



EMPIRICAL ANALYSIS OF ROAD TRAFFIC CRASHES: A STUDY OF BAUCHI STATE, NORTH-EAST NIGERIA

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Abstract

The Study analyzed the trend of road traffic crashes in Bauchi sta The Study analyzed the trend of road traffic crashes in Bauchi state over the period 2007-2016. To realize the objective, the study used descriptive statistics to analyse using the data collected from Federal Road Safety Commission (FRSC). The results reveal that 2,395 accidents were recorded during the period, and 1,565 people got either killed or seriously injured in the accidents. It was further discovered that the accidents involved mostly motor cycles or cars. In the light of the findings, the study recommended that government through FRSC should make training of drivers compulsory and put in place mechanism for monitoring, supervising and punishing culprits in the state.

Keywords: *Traffic Crashes, Trend, Casualty, Vehicles and Bauchi State*

Introduction

Road accidents or crashes remain one major causes of deaths the world over for they are responsible for 1.2 million deaths and 25 million severe injuries annually Gitelman, Doveh, and Hakkert, (2010) and World Health Organisation, WHO, (2014). Again, WHO (2015) observes that 90 percent of the world's road fatalities occur in low- and middle-income countries, which could have underestimate as only 48 percent of the vehicles were registered. 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, Aeron-Thomas and Astrop 2000).

Despite this growing 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 scarcity of funds and lack of relevant data. Given these numbers, road traffic injuries have to be seen in low and middle income countries as one of the most important health problems alongside diseases such as diarrhea, malaria, HIV/AIDS and tuberculosis. Road traffic injuries may also entail major economic problems. Providing medical services to those injured may imply a high burden on national health systems and budgets. The WHO estimation that global losses due to road traffic injuries are probably close to US\$ 518 billion and are likely to cost governments between 1% and 3% of their GDP (Ansari, Akhdar, Mandoorah *et al.*, 2000; Jacobs, Aeron-Thomas and Astrop, 2000; WHO, 2009).

Nigeria has the highest rate of fatalities from motor crashes 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). Therefore, road crashes have taken away so many lives in the economy today that hardly does any single disease equivalent its death rate. This is only one of many unpleasant consequences of road crashes which also cause a lot of injuries as well as economic losses in all its ramifications (Gungul, 2012). Nigeria is said to have the highest road traffic accident rates in Africa and the second in the world (Akpogomeh, 1998; Obinna, 2007 and Atubi 2012e).

In Nigeria, road traffic accident situation over the last four 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 mean 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). However, between 2010 and 2012 in 16,364 road traffic crashes, a total of 12,652 people were killed (Bobai and Abarshi, 2014). Road traffic crashes in

Nigeria generally and Bauchi state in particular is in need of urgent solutions. This problem has been difficult to address most likely because of the level of road transport infrastructural development in the state.

The main objective of this study is to analyze the trend road traffic crashes in Bauchi state from 2007-2016. The remainder of this paper is organized as follows. In Section 2 we review the literature that deals with the determinants of road traffic crashes on the macro and individual level. We also briefly discuss theoretical approaches that were initially developed for other problems, but of which we think that they might be useful to conceptualize at least part of the questions raised above. In Section 3 we discuss available data sources on road traffic crashes in Bauchi State and the Methodology used. In Section 4 we analysis the data and then discuss it. Section 5 concludes the study.

