International Journal of Maritime and Interdisciplinary Research
©2022 IJMIR/VOL.3, Issue:15/December/2022| ISSN: 2734-3286.
Journal homepage: www.ijmir.edu.ng

Statistical Analysis of Crash Fatalities in Nigeria Based on Gender and Vehicle Types

[1]Awariefe, C and [2]Ekruyota, G.

1 Department of Statistics, Delta State University of Science and Technology, Ozoro
2 Department of Computer Science, Delta State University of Science and Technology, Ozoro
Email: awariefec@gmail.com and G. O. softsystem@gmail.com

Abstract

The focus of this study is to analyze the relative outcome of crash fatalities based on gender, age, and type of vehicle of road users in Nigeria. Data related to road fatalities in Nigeria for the period 2016 - 2020 were acquired from the National Bureau of Statistics and Federal Road Safety Commission (FRSC). The data were analyzed with the Two-Way ANOVA and Independent Samples tests using IBM Statistical Package for Social Science (SPSS) software. Evidence from the data analysis shows that for gender, the male has higher reported cases of persons injured and killed in road traffic crashes in Nigeria than female for the period under review. Also, based on age, the adult has higher cases of both persons injured and killed than children. Furthermore, on the vehicles involved in road traffic crashes, cars were reported to be the major type of vehicles involved in road crashes followed by motorbikes, Minibuses, and Trucks. Lastly, data on the category of vehicles involved in road crashes shows that commercial vehicles reported higher crashes than other categories followed by private vehicles. The study recommends amongst others, that the government at all levels should introduce road education in Nigeria's system of education and pay more attention to the maintenance of highways and roads in general for the safe use of the citizens.

Keywords: *Road Traffic Accident, Randomized Complete Block Design, Two-Way ANOVA, Shapiro-Wilk Test, Levene Test, and Independent Samples Test.*

1.0 Introduction

Eze (2012) described road traffic accidents (RTAs) as a situation whereby a vehicle crashes with another vehicle, pedestrian, animal, road debris, or another immobile barricade. Globally, RTAs lead to death and disability as well as financial cost to both society and the individual involved. Motor vehicle accidents are the leading cause of death in adolescents and young adults worldwide. Yousefzadeh-Chabok *etal* (2016) identified RTAs are the main cause of injuries and fatalities around the world. According to the World Health Organization (WHO), approximately 1.2 million people are killed and up to 50 million are injured annually due to road traffic accidents.

The road traffic accident situation in Nigeria over the last three decades has been very alarming. Atubi (2009) inferred that in 1976, there were 53,897 road traffic accidents resulting in 7,717 deaths. Although in 1981, the magnitude reduced to 5,114 accidents, the fatality increased to 10,236 which means that there was an average of 96 accidents, and the situation in subsequent years has not been any better. The number of people killed in road accidents between 1990 and 2005 rose from 28,253 and the fatality rate remains consistently high. According to World Bank (2017), Nigeria has been ranked second-highest in the rate of road accidents among 193 countries in the world. This phase of ranking has drawn the attention of various researchers to examine the causes and effects of this problem in Nigeria.

Gebretensay and Juremalani (2018) posited that if the current trends continue, road traffic accidents are estimated to be the third top contributor to the global burden of disease and injury by 2020 and beyond. According to Peden (2005), the burden of mortalities, disabilities, and injuries due to traffic accidents have a large effect on the health and on the social and economic developments of many nations, especially low and middle-income countries. Blattenberger *etal* (2013) examined several factors that contribute to motor vehicle accidents and associated road fatalities over the last two decades. Generally, these factors can be grouped into three categories: those associated with vehicles such as technology and design characteristics; those associated with roadways such as speed limits; and those associated with drivers themselves, such as alcohol consumption and seat -belt usage.

