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Spatial Analysis of Accident Prone Areas of Ondo State, Nigeria.

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ABSTRACT

Road accident crashes seem to be concentrated on some particular points on our roads. This scourge has left many families with psychological trauma and pains. In the overall, Nigeria has been drained of many active manpower. It is in the realization of these that this study aimed at analyzing factors of accident at the accident prone areas in Ondo State, Nigeria.

The study adopted survey design method. Forty five (45) accident black spots formed the sample frame and 400 copies of structured questionnaire were administered to respondents in the study area. Simple random sampling technique was adopted to select respondents in the study area. Road accident factors at the identified accident high-risk zones were analysed using inferential statistical tools of Principal Component Analysis and Linear Regression Analysis on the data to validate the hypothesis raised which evolved a Road Traffic Accident (RTA) model for the study area.

The findings established that road related factors (steepness of hill, corners/ bend, narrow freeway, potholes) were largely responsible for accidents (F = 724.293 > F-tab 3.84; P> 0.05) in Ondo State.

In conclusion, the study revealed strength combination of road accident factors such as human, vehicle and environmental issues actually made the study area accident-ridden environment. The study's recommendation include regular seminars and workshops for members of the public as well as the commercial vehicle drivers on road safety campaign in the study area. Erections of road condition's signage in the accident black spots to serve as early warning in reducing the occurrences of road accident. Also, enforcement of road close order on some roads, such as Akungba-Isua and Akungba-Ikare roadways in the North Senatorial district of the study area because of its topographic constraints to vehicles.

Keyword: Road accident, road safety, black spot, spatial, diurnal difference

1.0 Introduction

Road accident is indisputably one of the major calamities man faces in the world today (Ogunbodede, Olurankinse, Olabode & Ale, 2018). Indeed, road accidents occur worldwide but the incidence is more in developing countries (FRSC, 2021; Agbonkhese, Yisa, Akanbi, Aka, & Mondigha, 2013). Road traffic injuries have been singled out as the leading causes of death among young people, aged 15 - 29 years (Bodunde, 2020; Aderamo, 2012). Research findings revealed 91% of the world's fatalities on the road accidents occur in low-income and middle-income countries, despite these countries have approximately half of the world's vehicles (Omar, Basil, Daniel, & Effendi, 2017; WHO, 2013) as peculiar to Nigeria. As mark of negative effects, Nigeria joined the rest of the world to commemorate with the safety efforts worldwide in sad reflection that over 39,000 Nigerians die from road crashes every year at the 5th United Nation Global Road Safety Week held in Abuja May, 2019 (The Guardian, 2019).

Federal Road Safety Commission report (2019), expressed that deaths and injuries resulting from road traffic crashes remained serious heart-breaking statistics. The FRSC released further details that Nigeria recorded 1,618 deaths from road accidents in three months between December, 2018 and February, 2019. In the same vein, Onyemaechi, (2019), asserts that road accident is a threat to public health and such the policy makers at the various levels of government need to recognize this growing problem as public health crisis. Instances of deadly road accidents are frequently reported in Nigeria, for instance, The Punch newspaper, (2021) reported a multiple road accident occurred on the Ayingba – Ajakuta highway on January 15, 2021 in Kogi State which had 14 feared death. In a related accident development, January 30, 2021 in Kwara State, 20 people reportedly died in a multiple road crash at Olokonla along Bode-Saadu-Jebba expressway.

1.1 Statement of Problem

Road accidents from studies have been recognized as one of the major problems in the world (Omar, et al., 2017). Road accident has impacts on the society, economy and progress of a country. Aside deaths, it maims and it is a source of litigations in Nigerian courts of law. However, the effects of road

crashes are enormous, it is not borne by the victims only but people who manage the survivors bear the potential consequences as medical cost, psychological trauma, and pains and in some cases increased insurance premiums (FRSC, 2021).

However, same geographical spot has remained a major cause of road accident nationwide in Nigeria (The Nation, 2019).Therefore, the spatial analysis of road traffic accident at the various accident prone areas of Ondo State road system is justifiable. For example, the report of National Bureau of Statistics (NBS) indicates the second quarter of 2018, Ondo State had a total road crashes of 114 with 825 people involved and not fewer than 397 persons fear death.