Theoretical Literature

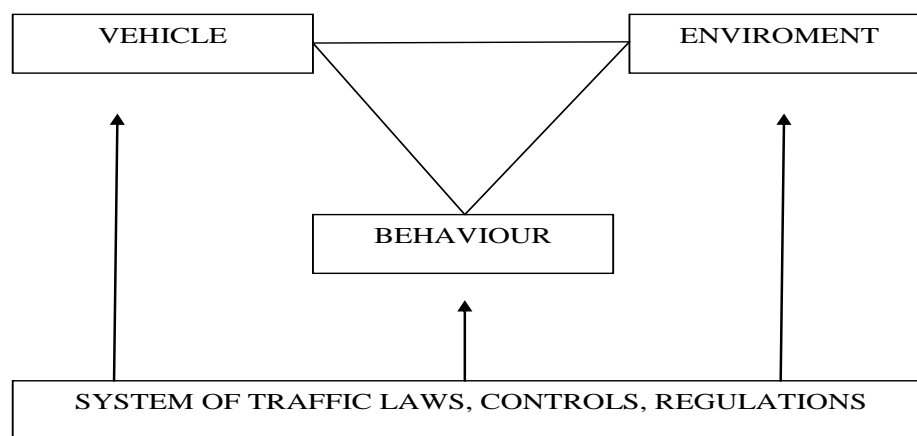
Model for Traffic Accidents

Traffic accidents bear strong elements of man-environment adjustments and maladjustment a well-known approach in Geography (Muhlrud and Lassare, 2005). Based on the logic of a modified human ecological model of a disease the approach can be transferred to studies of road traffic accident. A model for traffic accident as inspired by the ecological model of a disease was developed by Jørgensen and Abane (1999) who made a heuristic adjustment of this basic model to suit road traffic accident analysis. The model is characterized by three main components:

- i. The vehicle (corresponding to the vector in disease ecology) which describes vehicles into its composition, age, technical conditions and safety equipment like seat belts in a car.
- ii. The environment, comprising the road system and the wider physical and built up environment. The physical environment splits further into different aspects such as; daylight and climate (weather conditions and road conditions), Spatial conditions (arrangements and Macro structures), Settlement pattern (Urban or rural / sparse or populated area), situation of areas of residence and working areas, Principle of traffic separation, topography and road constructions qualities.
- iii. The behavior of the population; including its characteristics such as age and sex ratio as well as attitudes and general traffic behavior. And it goes further into driving behavior, driving experience, driving

style, risk compensation and risk driving (influence of alcohol and drugs).

Superimposed on this model is a system of traffic laws, regulations and mode of enforcement designed to ensure that the population adheres to the controls and regulations so as to maintain some level of road safety i.e. traffic rules (speed restrictions, road signs), speed controls and convictions for various road traffic offences (Jørgensen and Abane, 1999). The model as is shown in Fig 2.1 is used as a framework for understanding the multiple causes and prevention of traffic accidents that occur in developing cities.



Source: Jørgensen and Abane (1999).

Figure 2.1: A Model for Traffic Accidents

Thus, the relevance of systems theory in understanding the topic under consideration can be seen at three different levels. First, the theory helps to identify the system of traffic laws, regulations and mode of enforcement designed to ensure traffic safety in Nigeria. Second the model help to identify the multiple cause interplay of risk factors and prevention of traffic accidents that occur in the study area. Third, the model assist in identifying/understanding the three major contributory factors of road traffic accident including human, mechanical (vehicle) and road environment factors (Jørgensen and Abane, 1999).

Human Behaviour Approaches

A good control of the vehicles on the road depends very much on the behaviours (which is very complex) and skill of the driver (Odero, 1995). Driving is a complex system in which a large number of variables are interacting with each

other but also with varying degree of dependence. Accident may be due to judgment errors, ignorance, incompetence, rule violation, lapses or carelessness, all of which are human errors (Lemming, 1969). The human factor contributes to the majority of road traffic accidents.

i. Driving: Jorgensen and Abane (1999) notes that, concerning road traffic behavior, one can distinguish between driving skills (Knowledge and training) and driving style which reflects attitudes and traffic risk perception. Training of drivers increases their driver's skills. Study done by Asogwa in Nigeria revealed that a sizeable proportion of drivers who possesses driving licenses never showed up in any driving school or went through a driving test but simply bought their licenses. Untrained drivers, not unexpectedly, often result in high accident rates (Asogwa, 1992).

