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Comparative Study of Causative Factors of Road Traffic Accidents in Nigeria: Non-Parametric Approach (A Study of Delta State).

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Abstract

Road traffic accidents are one of the most basic factors that affect premature death and serious injury among individuals and financial loss of public and private property. This study aims to analyze the relative influence of causative factors on road crashes in Delta State. Data related to causative road traffic accidents in Delta State for the period 2016 - 2020 were acquired from the National Bureau of Statistics and the Federal Road Safety Commission/Corps (FRSC). The data were analyzed with Krustal-Wallis Test using Statistical Packages for Social Science (SPSS). In line with the objectives of the study, findings revealed that causative factors such as Speed violation emerges highest followed by Tyre burst and Break failure while the least is Dangerous overtaking, Bad Road, Road obstruction violation and Road violation. Based on the findings the study recommends that driver education and sensitization should be strengthened and enforced on the need for proper driving habits and road infrastructure should be provided along the highways.

***Keywords*:** *Road Traffic Accident, Causative Factors of Road Accidents, Mean Rank, Kruskal-Wallis Test.*

1.0 Introduction

Road traffic accident (RTA) has become one of the issues of extraordinary worry in Nigeria. This is as it involves each class of individuals in the country Oguagbaka (2019). Sanusi et al (2016) indicated that RTA is one of the major causes of bodily harm and mortality worldwide and classified RTAs as one of the ten ranked causes of death in the universe. The challenges caused by road transport in Nigeria are multifaceted. However, despite the substantial effort at road improvement, the frequency rate of accidents is high (Anyanwu *et al.,* 1997). The frequent rate of road traffic accidents (RTAs) on Nigerian roads can be decreased by the stringent implementation of traffic guidelines. The restoration of the Federal Road Safety Commission/Corps (FRSC) by the Nigerian government in 1988 is a commendable measure toward the reduction of high RTAs rates in Nigeria. It should be noted that good roads themselves cannot prevent accidents, there are certain factors that cause road traffic accidents Agbonkhese *et al.* (2013) identified vehicle operator or driver factors, vehicle factors, road pavement condition factors and environmental factors as the four major sources of road accidents in Nigeria.

The genesis of RTAs in Nigeria is complicatedly connected with road transport improvement. vehicle crashes began in Nigeria in 1906 in Lagos. Be that as it may, a lot of human and material resources are lost due to vehicular crashes whether internationally or nationally. Aside from the social and economic expenses of RTAs

as far as torment, sorrow and grief, the monetary impacts are quite a large number. The economic impact includes output loss due to death and injury, replacement cost of damaged vehicles, roads and road accessories, opportunity cost of delays in traffic hold ups and accident clearing, cost of 'goods in transit' destroyed in the accident etc. (Agunloye, 1993; Oluduro, 1998; cited in Arosanyin, 2001).

Gbadamosi (1997) stressed that more than half of all the road traffic accidents and casualties were due to drivers' errors which include recklessness, over speeding, improper overtaking, inattention or confusion, inexperience, carelessness at junctions and intoxication. Furthermore, according to him nearly six (6) per cent of the accidents were due to mechanical vehicular factors while another six (6) per cent was due to road construction problems. As for mechanical causes, the incidence is traced to owners' or drivers' refusal to take adequate care of the defects in their vehicles until they degenerate into disastrous conditions. Other human faults consist of irregular servicing, failure to check engine oil and cooling systems, failure to replace worn-out tyres or repair of defective brakes or clutch systems.

Ibitoye (2008) identified RTAs as one of the major social problems in Nigeria. He opined that in 1986, before the establishment of the Federal Road Safety Commission/Corps (FRSC) a total of 25,188 accidents were recorded and it increased to 28,215 in 1987. The number of deaths initially reduced from 8,154 deaths in 1986 to 7,912 deaths in 1987 before it increased in 1988 to 9,077 deaths. As soon as FRSC was constituted in 1988, the number of deaths dropped in 1989 to 8,714 deaths and 8,154 deaths in 1990. A sudden increase was observed in 1991 and 1992. The gradual reduction was observed from 1992 throughout 1999 and from 2002 to 2005 while increments were observed in 2000, 2001 and 2006. He further noted that non-consistency in the trend of fatalities for over twenty (20) years is an indication of the need to learn from the developed countries on how considerable success has been achieved in tackling their road safety problems. Developed nations have involved both the elimination of the most hazardous location and safety-conscious planning and design to improve traffic safety on their road network The world health organization in 2013 declared Nigeria the most dangerous country in Africa in terms of deaths per 100,000 population yearly. Their report indicates that 33.7 deaths per 100,000 population yearly and 1 per 4 road accidents in Africa take place in Nigeria. Every. The world health organization (WHO) review and the FRSC report of 5,693 deadly RTAs in 2009 leave no question about the hazardous circumstance on Nigerian roads. The reasons for lethal auto collisions in Nigeria have been classified into human, mechanical, and natural elements.