Consequently, Ogunbodede, *et al (*2018*)* revealed that road traffic accidents' mortality of Ondo State was ranked 6th position out of 36 states in Nigeria. In order to achieve development, Ondo State needs to minimize significantly road accident so as to increase the safety level of road users. FRSC, (2020) in African Road Safety Day and World Day for the remembrance traffic victims held on Sunday 21 November, (2020) commiserated with Ondo State that there were some road accident black spots in the state such as in Oka Akoko axis, Ore – Lagos expressway and Owo –Akure axis.

Therefore, the study is set to answer the questions of where are the locations where accident frequently occur and what are the factors responsible in the study area?

1.2 Objective of the Study

The aim of the study is to analyse the factors of accident of the accident prone areas in Ondo State, Nigeria.

The specific objectives are to:

i. Identify the accident black spots in the study area.

ii. Assess the factors of road accidents in the identified accident black spots.

1.3 Research Hypothesis

H_0: The interdependencies between road accidents and its causal factors are not statistically related.

1.4 The study area

Ondo State lies between latitude 5^{0}45' and 7^{0}52'North of Equator and longitude 4^{0}20' and 6^{0}05'East of Greenwich Meridian. Its land area is about 15,500 square kilometres. Ondo State is bounded in the East by Edo State and Delta States, in the West by Ogun and Osun States, in the North by Ekiti and Kogi States and to the South by Bight of Benin and the Atlantic Ocean respectively (Ondo State Annual Reports, 2020).

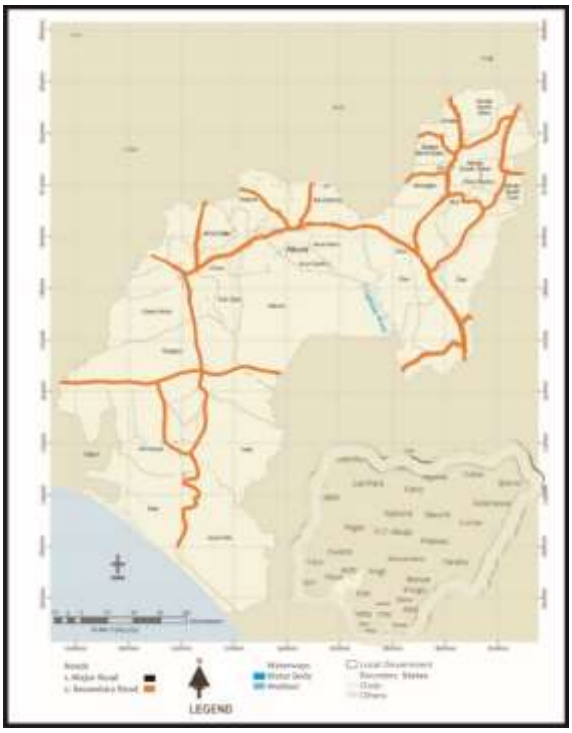

Fig. 1: Road Network of Ondo State
Source: Ondo State Annual Report, 2022.

2.0 Literature Review

2.0.1 Theoretical Perspective

This study draws well from the potentials and capability of Muhlrad and Lassaire, (2005) as reviewed by Omar, *et al (*2017) on systems theory whose explanations are based on the concept of risks and man-environment adjustments and maladjustments. The systems perspective views human performance in space as a function of many interacting system-wide factors. In the context of human error and accident causation, for example, it is now accepted that errors are a consequence of 'systems' failure rather than merely aberrant psychological factors within individuals (Bodunde, 2020). Human error is thus no longer always seen as the primary cause of accidents; rather, it is treated as a consequence of latent failures residing within the wider system (Ogunbodede, *et al* 2018).

In a road safety context, there are elements of the system for road users, such as vehicle design and condition, road design and condition, road policies, agency surveillance and so on, all shape drivers behaviour on the road. In addition, the systems-based models is the most prominent and it is now widely accepted that the accidents which occur in complex socio-technical systems are caused by a range of interesting human and systemic failures (Salmon & Lenne, 2009).

