
Variations of Injuries from Road Traffic Accidents in Lagos State: An Analysis of Variance Spectra

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Abstract: *The major objective of this paper is to examine the variations of injuries from road traffic accident in Lagos State. The study used mostly secondary data. The data were obtained for a period of thirty-two (32) years from 1970-2001. The 16 harmonics for the selected Local Government Areas considered contribute above 70% of the total variance in the time series. This means that more than 70% of injuries from road traffic accidents in Lagos State could be attributed to recklessness on the part of drivers, ignorance of high way codes, over speeding etc. Also, the dominant cycles of injuries from road traffic accidents observed in the study area have periodicities of 32.00 and 16.00 years with the most dominant being 32 years. Based on the findings, recommendations were proffered.*

Keywords Injuries; Traffic; Accidents; Variations; Lagos State.

1. Introduction

Road traffic accident rates and fatality rates in the industrialized countries have tended to exhibit pronounced downward time trends. Some Scholars i.e. Oppe (1999) interpret the downward trend as evidence of experimental learning, while others like Peltzman (1974), Harvey and Durbin (1986) and Broughton (1991) treat it as a nuisance parameter that happens to be essential for model fitting.

Motor Vehicle Traffic Injuries (MVTIs) are an important public problem in both developed (Baker et al, 1992; Graham, 1993) and developing (Smith and Barss, 1991; Atubi, and Onokala, 2009; Atubi, 2010a) countries. When designing a relevant MVTI control programme, the first two questions that should be asked are “who” are at the highest risk and “where” are MVTI’s most likely to occur.

In many cases these higher percentages are an obvious consequence of the differences between the traffic and population characteristics of developed and developing countries. For instance, the average percentage of the population aged 5 to 14 years in a sample of 16 developing countries is 28 percent compared with 15 percent for developing countries (Downing and Sayer, 1982).

It has been estimated that over 300,000 persons die and 10-15 million persons are injured every single year in road accidents throughout the world (Afukaar, 2001). Moreover, road traffic accidents have been shown to cost around one percent of annual gross national product (GNP) resources of the developing countries which they can ill-afford to lose (Afukaar, 2003).

Road traffic injuries are a major cause of mortality worldwide, but especially in low-and middle-income countries. The World Health Organization estimates that more than 3000 people are killed everyday in road traffic accident globally, with at least 30,000 others injured or disabled. This adds up to over 1 million people killed and between 20-50 million injured or crippled in road traffic accidents each year (Krug, 2000). Low-and middle income countries account for more than 85% of the deaths and up to 90% of disability globally (Murray et al, 2001). At the current rate, it is projected that road traffic disability-adjusted life years lost will move from being the ninth leading cause of disability adjusted life years (DALY's) in 1999 to the third leading cause by 2020 (Krug et al, 2000). The rising trend in morbidity and mortality rates due to road traffic accidents in low-and middle-income countries has moved some to declare road traffic accidents an 'epidemic' (Nantulya and Reich, 2002; Roberts et al, 2002).

Road traffic accidents have attracted more studies in developing nations in the 21st century. For instance, in Asia, pedestrians and motorcycles have the highest rate of injury (Yang et al, 2003; Wang, 2003; Suriyanwongglassal, 2003). Pedestrians, passengers in mass transportation are the main concern in Africa (Afukaar et al, 2003; Odero et al, 2003; Romao et al, 2003; Atubi, 2006; Atubi and Ekrugdakor, 2008). In Latin America and the Caribbean, pedestrians in

urban areas are the biggest concern (Hijiar et al, 2003; Rodriguez et al, 2003; and Benard et al, 2003).

Whereas road traffic accidents were considered rare events, they have been found to constitute a menace in modern times. Both the developed and the developing nations of the world alike have suffered from the menace, with Nigeria occupying an unrivaled leadership position (Atubi, 2009b).

Nigeria has the highest rate of deaths from motor accidents in the world, according to statistics compiled by the Federal Road Safety Commission (FRSC). The country leads 37 other nations with 240 deaths in 10,000 vehicles crashes. Ethiopia ranked second with 200 deaths per 10,000 vehicles, Malawi took the third position with 180 deaths (the Guardian Newspaper, Lagos, 19 December 1989, P. 12, Atubi, 2010b).

