

Assessing the Trends in Road Traffic Accident Casualties on Nigerian Roads

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ABSTRACT The paper assesses the trend of road traffic accident casualties on Nigerian roads. In spite of efforts by law enforcement agencies to curb the carnage on Nigerian roads, traffic safety still remains a crucial issue in the country. The study used data on number of casualties from road traffic accidents in Nigeria for the period 1975 – 2009. These were obtained from records of the Nigerian Police, Federal Road Safety Commission and National Bureau of Statistics. The data were analysed using the Statistical Package for the Social Sciences (SPSS) and Regression models were developed for predicting death and injuries on Nigerian roads. The study showed that the establishment of the Federal Road Safety Commission in the country has had positive impact on the rate of casualties from road traffic accidents in the country. In order to reduce deaths and injuries from road traffic accidents in Nigeria, the study recommends that law enforcement, education and research funding should be the focus of government in the country.

INTRODUCTION

A major problem in the world today is the high rate of accidents and deaths on our roads. According to the World Health Organisation (WHO), traffic accidents and deaths are a global epidemic sweeping through the world gradually. This scourge, if not addressed properly will be the second most common cause of disability – adjusted life year loss in developing countries by the year 2010 (Murray and Lopez 1997). Each year, an estimated 1.2 million people are killed in road crashes and up to 50 million injured worldwide (WHO 2002; WHO 2004).

Developing countries bear the brunt of the fatalities and disabilities from road traffic crashes accounting for more than 85 per cent of the world's road fatalities and about 90 per cent of the total DALYs cost due to road injuries. The problem is increasing in these countries at a fast rate, while it is declining in all industrialised nations such as Western Europe, North America, Japan, Australia and New Zealand. For instance, about 10 per cent of global road deaths in 1999 took place in Sub-Saharan Africa where only 4 per cent of global vehicles are registered (Odero et al. 2003). Conversely, in the entire developed world, with 60 per cent of all globally registered vehicles, only 14 per cent of road deaths occurred. Two countries, South Africa and Nigeria accounted for most of the reported deaths in

Sub-Saharan Africa. Other countries that experience high number of road deaths are Ethiopia, Kenya, Uganda, Tanzania and Ghana.

Also in Africa, it has been estimated that 59,000 people lost their lives in road traffic crashes in 1990 and that this figure would be 144,000 people by 2010, a 144 per cent increase (Kopits et al. 2005). In addition, the annual cost of road crashes is in excess of US \$500 billion globally and in the developing world the estimated cost is about US \$70 billion each year (Ashong 2010).

Statistics has shown that mortality in road traffic accidents is very high among young adults in their prime and who also constitute the workforce (Balogun et al. 1992; Posada et al. 2000). These are usually the breadwinners in many cultures. Over 75 per cent of road traffic casualties in Africa are in the economic productive age bracket of between 16 and 65 years. Those aged over 65 years account for a small proportion of road casualties partly due to their small numbers in the general population. Children often get injured as pedestrians and many become orphaned from these accidents. This imposes harsh social conditions made much worse in countries without social security services (Eke 2000).

The establishment of law enforcement agencies in some countries has not significantly helped the situation. In Nigeria for example, the mandate of the Federal Road Safety Commission established in 1988 includes ensuring law

enforcement, collecting road accident statistics, revising traffic legislation, promotion of road safety education, ensuring adequate provision of medical facilities for traffic injury victims, undertaking research in road safety and coordination of all road safety activities. But it is unclear whether the Federal Road Safety Commission has been reabsorbed into the Police Force or not. Besides, inadequate funding, lack of sufficient human and material resources as well as lack of authority to fully discharge their duties have been the bane of the law enforcement agencies in Nigeria. The objective of this paper is to examine the trends of Road Traffic Accident Casualties on Nigerian roads with a view to making recommendations for improving traffic safety in the country.

Studies on Road Accident Casualties

Casualties from Road Traffic Accidents have been a serious concern of researchers in traffic safety. Models have also been used to study injuries and deaths due to Road Traffic Accidents. For instance, Harvey and Durbin (1986) applied structural time series method to the monthly data series of the numbers killed and seriously injured in Great Britain from January 1969 to December 1984. The results demonstrated the effectiveness of the introduction of seat belt legislation.

