IDENTIFICATION OF CYCLES AND PERIODIC OSCILLATIONS OF REPORTED NUMBER OF INJURED FROM ROAD TRAFFIC ACCIDENTS IN LAGOS STATE, NIGERIA

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BACKGROUND INFORMATION

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ABSTRACT

Using mostly secondary data on vehicular accidents obtained from the Nigeria Police Force and Federal Road Safety Commission, the study examined a forty-five year review of number of injured from road traffic accidents (1970-2015) in Lagos State. The reported injured from road traffic accidents in the 20 Local Government Areas of Lagos State were compared using the Analysis of Variance (ANOVA). The result showed that for the two factors, Local Government Areas and years, the F-calculated of 22.34 and 9.82 respectively were higher than the F-tabular of 1.57 and 1.46 respectively at 0.05 level of significance. It then implies that the means for each of the factors, reported number of injured from road traffic accidents across the 20 Local Government Areas of Lagos State and across different years were significantly different. The result of the multiple regression analysis was 0.41. This implies that the proportion of variation in the dependent variable (i.e. number of injured from road traffic accidents) explained by the independent variables (i.e. length of roads, presence of road safety and population) was 41%. Based on the findings, recommendations were proffered on how to reduce the phenomenon of injured and possible deaths from traffic accidents in Lagos State.

Keywords: Oscillations; periodic, cycles; reported number of injured; accidents; traffic.

INTRODUCTION

Road traffic injuries are among the leading causes of death and life-long disability globally (World Health Organization, 2015). The World Health Organization (WHO) reports that about 1.24 million people die annually on the world's roads, with 20–50 million sustaining non-fatal injuries (World Health Organization, 2013 & 2015). Globally, road traffic injuries are reported as the leading cause of death among young people aged 15–29 years and are among the top three causes of mortality among people aged 15–44 years (World Health Organization, 2015). The Institute for Health Metrics and Evaluation (IHME) estimated about 907 900, 1.3 million and 1.4 million deaths from road traffic injuries in 1990, 2010 and 2013, respectively (Global Burden of Disease, 2013).

In Africa, the number of road traffic injuries and deaths have been increasing over the last three decades (World Health Organization, 2010). According to the 2015 Global status report on road safety, the WHO African Region had the highest rate of fatalities from road traffic injuries worldwide at 26.6 per 100 000 population for the year 2013 (World Health Organization, 2015, World Health Organization, 2013). In 2013, over 85% of all deaths and 90% of disability adjusted life years (DALYs) lost from road traffic injuries occurred in low- and middle-income

countries, which have only 47% of the world's registered vehicles (World Health Organization, 2013 and Global Burden of Disease, 2013). The increased burden from road traffic injuries and deaths is partly due to economic development, which has led to an increased number of vehicles on the road (World Health Organization, 2009 and Nantulya & Reich, 2002). Given that air and rail transport are either expensive or unavailable in many African countries, the only widely available and affordable means of mobility in the region is road transport (World Health Organization, 2015, World Health Organization, 2013 & Juillard, Labinjo, Kobusingye, Hyde, 2010). However, the road infrastructure has not improved to the same level to accommodate the increased number of commuters and ensure their safety and as such many people are exposed daily to an unsafe road environment (World Health Organization, 2010 & 2015).

The 2009 Global status report on road safety presented the first modelled regional estimate of a road traffic death rate, which was used to statistically address the underreporting of road traffic deaths by countries with an unreliable death registration system (World Health Organization, 2009). In the 2009 report, Africa had the highest modelled fatality rate at 32.2 per 100 000 population, in contrast to the reported fatality rate of 7.2 per 100 000 population (World Health Organization, 2009). The low reported death rate reflects the problem of missing data due to non-availability of road traffic data systems, which has a direct impact on health planning including pre-hospital and emergency care and other responses by government agencies.

At the global level, road accidents have been ranked as the 9th leading cause of mortality (World Health Organisation, 1998). The World Health Organisation (WHO) estimated that 1.17 million deaths occur each year worldwide due to road traffic accidents. Succinctly, this accounts for about 70% of deaths in developing countries such as Nigeria. The increased rate of fatal road traffic accidents worldwide has been attributed to population explosion and increased motorization (Atubi, 2008 and 2012d). Increased motorization may be characterised briefly as the "automotive revolution", that is, the motorizing of urban population especially in the developing countries.