The following conclusions are therefore inevitable, Nigeria is worse than most countries in terms of traffic accidents, in spite of her relatively good road network and the establishment of the Federal Road Safety Commission (FRSC). In fact a World Bank report asserts that from the view-point of road development, Nigeria would no longer be regarded as a developing country (World Bank, 1981).

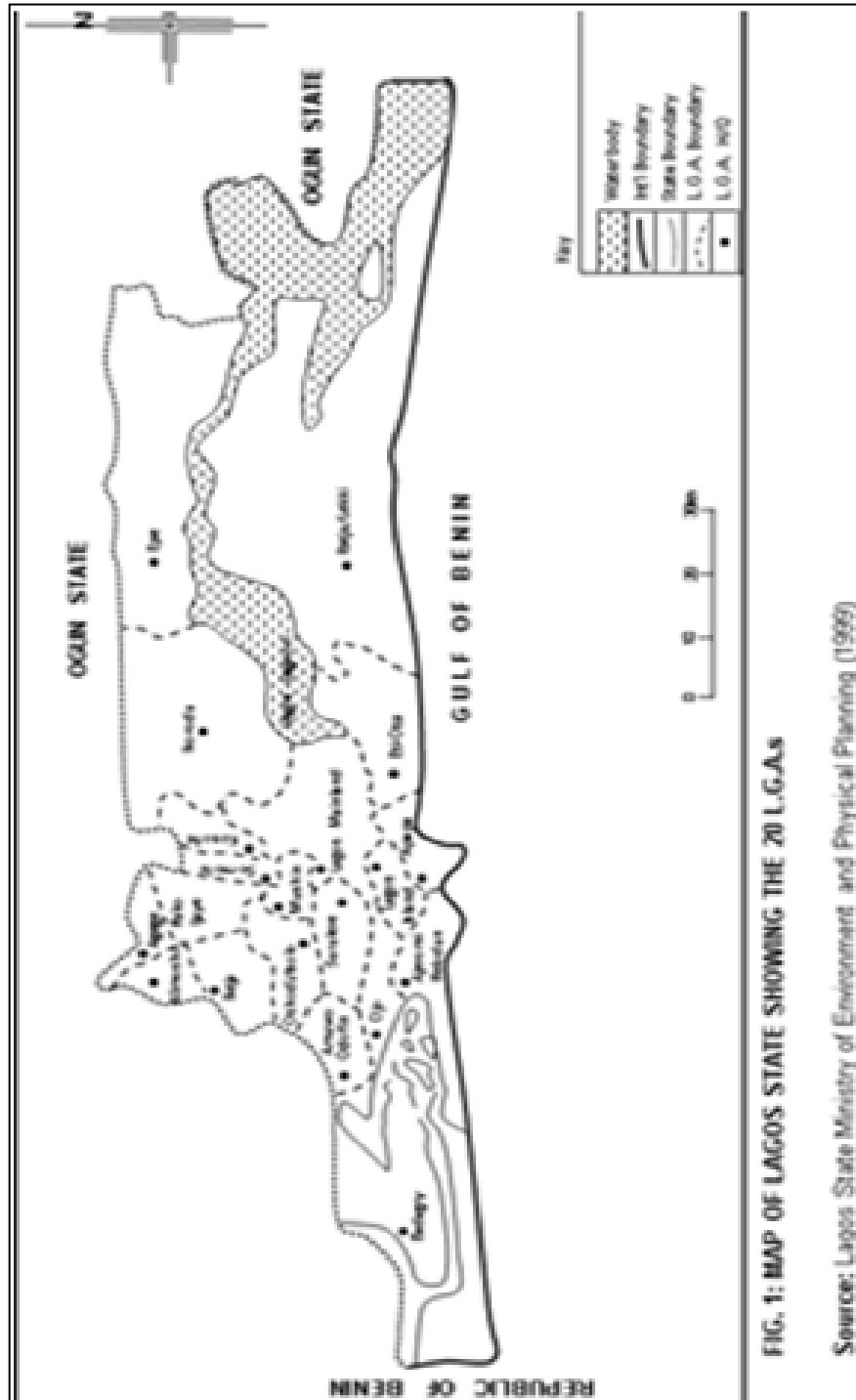
Indeed, the Nigeria accident pattern seems to suggest that the better the road, the higher the accident rate and the fatality, severity and non-survival indices. Road safety is a potent theme steadily growing in significance in urban and rural transportation in both developed and developing countries (Onakomaiya, 1988; Gbadamosi, 1994; Filani and Gbadamosi, 2007).