Jacobs (1986) carried out an analysis of road traffic accident fatalities in 20 developing countries for different years using linear regression and established significant relationships between fatality rates and level of vehicle ownership (see also Valli 2006). Zlatoper (1984) investigated the causes of motor vehicle deaths in the United States for 1947 – 1980. He also used linear regression models to explain total motor vehicle deaths, vehicle occupants' deaths and pedestrian deaths. He found that disposable income and driving speed had statistically significant effects on increasing the three types of highway deaths.

Balkin and Ord (2001) applied a stochastic structural equation modeling approach to predict the effect of speed limit changes on the number of fatal crashes on both urban and rural interstate highways in the United States. They found that the view that higher speeds mean more fatalities could not be universally sup-

ported. Bunn et al. (2003) sought to assess whether area-wide traffic calming schemes could reduce crash related deaths and injuries. They used data from Transport Research Information Service, International Road Research Documentation and other sources on deaths, injuries and traffic crashes. The study showed that area-wide traffic calming in towns and cities has the potential to reduce traffic injuries.

Abbassi (2005) studied road accidents in Kuwait using an Autoregressive Integrated Moving Averages (Box Jenkins) model and compared it with the Artificial Neural Networks (ANN) Analysis to predict fatalities of the Road Traffic Accidents in Kuwait. He found that ANN was better in case of long term series without seasonal fluctuations of accidents or autocorrelation components. Also, Ismaila et al. (2009) attempted to model Road Traffic Accidents deaths and injuries on Nigerian roads using data collected for 1960 – 2006. They found that out of the eleven models available in SPSS 16.0 statistical package, namely, linear, logarithmic, inverse, quadratic, cubic compound, power, S, Growth, exponential, Logistic; the cubic equation had the best fit for predicting the number of injuries and number of deaths.

Van et al. (2006) used capture-recapture method to estimate non-fatal Road Traffic Injuries (RTI) in Thai Nguyen, Vietnam. The capture-recapture method is based on matching two independent samples to arrive at an estimation of the total. The method was applied using the combined records of police sources and hospitals in Thai Nguyen city to estimate more accurately non-fatal RTIs. They found that with limited resources in establishing and maintaining routine reporting systems, the capture-recapture method may be an affordable alternative to evaluate road traffic injuries in developing countries.

Fatim et al. (2007) estimated the annual incidence patterns and severity of unintentional injuries among persons over 5 years of age in Pakistan using data from National Health Survey of Pakistan (NHSP 1990 – 1994). Through a two-stage stratified design, 18,315 persons over 5 years of age were interviewed to estimate the overall annual incidence, patterns and severity of unintentional injuries for males and females in urban and rural areas. They found that there is a high burden of unintentional injuries among persons over 5 years of age in Pakistan. The

results were found useful to plan further studies and prioritise prevention programmes on injuries nationally and for other developing countries with similar situation.

Nasr (2010) studied deaths resulting from road accidents in Pakistan for both rural and urban areas using regression model that attributed accidents to weather condition, driving skills, condition of the vehicle, length of roads and number of population in the different regions and adherence to car insurance. He found that while total accidents had grown by 10 per cent during the period 1998 – 2008 the rate of growth in fatal accidents was even worse as it grew by 16 per cent.

However, Raeside (2004) had suggested the use of models based on Broughton's (1991) approach to produce predictive distribution based on numbers rather than rates per some million vehicle – kilometre driven. The models do not incorporate traffic volumes. The approach used annual data series of the number of total, serious and slight casualties for Great Britain and modelled the series using autoregressive and linear trend terms. This study attempts to use Raeside's approach with modifications to suit local conditions of Nigeria. It is believed that applying the model to a developing country will fill an important gap in research efforts.

MATERIALS AND METHODS

The data collected for this study covered total number of Road Traffic Accidents in Nigeria for the period of 1975 – 2009. Data were also collected on number of persons injured and number of persons killed for the same period. All these were collected from the records of the Nigeria Police Force, the Federal Road Safety Commission and the National Bureau of Statistics. In addition, past studies on Road Traffic Accidents were consulted and data were also sourced from the internet.