As in other developing countries, road traffic accidents in Nigeria are one of the most serious problems in need of pragmatic solutions. Yet this problem has been difficult to address probably because of the country's level of development. Nigeria is said to have the highest road traffic accident rate in Africa and second in the world (Akpoghomeh, 1998; Obinna, 2007, p. 35; Atubi, 2012c).

According to data from the Nigerian Federal Road Safety Commission, the country has the highest rate of death from motor accidents in Africa; leading 43 other nations in the number of deaths per 10,000 vehicle crashes (FRSC, 2006; Obinna, 2007, p. 35). Nigeria is followed by Ethiopia, Malawi and Ghana with 219, 183 and 179 deaths per 10,000 vehicles respectively (Daramola, 2004; Atubi and Onokala, 2009; Atubi, 2015a).

The number of reported cases of fatal road traffic accidents in Nigeria has shown an increasing trend from 12,212 cases of accidents in 1995 to 1996 (Central Bank of Nigeria, 1997). Fatal road accident figures across the federation of Nigeria rose sharply in 1992 resulting in 22,992 deaths (CBN, 1994). According to the Annual Abstract of Statistics (2008), between 2003 and 2007, a total of 225,891 accident cases were reported by the Nigeria Police Force, out of which 29,490 were fatal, 39,065 were serious cases, 23,380 were minor cases.

Dramatic increases in the proportion and absolute number of traffic fatalities have been witnessed in a number of developing countries, while they decreased by more than 20% in industrialised nations (Ross et al, 1991). In both Nigeria (Oluwasanmi, 1993; Ezenwa, 1986; Atubi, 2009b and 2010a) and Kenya (National Road Safety Council of Kenya, 1992), for example, a fivefold

increase in traffic-related fatalities was observed over the last 30 years. African and Asian countries, with relatively low vehicle densities, are experiencing substantially higher fatality rates per 10,000 vehicles than the industrialised European and North American States (Jacobs and Sayer, 1983; WHO, 1984).

Other researchers concentrated on the factors affecting road safety (Ajedi, 1980; Perrow, 1984; Agunloye, 1989; Golias et al, 1997). For instance, Ajedi (1980) and Atubi (2010b) reported that the poor inter connections of existing Nigerian roads and poor maintenance of these roads were responsible for the chaotic urban transportation, which in turn leads to accidents and irreparable looses in human lives and physical resources.

International comparison indicates that 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 low. For example, while Czech Republic has only one death in 175 accidents, France one death in 175 accidents, Nigeria has one death in 2.65 accidents (Atubi, 2010b).

Road traffic accidents' statistics in Nigeria reveal a serious and growing problem with absolute fatality rate and casualty figure rising rapidly. In majority of developing countries, accident occurrence and related deaths are relative to either population or number of vehicles. Ironically, in Nigeria, studies have indicated that better facilities in terms of good quality and standardized roads have been accompanied by increasing number of accidents (Onakomaiya, 1998; Ghadamosi, 2002; Atubi, 2012j).

According to the Nigerian Federal Road Safety Corps (2006), between 1970 and 2001, Nigeria recorded a total of 726,383 road traffic accidents resulting in the death of 208,665 persons and 596,425 injuries. In that period, each succeeding year recorded more accidents, deaths, and injuries. Also between 1997 and 2002, Lagos State alone recorded a total of 39,141 road accidents resulting in the death of 10,132 persons and 18,872 injuries (Atubi, 2006; 2011a).

Indeed, the Nigeria accident seems to suggest that the better the road, the higher the accident and fatality rate as well as severity and non-survival indices because of driver non compliance with speed limits (Onakomaiya, 1988; Gbadamosi, 1994; Filani and Gbadamosi, 2007; and Atubi, 2011b).

In almost all countries in Africa, Asia and Latin America, road traffic crashes have become one of the leading causes of death in older children and economically active adults between the ages 30 and 49 years (Murray, 1996; Ross et al, 1991; Jacobs et al, 2000). Despite this burgeoning problem, little attention has been paid to road traffic injury prevention and treatment in most developing countries. Efforts to combat the problem of injuries have, in most cases, been hampered by paucity of funds and lack of relevant data.

In Nigeria, road traffic accident situation over the last three decades has been particularly disturbing. In 1976, there were 53,897 road traffic accidents resulting in 7,717 deaths. Although in 1981, the magnitude reduced to 5,114 accidents, but the fatality increased to 10,236 which means that there was an average of 96 accidents and 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 (Atubi, 2009c).