It is not enough to merely organize endless seminars, symposia, lecture and workshops on road safety, actions must follow ways to reduce accident on Nigerian highways.

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.



3. Research Methodology

Data for the study were mainly obtained from the Nigeria police force accident records, the Federal Road Safety Commission (FRSC) and were complemented with data from research reports and articles and national statistical abstracts and newspapers. The author reviewed the statistics of injuries for the year 1970 to 2001, disaggregated by administrative councils.

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. However, the justification for choosing Ikeja, Lagos Island, Lagos Mainland and Ajeromi/Ifelodun Local Government Areas for this study lies in the fact that they carry more than fifty (50%) percent of the vehicular traffic in Lagos State (Atubi, 2007).

4. Discussion of Results/Findings

Table 1 and Figure 2 revealed the reported number of injured people from road traffic accidents in Lagos State from 1970 – 2001. As shown in Table 1, Ikeja Local Government Area recorded the highest number of injury from road traffic accident among the 20 Local Government Areas. The number was 2234, representing 12.61% of the injured during the period of study. This is followed by Lagos Mainland Local Government Area with a total number of 2005 representing 11.32%. This is then followed by Lagos Island with a total of number of 1930 representing 10.90% and Ajeromi/Ifelodun Local Government Area with a total number of 1694 representing 9.56% respectively.

Table 1: Reported number of injured from road traffic accident in selected L.G.A.'s in Lagos State from 1970-2001

Year	Lagos Island	Ajeromi/ Ifelodun	Ikeja	Lagos Mainland
1970	40	32	56	40
1971	45	30	60	40
1972	33	35	33	35
1973	30	78	102	90
1974	50	60	70	60
1975	70	62	90	70
1976	90	72	90	90
1977	60	60	63	70
1978	98	70	99	90
1979	80	80	86	90
1980	100	92	105	98
1981	100	76	90	90
1982	60	50	64	70
1983	70	50	30	72
1984	65	50	70	66
1985	102	100	102	100
1986	82	76	85	35
1987	56	53	60	60
1988	100	79	100	101
1989	70	60	So	73
1990	71	50	73	71
1991	40	30	50	50
1992	35	35	40	4C
1993	40	29	50	45
1994	49	30	60	50
1995	20	32	40	30
1996	30	30	40	31
1997	30	40	45	30
1998	42	41	48	40
1999	40	30	50	41
2000	40	30	60	41
2001	42	33	53	44
Total	1930	1694	2234	2005
%	10.9	19.56	12.61	11.32

Source: Lagos State Police Command, Ikeja 2004

The observations in Table 1 shows that Ikeja, Lagos Mainland and Lagos Island Local Governments are the three Local Governments with the highest number of injured in the study area. These three Local Governments emerged as the

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ones with highest road traffic accident records. Ikeja Local Government Area in particular also appear among the Local Governments with highest number of deaths from road traffic accidents. All these then show that Ikeja, Ajeromi/Ifelodun, Lagos Island and Lagos Mainland Local Government Areas are very notorious for road traffic accidents and associated consequences such as deaths and injuries.

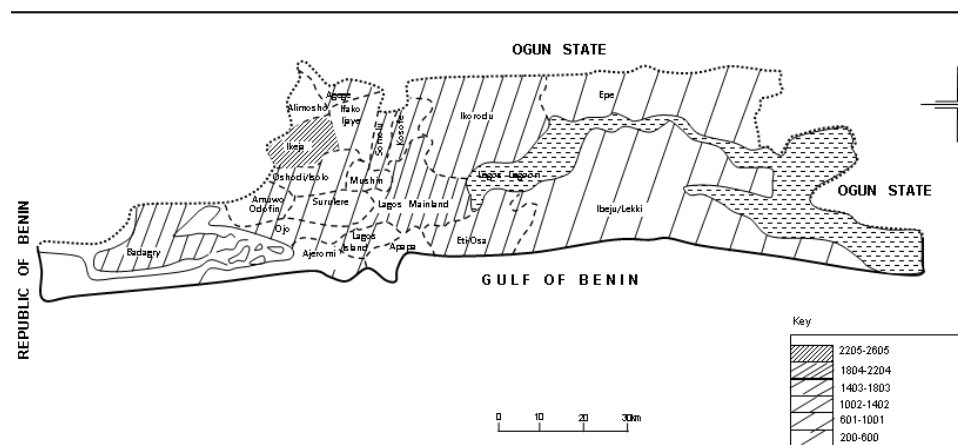


Figure 2: Choropleth Map Showing the Reported Number of Injured from Road Traffic Accident in Lagos State (1970-2001)