Numerous empirical studies have been performed on the analysis of road accidents in Nigeria and other countries. Adebola et al. (2015) examined road accidents in Nigeria utilizing the ARIMA model to ascertain the patterns of RTA outcomes; injured, killed and total fatality of the road accidents along the highways. Isa and

Siyan (2016) developed a category regression analysis to analyze the causes accountable for RTAs along the Kaduna-Abuja expressway. Atubi (2012) investigated and analyzed the month-to-month variations of RTA cases in certain local government areas of Lagos State, Nigeria. Atubi (2012) examined and analyzed the monthly variations of accident cases in certain local government areas of Lagos State, Nigeria. Hajeeh (2012) compared an Autoregressive integrated moving average (ARIMA) model with Artificial Neural Network (ANN) to predict killed in Kuwait, he concluded that (ANN) was better in case of long-term series without seasonal fluctuations of accidents. Razzaghi et al. (2013) utilized a time series model to determine the pattern of accidents, and the application of the ARIMA model was used to establish the viability of the data from Taybad city in Iran, the results from the study demonstrate that Traffic accidents in Taybad have an upward trend.

This study will enable road users, all levels of government and the Federal Road Safety Commission/Corps to identify the major factors responsible for road crashes in order to engage in an aggressive sensitization campaign so as to curtail auto crashes and loss of lives in Nigeria's roads. Most importantly, this paper could offer the anticipated benefit to the road users, Road Safety Authority, researchers, and other Stakeholders in understanding the causative factors of road accidents**.** In order for the government to implement policies that will reduce the occurrence of road accidents in Nigeria, there is a need to undertake statistical analysis to identify the relative causative factors of RTAs in Nigeria using Delta State as a case study. Therefore, the aim of this study is to analyze the relative influence of causative factors on road crashes in Delta State. To achieve this aim, this study has the following specific objectives: (i) to determine whether there is a significant difference between the identified causative factors responsible for road crashes, and (ii) to determine the causative factor with the highest frequency of road crashes.

2.0 Materials and methods

2.1 Source of Data for The Study

The information used in this study is based on a variety of sources. Data related to causative road traffic accidents in Delta State for the period 2016 - 2020 were acquired from the National Bureau of Statistics and the Federal Road Safety Commission/Corps (FRSC).

2.2 Data Analysis Method

The data were analyzed with **Kruskal-Wallis Analysis Rank Sum Test** using Statistical Package for Social Sciences (SPSS)

2.2.2 Kruskal-Wallis Analysis Rank Sum Test

The Kruskal-Wallis (KW) test is a non-parametric statistic which is an alternative to the parametric One-Way ANOVA Test. In circumstances where-by the Gaussian (normality) of the population(s) is uncertain or the sample sizes are so small that checking normality is not certain, at times it is preferable to utilize

nonparametric tests to make inferences about the "average" value. Non-parametric statistics require fewer assumptions and do not require the assumption of normality. These tests are usually applied to survey and count data. The KW test can be used to compare the size of the values drawn from the different populations.

The basic assumptions for the KW test are:

(i) The test is utilized when the normality assumption of ANOVA is violated.

(ii) The samples from the *q* populations are independently drawn. The observations should be independent. That is, there should be no relationship between the members in each group or between groups.

(iii) The response variable should be ordinal or continuous.

(iv) The null hypothesis is that all q populations are identical in shape, with the only potential difference being in the measure of location of the typical values (e.g., mean or medians). This indicates that all the groups should have the shape distributions

In practice, while carrying out the Kruskal-Wallis test, if the groups and the number of observations are more than three and five respectively, then, the sampling distribution is approximated with the chi-square distribution. The approximation precision becomes better as both the number of groups and observations increases.

Hypotheses to be Tested are:

H_o : All q populations have the same measure of location, e.g., mean or median.

