Time Series and Trend Analysis of Fatalities from Road Traffic Accident in Lagos State, Nigeria

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Abstract

This study examined time series and trend analysis of fatalities from road traffic accident in Lagos State, Nigeria. The data generated were mostly secondary data; accident records where obtained from the Nigeria Police Force and Federal Road Safety Commission. The data were obtained for the period of thirty two (32) years. From the time series and trend analysis, it was observed that fatalities from road traffic accidents for each of the Local Governments under study between 1970 and 2001, showed that fatalities is on the decrease with the exception of Lagos Island Local Government Area over the period of study. The 16 harmonics for all the Local Government Areas considered contributed above 90% of the total variance in the time series. This means that more than 90% of road traffic accident in Lagos State could be attributed to recklessness on the part of drivers, ignorance of highway codes, driving under the influence of alcohol, over speeding etc. based on the findings, recommendations were proffered on how to reduce the phenomenon of fatalities from traffic accidents in Lagos State.

Keywords: *Fatalities; trend; time analysis; traffic; accident; road; Lagos State*

1. Introduction

Road traffic accident rates and fatality rates in the industrialised countries have tended to exhibit pronounced decreasing time trends. Some scholars like Oppe (1991) interprets the downward trend as evidence of experimental learning, while others like Peltzman (1975), Harvey and Durbin (1986) and Broughton (1999) treat it as a nuisance parameter that happens to be essential for model fitting.

Nigeria has the highest rate of fatalities from motor accidents in the world according to statistics compiled by the Federal Road Safety Commission (FRSC). The country leads 43 other nations with deaths in 10,000 vehicle crashes. Ethiopia ranked second with 219 deaths per 10,000 vehicles while Malawi, took the third position and Ghana took the fourth position with 183 and 178 deaths respectively (Daramola, 2004, Atubi, 2012g).

While traffic related injuries take a very large tool in almost every country around the world particularly in developing countries or less industrialized countries, significant progress towards prevention and control has been limited to high income and/or highly industrialized countries (Soderland and Zori 2001; Zaza et al, 2003). Much of the progress in developed countries is attributed to the combination of interventions, strategies and policies that have been developed mainly in these developed countries settings over the past few decades. Such factors as high health budgets, adequate number of researchers, high levels of health and safety awareness, and near universal literacy, have also catalyzed this progress (Rivera et al, 2000; Barss et al, 2001; Forjuoh, 2003).

As in other developing countries, road traffic accidents in Nigeria are one of the most serious problem in need of pragmatic solution. 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 rates in Africa and the second in the world (Akpogomeh, 1998; Obinna, 2007, P. 35, and Atubi 2012e).

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 accident between 1990 and 2005 rose from 28,253 and the fatality rate remains consistently high (Atubi, 2009c).

International comparison indicates that the chances 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 example, while Czech Republic has only

one death in 197 accidents, France one death in 175, South Africa, one death in 47 accidents, Nigeria has one death in 2.65 accidents (Atubi, 2010b).

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 et al, 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.

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 indicate that better facilities in terms of good quality and standardized roads have been accompanied by increasing number of accidents (Onakomaiya, 1988; Gbadamosi, 2002; Atubi and Onokala, 2009). This is totally contrary to the trends in countries were even the level of sophisticated road network and volume of vehicular traffic are much higher (Atubi, 2010a).

2. 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 (Federal Republic of Nigeria, 1997, p. 6). 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 140 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 (Lagos urban Transport Project, 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.
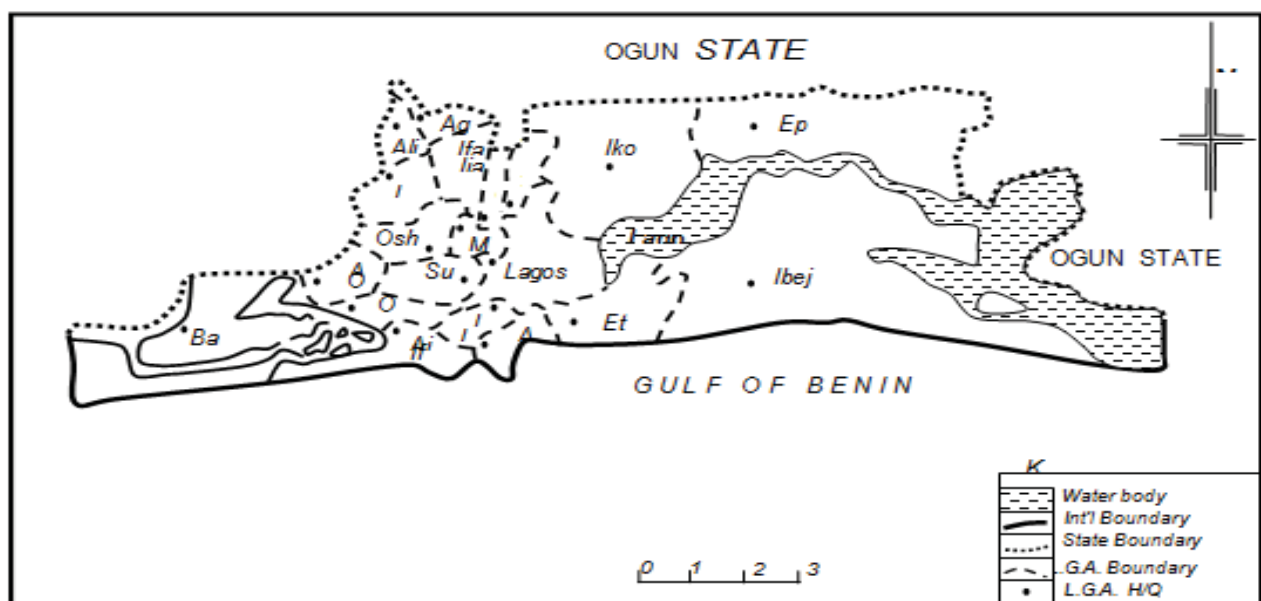