Based on data that are at best conservative estimates, Nigeria is a country with a serious and growing road accident problem that is among the worst in the world (Asogwa, 2002). Analysis of global statistics indicates that fatality rates (per licensed vehicle) in developing countries are high

in comparison with those of developed countries (Adeniji, 2002). African countries in particular have rates often 30 to 50 times greater than those in the countries of Western Europe.

RESEARCH METHODOLOGY

This study, in a broad sense, under takes a spatial analysis of death from road traffic accidents over a period of 45 years (i.e. 1970-2015) in Lagos State. This attempt to conduct a detailed investigation of accident phenomenon more than the ones that had hitherto engaged the attention of researchers.

Secondary data were collected from various sources, which include the records of the Federal Road Safety Commission, the Nigeria Police, Federal Ministry of Transport and the Federal Office of Statistics. The data collected were analyzed using both descriptive and inferential statistics.

Data Analysis

The analysis of variance statistical (ANOVA) techniques were used to test for the significance of variability in the spatial pattern of death from road accidents in Lagos State. Also, the multiple regression analysis statistics was used in this study to investigate the factors that influence the number of injured from reported road traffic accidents in Lagos State. The dependent variable was reported number of injured from road accident, while the independent variables considered include length of roads in Lagos State from 1970-2015, presence of road safety corps and population. However, data on alcohol induced accidents, over speeding and reckless driving could also have been useful but were not considered for lack of data.

Study Area

Lagos State is a suitable case study because it hosts metropolitan Lagos, Nigeria's major traffic centre, fastest growing city, and most heavily motorized urban area in the country. Consequently, the state has one of the highest accident and casualty rates in the country (Atubi, & Onokala, 2009). Moreover, the traffic situation in Lagos State is bad because of the absence of effective planning, vehicle-misuse, poor management, inadequate street parking, traffic congestion, delays and accidents among other contributory factors.

Lagos State is situated in the South Western corner of Nigeria. This elongated state spans the Guinea Atlantic coast for over 180km, from the Republic of Benin on the west to its boundary with Ogun State in the east (figure 1), while Lagos State is the smallest in Nigeria, it has over 5 percent (i.e. 9,013,534) of the country's estimated 180 million people (National Population Census, 2006). Its rate of population growth has been in excess of 9 percent per annum, or 25,000 per month or 833 per day or 34 per hours in the last decade (LAMATA, 2002). This population increase has been accompanied by a corresponding increase in motor vehicles and traffic accidents. However, accident rates in Lagos State are still very much on the high side compared to other states in the federation. But, fatalities and non-survival indices for the state are on the decline. This is attributable to its high level of traffic congestion (which reduces the probability of the high fatality accidents resulting from over speeding) and accessibility to good post – crash medical care in the Lagos metropolitan area.