Source: Lagos State Ministry of Environment and Physical Planning (1999)

In an attempt to examine the temporal patterns of the reported number of injured from road traffic accidents in Lagos State, the time series and trend analysis of the injured statistics in respect to each of the selected Local Governments were undertaken. The results of these analyses are shown in (Figure 3 and Table 2). As shown in figure 3, the time series analysis of the reported number of injured from road traffic accidents for Lagos State show variation over time. The year 1989 recorded the highest figure of 692 while the least was in 1972 with 383 injured from road traffic accidents. The trend of injured from road traffic accidents as shown in this figure 3 reveals that the phenomenon is on the increase; in other words, the gradient of injured occurrence from road traffic accidents is on the increase in Lagos State between 1970 and 2001. This is as a

result of the fact that there are more roads in Lagos now and more vehicles compared to the 1970's hence more injuries on the road.

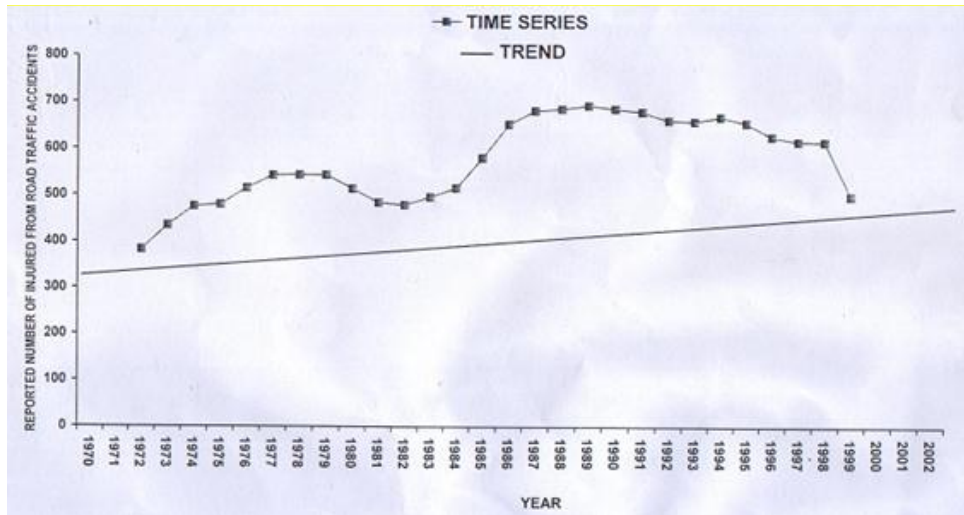


Figure 3: Time Series and trend of the reported number of injured from road traffic accidents in Lagos State (1970-2001)

Table 2: 5 Year Moving Averages of Reported Number of Injured 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	382.80	55.00	34.80	53.00	31.20	27.20	65.20	43.00	53.00
2	435.40	64.60	43.20	61.40	35.60	28.20	72.00	49.00	59.00
3	476.20	70.00	51.00	66.40	38.60	29.00	78.00	54.60	69.00
4	480.00	73.60	49.00	68.80	40.60	29.40	84.00	60.80	76.00
5	515.00	79.60	51.80	74.80	46.20	30.80	83.40	61.80	76.00
6	542.60	85.60	51.60	7560	46.20	32.20	86.60	67.80	82.00
7	543.60	87.60	47.80	73.60	44.00	35.20	89.60	71.80	87.60
8	543.60	87.60	44.00	69.60	42.40	37.20	89.60	74.20	87.60
9	513.80	82.00	44.40	65.60	38.20	40.20	92.80	75.40	87.60
10	484.60	79.00	40.60	67.20	34.40	38.20	89.00	68.40	84.00
11	479.40	79.40	36.60	67.20	33.60	37.60	85.80	62.00	79.60
13	496.40	75.80	36.30	67.80	33.20	35.40	85.20	62.00	80.00
13	519.80	75.00	35.50	73.60	34.80	33.60	84.20	57.00	79.00
14	580.80	81.00	35.20	73.60	37.00	32.20	79.40	50.20	77.00
15	65300	82.00	32.00	63.60	35.80	34.80	83.40	54.40	82.80