FIG. 1: Map Of Lagos State Showing The 20 L.G.AS
Source: Lagos State Ministry of Environment and Physical Planning (1999)

3. Research Methodology

The bulk of the information that were used in this paper came from secondary sources, which include accident records of the Federal Road Safety Commission, the Nigeria Police Force, Federal Ministry of Transport and the Federal Office of Statistics. Finally, in an attempt to examine the temporal pattern of fatality from road traffic accidents in the study area, the time series and trend analysis of the road traffic accident statistics was under taken. The time series and trend analysis showed the pattern of the number of fatalities over the period of study (i.e. 1970-2001). Also, the harmonic analysis was used to estimate the contributions of particular bands of frequencies to the overall variance in terms of a fluctuating time series.

4. Discussion of Results/Findings

In an attempt to examine the temporal trend of fatalities from road traffic accidents in Lagos State, the times series and trend analysis of the accident statistics leading to fatalities in respect of each of the selected Local Government Area were undertaken. The result of this analyses are shown in Fig. 2 and table 1. This figure revealed the time series as well as trend of fatality from road traffic accidents for Lagos State. As shown in fig. 2, the time series of fatality from road traffic accidents show variation over time. The year 1988 recorded the highest figure of 478 while the least was in 1972 with 209 fatalities from road traffic accidents. The trend of fatality from road traffic accidents as shown in fig. 2 reveals that the phenomenon is on the increase, in other words, the trend of fatalities occurrence from road traffic accidents is on the increase in Lagos State between 1970 and 2001 as revealed by the trend analysis. Accidents were high during the years because of the fact that the federal road safety commission was not in existence then.

Table 1: *5 Year Moving Averages of Fatalities from Road Traffic Accidents in Selected Local Government Areas in Lagos State (1970-2001)*

| S/N	Lagos State	Lagos Island	Ikorodu	Ajeromi/ Ifelodun	Badagry	Epe	Ikeja	Mushin	Lagos Mainland
1	208.60	37.40	15.40	30.20	15.60	11.40	42.80	32.00	33.20
2	250.00	47.60	19.40	35.20	17.20	12.20	53.20	37.20	37.60
3	299.60	59.60	25.40	41.40	20.60	13.00	64.80	41.20	42.00
4	33300	67.80	25.40	45.40	24.20	14.00	73.00	38.80	40.00
5	340.80	73.80	25.20	45.00	25.80	15.20	77.00	43.00	46.40
6	379.40	80.60	27.20	52.40	30.80	16.00	82.80	47.00	52.40
7	407.80	86.20	26.60	57.60	32.60	17.40	87.60	49.60	54.40
8	415.00	88.60	22.60	59.60	30.60	19.00	90.40	49.60	56.40
9	410.00	85.40	23.40	58.40	28.60	21.00	87.20	47.20	51.80
10	379.80	77.40	24.00	52.80	25.00	19.60	80.00	42.60	47.00
11	35120	73.00	23.00	47.00	22.80	19.20	74.60	42.60	51.20
13	359.20	74.00	21.00	51.80	22.80	18.80	75.00	40.60	51.20
13	367.80	70.40	23.00	50.20	22.80	17.40	70.80	39.60	49.00
14	393.60	73.20	24.40	51.20	22.80	16.20	73.80	42.00	53.40
15	441.00	79.40	24.00	55.40	24.60	18.20	79.40	43.00	52.80
16	478.20	78.80	21.80	54.80	24.00	19.40	79.60	36.60	40.20
17	460.00	69.00	22.20	41.60	23.80	19.60	79.30	29.40	32.80
16	437.60	60.00	21.60	34,20	23.80	19.60	70.80	24.80	27.00
19	417.40	52.40	18.40	29.20	21.40	17.60	62.60	19.80	20.40
20	391.40	38.20	16.80	22.40	20.40	16.40	54.60	15.80	16.60
21	372.80	30.20	15.80	18.60	18.40	14.40	41.00	13.00	13.30
22	36060	22.20	13.40	15.80	14.80	12.60	32.80	13.40	15.00
23	37040	20.80	10.20	16.40	14.00	11.60	24.40	14.80	16.20
24	383.20	21.60	10.00	17.60	14.00	11.40	22.80	15.40	17.20
25	377.80	24.00	9.60	18.20	12.20	10.80	23.60	16.20	18.40
25	368.20	26.00	9.60	18.80	12.20	11.00	26.80	16.40	19.20
27	360.20	28.80	9.40	19.60	12.40	10.80	30.40	17.00	21.28
28	371.80	114.80	10.40	19.80	12.00	11.00	36.30	25.20	29.60