Atubi (2010) compared road traffic fatalities between Nigeria and some countries, the chance of a vehicle killing someone in Nigeria is 47 times higher than in Britain. The proportion of fatalities to injuries reported is also very high. For Nigeria it is one death in 2.65 accidents while Czech Republic has only one death in 197 accidents, France one death in 175, South Africa, one death in 47 accidents. Bobai and Abarshi (2014) analyzed the trend of road traffic accidents in Nigeria for a period of six years; from 2007 to 2012. The study observed that in Nigeria the trend of RTAs was on the increase with serious fatal crashes, which is about 79.7 percent fatality rate. Only 21.3 percent of the crashes were minor. It was also discovered that 159,086 persons were killed or injured in 47,036 accidents. This indicates that, on the average three persons were either killed or injured in every accident. Hassouna and Pringle (2019) investigated crash fatalities data in Australia from 1965 to 1985 based on gender, causes of crash fatalities, and type of road users and compared their results with global averages and also develop an autoregressive integrated moving average (ARIMA) predictive model to forecast future annual crash deaths. On the analysis based on gender, the rate of male road fatalities in Australia was significantly higher than the rate of female road fatalities for all years for the period 2014-2017; this higher male road fatalities rate was greater than 70 percent for years under study.

Road traffic accidents in Nigeria and other less developed economy is one of the most serious challenges that require a realistic solution. Due to the difficulty in addressing the problem caused by motor accidents, the Nigerian government established Federal Road Safety Commission in 1988 to tackle the death and damage on highways and roads.

To enable road users and the Federal Road Safety Corporation to understand probable means or ways of reducing auto-crash and loss of lives on Nigeria roads and for government to implement policies that will reduce the occurrence of road accidents in Nigeria, there is need to undertake statistical analysis of the outcome of crash fatalities based on gender, age, and type of vehicle of road users in order to proffer solution to the problem.

Though similar studies have been carried out on RTA in Nigeria and other part of the universe, this paper reports yet another input to the types of research works described above; that is, research efforts directed towards the study of the outcomes of crash fatalities in Nigeria. Consequently, the main thrust of this paper is to investigates the relative outcomes of crash fatalities based on gender, age, and type of vehicle of road users in Nigeria in order to inform policy recommendations. The rest of paper is structured as follows: section 2 illustrates the data and methodology for the study. Section 3 presents data analysis and discuss of results while section 4 presents the concluding remarks and recommendations.

2.0 Material and methods

This study was executed to investigate the relative outcome of the occurrence of crash fatalities in Nigeria with focus on factors such as gender, age, and type of road users in Nigeria. This focus therefore will limit the findings of this study.

2.1 Source of Data for the Study

The information used in this study is based on a variety of sources. Data related to RTAs in Nigeria for the period 2016- 2020 were acquired from the National Bureau of Statistics and Federal Road Safety Corporation (FRSC).

2.2 Data Analysis Methods

The data was analyzed with Mann-Whitney U Test and Kruskal Wallis non-parametric tests using IBM Statistical Package for Social Science (SPSS) software.

Non-parametric tests are alternative approach which assume that data don't necessarily have to follow normal distribution, in this approach, the data are usually count data, sometimes the data are ranked. These tests are utilized because fewer assumptions about the distribution of the data are not required.

2.2.1 The Randomized Complete Block Design (RCBD)-Without Interaction

A randomized complete block design without interaction is known as a Two-Way Analysis of Variance (Two-Way ANOVA). It is an experimental design where each observation is categorized by a treatment that it receives and by the block to which it belongs. A two-way ANOVA test reveals the results of two independent variables on a dependent variable. The is used to establish whether or not there is a statistically significant difference between the means of three or more independent groups using the F-distribution.

The Assumptions of the Two-Way ANOVA Test

I. **Normality** – The observations or response variables have to be approximately normally distributed for each group.
II. **Homogeneity of Variances** – The variances for each group should be equal. That is, the error term is normal with mean zero and constant variance. E(ε_{ij}) = 0, Var (ε_{ij}) =σ_e^2.
III. **Independence** – The observations in each group are independent of each other and the observations within groups were obtained by a random sample. That is, all the random variables in the model have to be independently distributed.