ii. Age: The driver's age is also known to be an important factor contributing to occurrence of accidents Available literatures shows that adolescents or young drivers are frequently involved in traffic accidents than other age groups Leon (1996) have also shown the studies that young drivers are more frequent involved in accidents caused by inappropriate speed and loss of control of the vehicle compared to other age group of drivers, Graham (1993) revealed that motor accidents were prevalent in certain age group. **iii. Sex:** With regards to gender, it appears that males are more involved in motor accidents than females (Council of Scientific Affairs, 1993). Studies have shown that males compared to females have a higher risk of experiencing fatal crashes, while women have higher rates of involvement in injury crashes (Massie, Campbell and Williams 1995). **iv. Vehicle:** It has been established by Abane (1993) that the number of road worthy vehicles operating in developing countries is lower than those in developed countries. Worn out vehicles are more likely to be involved in traffic accidents. Vehicles with seatbelts, adequate lights, brakes, steering wheel, tyres as well as direction indicators among others and in good condition can help to reduce traffic accident.

Vehicle Factor Approaches

Under the vehicle factors including its design, lighting system, break system and its use are significant contributors to road traffic accident (Odero, 1995). According to Jørgensen and Abane, (1999), a mixture of different type of vehicle including motorcycles and bicycles operating at different speeds is more widespread in urban areas. This influences the system risk due to the risk of crashes or collisions between various types of vehicles (Light, heavy or overloaded) with various speed levels and non-motorized road users.

Environment Factor Approaches

The environments factors including design of road, its geographic location, season, weather, visibility, time of day and traffic regulations CSA (1993). A clear understanding of the causal factors is of utmost importance in any attempt to design a road safety promotion or preventive program (Sarungi, 1981). Well-designed roads with separate lines for pedestrians and cyclists are much safer than those without such facilities. The road signs should be clear by themselves and should convey an unmistakable message to the driver. In Nigeria they regrettably reported that better roads have resulted in excessive speed and reckless driving resulting in an increase rather than decrease in death toll on national roads (Asogwa 1992). There is a relationship between seasonality; weather and time factor in road traffic accident occurrence (Jegade, 1988).

System of Traffic Laws, Control and Regulations

Enforcement and traffic laws have to do with government policy regarding road safety issues. The aim of traffic regulation systems and enforcement is to ensure adequate operations in the traffic environment and system maintenance by legislation and controls. Regulations by traffic signaling systems, speed limits and speed controls as well as the existence of police patrols and checkpoints can lead to some reduction of accidents by influencing the road user's behavior.

Risk and Road Safety Analysis

Road safety analysis is related to the survival of humans on roads and, during road safety risk evaluation, 'risk' is associated with a number of fatalities and known as a road safety outcome. In the field of road safety, the risk is defined as 'the road safety outcome to the amount of exposure', as shown in Equation (1):

$$\text{Risk} = \text{Road Safety Outcome/ Exposure} \dots \dots \dots (1)$$

Researchers have calculated exposure according to the availability of data; some have used passenger kilometers traveled, population, number of registered vehicles, etc. [Al Haji,(2005); SafetyNet (2005)]. Risk assessment is necessary for road safety performance analysis. Previously, road safety outcome was directly related with and calculated using the different exposure variables, but handling the multiple variables remained a problem. It is necessary to evaluate

the risk and its relationship with the road safety performance indicators. The concept of Safety Performance Indicators (SPIs) was developed by the European Transport Safety Council (ETSC 2001). The reason for the SPIs development was the assumption that accidents and injuries are only the tip of the iceberg because they occur as the ‘worst case’ result of unsafe operational conditions in the road traffic system. Thus, SPIs can be defined as measures that are causally related to accidents or injuries and are used in addition to the figures about accidents or injuries, in order to indicate safety performance or understand the processes that lead to accidents (Gitelman, Doveh, Hakkert, 2010).