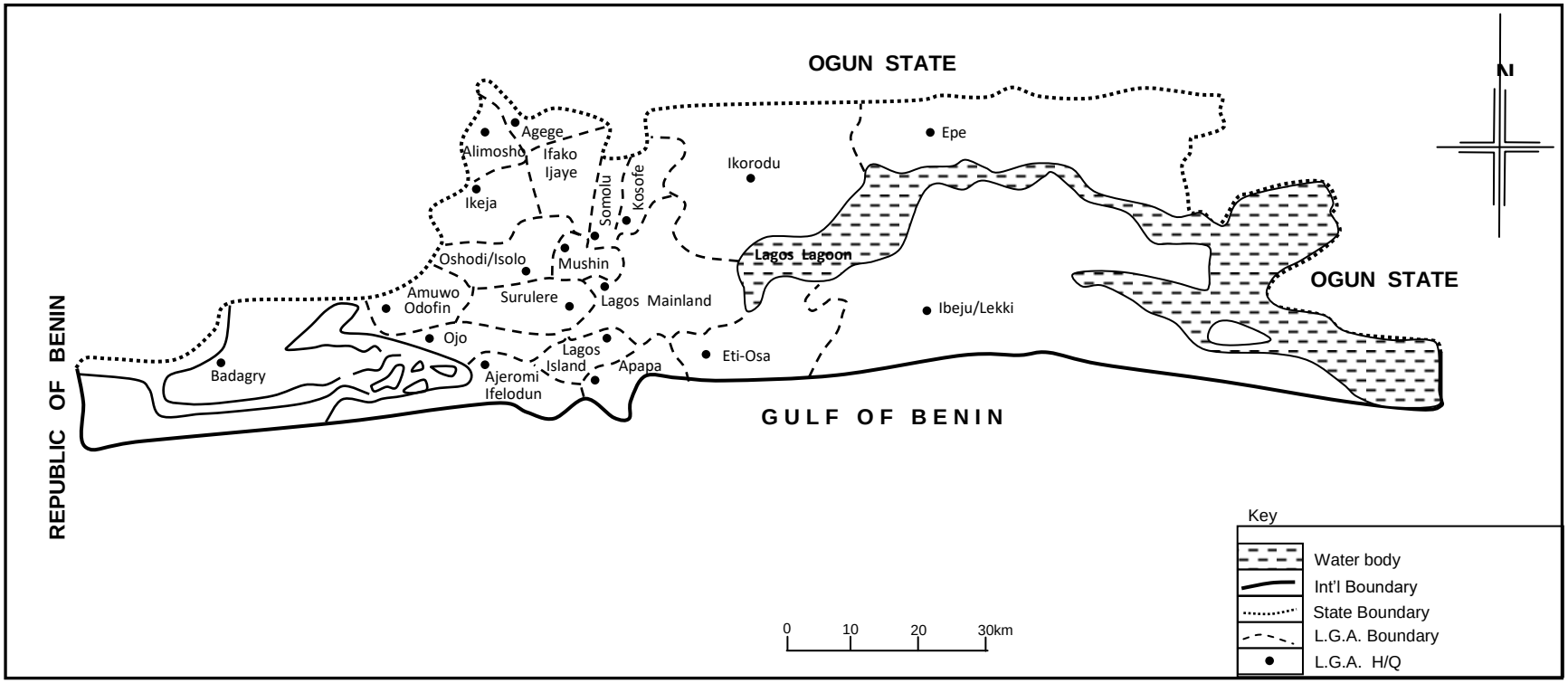

FIG. 1: MAP OF LAGOS STATE SHOWING THE 20 L.G.AS

Source: Modified by Atubi A.O. (2011)

DISCUSSION OF FINDINGS/RESULTS

Table 44 shows that for Lagos State as a whole, dominant cycles of reported number of injured from road traffic accidents observed have periodicities of 45.00, 15.45 and 22.00 years with the most dominant being 45.00 years. This means in other words, that the dominant and strongest number of injured from road traffic accident pattern over Lagos State repeats itself every 45 years.

Table 1: Dominant Injured from Road Traffic Accidents in Lagos State.

Location		Cycles (years)	% Variance	Amplitudes
Lagos State	1st	45.00	29.15	135.20
	2nd	15.45	10.02	79.28
	3rd	22.00	8.40	72.60
Lagos Island	1st	45.00	54.99	26.61
	2nd	2.94	7.65	9.92
	3rd	15.45	4.27	7.42
Ikorodu	1st	45.00	20.60	9.01
	2nd	5.33	12.79	7.10
	3rd	15.45	8.29	5.72
Ajeromi/Ifelodun	1st	45.00	51.44	21.87
	2nd	15.45	5.11	6.89
	3rd	4.00	5.08	6.82
Badagry	1st	2.91	20.72	6.55
	2nd	45.00	13.97	5.38
	3rd	15.45	12.59	5.11
Epe	1st	45.00	47.74	7.83
	2nd	8.00	6.88	2.97
	3rd	5.33	5.18	2.58
Ikeja	1st	45.00	48.90	23.06
	2nd	2.94	8.09	9.38
	3rd	5.33	3.13	5.83
Mushin	1st	45.00	61.71	21.96
	2nd	4.00	5.81	6.74
	3rd	2.94	3.55	5.27
Lagos Mainland	1st	45.00	60.74	27.12
	2nd	2.94	4.97	7.76
	3rd	15.45	3.39	6.41

Examination of table 1 shows that for Lagos State as a whole, dominant cycles of reported number of injured from road traffic accidents observed have periodicities of 45.00, 15.45 and 22.00 years with the most dominant being 45.00 years. This means in other words, that the dominant and strongest number of injured from road traffic accident pattern over Lagos State repeats itself every 45 years.

For Lagos Island Local Government Area, a dominant cycle of 45.00 years is also observed. Other strong cycles, a fairly short one of 2.94 years and a short period one of 15.45 years are also observed.