The Linear Model of Two-Way ANOVA

The model of a Two-Way ANOVA is given as:

$$Y_{ij} = \mu + T_i + B_j + \alpha_{ij}: \begin{cases} i = 1,2 \ldots \ldots .. t \\ j = 1,2 \ldots \ldots .. b \end{cases} \quad (2.1)$$

where:

Y_{ij} = observation

μ = common mean

T_i = the ith treatment effect

B_j = the jth block effect

α_{ij} = the residuals, the deviations of each observation from their expected values.

$\alpha_{ij} \sim (0, \sigma_\alpha^2)$,

The Sum of Squares of Two-Way ANOVA

The purpose of a Two-way ANOVA is to **split the total variation of a dependent variable, Y**, which

is measured as Sums of Squares into different sources of variation. Sum of squares are squared deviation from the mean Patel (2015).

Formulas to Compute Sum of Squares (SS) of the Two-Way ANOVA model

$$SS_{Total} = \sum_i^t \sum_j^b Y_{ij}^2 - \frac{Y_{..}^2}{bt} \quad (2.2)$$

$$SS_{Treatment} = \frac{\sum_i^t Y_{i.}^2}{b} - \frac{Y_{..}^2}{bt} \quad (2.3)$$

$$SS_{Block} = \frac{\sum_j^b Y_{.j}^2}{t} - \frac{Y_{..}^2}{bt} \quad (2.4)$$

$$SS_{Error} = SS_{TOTAL} - SS_{Block} - SS_{TRT} \quad (2.5)$$

The Mean Squares (MS)

$$MS_{Block} = \frac{SS_B}{b-1} \quad (2.6)$$

$$MS_{Treatment} = \frac{SS_{TRT}}{t-1} \quad (2.7)$$

$$MS_E = \frac{SS_E}{(t-1)(b-1)} \quad (2.8)$$

where: b-1= degrees of freedom for block; t-1=degrees of freedom for treatment; $(t-1)(b-1)$ =degrees of treatment for error.

The Way ANOVA F-Test Statistics

$$F_{ratio} \text{ (Treatment)} = \frac{MS_{Treatment}}{MS_E} \quad (2.9)$$

$$F_{ratio} \text{ (Block)} = \frac{MS_{Block}}{MS_E} \quad (3.0)$$

Test of Hypothesis:

$\boldsymbol{H_0}: \mu_1 = \mu_2 =, \dots \dots .. = \mu_n$ (There are no significant differences between the groups)

$\boldsymbol{H_1}: \mu_1 \neq \mu_2 \neq, \dots \dots .. \neq \mu_n$(There are significant differences between the groups)

Decision Rule: The null hypothesis is rejected for level of significance (α) if the value of F_{ratio} is greater than the critical value obtained from the F distribution. Alternatively, the null hypothesis is rejected if the p-value is less than the significance level (α).

Testing Normality Assumption

Normality assumption can be determined using Shapiro–Wilk (SW) test. The SW test is a test of normality in frequent statistics. It was published by Shapiro and Wilk (1965). The Shapiro–Wilk test uses the null hypothesis principle to verify whether a sample $x_1, x_2, \ldots, x_n$ came from a normally distributed population. The sample is normally distributed when p-value for Shapiro-Wilk test is greater than (>) 0.05.

Testing Equality of Variances Assumption

The equality of variances across each group can be evaluated using the Levene Test. Homogeneity of variances is achieved when p-value for Levene statistic is greater than (>) 0.05

2.2.2 The Independent Samples T-test

Independent samples t-test is a statistical procedure used to compare the difference between means of two independent groups or populations. The test is parametric test that is used by researchers to compare the statistical differences between the means of two populations or groups in order to determine whether there is statistical proof that the associated population means are significantly different. The statistical null hypothesis states that the two population means equal.

$H_0: \mu_1 = \mu_2 \rightarrow \mu_1 - \mu_2 = 0$ (There are no significant differences between the group one and two)

$H_1: \mu_1 \neq \mu_2$ (two tailed) (There are no significant difference between the group one and group two)

Assumptions of Independent T- test are:

(i) For The independent samples or groups, there should be no relationship between subjects in each sample, that is, the subject in first group cannot be in the second group, the subject in either group should not influence each other.