Source*: Analysis of Data Collected*
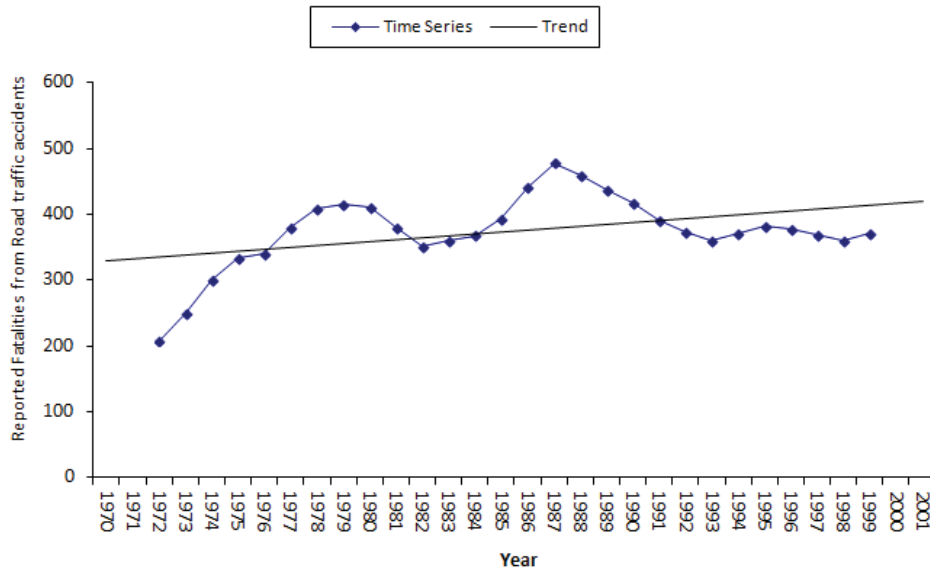
Fig 2: *Time Series and trend of fatalities from road traffic accidents in Lagos State (1970-2001)*
Source*: Adapted from Table 1*

As shown in (Fig. 3 and Table 1), the time series analysis for fatality from road traffic accidents in Lagos Island Local Government Area shows variation over time. The year 1979 recorded the highest figure of 114 fatalities while the least was in 1984 with fatalities from road traffic accidents of 21. The trend of fatalities as shown in Fig. 3 reveals that the phenomenon is on the increase, in other words, the trend of fatalities is on the increase over the years. This shows that fatality occurrence from road traffic accidents is on the increase between 1970 and 2001 as revealed by the analysis. This could be as a result of the high vehicular traffic that leaves and enters Lagos Island Local Government Area on a daily basis (See Atubi, 2010b).
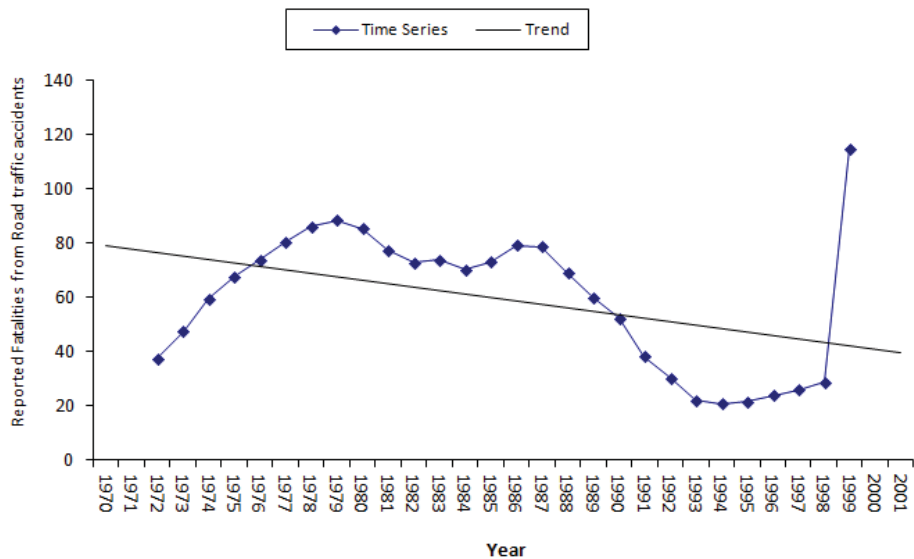

Fig 3: *Time Series and trend of fatalities from road traffic accidents in Lagos Island Local government Area (1970-2001)*
Source:*Adapted from Table 1*

