline{x}$ =36.6203 Variance =222.03 C.V.=40.68 Central moments : μ2=222.03 μ3=909.91 μ4 = 117567.71 Skewness:- $\beta 1$=0.0756 $\gamma 1$ = 0.2749 Kurtosis :- $\beta 2$=2.3848 $\gamma 2$ =-0.6152	Mean=$\overline{X}$ =39.9655 Variance=246.62 C.V.=39.29 Central moments : μ2=246.62 μ3=-474.56 μ4 = 142869.43 Skewness:- $\beta 1$=-0.0150 $\gamma 1$ = 0.1224 Kurtosis : $\beta 2$=2.3489 $\gamma 2$=-0.6511

Age distribution of male who suffered in the accidents	**Age distribution of female who suffered in the accidents.**
Mean =$\overline{X}$ =37.1039 Variance =214.6181 C.V.=39.4725 Central moments : μ2=214.6181 μ3=616.730 μ4 = 104009.019 Skewness:- $\beta 1$=0.0384 $\gamma 1$ = 0.1961 Kurtosis :-$\beta 2$=2.2580$\gamma 2$ =-0.7419	Mean =$\overline{X}$ =38.76 Variance =246.17 C.V.=40.45 Central moments : μ2=246.17 μ3=-499.25 μ4 = 144601.43 Skewness:-$\beta 1$=-0.0167 $\gamma 1$= 0.1292 Kurtosis :-$\beta 2$=2.3861$\gamma 2$ =-0.6139

f) TIME SERIES ANALYSIS

Years	**2010**	**2011**	**2012**	**2013**	**2014**
No. of Accidents	215	258	232	198	185

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

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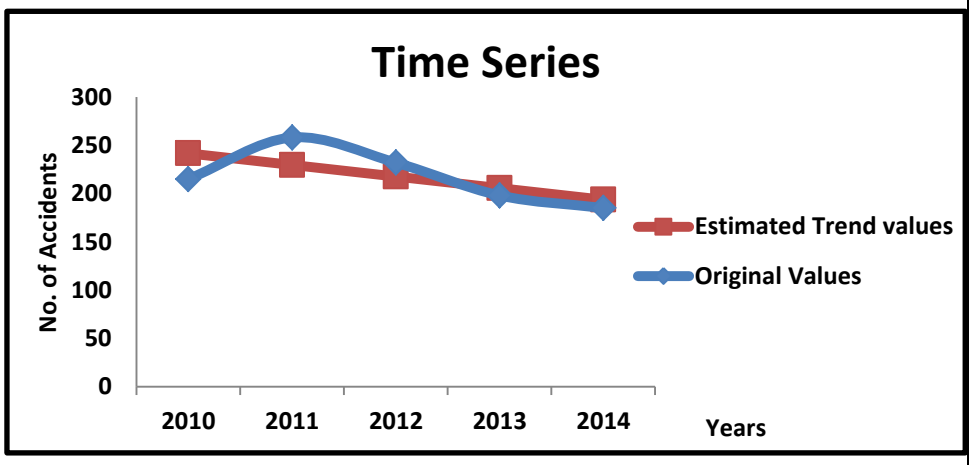
Let, X=Year, Y=No. of Accidents.

$$\therefore \bar{x} = \frac{\Sigma X_i}{n} = \frac{10060}{5} = 2012 \text{ , } u = X - \bar{X} \text{ , } \hat{Y} = a + bu$$

Year		No. of Accidents			Estimated Trend values
X	U	Y	uy	U^2	
2010	-2	215	-430	4	241.6
2011	-1	258	-258	1	229.6
2012	0	232	0	0	217.6
2013	1	198	198	1	205.6
2014	2	185	370	4	193.6
		Σy = 1088	Σuy =-120	ΣU^2= 10	



$\hat{a} = \frac{\Sigma Y_i}{n} = \frac{1088}{5} = 217.6$,

$\hat{b} = \frac{\Sigma U_{iY_i}}{\Sigma U_i^2} = \frac{-120}{10} = -12$

$Y = \hat{a} + \hat{b}u$

$\therefore$ For year 2015

U=3, $\hat{a}$=217.6, $\hat{b}$=-12

$Y = \hat{a} + \hat{b}u = 217.6 + (-12)*3$

Y=181.6

Y≅ 182

For year 2015 Estimated no. of accidents is182

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g) Test for Regression Coefficient:

Test for Regression Coeffiecent of y on x i.e. β=0

Year	No. of Accidents	Estimated Trend values
X	Y	
2010	215	241.6
2011	258	229.6
2012	232	217.6
2013	198	205.6
2014	185	193.6
	Σy = 1088	

Hypothesis:- Ho:- β = 0 H1:- β≠ 0

Calculation :

Cov(x,y)= -24 , σx^2 =2, $\therefore \mathbf{b_{yx}} = \frac{\mathbf{Cov(x,y)}}{\sigma \mathbf{x^2}}$ =-12 , $\Sigma(\mathbf{x_i} - \bar{\mathbf{x}})^2$=10, $\Sigma(\mathbf{y_i} - \hat{\mathbf{y}}_\mathbf{i})^2$ =1440,n=5.

$$|\mathbf{t}| = \left| (\mathbf{b_{yx}} - \boldsymbol{\beta}) \left[\frac{(\mathbf{n-2})\Sigma(\mathbf{x_i} - \bar{\mathbf{x}})^2}{\Sigma(\mathbf{y_i} - \hat{\mathbf{y}}_\mathbf{i})^2} \right]^{\frac{1}{2}} \right| \sim \mathbf{t_{(n-2)}}$$

Under Ho,

$$|\mathbf{t}| = \left| (\mathbf{b_{yx}}) \left[\frac{(\mathbf{n-2})\Sigma(\mathbf{x_i} - \bar{\mathbf{x}})^2}{\Sigma(\mathbf{y_i} - \hat{\mathbf{y}}_\mathbf{i})^2} \right]^{\frac{1}{2}} \right| \sim \mathbf{t_{(n-2)}}$$

|t|= 1.73066

At the level of significance 5% ,$t_{(n-2)}$=$t_3 0.05$ = 3.182 and$|t| < t_3 0.05$

OVERALL CONCLUSION

- 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.
- The mean age of male drivers is almost equal to mean age of female drivers.
- There is significant difference in the average number of accidents made by different types of vehicles.
- The average number of accidents made by different types of vehicles are significantly different.
- The distribution is negatively skewed &platykurtic. Variation in female death isgreter than male death.
- 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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