All in all, this study adopts system theory as its theoretical frame work. Superimposed on this model is a system of traffic 'laws, regulations and mode of enforcement designed, such that the road users adhere to road traffic controls and regulations so as to maintain some level of road safety (Fig.1). These include traffic rules, speed controls and convictions for various road offences (Jorgensen & Abane, 1999).

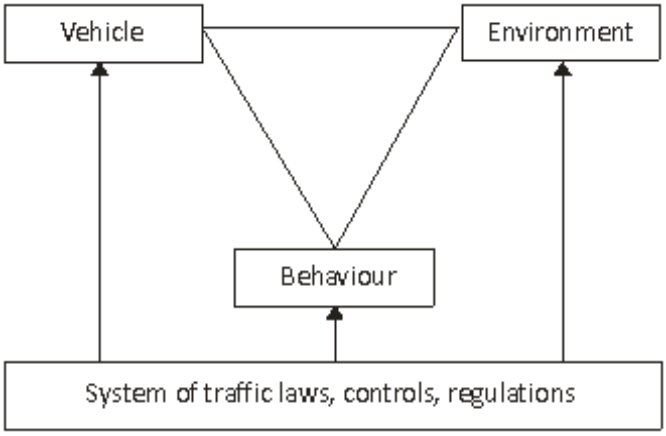

Fig. 2: A model for road traffic accident.

Source: Adapted from Jorgensen and Abane, 1999.

In addition, Risk theory has also been widely used in the description of accident causation (Aderamo, 2012, Bodunde, 2020). Risk can be defined as the effect of uncertainty on objectives set whether positive or negative. Its management is followed by coordinated economical application of resources to minimize, and control the probability and impact of unfortunate events (Emmanuel, (2016) or to maximize the realization of opportunities. Road traffic accidents risk, FRSC, ((2018) opines a function of four elements. The first is the amount of movement within the system by different users. The second is the underlying probability of crash, given a movement. The third is the probability of injury given a crash. The fourth element is the outcome of injury. Risk can also be explained by human error (Abayomi, (2017); tolerance of human body and post-crash care (Ogunbodede, *et a.,l 2018*).

In furtherance of the understanding of road accident causation premised on the derived demand of transport development, Ullman, (1956) cited in Bodunde, (2020) a three – factor concept typology of complementarity, intervening opportunities and transferability affect spatial interaction between places that equally propel accident occurrences.

2.0.2 Empirical Issue

Odinfono, et al., (2020) carried out a study on road characteristics and road traffic crashes along Akure-Owo highway in Ondo State by survey method. The data used was acquired on road characteristics from Road Traffic Crashes (RTC) black spots in the study area between 2012-2016. The study applied ArcGIS techniques and analysed the data with the application of linear regression. The findings reveled cluster pattern in the occurrences of RTC along the route (Moran's index =1, z =58, p = 0.00). The study concludes that road intersection, road curvature and steep slopes were largely responsible for accident along the route.

Similarly, Afolayan, et al., (2019) carried out a research in the evaluation of road traffic accidents along Akure –Owo, Ondo State with the application of questionnaire method. The study administered 180 copies of questionnaire to carry out the study. The findings revealed (52%) factors of accident attributed to vehicle issues.

In addition, Ogunbodede, et al., (2018) made contributions to road accident studies of Ondo State with particular emphasis on transport planning implications. The study adopted questionnaire method to provide solutions to accident occurrences in the high-risked zones. The concluding part of the study ranked Ondo State 6th place in accident vulnerability out of the 36 states of the federation.

However, on Road Traffic Accident (RTA) concept, Agbonkhese, (2013) studies classifies four basic factors in road traffic accident as cited in Bodunde, (2020) to include road, human, vehicle and environmental characteristics. The road related factors hinge on its specifications and infrastructure such as width of the freeway, intersection, bend, bridge and sloppiness. The human attributes are found in the driving behavours of the motorists. The vehicle factors are such linked with the vehicle conditions particularly in the component parts. The features of the road surrounding areas are considered as environmental factors; emphasis on weather, land use activities and vegetal cover.

