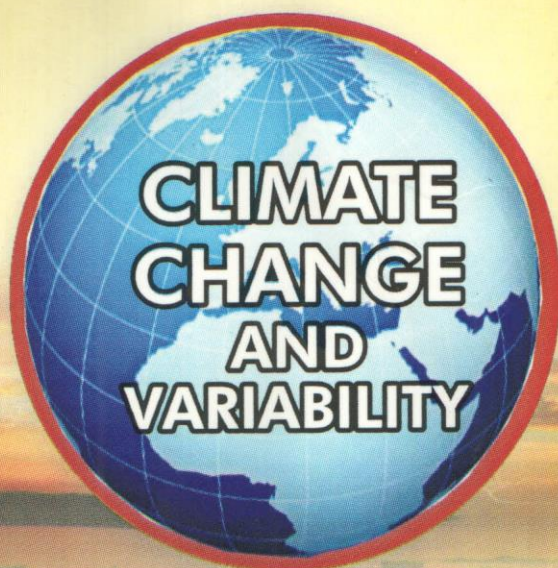


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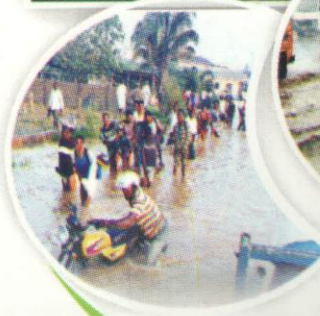
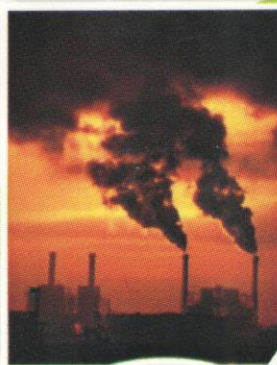
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SEASONAL CLIMATIC VARIATIONS AND ROAD ACCIDENTS IN LAGOS, NIGERIA

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ABSTRACT

There are various causes of road accidents, some of which include carelessness, drunkenness, malfunctioning traffic lights, bad roads, road worthless vehicles and climatic conditions. This study examined road accidents in Lagos State, Nigeria in relation to seasonal climatic variations for 6 years (2005 - 2010). The road accidents data were sourced from the archives of the Federal Road Safety Commission and Nigeria Police Force (RS 2.1 Lagos) while the climatic data were sourced from the Nigerian Meteorological Agency Oshodi, Lagos. In order to generate the total monthly occurrence of road accidents, the number of accidents occurred in each month were summed while monthly climatic variables average was determined using Arithmetic mean. The results revealed that on the average, 46.69% accidents occurred in dry season. This indicates an increase of 6.62% in the rainy season. The higher cases of recorded accidents in the rainy season are attributed to the slippery condition of road surfaces and low visibility. The casualty cases is about 45.64% during the dry season which increased by 8.64% in the raining season. The highest and lowest casualties were recorded in the June and April respectively. Of the 4375 death recorded, 50.22% occurred in dry season with the highest incidence of 431 in the month of December. Correlations results shown strong positive relationship between rainfall and accident cases while temperature and accident cases revealed a negative relationship. The results indicate that the frequency of accidents is nearly equal in all climatic seasons, but higher in the wet weather.

Key words: Road, accident, deaths, slippery conditions, variation and Lagos

INTRODUCTION

Road accidents are among the major causes of death, injuries and financial problems (Farajzadeh, 2010). Each year, more than 1.2 million people die on the world's roads, and between 20 and 50 million suffer non-fatal injuries (WHO 2009). This rise of road accident is still increasing in most regions of the world. According to World Health Statistics (2008), road accident injuries will become the 5th leading cause of death by 2030 as against the 9th position 2004. In addition, over 90% of the world's fatalities on the roads occur in low-income and middle-income countries which have only 48% of the world's registered vehicles. For instance, the road accident fatality rates are about 21.5 per 100,000 population and 19.5 per 100,000 populations for low income and middle income countries respectively. This is lower in the high income countries which are about 10.3 per 100,000 populations (WHO 2009).

Road accidents, unfortunately, are not often due to ignorance, but are associated with numerous factors of human, vehicle and environmental interplays (Johnson, 1992). Accidents, therefore, can be studied in terms of agent, host and environmental factors (Edwards, 1999 and Nilamber, *et al*, 2004) and epidemiologically, it is classified into time, place and person distribution in terms of carelessness, thoughtlessness and over confidence. For instance, vehicles drivers operate under inhospitable conditions which induce high levels of stress and possibility of accidents; poor maintenance of wayside amenities and/or facilities; coverage of long distances by drivers leading to fatigue; roadside hawkers, dumping of construction material and parking indiscriminately on roads due lack of parking space alongside road networks as well as the use of mobile phones while driving.