H_a : At least one of the populations has a measure of location e.g., mean or median different from other others or at least one population is shifted away from the others.

The KW test determine if there is significant difference between groups, However, it won't determine which groups are different. So, Post Hoc test or the mean plot is used to determine the difference.

The test is performed by ranking all of the data from smallest to largest and compute the rank sum for each of the *q* samples. The test statistic looks at the difference between the average rank for each group $\left(\frac{R_{xi}}{n_{xi}}\right)$ and average rank for all observations $\left(\frac{N_x+1}{2}\right)$.

Assuming there are differences in the total number of observations, it is normal that a few groups will have a mean rank a lot bigger than the mean rank of the population and some to have smaller mean ranks.

The test statistic is:

KRU = $\frac{12}{N_x(N_x+1)}\sum_{i=1}^{q} n_{xi}\left(\frac{R_{xi}}{n_{xi}}-\frac{N_x+1}{2}\right)^2 \sim \boldsymbol{\chi^2_{q-1}}$ with degrees of freedom (df) = q-1

where:

KRU is the Kruskal-Wallis test statistic; R_{xi} is the rank for each random sample; n_{xi} is sample size for each variable; N_x is the size of all observations.

The larger KRU is the stronger the evidence we have against the null hypothesis that the populations have the same location/median. Large values of *KRU* lead to small p-values.

3.0 Data presentation and analysis

3.1 Data Presentation

In this study, data for causative factors road accidents for the period 2016-2020 were analyzed according to the factors responsible for road crashes in Delta State. The data for this study is summarized in Table 3.1.

Table 3.1: **Causative factors of road crashes in Delta State (2016-2020)**

	Causative Factors										
Year	**SPD**	**UPD**	**TBT**	**LOC**	**MDV**	**WOV**	**BFL**	**OVL**	**DOT**	**WOT**	**DGD**
2016	62	0	21	28	1	3	5	0	0	2	5
2017	65	0	21	23	1	4	8	3	0	0	3
2018	46	0	18	0	3	0	5	3	0	1	3
2019	96	0	26	0	3	0	4	2	0	16	19
2020	90	1	3	0	0	0	7	0	0	11	5

	Causative Factors											
Year	**BRD**	**RTV**	**OBS**	**SOS**	**DOV**	**DAD**	**ROV**	**PWR**	**FTQ**	**SLV**	**Others**	**Tot**
2016	0	6	1	3	0	0	0	2	0	1	0	140
2017	0	5	1	0	0	2	0	0	0	10	3	149
2018	0	3	4	0	0	0	0	0	0	8	1	95
2019	0	13	3	0	0	0	0	0	2	12	5	201
2020	0	2	0	0	0	0	0	0	2	5	0	126

Source: National Bureau of Statistics (NBS) 2021

3.1.1 Road Crashes Causative Factors Code:

The causative factors responsible for road crashes with their respective codes are list below:

SPD-Speed violation; UPD-Use of Phone While Driving; TBT-Tyre Burst; LOC-Loss of control; MDV-Mechanical Deficient Vehicle; WOV-Wrongly Overtaking; BFL-Break failure; OVL-Overloading; DOT-Dangerous overtaking; WOT-Worn out tyre; DGD- Dangerous driving

BRD-Bad Road; RTV-Route violation; OBS-Obstruction violation; SOS-Sleeping on steering; DOV- Road obstruction violation; DAD-Driving under influence of alcohol/drug; ROV-Road violation; PWR-Poor weather; FTQ-Fatigue; SLV-Sign light violation.

3.2 Data Analysis

In this work, causative factors responsible for road crashes data were analyzed as defined by their code in subsection 3.1.1. All the data were analyzed by Kruskal-Wallis Test and graphical tools using SPSS.

Table 3.2: Tests of Normality[c,d,e,f]

	Factors	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Observations	SPD	.228	5	.200*	.927	5	.577
	UPD	.473	5	.001	.552	5	.000
	TBT	.309	5	.133	.836	5	.153
	LOC	.366	5	.028	.736	5	.022
	MDV	.273	5	.200*	.852	5	.201
	WOV	.364	5	.029	.753	5	.032
	BFL	.287	5	.200*	.914	5	.490
	OVL	.254	5	.200*	.803	5	.086
	WOT	.313	5	.122	.843	5	.173
	DGD	.416	5	.005	.672	5	.005
	RTV	.282	5	.200*	.863	5	.240
	OBS	.287	5	.200*	.914	5	.490
	SOS	.473	5	.001	.552	5	.000
	DAD	.473	5	.001	.552	5	.000
	PWR	.473	5	.001	.552	5	.000
	FTQ	.367	5	.026	.684	5	.006
	SLV	.173	5	.200*	.970	5	.875
	OTHERS	.244	5	.200*	.871	5	.272

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

c. Observations is constant when Factors = DOT. It has been omitted.

d. Observations is constant when Factors = BRD. It has been omitted.

e. Observations is constant when Factors = DOV. It has been omitted.

f. Observations is constant when Factors = ROV. It has been omitted.