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16	682.00	75.80	36.20	54.40	36.60	37.00	85.40	85.40	83.80
17	695.80	67.40	39.60	50.80	36.60	37.40	80.60	47.80	78.00
16	692.80	63.20	38.40	40.80	33.00	37.20	73.60	43.80	71.00
19	686.00	51.20	39.40	34.80	31.00	35.20	69.60	41.20	67.00
20	679.40	47.00	37.40	31.20	29.60	33.20	59.60	37.00	55.80
21	661.20	36.80	31.60	31.20	27.60	31.20	55.60	31.00	51.20
22	659.20	34.80	26.00	32.20	28.40	28.80	48.00	30.00	43.00
23	669.40	33.80	23.40	34.60	30.00	27.60	46.00	29.60	39.20
24	656.20	34.20	22.60	34.60	30.40	25.60	47.00	29.60	37.20
25	627.00	32.40	26.60	36.00	32.40	23.60	46.60	27.60	36.20
25	616.60	36.40	28.00	36.60	32.00	21.80	44.60	29.80	34.40
27	616.00	38.80	30.00	38.80	30.80	21.80	48.60	29.80	36.60
28	499.40	44.80	39.00	40.60	36.80	21.40	52.20	30.20	39.20

Source: Analysis of Data Collected

Furthermore, the technique of Harmonic analysis was applied to the series of injured from road traffic accident totals over the period 1970 – 2001 for the selected Local Government Areas in Lagos State. Since the period under study is 32 years, the maximum number of harmonic $N/2$ is $32/2 = 16$ harmonics. This is because after 16 harmonics the values wrap round and start repeating itself. These 16 harmonics (Table 3) are utilized to give an accurate representation of the observed annual curve.

Table 3: Variance Spectra of Lagos State injuries from Road Traffic Accidents for Selected Local Government Areas

Harmonics	Lagos		Lagos Island		Ikorodu		Ajeromi		Badagrey		Epe		Ikeja		Mushin		Lagos Mainland	
	%V	Amp	%V	Amp	%V	Amp	%V	Amp	%V	Amp	%V	Amp	%V	Amp	%V	Amp	%V	Amp
1	29.15	135.20	45.99	26.61	20.6	9.01	51.44	21.87	13.97	5.38	47.74	7.83	48.9	23.06	61.71	21.96	60.74	27.12
2	8.4	72.6	0.74	3.08	5.46	4.64	0.97	3	0.90	1.37	3.05	1.98	0.95	3.22	1.83	3.78	1.5	4.27
3	10.02	79.28	4.27	7.42	8.29	5.72	5.11	6.89	12.59	5.11	4.39	2.37	2.13	4.81	1.64	3.58	3.36	6.41
4	0.95	24.37	0.84	3.28	7.97	5.610	2.34	4.66	3.24	2.59	6.88	2.97	0.62	2.6	1.98	3.93	0.37	2.12
5	4.75	54.61	0.85	3.31	0.16	0.80	2.60	4.92	0.82	1.30	2.87	1.92	2.19	4.88	1.45	3.37	1.91	4.81
6	3.53	47.04	0.47	3.15	12.79	7.10	4.96	6.79	4.3	2.98	5.18	2.58	3.13	5.83	0.08	0.79	1.78	4.64
7	0.83	22.77	4.09	7.26	0.07	0.51	2.78	5.08	7.67	3.99	0.09	0.34	1.74	4.35	1.03	2.84	1.33	4.01
6	3.40	46.21	3.33	6.55	1.29	2.25	5.08	6.82	2.60	2.32	1.25	1.26	2.73	5.45	5.81	6.74	2.56	5.56
9	1.91	34.58	0.44	2.37	7.44	5.41	1.39	3.60	2.47	2.26	0.38	0.70	0.04	0.62	2.01	3.96	0.28	1.84
10	1.11	26.4	0.63	2.84	6.54	5.08	2.67	4.98	3.00	2.49	0.27	0.59	0.75	2.89	3.05	4.89	1.49	4.24
11	0.2	11.3	2.62	5.81	7.87	5.57	2.18	4.51	20.72	6.55	0.92	1.09	3.00	5.72	2.14	4.09	2.8	5.82
12	0.06	6.03	3.47	6.69	1.64	2.54	0.75	2.64	1.02	1.46	0.01	0.10	1.55	4.11	0.68	2.31	0.92	3.34
13	2.2	7.16	7.65	9.92	0.86	1.84	4.55	6.51	3.98	2.87	0.12	1.65	8.09	9.38	3.55	5.27	4.97	7.76
14	2.37	39.52	1.65	4.63	7.4	5.40	0.12	1.06	3.11	2.54	3.42	2.09	1.97	4.63	1.02	2.82	0.77	3.05
15	2.54	39.9	0.85	3.3	0.15	0.76	0.37	1.85	0.84	1.32	0.73	0.97	2.22	4.62	0.38	1.72	1.29	3.95
16	1.36	29.19	1.09	3.75	0.05	0.4	0.54	2.25	0.75	1.25	1.34	1.31	0.05	0.75	1.68	3.68	0.07	0.94