(ii) The populations sampled are normally distributed, if the samples are large enough, that is, n> 30 violation of normality may still yield accurate results.

(iii) Homogeneity of variances (Homoscedasticity), that is, variances should be equal across the groups or populations.

(iv) No presence of outliers in the sample data

When one or more of the assumptions are violated, the test can be carried out using the non-parametric test known as Mann-Whitney U – Test. When the sample size is less than 30 and the population variance is unknown the test statistic is computed by the following equation:

$$t_{cal} = \frac{\bar{Z}_1 - \bar{Z}_2}{v_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \sim \text{t distribution with } n_1 + n_2 - 2 \text{ degrees of freedom} \qquad (3.1)$$

$$v_p^2 = \frac{v_1^2(n_1-1)+v_1^2(n_1-1)}{n_1+n_2-2} \rightarrow \text{pooled variance} \qquad (3.2)$$

where: $\bar{Z}_1$ = mean of group one; $\bar{Z}_2$ = mean of group two; v_1^2 = sample variance of group one; v_2^2 = sample variance of group two; n_1 = sample size of group one; n_2 = sample size of group two.

The critical value for the test is: $t_{(n_1+n_2-2)\alpha/2}$. The value is obtained from the t distribution table.

Decision Rule: The null hypothesis (H_0) is rejected for level of significance (α), if the absolute value $t_{cal} >$ critical value of $t_{\frac{\alpha}{2}}$ for two tailed tests. That is, we reject (H_0) if $|t_{cal}| > t_{(n_1+n_2-2)^{\alpha}/_2}$. Alternatively, the null hypothesis is rejected if the p-value is less than the significance level (α).

3.0 Data presentation and analysis

In this study, data for road fatalities for the period 2016-2020 were analyzed according to gender, age, type of vehicles involved, and category of vehicle.

3.1 Data Presentation

The data for this study regarding crash fatalities for the period 2016-2020 in Nigeria roads based on sex/age distribution of those injured and killed, type of vehicles involved, and category of vehicle is summarized in tables 1 to 4 respectively.

Table 1: Sex Distribution of Persons Injured (2016-2020)

(Year)	Male	Female	Adult	Child
2016	22,705	7400	28,250	1,855
201	16,693	5,729	21,079	1,343
2018	19,003	6,306	23,534	1,775
2019	27,120	8,861	33,831	2,150
2020	10,437	2,749	12,052	1,134

Source: National Bureau of Statistics 2021

Table 2: Sex Distribution of Persons Killed (2016-2020)

Frequency (Year)	Male	Female	Adult	Child
2016	3,970	1,083	4,496	357
2017	2,856	799	3,388	267
2018	3,264	897	3,865	296
2019	4,255	1,228	5,059	424
2020	1701	390	1964	127

Source: National Bureau of Statistics 2021

Table 3: Number of Vehicles Involved in Road Traffic Crashes in Year 2016-2020

Year	Bicycle	Motor	Tricycl	Car	SUV	Van	Mini	Lux	Pick	Truck	Tan	Trailer	Othe

		Bike	e				Bus	Bus	-up		Ker		rs
2016	41	3123	461	5310	557	61	2877	68	441	1637	359	657	90
2017	41	2840	411	5061	494	30	2954	55	456	1732	308	624	74
2018	29	2199	293	3922	368	22	2441	52	370	1425	233	524	45
2019	32	3,488	613	5,479	546	36	3,389	42	498	2,214	364	722	77
2020	18	1,918	362	2439	241	27	1248	10	203	1144	173	383	61

Source: National Bureau of Statistics 2021

Table 4: Category of Vehicles involved Road Traffic crashes (RTC) (2016-2020)

Year	Private	Commercial	Government	Diplomat
2016	6521	8876	270	15
2017	6,000	8,886	189	5
2018	4580	7184	156	3
2019	5972	11319	204	5
2020	3,015	5,111	100	1

Source: National Bureau of Statistics 2021

3.2 Data Analysis

In this study, crash fatalities data were analyzed according to several factors, including sex/age distribution of those injured and killed, type of vehicles involved, and category of vehicle. All the data were analyzed with Two-Way ANOVA and Independent Samples parametric tests using IBM Statistical Package for Social Science (SPSS).