The time series analysis of fatalities from road traffic accidents for Ikorodu Local Government Area reveal the least figures of 9 fatalities from road traffic accidents in 1998 and highest figure of 27 in year 1977. The trend analysis however, show that the fatality occurrence is on the decrease in Ikorodu Local Government Area as there is downward direction (Fig. 4). This could be as a result of the not too very busy nature of Ikorodu because it is on the outskirt of Lagos State.
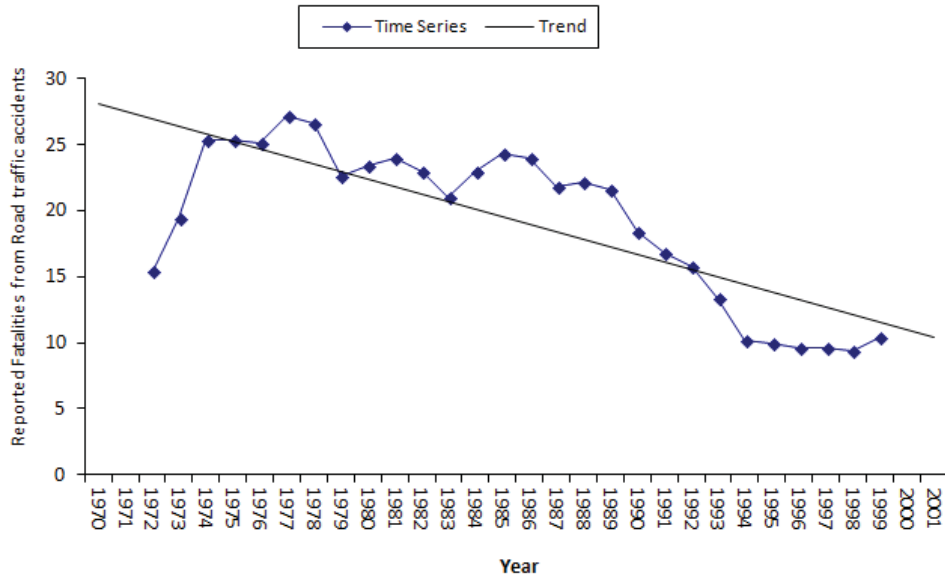
Fig 4: *Time Series and trend of fatalities from road traffic accidents in Ikorodu Local government Area (1970-2001)*
Source*: Adapted from Table 1*

The time series of fatality from road traffic accidents for Ajermoi/Ifelodun Local Government Area reveal the least figure of 16 fatalities from road traffic accidents in 1993 and highest figure of 60 in year 1979. The trend analysis however, show that the fatality occurrence from road traffic accidents is on the decrease as the gradient is in downward direction (Fig. 5). Fatalities were high in 1979 because at that time road safety commission was not in existence so people tend to be more reckless on the roads. While in 1993, it could be because of the very existence of road safety commission hence the decreasing trend fatalities from road traffic accidents.
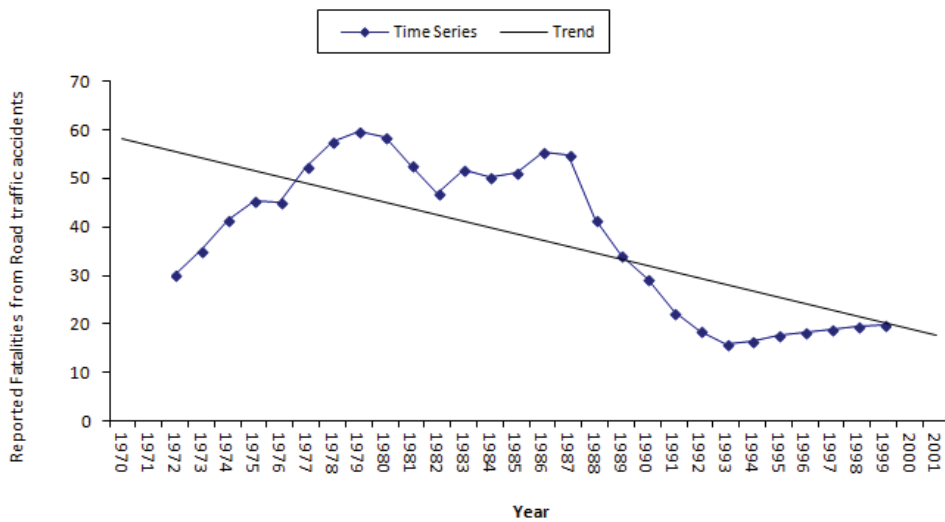

Fig 5: *Time Series and trend of fatalities from road traffic accidents in Ajeromi/Ifelodun Local government Area (1970-2001)*
Source:*Adapted from Table 1*