Source: SPSS Output

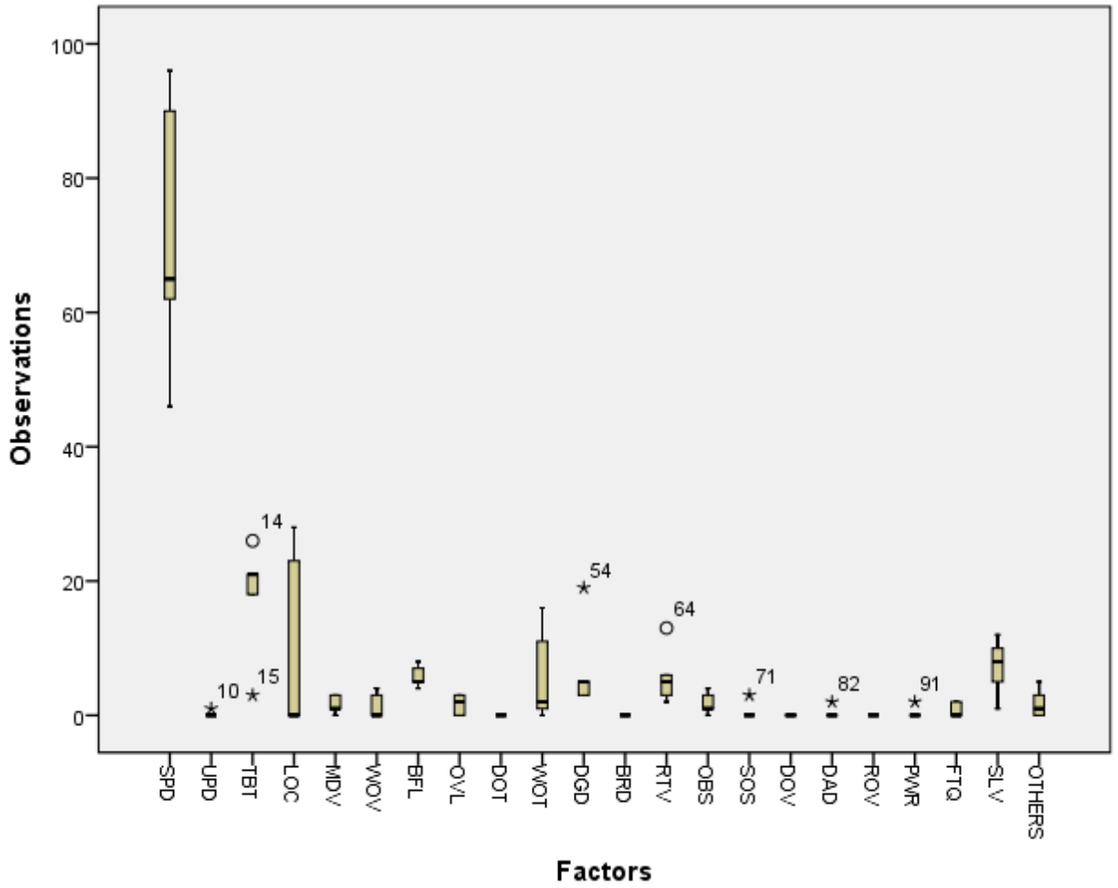
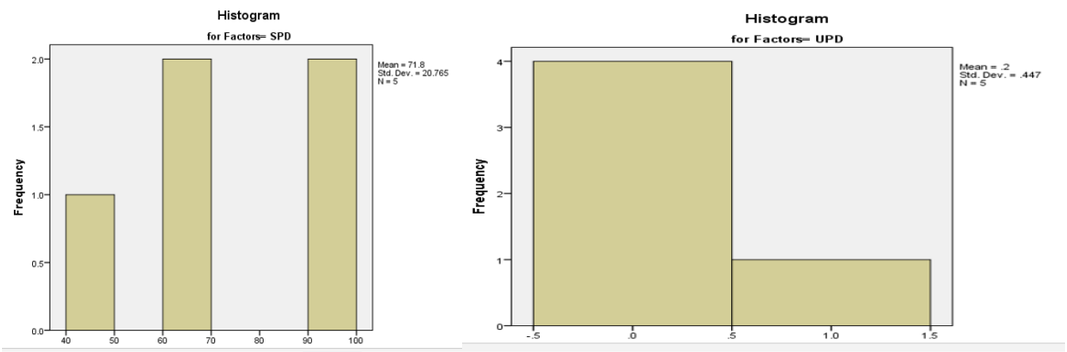
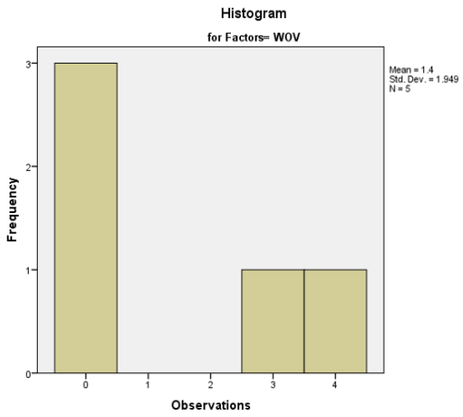
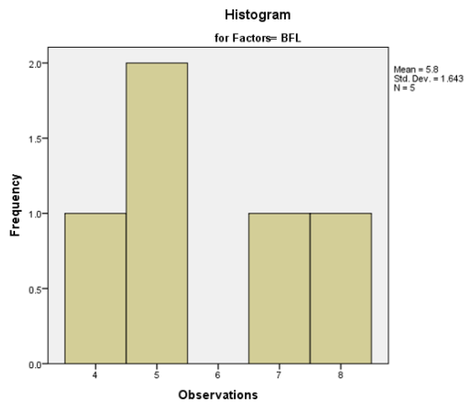