3.2.1 Normality test of Vehicles Involved In RTA

Table 5: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Bicycle	.221	5	.200*	.901	5	.418
Motorbike	.186	5	.200*	.954	5	.767
Tricyle	.192	5	.200*	.962	5	.821
Car	.286	5	.200*	.854	5	.209
SUV	.252	5	.200*	.881	5	.315
Van	.279	5	.200*	.844	5	.177

Minibus	.241	5	.200*	.894	5	.378
LuxBus	.238	5	.200*	.909	5	.463
Pickup	.258	5	.200*	.872	5	.274
Truck	.199	5	.200*	.979	5	.930
Tanker	.206	5	.200*	.902	5	.419
Trailer	.225	5	.200*	.947	5	.717
Others	.206	5	.200*	.975	5	.909

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

a. Lilliefors Significance Correction

Source: SPSS Output

The p values obtained from Table 5 in respect of Shapiro-Wilk and Kolmogorov-Smirnov tests shows that all the factors are normally distributed, (p value> 0.05). Therefore, the parametric ANOVA Test will be appropriate since the normality assumption is satisfied.

Test of Homogeneity of Variances

Table 6: LOGObservations

Levene Statistic	df1	df2	Sig.
.882	12	52	.570

Source: SPSS Output

The Levene test of equality of variance for logarithm transformation of the RTAs observations in Table 1 satisfied the ANOVA parametric test of Homogeneity of variance across each group.

Univariate Analysis of Variance

Tests of Between-Subjects Effects

Table7: Dependent Variable-LOGObservations

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	Hypothesis	420.852	1	420.852	1801.617	.000
	Error	.934	4	.234[a]		
RTA	Hypothesis	33.820	12	2.818	312.400	.000
	Error	.433	48	.009[b]		
Year	Hypothesis	.934	4	.234	25.893	.000

Error	.433	48	.009[b]		

a. MS(Block1)

b. MS(Error)

Source: SPSS Output

The Hypothesis test summary in Table 7 reveals that there is significant difference between distribution of RTAs across categories of Vehicle involved (p-value< 0.05). Therefore, mean plot in Figure and Post Hoc test is used to determine the vehicle involved with the highest cause of RTA (see Table 8).

LOG Observations1

Table 8: Scheffe

Treatment t	N	Subset					
		1	2	3	4	5	6
Bicycle	5	1.4897					
Van	5	1.5185					
Luxbus	5	1.5824	1.5824				
Others	5		1.8297				
Tranker	5			2.4420			
Pickup	5			2.5753	2.5753		
Tricycle	5			2.6181	2.6181		
SUV	5			2.6249	2.6249		
Trailer	5				2.7548		
Truck	5					3.2020	
Minibus	5					3.3886	3.3886
Motorbike	5					3.4231	3.4231
Car	5						3.6298
Sig.		.998	.193	.675	.702	.360	.227

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = .009.

a. Uses Harmonic Mean Sample Size = 5.000.

b. Alpha = .05.

Source: SPSS Output

Table 8: Scheffe

Treatmentt	N	Subset					
		1	2	3	4	5	6
Bicycle	5	1.4897					
Van	5	1.5185					
Luxbus	5	1.5824	1.5824				
Others	5		1.8297				
Tranker	5			2.4420			
Pickup	5			2.5753	2.5753		
Tricycle	5			2.6181	2.6181		
SUV	5			2.6249	2.6249		
Trailer	5				2.7548		
Truck	5					3.2020	
Minibus	5					3.3886	3.3886
Motorbike	5					3.4231	3.4231
Car	5						3.6298
Sig.		.998	.193	.675	.702	.360	.227