Empirical Literature

Shah, Ahmad, Shen, Pirdavani, Basheer, and Brijs (2018) assessed road safety risk whereby the focus was more on risk evaluation in the Asian region by exploring the interaction between road safety risk and influencing factors. The study used data envelopment analysis (DEA) method to calculate and rank the road safety risk levels of Asian countries. The structural equation model (SEM) was applied to analyze the interaction between the road safety risk level and the latent variables, measured by six observed performance indicators, i.e., financial impact, institutional framework, infrastructure and mobility, legislation and policy, vehicular road users, and trauma management. In conclusion, the study illustrated the applicability of the DEA-SEM approach for road safety performance analysis. Chador, Monal, Tashi, Ewan, Zaw and Jaya

(2017) examined the burden and characteristics of road traffic accidents in Bhutan. The study made used cross-sectional study to analyze police case records data from 2013–2014. The study discovered that in 1866 accidents which resulted to 1143 injuries and 157 deaths. The study further identified that there was 39% more deaths from RTAs than that submitted to WHO in 2013 as the 30-day mortality. Drivers and passengers constituted 86% of the deaths with few pedestrian deaths. Productivity loss due to RTA is around 1% of national GDP. There is significant mortality and morbidity from RTAs in Bhutan.

Umar (2009) mapped Road Traffic Crashes (RTC) along Kano-Zaria Road using Remote Sensing and GIS. The top five black-spots in the study area were highlighted. The results of the study showed that over speeding was the factor most responsible for Road Traffic Crashes along the road with 37.5%. Aworemi and Abdul-Azeez (2010) examined the causal factors of road traffic crashes in

some selected states in South Western part of Nigeria. They used regression analysis to establish the relationship between human characteristics, vehicular characteristics, roadway characteristics, environmental characteristics, and road traffic crashes in the study areas. The findings of the study revealed that human, vehicle, roadway and environment had significant contributions of about 79.4% on the road traffic crashes in the study area. Ogunmodede, Adio, Ebijuwa, Oyetola and Akintola (2012) studied the factors influencing high rate of commercial motorcycle accidents in Oyo State, Nigeria. The findings from the study showed that demographic information has significant influence on the causes of road accidents among commercial motorcycle riders in Nigeria. It was also discovered that commercial motorcycle riders do not comply with Road Safety Highway Codes.

Adekunle (2012) examined the effect of Road Traffic Accident Injuries on Productivity in Nigeria. The data used included number of passengers who sustained injuries in road traffic accidents in Nigeria for 2007. Multiple regression was employed as the major tool of analysis in the study. The results revealed that a clear relationship exists between road traffic accident injuries and productivity in Nigeria. Agbeboh and Osabuohien-Irabor (2013) examined the trend of road accident in Kogi State from January, 1997 to December, 2010. A univariate time series data which was collected from FRSC Lokoja was used in the study. They were able to discover that there is no seasonal variation but trend which shows steady increase in Kogi State accident rate. Atubi (2013) examined time series and trend analysis of fatalities from road traffic accident in Lagos State, Nigeria. Using 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. The result revealed that more than 90% of road traffic accidents in the area could be attributed to recklessness on the part of drivers, ignorance of highway codes, driving under the influence of alcohol, over speeding etc.

Jibril and Wabundani (2014) observed the spread of RTA frequencies based on the period of occurrences. The classification was based on two distinctive seasons of wet and dry. Effects of religious festive seasons on road traffic accident occurrence were also considered. A record on Road Traffic Accidents (RTAs) frequency on the study route was analyzed under temporal variable of festivals and seasons against the total cases of accidents covered by the study.

To estimate the effects of each of the temporal variables on accidents, one way analysis of variance ANOVA was used at 0.05 level of significance at 95% confident intervals. The result revealed amongst others that road traffic accident is high during wet season throughout the four years of study spanning 2007 to 2010.

Bobai and Abarshi (2014) analyzed the trend of road traffic accidents in Nigeria for a period of six years; from 2007 to 2012. The tool of analysis used was descriptive statistic, tables, averages, graphs and percentages. The study revealed that the casualty trend in Nigeria has been declining, while the trend and nature of road traffic crashes in the country was on the increase with serious and fatal crashes, which is about 79.7 percent fatality rate in Nigeria. Only 21.3 percent of the crashes were minor. This study also revealed that most accident prone states in Nigeria are Kaduna, Ogun, Kano, F.C.T. Abuja, Kogi, Edo, Oyo, Kastina, Niger, Ondo and Nasarawa.