3.0 Materials and Methods

3.1 Research Design

The study adopted descriptive research approaches to investigate factors of road traffic accidents in the study area. The research design was divided into four stages. The first stage comprises reconnaissance visit to the study area, while the second stage comprises data collection. The third and fourth stages comprise the analysis of data collected from the field using structured questionnaire and the discussion of findings respectively.

3.2 Sample Size

A total of forty five (45) accident black spots was purposively identified in the study. Fifteen (15) accident black spots was identified from each of the three senatorial districts of Ondo State. However, a total of four hundred (400) respondents (0.1% of the study's population) formed the sample size. In the determination of the above sample size, the Taro Yamane formula was adopted in line with the method of Balogun, *et al.,* 2015.

The mathematical expressions are as follows:

$n = \frac{N}{1 + N(e)^2}$ ……Equation I.

Where:

N= total population size (4,394,300) of Ondo State

1= a constant

e^2 = level of significance (0.05)

Therefore, $n = \frac{N}{1 + N(e)^2}$

$n = \frac{4,394,300}{1+4,394,300(0.005)^2}$

$n = \frac{4,394,300}{4,394,301(0.0025)}$

$n = \frac{4,394,300}{10985.75}$

n = 400.

4.0 Findings and Discussion

4.1 Identification of Accident Black Spots

Table 1 presents the study's 45 accident black spots identified in the study area.

Table 1.0 Identified Accident Black Spots in the Study

S/N	*Senatorial District*	*Accident Black Spot*	*Road Description*	*Geographic Description*
1	*Ondo North*	Okerigbo, Akungba	Akungba - Ikare	Hill slope
2	*Ondo North*	Oke Oka - Iwaro Oka	Akungba- Isua	Hill Steep Slope
3	*Ondo North*	Okeagbe Bend	Okeagbe – Ikare	Table land
4	*Ondo North*	Ogbagi Single Lane	Ikare- Ado Ekiti	Hill Crest
5	*Ondo North*	Obasanjo Garrage Junction	Kabba-Okene-Idoani,Isua Junction	Table land
6	*Ondo North*	Akungba – Iwaro Oka Junction	Akungba - Owo	Mini Hill Crest
7	*Ondo North*	Okia-Oka Bend	Akungba- Isua	Valley
8	*Ondo North*	Oba Akoko Town	Ikare - Owo	Gentle Slope
9	*Ondo North*	Owo – Ikare Junction	Owo	Table land