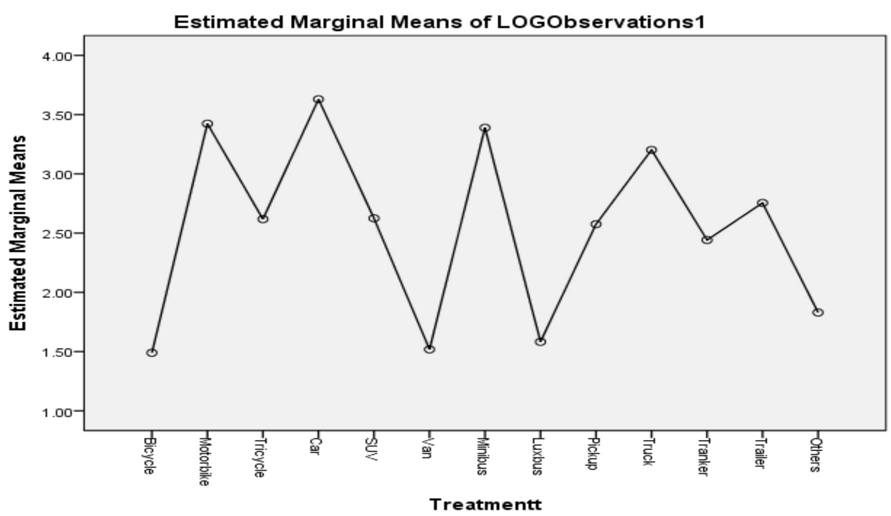

Figure 1: Estimated mean plots of the RTAs observations in respect of Vehicle category.

Source: SPSS Output

Table 8 and Figure 1 shows that Cars, Minibus and Motorbike have the highest reported cases of RTAs for the period under study. (2016-2020).

3.2.2 Normality Test for Category of Vehicles Involved In RTA

Table 9: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
LogPrivate	.306	5	.141	.838	5	.159
LogCommercial	.236	5	.200*	.948	5	.722
LogGovernment	.185	5	.200*	.966	5	.851
LogDiplomat	.218	5	.200*	.961	5	.814

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

a. Lilliefors Significance Correction

Source: SPSS Output

The p values obtained from Table 9 in respect of Shapiro-Wilk and Kolmogorov-Smirnov tests shows that all the factors are normally distributed, (p-value> 0.05). Therefore, the parametric ANOVA Test will be appropriate since the normality assumption is satisfied.

Test of Homogeneity of Variances

Table 10: LogObservation

Levene Statistic	df1	df2	Sig.
2.053	3	16	.147

Source: SPSS Output

The Levene test of equality of variance for logarithm transformation of the RTAs observations in Table 10 satisfied the ANOVA parametric test of Homogeneity of variance across each group.

3.2.3 Univariate analysis of variance

Tests of Between-Subjects Effects

Table 11: Dependent Variable-LogObservation

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	Hypothesis	136.692	1	136.692	803.241	.000
	Error	.681	4	.170[a]		
treatment	Hypothesis	34.992	3	11.664	482.652	.000
	Error	.290	12	.024[b]		
Block	Hypothesis	.681	4	.170	7.042	.004
	Error	.290	12	.024[b]		

a. MS(block)
b. MS(Error)

The Two-ANOVA Test in Table 11 reveals that there is significant difference between distribution of RTAs across categories of Vehicle involved (p-value< 0.05). Therefore, mean plot in Figure 2 and Scheffe Post Hoc Test is used to determine the vehicle involved with the highest cause of RTA .

Table 12: Scheffe Post Hoc Test

LogObservation

	treatment	N	Subset 1	Subset 2	Subset 3
Scheffe[a,b]	Diplomat	5	.6102		
	Government	5		2.2421	
	Private	5			3.7017
	Commercial	5			3.9031
	Sig.		1.000	1.000	.291

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square(Error) = .024.

a. Uses Harmonic Mean Sample Size = 5.000.
b. Alpha = 0.05.