Ikorodu Local Government Area has a dominant number of injured from road traffic accident cycle with periodicities of 45.00 years, 5.33 years and 15.45 years. The result showing the ANOVA table for the mean comparisons are presented in table 2.

Table 2: Analysis of Variance for reported number of injured from road traffic accidents in Lagos State

Factor	Source of variation	Sum of squares	Df	Mean squares	F.Cal.	F. Table
Local Government Area	Between L.G.A Within L.G.A. Total	9839178 9722.40 108114.18	19 409 451	4972.50 233.02	22.34	1.57
Years (1970-2015)	Between years Within years Total	82220.67 106395.11 188615.77	44 392 423	2652.28 271.42	9.82	1.46

The result shows that for the 2 factors, Local Government Areas and years, the calculated F-ratios of 22.34 and 9.82 respectively at 0.05 level of confidence were higher than the table F-ratios of 1.57 and 1.46 respectively. Since their F-calculated were higher than F-table at 0.05 level of confidence, it then implies that the means for reported number of injured from road traffic accidents for each of the two factors, Local Government Areas and years were significantly different. In order to ascertain he means that were significantly different, DNMRT was used for mean comparisons. The result for the mean comparisons for different Local Government Areas and that for different years (1970-2015) are shown in tables 3 and 4 respectively.

Table 3: Means of reported number of injured from road traffic accidents in different LGA's in Lagos State

S/N	L.G.A	N	Means
1	Ikeja	32	69.81a
2	Lagos mainland	32	62.03ab
3	Lagos Island	32	60.31ab
4	Ajeromi/Ifelodun	32	52.94bc
5	Mushin	32	47.25c
6	Apapa	16	46.81c
7	Oshodi/Isolo	16	36.63d
8	Ikorodu	32	36.09d
9	Surulere	16	35.50d
10	Badagry	32	34.13d
11	Alimosho	13	34.08d
12	Agege	13	33.62d
13	Ojo	13	32.69ef
14	Epe	32	30.53ef
15	Shomolu	16	29.75ef
16	Ifako-Ijaye	13	25.46efh
17	Amuwo-odofin	13	22.08fgh
18	Ibeju-Lekki	13	21.54gh
19	Kosofe	13	21.38gh
20	Eti-osa	13	14.62i

In table 3, the means were arranged from the highest mean to the lowest mean. The letters of alphabet indicated significant difference. Means with the same letter of alphabet attached to them are not significantly different while mean that have a different letter of alphabet

attached to them are significantly different. For example, from table 3, the means of reported number of injured from road traffic accidents in Ikeja Local Government Area is not significantly different and significantly different from those in Lagos Mainland and Lagos Island Local Government Areas which are not significantly different. However, that of Ajeromi/Ifelodun Local Government Area is significantly different from that of Mushin Local Government Area and Apapa Local Government Area, although that of Oshodi/Isolo Local Government Area is not significantly different from those of Ikorodu, surulere, Badagry, Alimosho, Agege, Ojo and Epe Local Government Areas. The result suggests that although Kosofe and Agege Local Government Areas had the highest reported accidents, the road traffic accidents were not serious as much as injured were reported in Ikeja and Lagos mainland Local Government Areas (Table 3 and Fig. 2).

In table 3, the means were equally arranged from the highest down to the lowest. The letter of alphabet indicates significant difference. Means with the same letters of alphabet attached to them are significantly different. For example, the means of reported number of injured form road traffic accidents was highest in 1980 and 1985 and they were not significantly different from those of 1979, 1981, 1973, 1978, 1976, 1988 and 1977 but were significantly different from that of the other years. The result shows that reported number of injured from road traffic accident was highest in 1980 which also recorded the highest number of road traffic accidents (Table 3).