The time series of fatality from road traffic accidents for Badagry Local Government Area reveal the least of 12 fatalities from road traffic accidents in 1999 and highest figure of 33 in year 1978. The trend analysis however, show that the fatality occurrence is on the decrease as the gradient is in downward direction (Fig. 6).
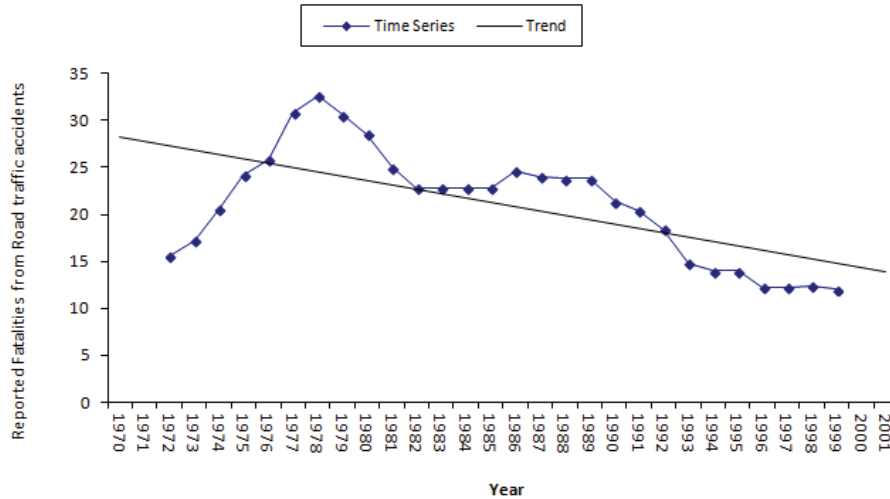
Fig 6: *Time Series and trend of fatalities from road traffic accidents in Badagry Local government Area (1970-2001)*
Source*: Adapted from Table 1*

For Epe Local Government Area, the series show highest fatality from road traffic accident of 21 for 1980 and least figure of 11 for 1998. The trend as shown in figure 7, shows the phenomenon was on the decrease over the years (Fig. 7).
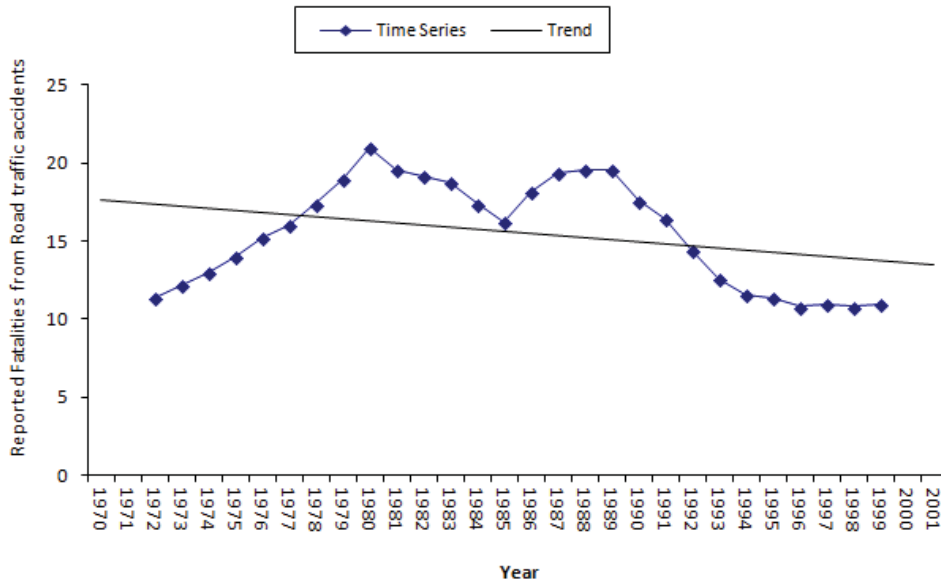

Fig 7: *Time Series and trend of fatalities from road traffic accidents in Epe Local government Area (1970-2001)*
Source*:Adapted from Table 1*