Jobin (2015) analyze road traffic accident hotspots along Zaria-Kaduna Expressway, Kaduna State, the study applied Remote Sensing and Geographic Information Systems (GIS). The results of the study revealed that over speeding (27.7%), tyre burst (17.6%), loss of control (15.5%) and dangerous driving (13.6%) were the major causes of accidents along the route. The study also discovered that Jaji, Birnin Yero, Foundation and Konar Farakwai are the most dangerous locations along the study route. Finally, characteristics of the road such as Bridges (24.9%), built-up areas (24.9%) were the cause of accident while sharp bend (21.9%), Uturn/intersection (13.8%), stationary vehicles (6.2%), slope (4.2%), market (2.7%), potholes (1.4%) also contributes significantly to accidents along the study area. Many literatures have discussed the variety of factors affecting road traffic accidents in Nigeria but none has looked at the trend of road traffic accident in Bauchi state, this gap the study intends to fill.

Materials and Methods

The Study Area

Bauchi State occupies a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' north and longitudes 8°

50' and 11° east. The state is bordered by seven states, Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east and Kaduna to the west. Bauchi State has 20 local government areas with the state headquarter in Bauchi



Figure 3.1: Location of Bauchi State in Nigeria

Methodology

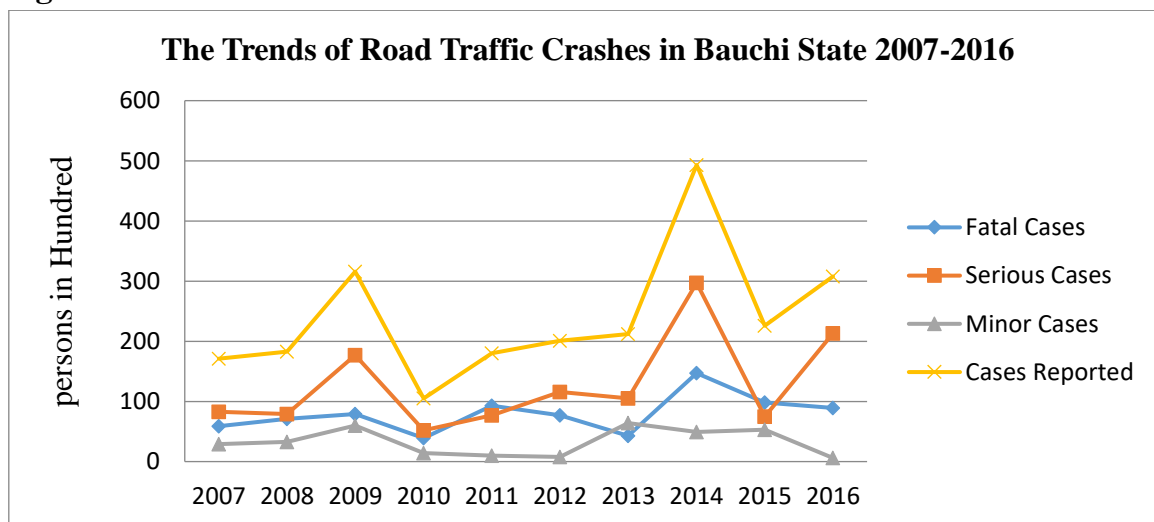
The data used in this study are sourced from secondary sources. The most of data are obtained from Federal Road Safety Commission annual statistical bulletin 2017. However, simple descriptive statistics such as tables, graphs and percentages were employed to analysis the trend of road traffic crashes in this study.