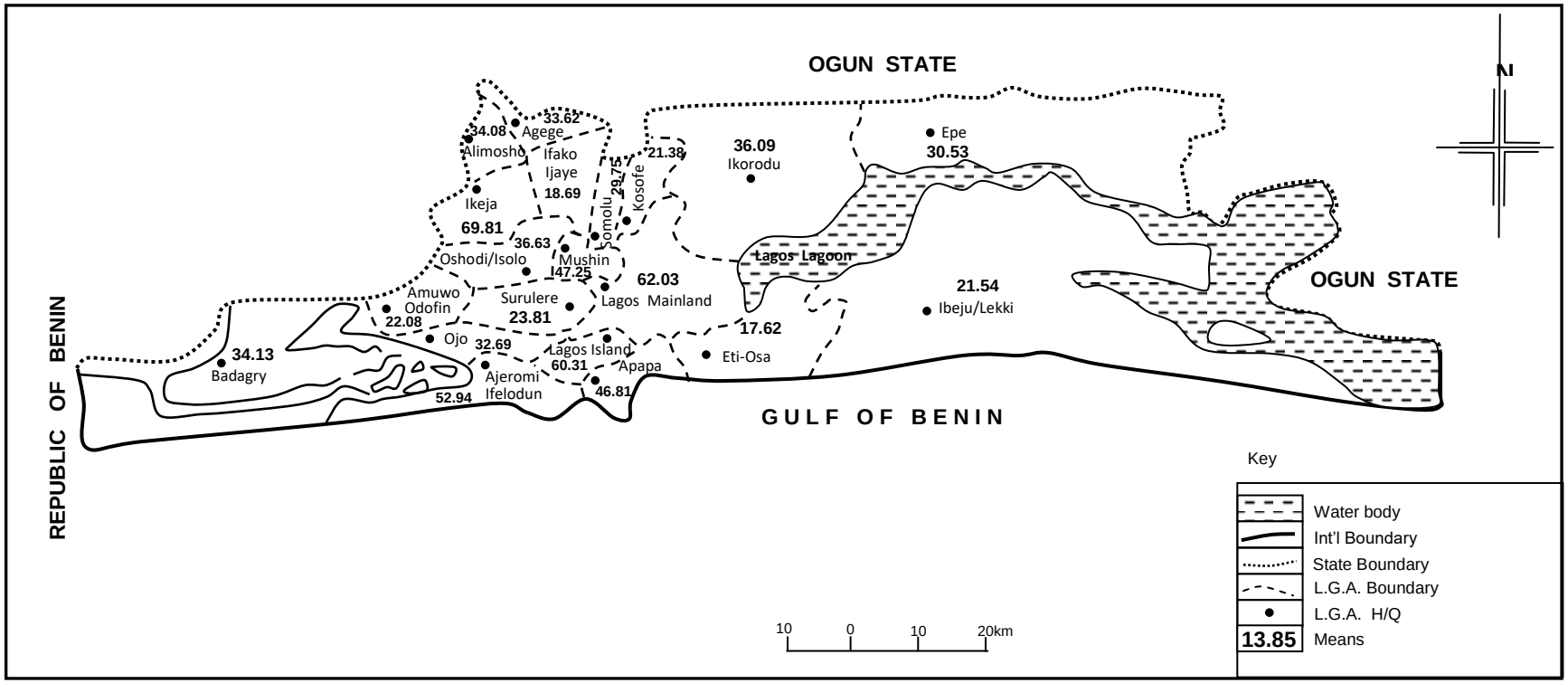

Fig. 2: Map of Lagos State Showing L.G.A's with Means of Reported number of injured from R.TA's

Source: Adopted from Table 3.

Table 4: Means of reported number of injured from reported Road Traffic Accidents from 1970 – 2015

S/N	Years	N	Mean
1	1980	8	75.75a
2	1985	8	72.50ab
3	1979	8	70.13ab
4	1981	8	67.63abc
5	1973	8	66.38abcd
6	1978	8	66.25abcd
7	1976	8	64.50abcd
8	1988	12	60.50abcd
9	1977	8	60.00abcd
10	1975	8	58.50f
11	1982	8	57.50f
12	1986	12	52.17fg
13	1984	8	51.88fg
14	1983	8	50.13fgh
15	1974	8	48.25fghi
16	1987	12	46.42fghij
17	1989	20	38.80ghlij
18	1994	20	37.65ghij
19	1993	20	34.60hijk
20	1990	20	34.45hijk
21	1971	8	34.13hijk
22	1970	8	32.38ijk
23	1991	20	32.25ijk
24	1997	20	32.15ijk
25	1072	8	32.00ijk
26	1996	20	31.75ijk
27	1995	20	31.70ijk
28	2001	20	31.60ijk
29	1998	20	31.30jkl
30	1999	20	29.85kl
31	1992	20	29.60ki
32	2000	20	29.10m
33	2002	13	34.13hij
34	2001	20	32.15ijk
35	2003	8	29.85jki
36	2004	12	29.61kmi
37	2010	20	48.26mi
38	2012	8	46.44mki
39	2007	8	61.66N
40	2008	8	64.63Nij
41	2013	12	53.55Njk
42	2015	13	58.48oi
43	2013	13	63.14oij
44	2012	12	60.09ojk
45	2013	8	57.59pk