The time series of fatalities from road traffic accident for Ikeja Local Government Area reveal the least figure of 23 fatalities from road traffic accidents in 1995 and highest figure of 90 in year 1979. The trend analysis however, show that the fatality occurrence is on the decrease as the gradient is in downward direction (Fig. 8).
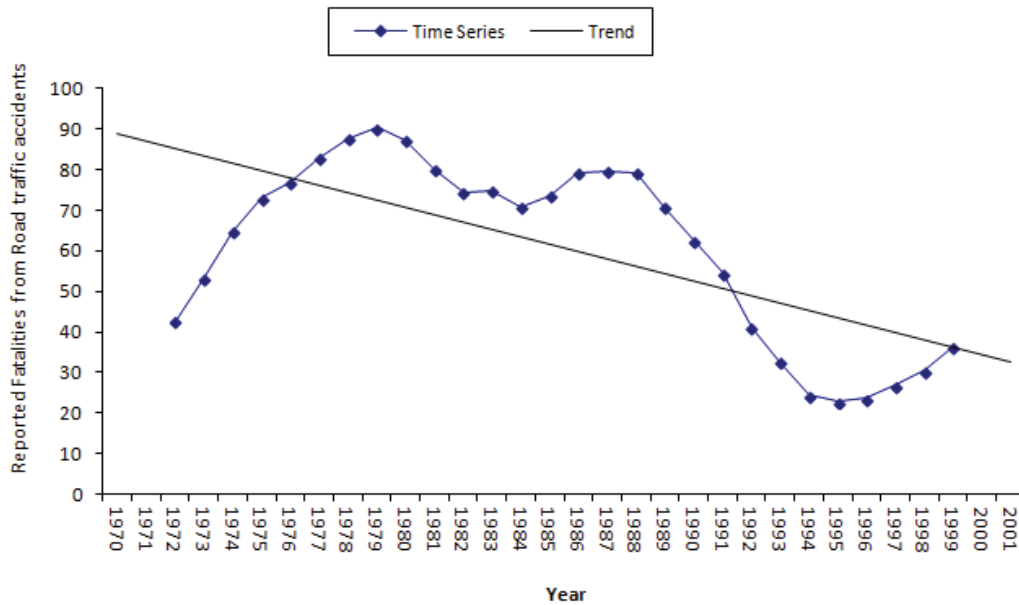
Fig 8: *Time Series and trend of fatalities from road traffic accidents in Ikeja Local government Area (1970-2001)*
Source*: Adapted from Table 1*

Mushine Local Government Area reveals the least figure of 13 fatalities from road traffic accidents in 1992 and highest figure of 50 in year 1978. The trend analysis show that the fatality from accident occurrences is on the decrease as the gradient is in downward direction (Fig. 9).

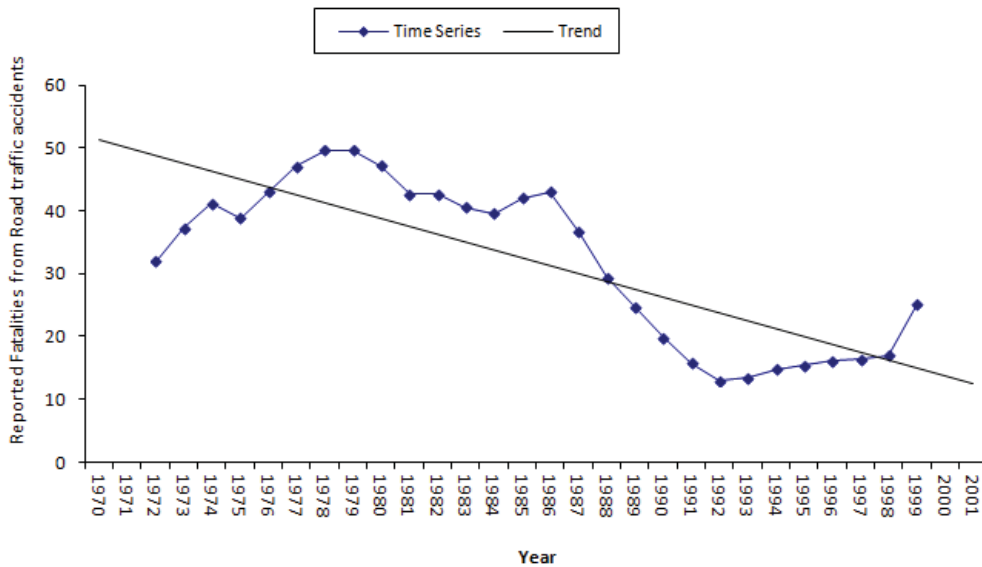Fig 9: *Time Series and trend of fatalities from road traffic accidents in Mushin Local government Area (1970-2001)*
Source*: Adapted from Table 1*

Lagos Mainland Local Government Area reveals the least figure of 14 in 1997 and highest figure of 56 in year 1979. The analysis show that the fatality occurrence from road traffic accidents is on the decrease as the gradient is in downward direction (Fig. 10).
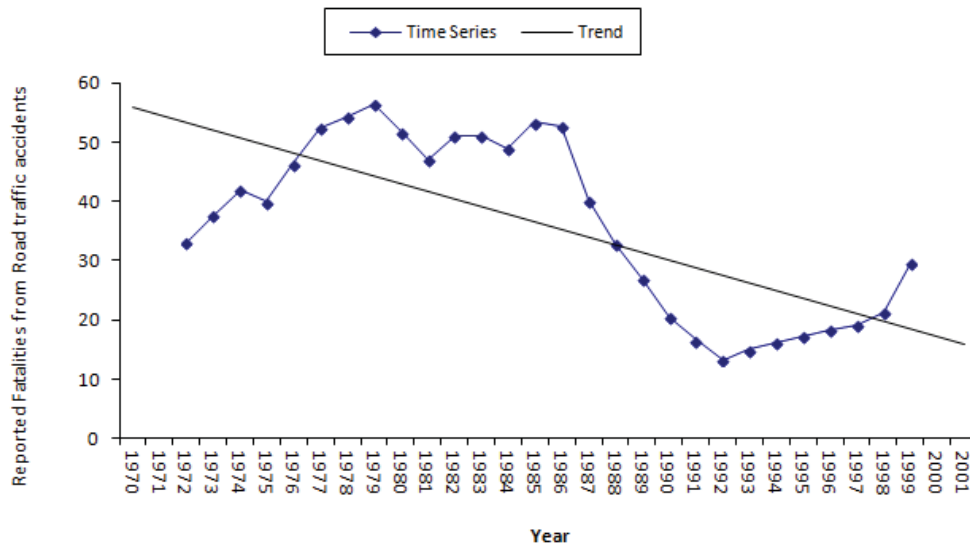
Fig 10: *Time Series and trend of fatalities from road traffic accidents in Lagos Mainland Local government Area (1970-2001)*
Source: *Adapted from Table 1*