The data were analysed using the Regression method while the statistical package used was the SPSS (Statistical Package for the Social Sciences). Graphs were also drawn to show the pictorial pattern of Road Traffic Accidents casualties in the country using Excel. The logarithm functions were fitted to motor vehicle deaths and motor vehicle injuries to assess accident casualties on Nigerian roads.

RESULTS AND DISCUSSION

1. Trends in Road Accident Casualties

In 1975, the total number of accident casualty for the country was 25,684 persons. By 1978 however, the figure had risen to 38,106 persons which dropped to 29,225 persons in 1979. The figure rose again to 39,921 persons in 1982 and started fluctuating until it nose-dived to 15,379 persons in 1992. A sharp rise to 33,600 persons was recorded in 1993 after which fluctuation in traffic accident casualties set in. This trend continued until 2009 when it attained a value of 32,963 persons. The pattern is as shown in Figure 1.

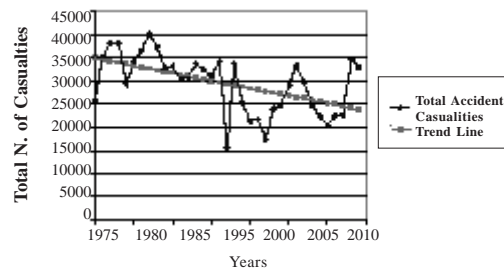


Fig. 1. Trend in total accident casualties (1975-2009)

Total accident casualties is a combination of total number of people killed and the number injured in accidents. The pattern therefore depicts the level of safety available in motor vehicle mode of transportation for the study period. Such patterns can assist in safety policy formulations in order to stem accident casualty figures for any country.

2. Trend in Number of Persons Killed

The trend in the number of persons killed in Road Traffic Accidents (TRA) in Nigeria between 1975 – 2009 shows an initial value of 5,552 persons in 1975 which rose to 9,252 persons in 1978 representing an increase of 66.64 per cent. The trend shows a sharp rise to 11,382 persons in 1982 and started fluctuating in values until it dropped to 6,364 persons in 1996. Thereafter, it rose again to 9,946 persons in 2001. From then on, the trend showed a gradual fall to 4,673 persons in 2007 and a rise to 5,693 persons in 2009.

The pattern depicts a fluctuating trend in the number of people killed in Road Traffic Accidents in Nigeria within the study period and could be associated with the fluctuation in the economic climate of the country. The period 1975 – 1983 represented the period of economic boom in the country when people could afford more cars which increased vehicular movements in the country and consequently more accidents and loss of lives. The period 1983 – 1999 represented the time when the Structural Adjustment Programme (SAP) was introduced in the country resulting in austerity measures and a reduction in the level of mobility on Nigerian roads. Besides, the establishment of the Federal Road Safety Commission in 1988 led to the enforcement of strict control of traffic movements. Since the year 2000, the state of the economy seemed to have improved but stricter enforcement of Traffic Regulations on Nigerian roads by the Federal Road Safety Commission has had positive effect and has resulted in fewer accidents and fewer deaths on Nigeria roads. The pattern is as shown in Figure 2.

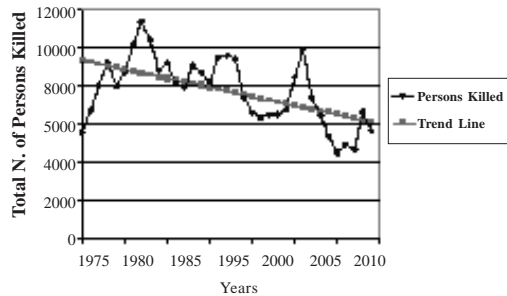


Fig. 2. Trend in motor vehicle deaths (1975-2009)

3. Trend in Number of Persons Injured

The trend in the number of persons injured in Road Traffic Accidents shows that 20,132 persons were injured in 1975 which rose to 30,023 persons in 1977. This represented an increase of 49.13 per cent. The figure then dropped sharply to 21,203 in 1979. Thereafter, the number fluctuated between 25,484 persons in 1980, to 23,853 persons in 1985 and nosedived to 5,759 persons in 1992. Since then, road traffic injury had been fluctuating between 24,146 persons in 1993 to 10,786 persons in 1997. 23249 persons in 2001 until it attained a value of 27,270 persons in 2009. The pattern is as shown in Figure 3