In order to determine the factors that influence the number of injured from road traffic accidents, a multiple regression analysis was done. Out of the three models tried, the linear form proved better than the double log form and log form considering the number of significant variables, sign of the coefficients with respect to a prior expectation and the size of R2. The result of the analysis shows that the R2 value was 0.61. This implies that the proportion of variation in the dependent variable (injured from road traffic accidents) explained by the independent variable was 61%. F-ratio of 14.34 was higher than the table value of 2.92 at 0.05 level of confidence indicating that at least one of the independent variables had significant influence on the dependent variable. Table 5 shows the regression result.

Table 5: Regression Results of the Factors of Road Traffic Accidents in Lagos State.

Independent variables	Regression Coefficients	Std. Error	T-Start	Remark
Length of roads (km)	1.866	0.553	3.371	S
Presence of road safety	95.453	69.76	1.368	NS
Population	$-1.47x10^{-5}$	0.000	-.955	NS
Constant	36.321	127.104	0.286	

S = Significant at 0.05 level of probability
NS = Not significant

From table 5, only the number of roads (km) positively and significantly influenced injured from road traffic accidents. This shows that the higher the length of roads (km), the more the number of injured from road traffic accidents. Road safety had positive but not significant effects on injured from road traffic accidents while population had negative but non-significant influence on injured from road traffic accidents. This implies that the number of injured decreases with increase in population.

Policy Recommendations

This study has revealed that road traffic accidents led to wanton destruction of life and property and as such the menace should be curtailed with more serious efforts. The pattern of road traffic accident in Lagos State is becoming an alarming phenomenon. This is because the menace is fastly engulfing different units and sections of the state for instance this study is carried out on the twenty (20) Local Government Areas of the State with the mission to establish significant variation if any in the road traffic accidents between the Local Government Areas. However, the results as earlier discussed shows that the alarming records of road traffic accidents varies significantly among the local government areas.

Government efforts towards road traffic accident reduction in the study area; in the light of the findings of this study should be elaborate, total and wide spread covering every segment of the state. Both the police and the FRSC should consider the whole of the study area as accident prone area, and thus, Police, FRSC should be treated accordingly. It is important to say that the setting up of Lagos Metropolitan Area Transport Authority (LAMATA) as an additional law enforcement agent for the maintenance of the roads, towing of broken down vehicles and those involved in road traffic accidents is inevitable.

Since the driver of a vehicle is the most important determinant of the occurrence of an accident, the quality of drivers on the roads in the study area cannot be over-emphasised. Consequently, training and retraining of drivers should be a basic effort towards reducing the carnage on our

roads. The training and retraining of drivers constitute a formidable means of effectively dealing with the issue of road traffic accident reduction. The road traffic system itself is dynamic in nature.

By the serious road traffic accident situation in the area of study, Local Government Areas like Lagos Island, Lagos Mainland, Ajeromi/Ifelodun, Ikeja, Mushin, Oshodi/Isolo, Apapa, Eti-Osa, Kosofe and Ojo Local Government Areas can be described as accident prone areas, because they are all associated with high accident rate, high number of deaths, high number of injuries and so on (Fig. 3). This trend therefore, suggest that these Local Government Areas of Lagos State are associated with the menace of road traffic accidents, and these deserves urgent attention and appropriate policy intervention.