Profile Plots

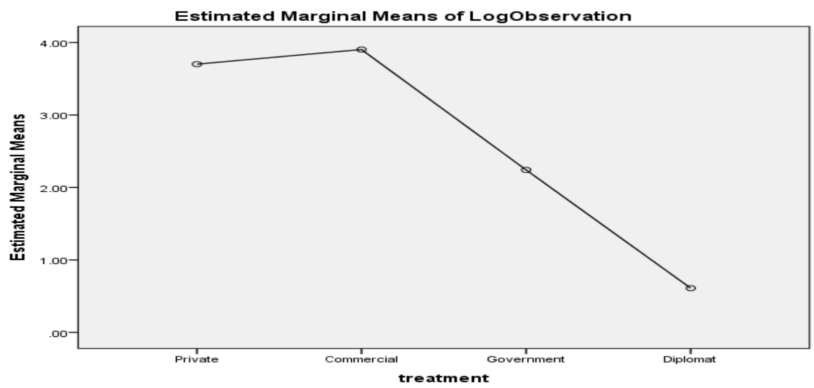

Figure 2: Mean plots of the Category of Vehicle

Table 12 and Figure 2 shows that Commercial and Private category of vehicles have the highest reported cases of RTAs for the period under study. (2016-2020).

3.2.4 Independent sample test (sex of persons Injured by RTA)

Table 13: Test of Normality for Sex of Persons Injured by RTA

	Shapiro-Wilk test for Persons Injured		
	Statistic	df	Sig (p-value)
Male	0.994	5	0.993
Female	0.965	5	0.843
Adult	0,988	5	0.971
Child	0.955	5	0.774

Source: SPSS Output

The p values obtained from Table 13 in respect of Shapiro-Wilk test shows that the male, female, adult and child data are normally distributed, (p-value> 0.05). Therefore, the parametric Independent Samples Test will be appropriate since the normality assumption is satisfied.

Table 14: Group Statistics for (Sex of Persons Injured by RTA)

	Group	N	Mean
RTAs	Male	5	19191.600
	Female	5	6209.00
RTAs	Adult	N	3754.400
	Child	N	294.200

Source: SPSS Output

Table 15: Independent Samples Test for (Sex of Persons Injured by RTA)

	Levene Test for Equality of Variance	T-test for equality of Means

	(Equality of variance assumed)			
	F-statistic	Sig	t-statistic	Sig(2-tailed)
RTAs (Male-Female)	2.922	0.126	4.342	0.002
RTAs (Adult-Child)	0.279	0.615	12.545	0.000

Source: SPSS Output

The Levene test of equality of variance for logarithm transformation of the RTAs observations in Table 15 satisfied the parametric test of Homogeneity of variance across each group. The test of equality means in Table 15 reveals that the distribution of persons injured is not the same across categories of sex ($p < 0.05$). Therefore, the mean of the group statistics in Table 14 is used to determine the category with the highest injured . Male has higher persons injured than the female for the peroid under study (2016-2020). Also, adult has higher person injured than child as shown in Table 14.

3.2.5 Independent Sample Test (Sex of Persons Killed by RTA)

Table 16: Test of Normality for Sex of Persons Killed by RTA

	Shapiro-Wilk test for Persons Injured		
	Statistic	df	Sig (p-value)
Male	0.949	5	0.729
Female	0.956	5	0.780
Adult	0,964	5	0.837
Child	0.970	5	0.876

Source: SPSS Output

The p values obtained from Table 16 in respect of Shapiro-Wilk test shows that the male, female, adult and child data are normally distributed, (p-value> 0.05). Therefore, the parametric Independent Samples Test will be appropriate since the normality assumption is satisfied.

Table 17: Group Statistics for (Sex of Persons Killed by RTA)

	Group	N	Mean
RTAs	Male	5	3209.2000
	Female	5	879.4000
RTAs	Adult	N	3754.400
	Child	N	294.200

Source: SPSS Output

Table 18: Independent Samples Test for (Sex of Persons Killed by RTA)

	Levene Test for Equality of Variance (Equality of variance assumed)		T-test for equality of Means	
	F-statistic	Sig	t-statistic	Sig(2-tailed)
RTAs (Male-Female)	3.675	0.092	4.920	0.001
RTAs (Adult-Child)	0.104	0.756	9.724	0.000

Source: SPSS Output

The Levene test of equality of variance for logarithm transformation of the RTAs observations in Table 18 satisfied the parametric test of Homogeneity of variance across each group. The test of equality means in Table 18 reveals that the distribution of persons killed is not the same across categories of sex ($p < 0.05$). Therefore, the mean of the group statistics in Table 17 is used to determine the category with the highest injured . Male has higher persons killed than the female for the peroid under study (2016-2020). Also, adult has higher person killed than child as shown in Table 17.