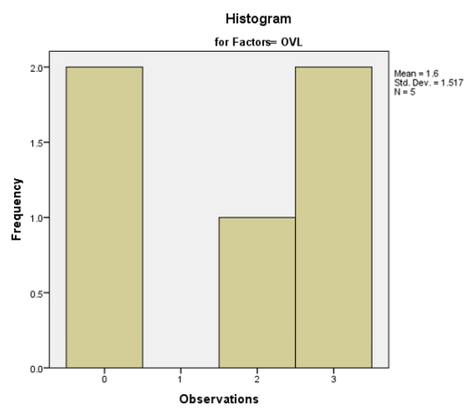
Figure 3.1: Boxplot Showing crashes by the Causative Factors in Delta State (2016-2020)

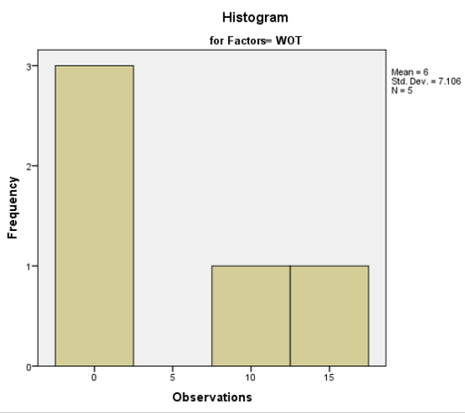
Source: SPSS Output

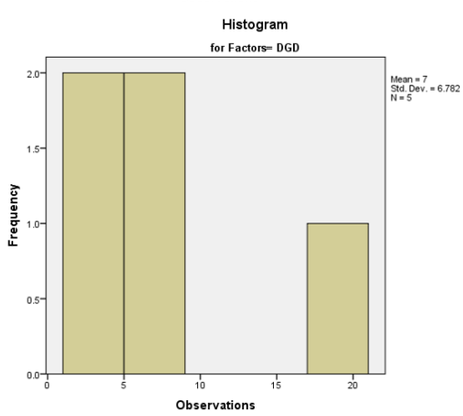


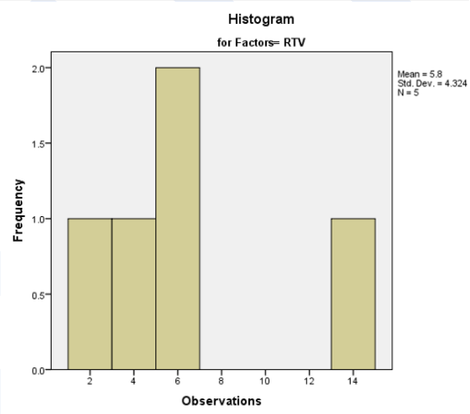

Histogram
for Factors= WOV
Mean = 1.4
Std. Dev. = 1.949
N = 5
Frequency
Observations