From the above discussions the time series analyses for fatality from road traffic accidents for each of the Local Government Area under study between 1970 and 2001 shows that fatalities is on the decrease with the exception of Lagos Island Local Government Area over the period of study.

The technique of harmonic analysis was applied to the series of fatalities from road traffic accident over the period 1970 – 2001 for Lagos State as a whole. Generally, the 1st harmonic contributes the highest percentage variance of 27.81%, closely followed by the 3rd and 8th harmonics contributing 22.15% and 9.57% of the total variance respectively (Table 2). The lowest percentage variance of 0.20% is contributed by the 7th harmonic. The 16 harmonics contribute 98.56% of the total variance in the time series.

Table 2: *Variance Spectra of number of Fatalities from Road Traffic Accidents for Selected Local Government Areas in Lagos State*

Harmonics	Lagos %V	Lagos Amp	Lagos Island %V	Lagos Island Amp	Ikorodu %V	Ikorodu Amp	Ajeromi %V	Ajeromi Amp	Badagrey %V	Badagrey Amp	Epe %V	Epe Amp	Ikeja %V	Ikeja Amp	Mushin %V	Mushin Amp	Lagos Mainland %V	Lagos Mainland Amp
1	27.81	73.50	4.36	22.37	50.27	8.20	57.26	21.78	50.21	8.10	59.03	5.00	58.75	29.98	33.21	16.92	47.14	19.10
2	3.77	27.05	5.59	25.32	6.42	2.93	0.11	0.95	7.51	3.13	0.45	0.44	0.25	1.97	1.55	2.39	4.12	5.65
3	22.15	65.59	7.48	29.31	3.49	2.16	4.87	6.35	9.41	3.51	7.30	1.76	12.39	13.77	1.23	2.58	4.43	3.33
4	1.63	17.7S	5.05	24.08	1.35	1.34	3.30	5.23	1 78	1.52	7.27	1.75	0.15	1.53	4.83	5.1	5.28	6.39
5	7.56	38.33	5.31	24.68	0.83	1.05	6.08	7.10	2.95	1.96	3.00	1.15	3.56	7.33	1.06	2.39	1.58	3.50
6	9.35	42.62	8.71	31.62	9.15	3.50	4.59	6.16	7.53	3.13	2.20	0.96	4.28	8.09	5.71	5.54	5.92	6.30
7	0.20	6.21	4.30	23.48	0.67	0.94	2.53	7.62	1.50	1.40	0.97	0.64	0.16	1.59	2.10	3.36	1.19	3.03
6	9.57	43.12	9.17	3.44	6.09	2.86	4.92	6.38	1.1S	1.25	4.15	1.33	3.55	7.33	5.81	5.59	6.44	7.06
9	1.18	15.11	5.55	2.24	10 32	3.30	0.39	1.79	0.57	0.66	150.00	0.30	0.17	1.64	1.54	2.88	1.55	3.47
10	3.40	25.63	7.77	29.37	1.25	1 2S	2.42	4.48	0.21	0.52	0.80	0.58	1.04	3.98	4.65	5	5.32	6.41
11	0.40	8.36	5.23	24.02	2.57	1 85	3.14	5.10	9.53	3.53	3.67	1.25	0.30	2.15	4.91	5.14	7.6	7.67
12	0.51	9.97	5.51	25.15	0.19	0.51	0.15	1.11	0.61	0.39	2.80	1.09	0.36	2.35	1.81	3.12	6.88	2.61
13	1.95	19.44	4.21	21.08	1.89	1.5S	4.74	6.27	0.27	0.59	0.23	0.32	3.65	7.47	5.09	5.23	6.32	6.99
14	3.88	27.46	8.38	31.01	0.04	0.23	1.18	3.12	1.12	1.21	1.71	0.85	1.35	5.32	0.45	1.55	6.66	2.26
15	1.84	10.92	6.55	27.42	1.72	1 52	0.49	2.01	0.71	0.96	1.57	0.83	0.57	2.97	0.7S	2.06	0.23	1.35
16	3.36	25.56	6.32	26.94	0.19	0.50	1.33	3.38	0.36	0.69	0.04	0.13	0.35	2.31	0.00	0.06	0.01	0.31

% v = Percentage variance
Amp = Amplitude

Similarly, for Lagos Island Local Government Area, the 8th harmonic contributes the highest percentage variance of 9.17% closely followed by the 6th harmonic of 8.71% and the 14the harmonic which has 8.38% variance of the total variance observed. The 13th harmonic contributes the lowest percentage variance of 4.21% to the total variance of the time series. The total percentage of variance contributed by all 16 harmonics is 99.84%. This means that 99.84% of the number of fatalities from road traffic accidents in Lagos Island could be attributed to recklessness on the part of drivers, ignorance of highway codes, driving under the influence of alcohol, wrongful over taking, over speeding etc leaving 0.16% to other factors.