3.3 Results and discussion

From the data analysis based on gender, the male has higher reported cases of persons injured and killed in road traffic crashes in Nigeria than female for the period under review. Also, based on age, adults have higher cases of both persons injured and killed than children. Furthermore, on the vehicles involved in road traffic crashes Cars were reported to be the major type of vehicles involved in road crashes followed by Motorbike, Minibuses, and Truck respectively for total vehicles involved in road traffic accidents for the period 2016-2020. Lastly, Data on the category of vehicles involved in road crashes reflected that commercial caused the highest RTAs followed by private and the least is diplomat's vehicles.

4 Conclusion and recommendation

In this study, crash fatalities data were analyzed according to several factors, including gender, age, category of vehicle, and type of road users. The data were analyzed with the Two-Way ANOVA and Independent Samples parametric tests using IBM Statistical Package for Social Science (SPSS) software. Based on factors of age, gender, and vehicle involved and category of vehicle, and using annual road fatalities for the period 2016-2020, conclusions are given as follows:

On gender, the rate of male road fatalities in Nigeria was significantly higher than the rate of female road fatalities for all years. This result was consistent with that of Hassouna and Pringle (2019). Among the different types of road users, the drivers and passengers of cars, motorbikes, and Minibus, Truck vehicles had the highest rate of fatalities.

Based on the category of vehicle commercial and private vehicles had higher reported cases of road accident crashes compared to government and diplomat vehicles. Based on the findings obtained from this research, we recommend that, the government at all levels should introduce road education in Nigeria's system of education and pay more attention to the maintenance of highways and roads in general for the safe use of the citizens. Furthermore, the driving license should be issued in strict compliance with the government regulations and Motor Vehicles should be inspected to ensure their roadworthiness before registration.

3.0 References

Atubi, A.O. (2009) "Urban Transportation: An Appraisal of Features and Problems in the Nigerian Society". International Journal of Geography and Regional Planning. Vol.1, No 1, Pp. 58-62.

Atubi, A.O. (2010) Road Transport System Management and Traffic in Lagos, South Western Nigeria. *Journal of African Research Review*. Vol. 4, No. 4, Pp. 459-470.

Blattenberger, G., Fowles, R and Loeb, P.D. (2013) Determinants of motor vehicle crash fatalities using Bayesian model selection methods. *Res. Transp. Econ*., vol. 43, no. 1, pp. 112 122.

Eze, B. (2012) Road Traffic Accidents in Nigeria: A Public Health Problem. *AFRIMEDIC Journal*.3 (2).

Federal Road Safety Corps (2012). National Road Traffic Regulations. Lagos: Federal Government Press, Lagos, Nigeria

Gebretensay, F.B and Juremalani, J. (2018) Road Traffic Accident Analysis and Prediction Model: A Case Study of Vadodara City, *International Research Journal of Engineering and Technology*, vol.5, no.1, pp. 191-196.

Hassouna, F.M.A and Pringle, I (2019) Analysis and Prediction of Crash Fatalities in Australia. *The Open Transportation Journal*. 13, 00-3.

Peden, M. (2005) Global collaboration on road traffic injury prevention, *Int.J. Inj. Contr. Saf. Promot.* vol. 12, no. 2, pp. 85-9.

Shapiro, S. S and Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika* 52 (3–4): 591–611.

World Bank (2017). Accident Fatalities: A global burden.

Yousefzadeh-Chabok, S., Ranjbar-Taklimie, F., Malekpouri, R and Razzaghi, A (2016) A Time Series Model for Assessing the Trend and Forecasting the Road Traffic Accident Mortality, *Arch. Trauma Res.*, vol. 5, no. 3.