For Lagos State, generally the 1st harmonic contributes the highest percentage variance of 29.15%, closely followed by the 3rd and 2nd harmonic contributing 10.02% and 8.40% of the total variance respectively. The lowest percentage variance of 0.60% is contributed by the 12th harmonic. The 16 harmonics contribute 72.78% of the total variance in the time series (Table 3). This means that 72.78% of injured from road traffic accidents in Lagos State could be attributed to recklessness on the part of drivers; ignorance of highway code, driving under the influence of alcohol, wrongful overtaking, over speeding, pot holes etc leaving 27.22% to other factors.

Similarly, for Lagos Island Local Government Area, the 1st harmonic contributes the highest percentage variance of 54.99%, closely followed by the 13th harmonic of 7.65% and the 3rd harmonic which has 4.27% variance of the total variance observed. The 10th harmonic contributes the lowest percentage variance of 0.64% to the total variance of the time series. The total percentage variance contributed by all 16 harmonics is 88.3%.

For Ajeromi/Ifelodun Local Government Area, the 1st harmonic accounts for the highest percentage variance of 51.44%, closely followed by the 3rd and 8th harmonics with percentage variances of 5.11% and 5.08% respectively. The 14th harmonic contributes to lowest percentage variance (0.12%). The 16 harmonics contributes a total of 87.85% to the temporal pattern of number of injured from road traffic accident occurrence over the part of Lagos State.

Similarly, for Ikeja Local Government Area, the 1st harmonic contributes the highest percentage variance of 48.90%, closely followed by the 13th and 6th harmonics which contributes 8.09% and 3.13% of the variance respectively. The 9th harmonic contributes the lowest percentage variance of 0.04%. All 16 harmonics contribute a total of 80.06% of the variance in the temporal occurrence of reported number of injured over the 32 years.

For Lagos Mainland Local Government Area, the 1st harmonic contributes the highest percentage (60.74%) of the

total variance, closely followed by the 13th and 3rd harmonics which contributes 4.97% and 3.39% of the variance respectively. The 16th harmonic contributes the lowest percentage variance (0.07%). All 16 harmonics contributes a total of 86.17% of the variance in the temporal occurrence of reported number of injured from road traffic accident over the 32 years. In other words, 86.17% of the number of injured from road traffic accident variation in the long period of accident occurrence of Lagos State are composed of different cycles.

Examination of table 4 shows that for Lagos State as a whole, dominant cycles of reported number of injured from road traffic accidents observed have periodicities of 32.00, 10.67 and 16.00 years with the most dominant being 32.00 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 32 years.

Variance spectra explaining the percentage variance explained by each harmonic have been drawn for Lagos State (see Table 4 and Figure 4).