10	*Ondo North*	Benin – Ifon Junction	Ifon, Benin - Akure	Gentle Slope
11	*Ondo North*	Ose – Oba Village	Ikare - Owo	Descending slope and valley
12	*Ondo North*	Ago Ajayi	Ikare - Owo	Valley
13	*Ondo North*	Ipeme Village	Owo–Ikare, Hezetoria Petrol Junction	Table land
14	*Ondo North*	Ago Panun	Owo- Ikare	Hill Crest with Descending Slope
15	*Ondo North*	Ulura Community Bend	Akure - Owo	Plane land
16	*Ondo Central*	Mekun Oil & Gas	Akure - Owo	Valley
17	*Ondo Central*	Eleyowo Town	Akure - Owo	Table land
18	*Ondo Central*	Osi - Owode Junction	Akure - Owo	Table land with Bend
19	*Ondo Central*	Oba –Ile Junction	Akure - Owo	Table land
20	*Ondo Central*	Federal Girls Sec. Shool	Akure - Owo	Valley
21	*Ondo Central*	Agbogbo Junction	Akure - Ilesa	Table land
22	*Ondo Central*	Road Block- Ijare Junction	Akure - Ilesa	Table land
23	*Ondo Central*	Igbara- Oke Junction	Akure - Ilesa	Hill Crest
24	*Ondo Central*	Igbara Oke- Igbara- Odo Bend	Igbara Oke- Igbara- Odo	Hill Crest
25	*Ondo Central*	Isinigbo Junction	Akure – Ado Ekiti	Table land
26	*Ondo Central*	Farokanmi Bend	Akure – Ado Ekiti	Gentle Slope
27	*Ondo Central*	Iju Roundabout	Akure – Ado Ekiti	Gentle Slope
28	*Ondo Central*	Gaga Junction	Akure - Idanre	Plane land
29	*Ondo Central*	Alade- Ododе Idanre Bend	Akure - Idanre	Steep Slope with Valley
30	*Ondo Central*	Ondo – Ife Junction	Ondo-Ore road	Low land
31	*Ondo South*	N.N.P.C Depot, Ore	Ondo-Ore	Gentle Slope
32	*Ondo South*	Ajue Town	Ondo-Ore	Low land
33	*Ondo South*	New Town	Ondo-Ore	Low land
34	*Ondo South*	Benin-Ore Junction	Benin - Ore	Gentle Slope
35	*Ondo South*	Akinde Block	Ore - Sagamu	Low land
36	*Ondo South*	Ore – Irele Junction	Ore - Okitipupa	Table land
37	*Ondo South*	Araromi Village Bend	Ore - Irele	Table land
38	*Ondo South*	Ode - Omi Town Bend	Irele - Ajagba	Low land
39	*Ondo South*	Ode – Ajagba Roundabout	Agadagba- Irele	Mini Hill Crest
40	*Ondo South*	Agadagba Town	Agadagba- Itapere	Plane land
41	*Ondo South*	Okitipupa – Ikoya Junction	Ore - Okitipupa	Plane land
42	*Ondo South*	Okitipupa Town Junction	Okitipupa- Igbokoda	Low land
43	*Ondo South*	Mega School ‘Y’ Junction	Ode-Ayeka - Igbokoda	Table land
44	*Ondo South*	Ode- Irele Town Roundabout	Ode –Irele Town	Plane land
45	*Ondo South*	A1 Furniture	Ondo - Ore	Low land

Source: Author’s Field Survey, 2023.

4.2 Factors of Accident in the Study Area.

The study revealed 30% of factors of accidents in the study area associated with road related issues, while human attributes accounted 27% of factors responsible for road accidents in the various identified accident black spots. The findings further revealed 22% regarding vehicle attributes as factors contributing to road accidents in the study area. In environmental related issues, the findings revealed 21% contribution of road accidents in the study area (Fig.3).

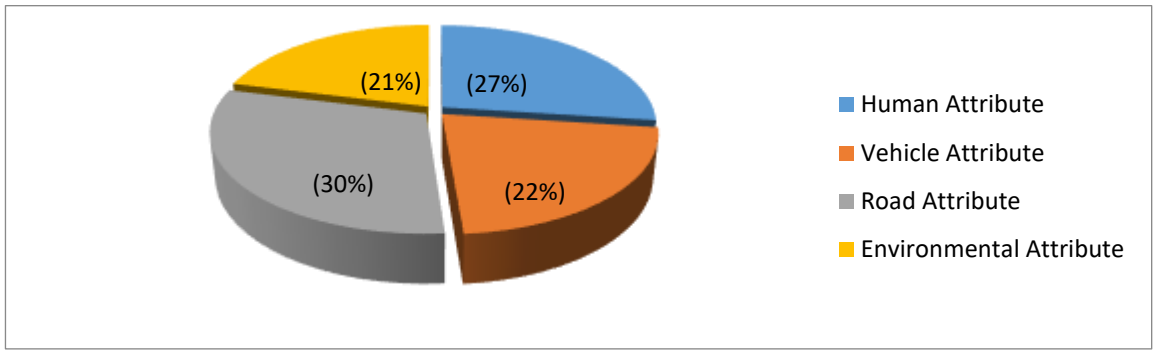

Fig. 3: Factors of Road Accidents in the study area

Source: Field Survey, 2023.

The study employed statistical tool of Principal Component analysis for the purpose of providing the most important factors that caused road accidents in the identified accident prone areas. Consequently, factors of road accidents in the accident black spots were transformed into components and provided the importance ones. Thereafter, the Linear Regression Analysis statistical test was used to rank the causal factors of accident in the study area in the order of importance.