Histogram
for Factors= BFL
Mean = 5.8
Std. Dev. = 1.643
N = 5
Frequency
Observations


Histogram
for Factors= OVL
Mean = 1.6
Std. Dev. = 1.517
N = 5
Frequency
Observations


Histogram
for Factors= WOT
Mean = 6
Std. Dev. = 7.106
N = 5
Frequency
Observations


Histogram
for Factors= DGD
Mean = 7
Std. Dev. = 6.782
N = 5
Frequency
Observations


Histogram
for Factors= RTV
Mean = 5.8
Std. Dev. = 4.324
N = 5
Frequency
Observations

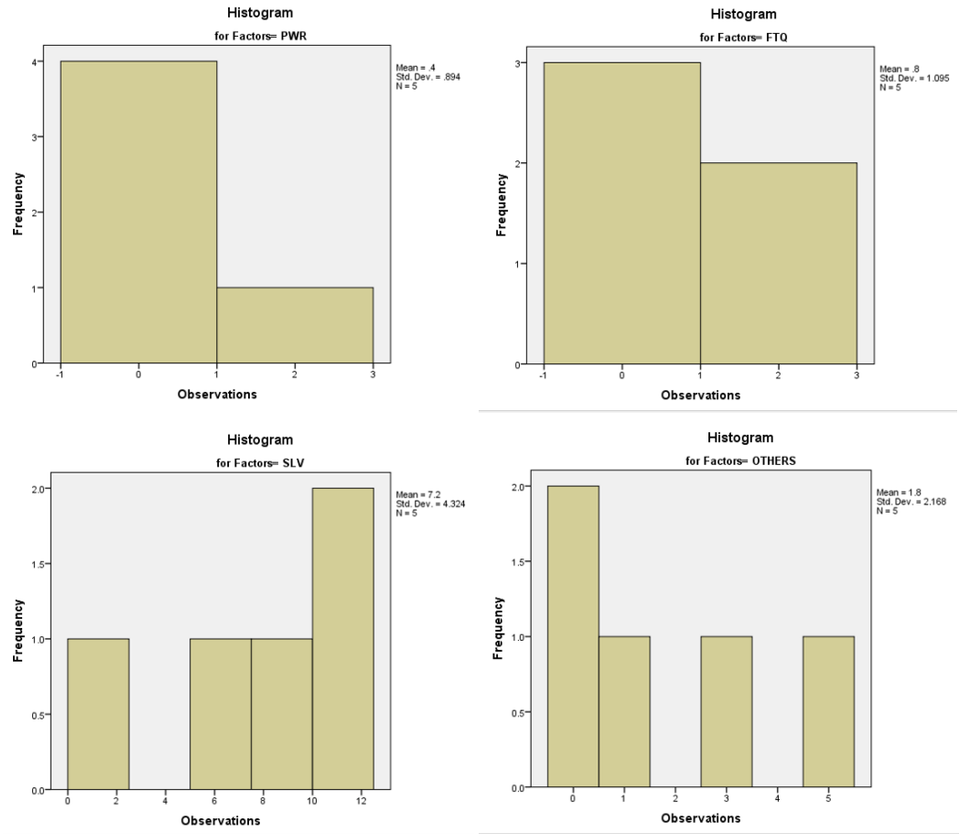


Figure 3.3: Histogram data distribution of causative factors of RTA in Delta State (2016-2020)

The p values obtained from Table 3.2 in respect of Shapiro-Wilk and Kolmogorov-Smirnov tests show that several factors are not normally distributed, (p value< 0.05). Further, the Boxplot (figure 3.2) and Histogram (figure 3.3) data distribution shape does not look normal. The Kruskal-Wallis non-parametric test will be appropriate for analyzing the differences among the causative factors of road traffic accidents in Delta State for the period under review.