Results and Discussions

The study revealed that most of the reported cases of road accidents in Bauchi state are either fatal or serious cases with fewer minor cases. In 2007 there were

171 reported cases of accidents in the state with only 16.9 percent were minor cases. About 83.1 percent were fatal and serious cases. In 2014 when the highest cases of accidents were reported, 9.9 percent of those accident where minor cases. However, 18 percent, 18.9 percent, 30.1 percent, 23.5percent and 1.9 percent respectively were the minor cases of 2008, 2009, 2013, 2015 and 2016 respectively. Indicating that 2013 had the highest minor cases while 2016 had the lowest. The implication of the above result is that over 75 percent of the accidents that occurred in Nigeria within the period of the study in Bauchi state were very fatal accidents. The study revealed that a very high number of people were killed in Bauchi state whenever, by a road traffic crash in occurred in the state.

Figure 4.1: The Trend of Road Crashes in Bauchi State 2007-2016



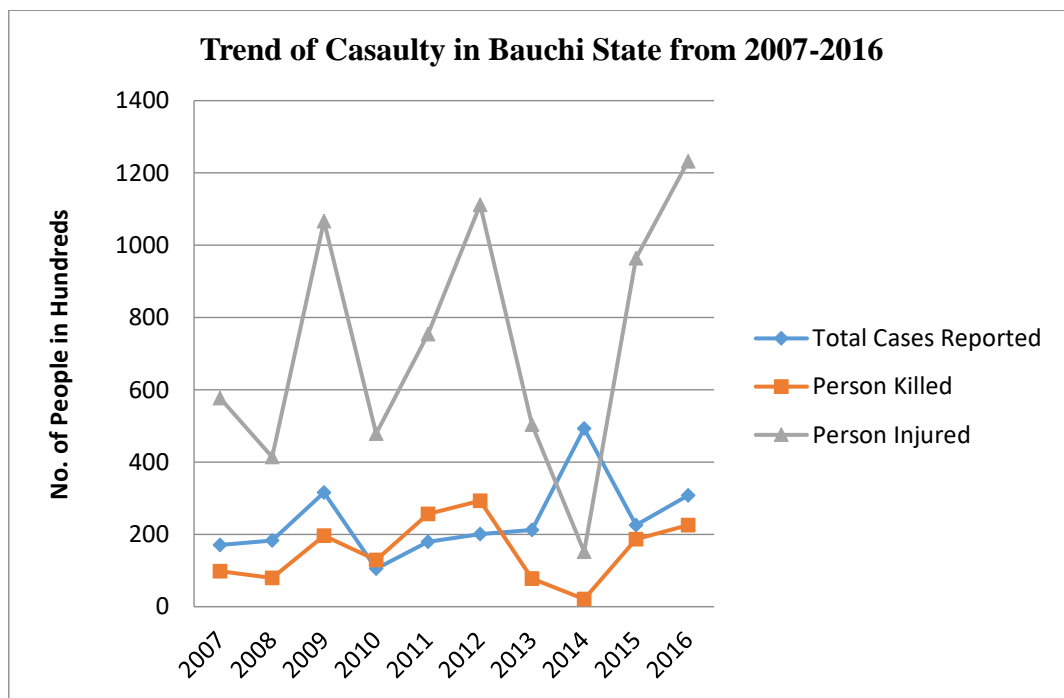
Sources: Authors estimation using excel

Apart from the high death tolls from road accidents in 2014, there are very many other persons that sustained serious injuries. Serious injuries range from total incapacitation of the victims to amputation of limbs and sights lost are some of the major effects of this kind of accidents. Minor injuries on the other hand, may involve fracture of the limbs to mere scratch and loss of some blood. The victim in this case fully regains perfect health after a few days/weeks. Usually, the number of minor cases is lower than that of serious as shown in figure 4.1 above. For the purpose of this study casualties are defined as those accidents in which

people are killed or injured. In Bauchi state it was discovered that in every accident occurs in the state it involves either an injury or a death.