4.3 Communality

The quantities in the communality column were the proportions of the variance of each variable accounted for by the common factors. The variables in the communalities were divided into four attributes as distinguished with colours. The closer the extraction values towards one, the perfect the variable was most extracted. The first one represented the human attributes, the second represented the vehicle attributes, the third represented the road attributes, and the fourth represented the environmental attributes. In each of the attributes, the major factors of road accidents in the identified accident prone areas were revealed (Table 2).

Therefore, the major human related factors of road accidents in the identified accident prone areas were drivers' fatigue with the extraction value of 0.938, driver's lack of concentration with the extraction value of 0.925, nonchalant attitude with the extraction value of 0.920, driver's poor knowledge of highway code with the extraction value of 0.869, and the violation of traffic rules with the extraction value of 0.864. It must be mentioned that the overriding human attributes was driver's fatigue which appeared a crux that may be difficult prima facie to tackle if not attitude of drivers change to have reorientation on explanation in terms of avoiding night travel particularly heavy duty vehicles. The insensitivity of drivers to acknowledge the serious side effects of fatigue is tantamount to nonchalant attitudes of drivers. This findings in human attributes of driver's fatigue was validly related to the consideration of why vehicle crashed during the night time. The other two important human attributes were related such that when assessing driver's poor knowledge of Highway Code would automatically resorts to gross abuse and violation of traffic rules leading to accident.

However, in the findings of vehicle attributes, the major vehicle related factors of road accidents in the identified accident prone areas were parking at obstruction with the extraction value of 0.954, rickety vehicle with the extraction value of 0.944, heavy traffic with the extraction value of 0.922, and poor lighting system with the extraction value of 0.904. Thus, it seems from all indications, it is essential to point out that vehicle attributes accident causing tendency were not mutually exclusive of one another. This is because in heavy traffic situation with poor lighting system in cases of rickety vehicle and blurring obstructions on the highway in the night would doubtlessly give birth to fatal multiple vehicle crashes.

Furthermore, the major road related factors of road accidents in the identified accident prone areas were narrow freeway with the extraction value of 0.899, road intersection with the extraction value of 0.876, deep porthole with the extraction value of 0.871, and exfoliating road portion with the extraction value of 0.865. It should be borne in mind and to swallow hook, line and sinker that narrow freeway poses serious road traffic movement, combined with subtle road intersection in the night time on the roadways characterized with deep potholes and exfoliated deploring condition portions, obviously presented a road dead trap. It is glaring now why road accident should be rampant in the night time.

In addition, the findings revealed environmental attributes of road accidents in the identified accident prone areas as heavy rain down pour with the extraction value of 0.874 and hasty weather with the extraction value of 0.852, and poor night visibility with the extraction value of 0.841. Considering the values of extraction, the causal effects were minimal and it must be pointed out that these attributes of environmental factor rarely comes into play, but it was clear that in circumstances of the study area, these environmental attribute could be highly devastating on road accident. The study cannot but add that all other factors attributes put together such as driver's fatigue with narrow freeway of heavy traffic in rickety vehicles and heavy down pour, road accident is inevitable.

However, with the help of Eigenvalues as shown in Table 3, eight variables were explained accounting for 84.52 percent of factors of road accidents in the identified accident prone areas. When the original thirty-two variables were analyzed with principal component analysis, eight variables were extracted from the analysis with eigenvalues greater or equal to 1, which explained 84.52% of the total variance.

The eight variables are as follows: parking at obstruction with factor extraction of 0.954, rickety vehicle with factor extraction of 0.944, drivers' fatigue with the factor extraction of 0.938, driver's lack of concentration with factor extraction of 0.925, heavy traffic with factor extraction of 0.922, nonchalant attitude with factor extraction of 0.920, poor lighting system with factor extraction of 0.904 and narrow freeway with factor extraction of 0.899.