SPSS Output of Kruskal-Wallis Test

Table 3.3: Ranks

	Factors	N	Mean Rank
Observations	SPD	5	108.00
	UPD	5	32.50
	TBT	5	95.90
	LOC	5	57.50
	MDV	5	57.30
	WOV	5	46.80
	BFL	5	87.30
	OVL	5	52.80
	DOT	5	26.50

	WOT	5	68.00
	DGD	5	83.80
	BRD	5	26.50
	RTV	5	82.10
	OBS	5	58.80
	SOS	5	35.90
	DOV	5	26.50
	DAD	5	34.00
	ROV	5	26.50
	PWR	5	34.00
	FTQ	5	41.50
	SLV	5	85.00
	OTHERS	5	53.80
	Total	110	

Table 3.3: Test Statistics[a,b]

	Observations
Chi-Square	74.004
Df	21
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: Factors

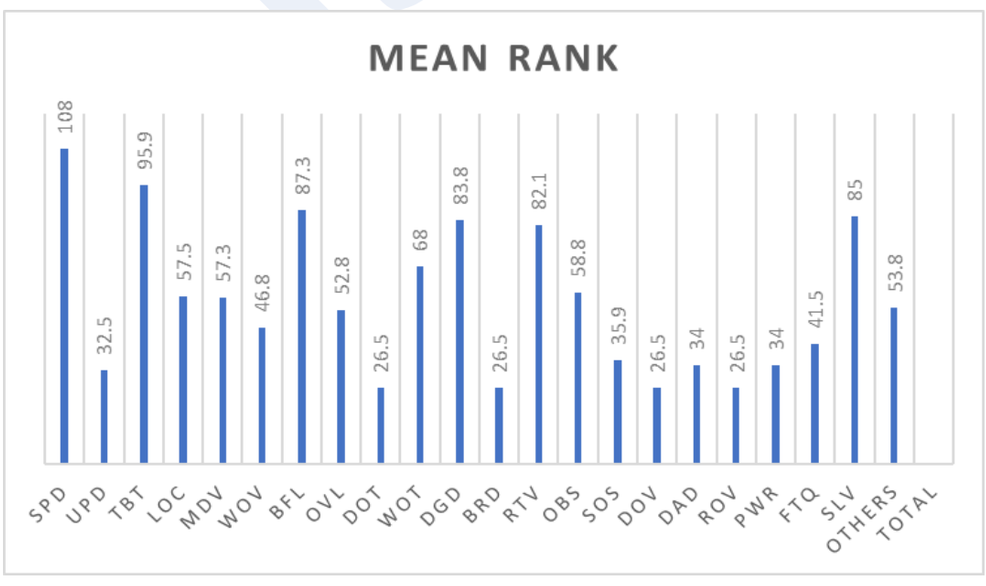


Figure 3.4: Bar chart of mean ranks of the causative factors of RTA in Delta State (2016-2020)

3.4 Discussion of Results

Table 3.3 Chi-square test statistics show that the p-value for causative factors is 0.00 which is less than 0.05, therefore, the null hypothesis is rejected implying that there is a significant difference between the causative factors. To identify the factor that emerges highest, the Mean Rank of Table 3.2 and Bar chart of Figure 3.4 shows that SPD-speed violation emerges highest cause of road traffic crashes with a mean rank of 108 followed by TBT-Tyre Burst with of 95.9 next is BFL-Break failure 87.3 while the least are DOT-Dangerous overtaking, BRD-Bad Road, DOV-Road obstruction violation and ROV-Road violation all have the mean rank of 26.5 respectively.

4.0 Conclusion and recommendation

In this work, Kruskal-Wallis non-parametric test was used to analyze the relative influence of causative factors on road crashes in Delta State. The study used secondary data related to causative factors of road traffic accidents in Delta State for the period 2016 - 2020 acquired from the National Bureau of Statistics and Federal Road Safety Corporation (FRSC). In line with the aim of the study, findings revealed that causative factors such as Speed violation, Tyre burst and Break failure as well as neglect by the government attributed to lack of repairs and maintenance by the government have led to road traffic accidents along the highway.

Based on the findings the study recommends that the relevant ministry and federal road safety corps (FRSC) and its agencies should aggressively engage in sensitization campaigns on the identified causative factors of road traffic crashes. And Government at all levels should always repair or fix bad portions of the highways. However, this study could be extended to other states in Nigeria or neighbouring states to explore other perspective(s).

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