Weather variables and seasonal variation could impact road accidents significantly (Mircea-Paul and Frost, 1998) and determine the rates at which any of these factors instigate accident occurrences. For instance, Bruce and Karsten (1997), associated between 30 and 50% of highway accidents in Quebec with harsh meteorological conditions. These including rain, snow, hail, and icy, and result to poorer safety

condition particularly, poor visibility, slippery of road surfaces. In addition Wan-Fairos *et al*, (2011) considered the amount of rainfall, the number of rainy day, time trend and the monthly effect of seasonality, and number of vehicle as factors associated with road accidents occurrence.

For the purpose of the study and better understanding of seasonal variations of road accidents, monthly records of road accidents were examined for in Lagos State, Nigeria on seasonal basis in relation to weather conditions for the periods of 6 years (2005 - 2010).

Study area

Lagos is located on the narrow coastal plain of the Bight of Benin in the south western part of Nigeria. It lies approximately on longitude $2^{\circ}42'E$ and $3^{\circ}22'East$ and between Latitude $6^{\circ}22'N$ and $6^{\circ}42'N$ (Fig. 1). It is bounded to the north and east by Ogun State of Nigeria, to the west by the Republic of Benin, and Atlantic Ocean to the south. Politically, Lagos State encompasses an area of about 3,577sqkm. The dominant vegetation of the State is the swamp forest consisting of fresh water and mangrove forests. The State is characterized with two climatic seasons (the dry from November to March and Wet from April to - October), the state receive between 140cm and 180cm of rainfall with annual temperature ranging between $28^{\circ}C$ and $32^{\circ}C$ (Uluocha and Ekop, 2002; Adejuwon, 2004). The drainage system of the State is characterized by a maze of lagoons and waterways which include Lagos and Lekki Lagoons, Yewa and Ogun Rivers, Ologe Lagoon, Kuramo Waters, Badagry, Five Cowries and Owu. According to the 2006 census, the State has a population of about 9.2millions out of a national estimate of 120millions (NBS, 2007).