Table 4: Dominant Injured from Road Traffic Accidents in Lagos State

Location		Cycles (Years)	% Variance	Amplitudes
Lagos State	1 st	32.00	29.15	135.20
	2 nd	10.67	10.02	79.28
	3 rd	16.00	8.40	72.60
Lagos Island	1 st	32.00	54.99	26.61
	2 nd	2.46	7.65	9.92
	3 rd	10.67	4.27	7.42
Ikorodu	1 st	32.00	20.60	9.01
	2 nd	5.33	12.79	7.10
	3 rd	10.67	8.29	5.72
Ajeromf/Ifelodun	1 st	32.00	51.44	21.87
	2 nd	10.67	5.11	6.89
	3 rd	4.00	5.08	6.82
Badagry	1 st	2.91	20.72	6.55
	2 nd	32.00	13.97	5.38
	3 rd	10.67	12.59	5.11

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Epe	1 st	32.00	47.74	7.83
	2 nd	8.00	6.88	2.97
	3 rd	5.33	5.18	2.58
Ikeja	1 st	32.00	48.90	23.06
	2 nd	2.46	8.09	9.38
	3 rd	5.33	3.13	5.83
Mushin	1 st	32.00	61.71	21.96
	2 nd	4.00	5.81	6.74
	3 rd	2.46	3.55	5.27
Lagos Mainland	1 st	32.00	60.74	27.12
	2 nd	2.46	4.97	7.76
	3 rd	10.67	3.39	6.41

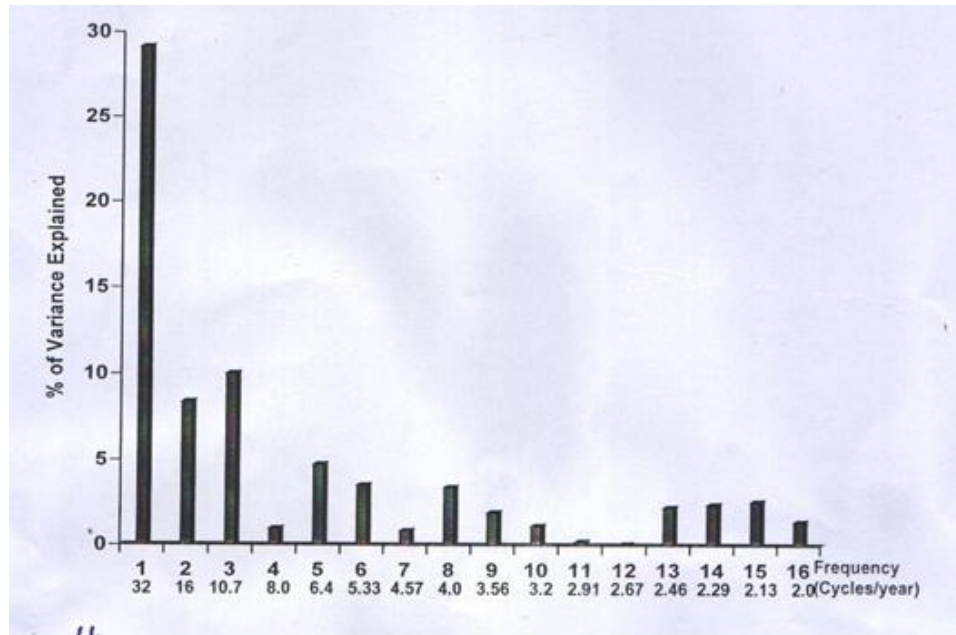


Figure 4: Variance Spectrum for Lagos State on the Number of Injured from Road Traffic Accidents

5. Policy Implications

By the serious road traffic accident situation in the study area, Local Government Areas like Lagos Island, Lagos Mainland, Ajeromi/Ifelodun and Ikeja 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. 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.

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 emphasized. 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.

In addition to the above, efforts should be made to provide parking spaces, sidewalks, road signs at appropriate places, adequate road and pavement markings and over head bridges at strategic points/places in all major roads in Lagos State.

These measures, if well executed, will contribute positively towards reducing the ugly incidence of road traffic accident in Lagos State and Nigeria in general. The current poor road safety record in Nigeria is not inevitable. As other countries like the U.S.A. and Britain have shown, population and vehicular traffic growth does not have to lead to increase in traffic crashes, deaths and permanent injuries as these undesirable outcomes can be minimized through adequate traffic accident control and injury prevention measures (Atubi, 2006).

6. Conclusion

In addition to the many environmental hazards that threaten transportation systems, transportation itself presents hazards to people, property and the environment. Road traffic accidents are the most common example, and the majority of transportation casualties in most countries can be attributed to road accidents. The contributing factors for road accidents are typically classified into those associated with driver, vehicle, and the environment.

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