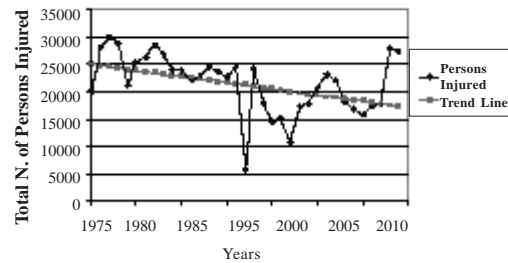


Fig. 3. Trend in motor vehicle injuries (1975-2009)

The number of people killed in road traffic accidents and the number of people injured are interactive and both depend on the level of motorization in a country. However, the level of safety measures taken by any country has a significant effect on both the death rate and injuries in any country. Besides, population growth and roads extended over the years have also been identified as important factors (Nasr 2010).

Modelling Road Traffic Accident Casualties

In its original form, Raeside (2004) developed a trend model for fatal and serious injuries in Britain. Annual data series of the number of fatal, serious and slight casualties were used. The series were then modelled using autoregressive and linear trend terms. The model took the form

$$\text{Log (casualties in year } t) = a + b (\text{year} - 1970) + c \log (\text{casualties in year } t - 1)$$

The trend variable was formed by subtracting 1970 from the year. In this study Raeside's model has been modified to reflect the local safety regulations efforts in Nigeria. The Federal Road Safety Commission was established in Nigeria in 1988 to check the rate of Road Traffic Accidents in the country and also to provide emergency services to people involved in road accidents. Since the Commission came on board, a lot of impact has been made to reduce the carnage on Nigerian roads.

The model for this study is

$$\text{Log (CAS)}_t = a + b (\text{YR}_t - 1988) + c \log (\text{CAS})_{t-1}$$

where $(\text{CAS})_t$ represents casualties in year t ,

YR_t represents the year

$(\text{CAS})_{t-1}$ represents casualties in year $t - 1$

a is the intercept while b and c are coefficients to be determined.

Data on reported cases of Road Traffic Accident trends in Nigeria for 1975 – 2009 were used for this study. The source is the compiled data

from both the Federal Road Safety Commission and the Nigerian Police Force. Statutorily in Nigeria, the two agencies are charged with the responsibility of collecting road traffic accident data in the country. Two models were developed using Regression method, one for motor vehicle deaths and the other for motor vehicle injuries. The Regression models were fitted using the SPSS (Statistical Package for the Social Sciences).

Motor Vehicle Deaths

The model for motor vehicle deaths takes the form

$$\text{Log (MVD)}_t = a + b (\text{YR}_t - 1988) + c \log (\text{MVD})_{t-1}$$

where (MVD)_t represents the number of deaths from motor vehicle accident in year t and (MVD)_{t-1} represents the figure in year t - 1 and YR_t represents the years.

Table 1 shows the Regression Summary of Motor Vehicle Deaths and the independent variables. The independent variables explain only 17.1 per cent of the total variation in motor vehicle deaths. This is very low and means that the remaining 82.9 per cent are due to variables which are not included in the model apart from road safety efforts and traffic regulations put in place by the government. These could be drivers' behaviour and environmental conditions.

The regression summary also shows that the improvement in safety measures as a result of the establishment of the Federal Road Safety Commission by the Federal Government in 1988 has helped to reduce motor vehicle deaths to some extent. This is shown by the negative correlation of the variable (YR_t - 1988) on motor vehicle deaths.

However, the model shows that the two independent variables are statistically insignificant as shown by the F = 3.289 value which is less than the table value of 3.32 at 0.05 level of significance. This means that the model is only suitable for explanation and not prediction of motor vehicle deaths in Nigeria. The regression model obtained is

$$\text{Log (MVD)}_t = 3.288 - 0.003 (\text{YR}_t - 1988) + 0.249 \log (\text{MVD})_{t-1}$$

Motor Vehicle Injuries

The model for motor vehicle injuries takes the form

$$\text{Log (MVI)}_t = a + b (\text{YR}_t - 1988) + c \log (\text{MVI})_{t-1}$$

Where (MVI)_t represents the numbers of injuries from motor vehicle accident in year t and (MVI)_{t-1} represents the number of injuries in year t - 1 and YR_t represents the years.