For lkorodu Local Government Area, the 1st harmonic contributes the highest percentage variance of 50.27% and the 9th harmonic which has 10.82% variance of the total variance observed. This is closely followed by the 6th harmonic

of 9.15%. The total percentage variance contributed by all 16 harmonics is 96.94%. The 14th harmonic contributes the lowest percentage variance of 0.04% to the total variance of the time series.

Similarly, the 1st harmonic accounts for the highest percentage variance of 57.26% for Ajeromi/Ifelodun Local Government Area, closely followed by the 5th and 8th harmonics with percentage variances of 6.08% and 4.92% respectively. The 2nd harmonic contributes the lowest percentage variance of 0.11%. The 16 harmonics contributes a total of 97.6% to the temporal pattern of fatalities from road traffic accident occurrence.

For Badagry Local Government Area, the 1st harmonic contributes the highest percentage (50.21%) of the total variance, closely followed by the 11th and 3rd harmonics which contributes 9.53% of the variance respectively. The 10th harmonic contributes the lowest percentage variance (0.21%). All 16 harmonics contributes a total of 95.48% of the variance in the temporal occurrence of the number of fatalities from road traffic accidents over the 32 years.

Similarly, the 1st harmonic account for the highest percentage variance of 59.03% for Epe Local Government Area, closely followed by the 3rd and 4th harmonics with percentage variance of 7.30% and 7.27% respectively. The 16th harmonic contributes the lowest percentage variance (0.04%). The 16 harmonics contribute a total of 96.8% to the temporal pattern of number of fatalities from road traffic accident occurrence.

For Ikeja Local Government Area, the 1st harmonic contributes the highest percentage variance of 58.75%, closely followed by the 3rd and 6th harmonics which contributes 12.39% and 4.28% of the variance respectively. The 4th harmonic contributes the lowest percentage variance of 0.15%. All 16 harmonics contribute a total of 91.38% of the variance in the temporal occurrence of fatalities over the 32 years.

Similarly, the 1st harmonic account for the highest percentage variance of 53.21% for Mushin Local Government Area, closely followed by the 8th and 6th harmonics with percentage variances of 5.81% and 5.71% respectively. The 16th harmonic contributes the lowest percentage variance (0.01%). The 16 harmonics contributes a total of 94.74% to the temporal pattern of fatalities from road traffic accident occurrence.

For Lagos Mainland Local Government Area, the 1st harmonic contributes the highest percentage (47.14%) of the total variance, closely followed by the 11th and 8th harmonics which contributes 7.60% and 6.44% of the variance respectively. The 16th harmonic contributes the lowest percentage variance (0.01%). All 16 harmonics contribute a total of 94.87% of the variance in the temporal occurrence of number of fatalities from road traffic accidents over the 32 years. In other words, 94.87% of the number of fatalities from road traffic accident variation in Lagos Mainland are composed of different cycles.

5. Policy Implications/Recommendations

By the serious road traffic accident situation in the study area, Local Government Areas like Lagos Island, Lagos Mainland, Ikorodu, Epe, Ikeja, Badagry, Ajeromi/Ifelodun and Mushin Local Government Areas can be described as fatalities prone areas, because they are all associated with high accident rate, high number of fatalities and so on. 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.

Government efforts towards road traffic accident reduction in the study area, 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 with respect. 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 over roads. The training and retraining of drivers constitute a formidable means of effectively dealing with the issue of road traffic accident reduction.

However, for historical and for operational convenience, road traffic law is enforced by the Nigerian Police, but recently this function has been shifted to the Federal Road Safety Commission whose activities have been limited through insufficient resources for checking speed violation, careless and dangerous driving and parking offences. Laws and regulations may carry little force of the probability of detection and perception of detection are so low that they can safely be ignored; with the present situation the chances of getting caught in a traffic violation are remarkably small. A further escape route for offenders exists in the court which often has erratic patterns of sentencing for road traffic law violation. This situation needs to be improved upon, by ensuring that Federal Road Safety Corps is well funded as no amount should be considered too great for saving the nation of economic loss associated with road fatalities.

6. Conclusion

Road traffic accident, a well documented consequence of motorization is the leading cause of deaths in Nigeria. While accidents occur in all modes of transport, including rail ways, no mode approaches the importance of the motor car in the scale of deaths and injuries. Living safely is a challenge that must be accepted by every one if we are to continue to move forward in an ever-changing society.

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