Table 2: Communalities

Variables	Initial	Extraction
Drunk Driving	1.000	.759
Driver Sleeping	1.000	.780
Driver's Poor Knowledge of Highway Code	1.000	.869
Over Speeding	1.000	.752
Non-Challant Attitude	1.000	.920
Driver's Lack of Concentration	1.000	.925
Mobile Phone Conversations	1.000	.762
Over-loading	1.000	.784
Fatigue	1.000	.938
Violating Traffic Rules	1.000	.864
Brake Failure	1.000	.855
Parking at Obstruction	1.000	.954
Bad Tyres	1.000	.872
Poor Light System	1.000	.904
Bad Engine	1.000	.756
Rickety Vehicle	1.000	.944
Heavy Traffic	1.000	.922
Too Sloppy Road/ Hill	1.000	.878
Slippery Road	1.000	.818
Sharp Bend	1.000	.839
Narrow Freeway	1.000	.899
Narrow Bridge	1.000	.808
Deep Porthhole	1.000	.871
Road Intersection	1.000	.876
Exfoliating Road Portion	1.000	.865
Poor Night Visibility	1.000	.841
Heavy Rain	1.000	.874
Hasty Weather	1.000	.852
Landuse Influence	1.000	.748
Flooding	1.000	.813
Fell Trees on the Road	1.000	.660
Extraction Method: Principal Component Analysis.		

Source: SPSS Version 21.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1.Drunk Driving	8.629	27.836	27.836	8.629	27.836	27.836	8.144	26.272	26.272
2.Driver's Sleeping	6.275	20.243	48.079	6.275	20.243	48.079	4.258	13.736	40.007
3. knowledge of Highcode	3.185	10.276	58.354	3.185	10.276	58.354	4.182	13.491	53.498
4.Overspeeding	2.304	7.432	65.786	2.304	7.432	65.786	2.510	8.096	61.595
5.Nonchalant Attitude	1.954	6.304	72.090	1.954	6.304	72.090	1.862	6.007	67.602
6.Drivers' lack of concentration	1.556	5.019	77.109	1.556	5.019	77.109	1.817	5.862	73.464
7.Phone conversition	1.205	3.887	80.996	1.205	3.887	80.996	1.737	5.604	79.068
8.Overloading	1.092	3.523	84.520	1.092	3.523	84.520	1.690	5.452	84.520
9. Fatigue	.723	2.332	86.852						
10. Violating traffic rules	.687	2.217	89.069						
11.Brake failure	.607	1.958	91.027						
12.Parking at obstruction	.538	1.736	92.763						
13.Bad tyres	.352	1.137	93.900						
14.Poor light system	.324	1.045	94.944						
15. Bad engine	.263	.847	95.792						
16. Rickety vehicle	.244	.788	96.580						
17. Heavy traffic	.202	.652	97.232						
18. Too sloppy road/ Hill	.142	.457	97.688						
19. Slippery road	.131	.424	98.112						
20. Sharp bend	.114	.368	98.480						
21. Narrow freeway	.097	.314	98.793						
22. Narrow bridge	.086	.277	99.071						
23. Deep pothole	.072	.234	99.304						
24. Road intersection	.057	.183	99.487						
25. Exfoliating road portion	.043	.139	99.626						
26. Poor night visibility	.035	.114	99.740						
27. Heavy rain down pour	.028	.092	99.832						
28. Hasty weather	.017	.053	99.885						
29. Landuse influence	.015	.049	99.935						
30. Flooding	.013	.042	99.977						
31. Fell trees on the road	.007	.023	100.000						

Extraction Method: Principal Component Analysis.

Source: SPSS Version 21

The major factors causing road accidents in the identified accident prone areas were parking of vehicles at obstruction, the use of rickety vehicles, drivers' fatigue, driver's lack of concentration, heavy traffic on the road, nonchalant attitude, poor lighting system, and narrow freeway. The factors were further restructured into human factors, vehicle factors, and road factors as shown in Table 4.

Table 4 Restructuring of Factors of Accident Attributes

Human Factors		Extraction
	Parking at Obstruction	.954
	Fatigue	.938
	Driver's Lack of Concentration	.925
	Nonchalant Attitude	.920
Vehicle Factors	Rickety vehicle	.944
	Heavy Traffic	.922
	Poor light system	.904
Road Factors		
	Narrow Freeway	.899

Source: Field Survey, 2021.

Further test was also carried out on the *Hypothesis* by applying Linear Regression analysis to rank road accident factors. The summary of the result was as shown in Table 5.