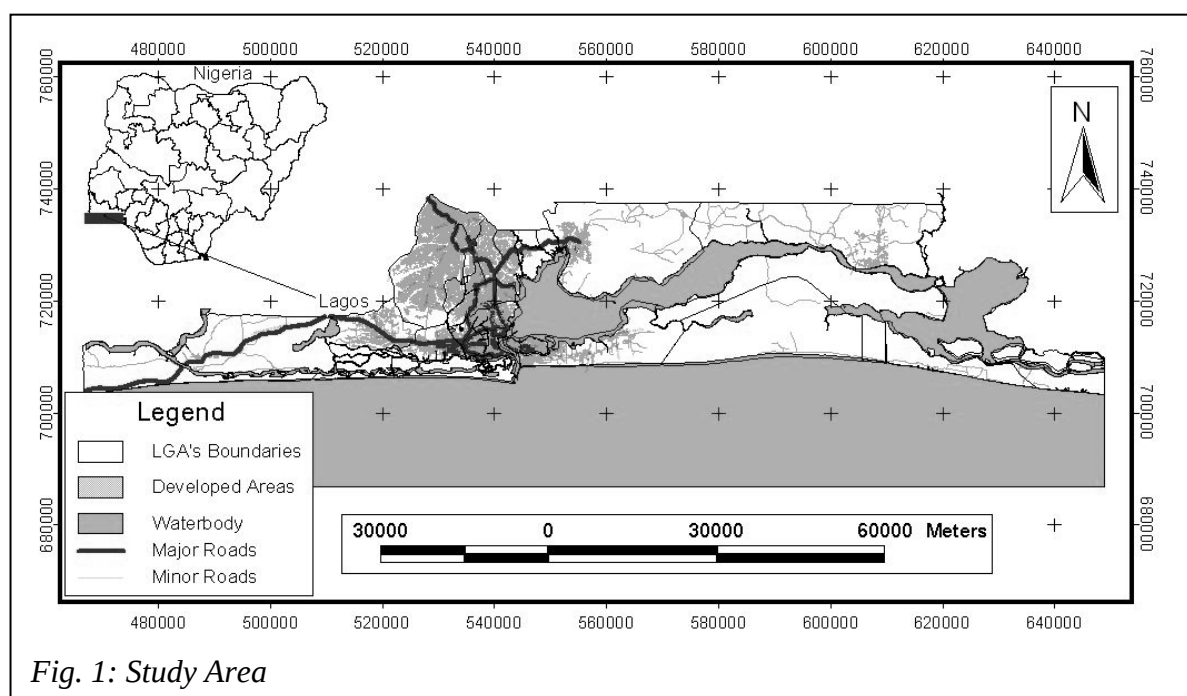


Fig. 1: Study Area

Methodology

Based on the aim of the study, a Road Accident was described as accident(s), which took place on the road between two or more objects and involves any kind of moving vehicle(s) including Taxi, Private, Buses, Motor cycle, Lorry, Trailer, Pedal cycle, Pick up, Kit car. The study examined road accidents in relation to seasonal climatic variations for the periods of 6 years (2005 - 2010) using road accident records and climatic data (rainfall and temperature) on monthly basis. The road accidents data were sourced from accident records of Federal Road Safety Commission (FRSC) and Nigeria Police Force (NPF) - RS 2.1 Lagos while climatic data were sourced from Nigerian Meteorological Agency (NIMET) Oshodi, Lagos. In order to generate the total monthly occurrence of road accidents for each of months between 2005 and 2010, the number of accidents occurred in each month for the 6 years (for example January 2005 – January 2010) were summed. The average monthly rainfall and temperature for the 6 years were determined by dividing the total value of rainfall and temperature for each month (for example

January 2005 – January 2010) within the studied years by the total number of years. The months were divided into two seasons based on the length and characteristics. The number of casualties (fatal, serious and minor), persons killed and persons injured were extracted from accident records and correlates with seasons (dry and wet) with respect to rainfall and temperature variability. The information on accident victims, magnitude and locations/points of occurrence were excluded from the study.

Results and Discussions

A total of 25,346 road accidents occurred between 2005 and 2010 in Lagos State, Nigeria. The months of July and January recorded the highest (9.59%) and lowest (7.40) respectively (Table 1). This is contrary to the studies Mehta (1968), Ghosh (1992) and Nilambar *et al.*, (2004) on road accident in Delhi - India where they observed that highest accident occurred in the month of January. Although, the month of April recorded 7.04%, this may due to missing data in April 2005. The increases in road accidents in the month of July may be attributed to the rainy season and, therefore, the wet condition of the roads intensify the rate. The reduction in November, December, January, February and March was attributed to absence of wet and slippery condition as well as no heavy rainfall in month. Of the total accidents, private cars account for 34.60% (highest), followed by Buses (24.69%), Motor cycle (19.59%), Lorry (11.34%), Trailer (4.03%), Taxi (3.04%), Pick up (1.72%), Pedal cycle (0.51%) while Kit car accounts for the least (0.48%).

Table 1: Lagos State monthly accident records between 2005 and 2010

	Seasons												
	Dry						Rain						
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
2005	509	318	433	364	493	-	436	486	493	364	493	202	4591
2006	396	284	286	333	346	375	424	494	600	511	356	410	4815
2007	444	266	278	378	362	292	441	289	401	416	350	392	4309
2008	223	273	225	348	289	252	268	323	364	308	299	222	3394
2009	254	397	227	231	262	376	307	407	320	289	255	376	3701
2010	320	421	426	276	387	490	402	413	253	361	423	364	4536
Total	2146	1959	1875	1930	2139	1785*	2278	2412	2431	2249	2176	1966	25346
Seasonal total	13,512						11,834						25346

Source: FRSC/NPF, 2010

The year 2006 and 2008 were recorded for highest (19.00%) and lowest (13.39%) accident cases respectively. In spite the missing accident data for April 2005, the year still accounts for the second highest (18.11%) of the total accidents record for the 6 years studied. The lowest accident occurred in 2008 which experienced highest rainfall of 318.67mm. The year 2006 with highest number of accidents received the second highest rainfall of 306.77mm. Generally, accident cases were very low for both season in 2008 compared to other years. For instance, 2006 accounts for the highest cases of accident during the raining season while 2010 account for the highest during the dry season.

The rainy months in Lagos are May, June, July, August and September. The result revealed that on the average 13,512 (53.31%) and 11,834 (46.69%) of the accidents occurred in rainy and dry seasons respectively (Table 1). These indicate an increase of 6.62 percent in the rainy season. The increase in the rainy season is attributed to slippery of road surfaces and low visibility as a result of consistent rainfall. Accidents do occur throughout the day but the peak time was different.

Fig. 2 showed the accident cases versus monthly rainfall and temperature trends. The casualties recorded for the period are 3,726 (14.70%) for fatal, 11,247 (44.37%) for serious and 10,373 (40.93%) for minor cases. The casualty cases is about 45.64 percent during the dry season which increased by 8.64 percent in the raining season. On the average, the highest and lowest casualties were recorded in the months of June and April respectively.