Table 2 shows the regression summary of motor vehicle injuries and the independent variables. In this case, the two independent variables explain 72.1 per cent of the total variation

Table 1: Regression summary for motor vehicle deaths and the independent variables

<i>Dependent variable</i>	<i>Independent variables</i>	<i>Regression coefficients</i>	<i>Standard error</i>	<i>t-values</i>	<i>Levels of significance</i>
Motor Vehicle Deaths(MVD) _t	Constant	3.288	.652	5.043	0.000
	YR _t - 1988	-0.003	.002	-1.363	0.182
	(MVD) _{t-1}	0.249	.150	1.657	0.107

R² = 0.171 DF = ²/₃₂ F = 3.289 < 3.32
 * Significant at 0.05 level

Table 2: Regression summary for motor vehicle injuries and the independent variables

<i>Dependent variable</i>	<i>Independent variables</i>	<i>Regression coefficients</i>	<i>Standard error</i>	<i>t-values</i>	<i>Levels of significance</i>
Motor Vehicle Deaths(MVD) _t	Constant	1.255	0.389	3.228	0.003
	YR _t - 1988	-0.003	0.001	-2.774	0.009*
	(MVI) _{t-1}	0.680	0.100	6.806	0.000*

R² = 0.0721 DF = ²/₃₂ F = 41.442 > 3.32
 * Significant at 0.05 level

in motor vehicle injuries. The remaining 27.9 per cent are variables which cannot be included in the model because of their exogenous features. These include availability of first-aid and emergency services in the event of motor vehicle accidents.

The regression summary also shows that the independent variable ($YR_t - 1988$) which relates to the effect of the Federal Road Safety Commission on road accident rates in the country has a negative correlation with motor vehicle injuries. This shows that some impact has been made on the rate of motor vehicle injuries due to stricter road safety measures and enforcement of compliance with traffic regulations since 1998 when the Federal Road Safety Commission was established. Further, the two independent variables are significant at 0.05 levels considering their t-values. The value of the coefficient of determination R^2 which is 72.1 per cent shows that the model is a good fit for the data. The F-test also shows that the regression is significant since the F-statistic of 41.442 is greater than the critical value of 3.32 at 0.05 levels of significance. The predictive ability of the model is thus confirmed. The regression model obtained is:

$$\text{Log (MVI)}_t = 1.225 - 0.003 (YR_t - 1988) + 0.680 \log (\text{MVI})_{t-1}$$

CONCLUSION

The paper attempts to model Road Traffic Accident casualties in Nigeria for the period 1975 – 2009. Analysis of data collected for this period shows that Road Traffic Accident deaths and injuries in the country fluctuated within the periods of economic boom, structural adjustment period and that of economic reforms.

The impact of the establishment of the Federal Road Safety Commission in 1988 to enforce traffic rules and regulations has also led to reduction of road accident rates in the country. However, governments all over the world are concerned about Road Traffic Accidents and national governments are always seeking for ways of reducing deaths and injuries in the event of traffic accidents. The key performance measures of the safety of a nation's transport system are the number of people who are killed or seriously injured in road accidents.

RECOMMENDATIONS

In order to reduce road traffic accident deaths and injuries on Nigerian roads the following are suggested:

1. Legislation of speed limits on both urban and rural roads. Motorists should drive within speed limits and with a speed consistent with road conditions.
2. There should be strict compliance with the procedures for obtaining driving licenses so that only qualified and responsible people receive the licenses.
3. Regulation on compulsory use of seat belts should be enforced.
4. The Federal Road Safety Commission should be equipped with materials and human resources to embark on regular and massive breath testing of drivers on the roads to detect drivers who drive under the influence of alcohol. Drunken drivers should be made to face the wrath of the law.
5. Traffic education should be made part of the curriculum of secondary schools in the country. Besides, Traffic Safety research should be encouraged and adequately funded. Road Safety professionals should be trained at national and local levels to monitor the magnitude, severity and burden of road traffic collisions and injuries.

Road safety is generally a mixture of three components, namely, the road, vehicle and the driver. Hence, policy measures law enforcement, environmental change, education and research funding should be the focus of governments in the bid to reduce road traffic deaths and injuries on Nigerian roads.

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