Table 5: Regression Model

R	R Square	Adjusted R Square	Std. Error of the Estimate
.930[a]	.866	.865	.14983

Predictors: (Constant), Environmental Factor, Vehicle Factor, Road Factor, Human Factor.

Table 6: Regression Residual for Factor Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	65.041	4	16.260	724.293	.001[b]
	Residual	10.080	449	.022		
	Total	75.121	453			

a. Dependent Variable: Accidents

Predictors: (Constant), Environmental Factor, Vehicle Factor, Road Factor, Human Factor

Table 7 Regression Analysis showing the contribution of Factor

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.455	.300		8.076	.000
Human Factor	.630	.041	.612	13.875	.000
Vehicle Factor	.543	.152	.530	8.034	.000
Road Factor	.720	.023	.756	31.756	.000
Environmental Factor	.280	.040	.231	7.063	.000

Table 6 revealed there was interdependencies of causal factors (human, vehicle, road and environmental) on road accident spot areas of the study area (F-cal. = 724.293 > F-tab. = 3.84, P<0.05), thus the null hypothesis was therefore rejected and the alternative was accepted implying that the interdependencies between road accidents and its causal factors were statistically related. The effects of interdependencies among human, vehicle, road and environmental accounted for 86.6% (R^2 = 0.866) as revealed in Table 7. The variance of road accidents among respondents was positive, high and significant at 0.05 level (r = 0.930, P<0.05). This is in agreement with the findings of Onyemaechi, (2019).

The effect of human factor (T = 13.875, P<0.05), vehicle factor (T = 8.034, P<0.05), road factor (T = 31.756, P<0.05) and environmental factor (T = 7.063, P<0.05) significantly contributed to road accident in the accident black spots. The highest of the factors causing accidents in identified accident prone areas was road factor with a beta weight of 0.756 (75.6%). This was closely followed by human factor (beta weight = 0.61.2; 61.2%), vehicle factor (beta weight = 0530; 53%), while environmental factor (beta weight = 0.231; 23.1%) was the least factors causing accidents in the study area.

Consequently, a regression model evolved from the statistical test on interdependencies between the road accidents and its causal factors as mathematical *(equation) given as: Y = 2.455 + 0.630 (HF) + 0.543 (VF) + 0.720 (RF) + 0.280 (EF).*

This Regression model developed can take the form, specified and operationalized as:

RA (Y) = 1 RF + 2 HF + 3 VF + 4 EF

Where:

(RA)Y: Road Accident (Dependent Variable)

RF: Road Attributes

HF: Human Attributes

VF: Vehicle Attributes

EF: Environmental Attributes

5.0 Conclusion

In, conclusion, the summary outputs of the linear regression technique moderated Aworemi, *et al.,* (2010) road accident model where human characteristics were singled out as the strongest factors influencing road traffic accident in Lagos, Oyo, Ogun and Osun State. In the case of this study, road attributes were the strongest factors responsible for accidents in the study area. Therefore, it is appropriate to submit that the model of Ondo State's road accident, suited and predicted variables in road traffic accident and exerted significant impacts. In addition, the model forecasted increase in future road accident crashes as an equation of the straight line which collaborated the works of Agbeboh and Osabuohien- Irabor,(2010), Balogun, *et al.,* (2015) and Muritala, *et al., (*2015).

6.0 Recommendations

Following the outcomes of the study and the need to reduce the road accident occurrences in the study area, the following are put forth:

Erections of signage indicating road conditions some metres away to the accident black spots, serving as early warning road signs for road safety in the study area.

Construction of speed breaker as calming device to slow motor-vehicle traffic in order to improve safety condition on speed-related accident in a little distances to the accident black spots in the study area.

Construction of flyover bridges at the road-nodes in some accident black spots such the area of Owo-Ikare junction, Ondo-Ile Ife junction, Ondo, Agbogbo junction, Akure, Road Block junction, Akure and Benin-Ore junction, Ore in the study area.

It is best in time to construct dual carriageway on the Akure-Ilesa passing through Owo to Ipele and Isua roadways to accommodate the noticed volume of traffic in the study area.

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