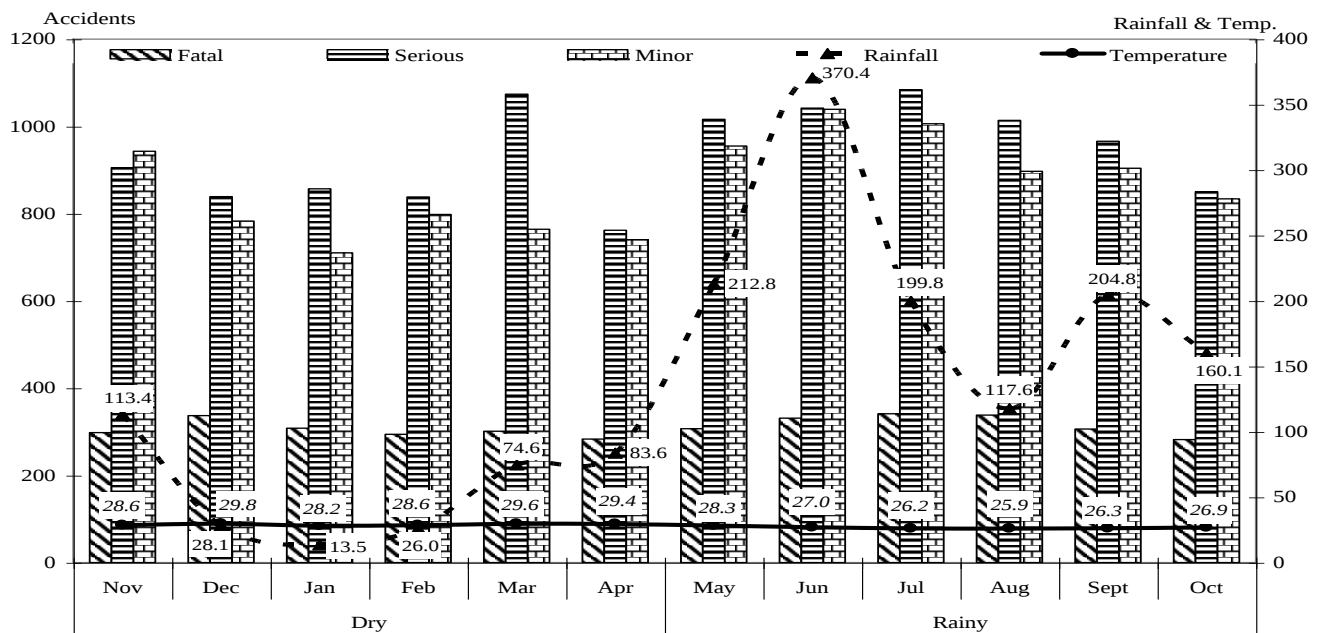


Fig. 2: Accident cases versus monthly rainfall and temperature (Sources: FRSC/NPF, 2010 and NIMET, 2010)

Of the 4366 (17.23% of 25,346) death recorded, about 50.22 % occurred in dry season with highest incidence of 431 in the month of December. The dead victims are higher in male than in female. About 80.53% male and 19.47% female were killed in road accident between 2005 and 2010. The result indicates that the rate at which male is being killed in road accident in Lagos is about 4.14 times higher than in females. Similar results were also observed in Delhi, India where male victims of road accident are 4.9 times higher than in female (Ghosh, 1992; Nilambar *et al.*, 2004). This shows that males are much more exposed to road accidents than females.

The correlation results shown strong positive relationship (0.77) between monthly rainfall and accident cases while temperature and accident cases revealed a moderate negative relationship (-0.59). The results indicate that the frequency of accidents is nearly equal in all climatic conditions, but higher in the wet weather.

Conclusion

The weather condition is found to have a significant impact on accident rate. In this study, it was found that the rainy season revealed a positive significant impact on the accident occurrence. However, the reverse was for temperature. This suggests that the accident increase with an increase in the amount of rainfall. Several interpretations are possible, for example, the surface of road might be slippery during the rainy month that might affect the safety effect. Implying that if the amount of rainfall increases, more accident is likely to occur in the subsequent peak of rainy season (June and July) compares to the peak of dry season (months of January through March) and vice versa. Interestingly, the explanation behind this is unique in Lagos due to the increase in the number of vehicles (road worthy and unworthiness); attitude and perception of road users particularly impatient way of life of Lagos dwellers (rushing and unique way of doing things); inhospitable conditions of drivers, bad conditions (pot-holes, narrowness etc) of most roads, and poor maintenance of road side amenities and/or facilities and poor citing of road signs amongst others.

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