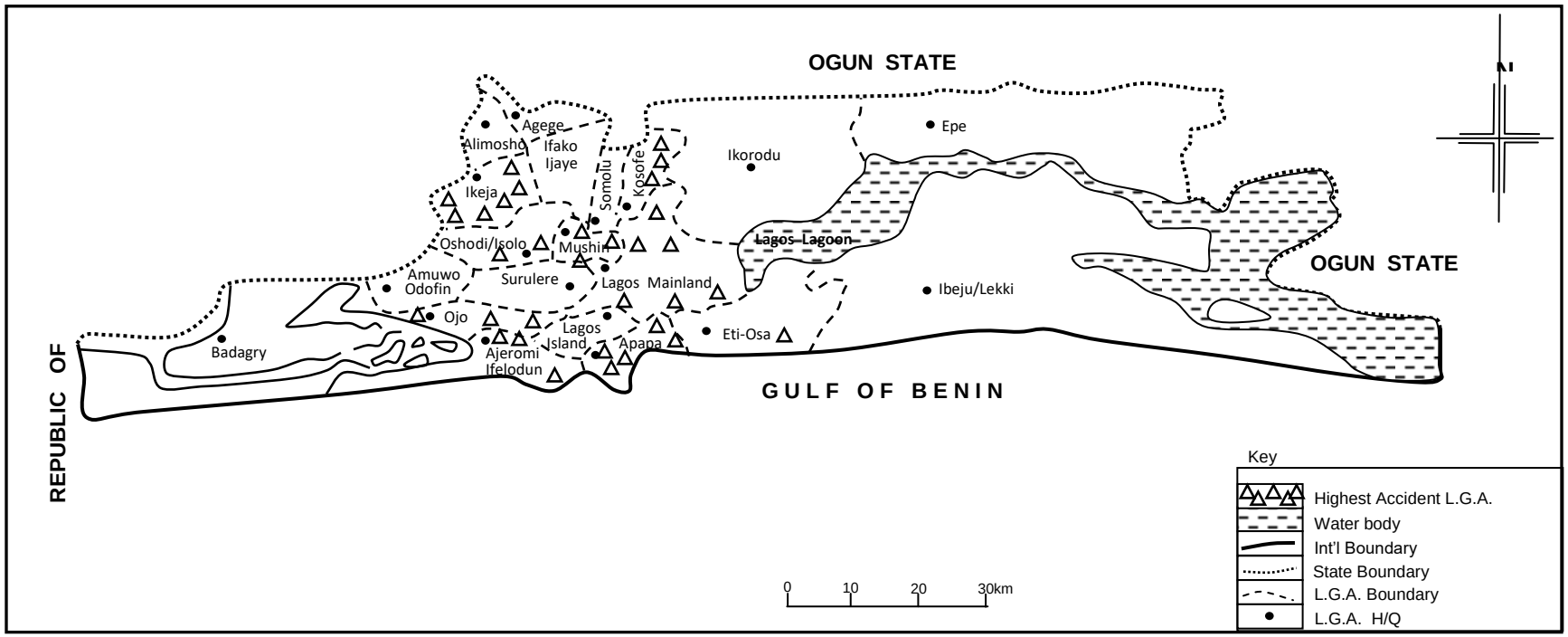

FIG. 3: SPATIAL DISTRIBUTION OF HIGHEST ACCIDENT L.G.As IN LAGOS STATE

Source: Atubi, A.O. (2006)

Therefore the training and retraining of operators of vehicles is a sine qua non if the operators are to develop, retrain, and display skills that match the demands imposed on them by constantly changing characteristics of the road system. This measure is the only means of ensuring that operators entering or remaining in action in the system are first endowed with the necessary skills.

Furthermore, road safety problems do not avail themselves to immediate solutions. They also require strong political commitment to ensure on a long-term basis, appropriate monitoring of the road accident situation on which pertinent decisions can be made. The financial implications are enormous and the budgetary constraints are extreme. A cost-effective approach to tackle and better tackle and better address the road safety issues is to implement innovative and well-structured pilot programmes, rationally allocate funds for research, identify problems calling for remedial actions and co-ordinate road safety policies at regional and sub-regional levels. There are two basic ways of financing road safety operations, these are self-financing and development aid financing. Self financing is the common method and it involves earmarking of funds or levying taxes on car owners. This method is recommended for adoption given the ever-increasing scarcity of external funding inflows for programmes. In general, while the role of most insurance companies is still very minimal and weak in road safety activities, some companies recognize that they have a social role to play and try to project a positive image by taking part in some road safety activities. These activities include financing research, co-operation with driving schools, development and production of teaching materials, information campaigns etc. Development aid financing is in two forms as well, bilateral aid and multilateral aid. Bilateral assistance often takes the form of technology transfer through technical assistance and training to develop local and road safety agencies. Assistance from financial institutions may encompass technical assistance for training, studies, institution building and finance for equipment and infrastructure improvements.

Preventive measures should also be taken which would include proper design of road networks as well as the planning of the general public transport system to ensure that it runs in an effective and efficient manner as this would reduce the volume of vehicles plying the roads; these measures must be commenced in the early stages of urban planning.

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