The casualty trend in Bauchi has shown that there has been an increase in the trend of road accidents in the state. Even more serious is the fact that 1565 persons were killed and 7255 persons were injured within the study period from 2007-2016 in the state. However the study further revealed that an average of four people are either killed or injured in every accident in that occur in Bauchi state. The implication is that there is a relatively high proportion of accident which four or more persons are killed or seriously injured. Hence figure 4.1 above revealed a serious and growing predicament with absolute fatality rate and casualty figure rising rapidly in the state.

Figure 4.2: The Trend of road traffic crash casualty in Bauchi state from 2007-2016

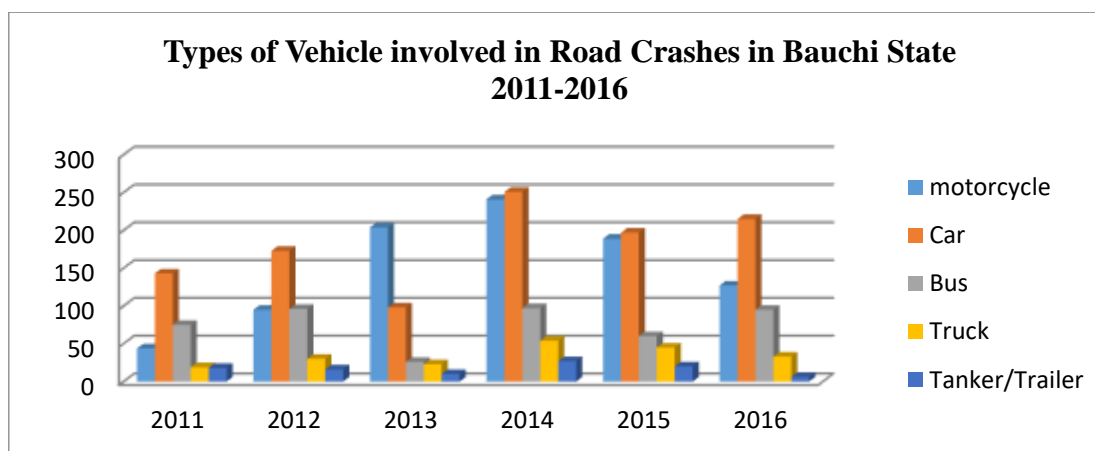


Sources: Authors estimation using excel

It was observed from figure 4.2 above that the lives lost through road accidents are many; a total of 1,565 lives were lost between 2007 and 2016. The highest number of death was recorded in 2012 where 293 people died through road accidents in Bauchi state. In fact, the four years in the state witnessed less

mournful period compared to the previous years for as many as 98, 80, 78 and 21 souls were lost in 2007, 2008, 2013 and 2014 respectively or had their lives terminated prematurely in various road accidents in the country. The reason for this drop in fatality during the four years is not unconnected with the serious activities of the Federal Road Safety Corp in most of the road in the country.

Figure 4.3: Types Of Vehicles Involved In Road Traffic Crashes In Bauchi State



Sources: Authors estimation using excel

From figure 4.3 above, it was discovered that cars are more involved in road crashes in Bauchi state, follow closely are motorcycles, buses, trucks and then Tankers/Trailers. This study further revealed that between 2011to 2016 most of the road crashes in the state involve cars except in 2013 where motorcycle took a led for that year in the state. Tankers/trailer are the least involve in road crashes in the state. The accident statistics also identified the high risk vehicles as cars, motorcycles and buses in Bauchi State. This is in line with the discovery made by this study. However, regardless of the vehicle type involved, road crashes are caused by various factors which include human error, engineering defects, poor vehicle alignment, and inadequate or absence of road furniture among others.

In Nigeria and particularly in Bauchi state most fatalities leading to death are mostly associated with head injuries. This serious have a negative effect on the Nigerian economy because most of those involve in this accidents are in the active productive age bracket. Dead or serious injuries will have a multiplier

effect on their family members and the economy. For instance annual road crashes has led to the loss of goods that are worth millions of naira, damage on the infrastructure which will need a lot of money to repair, monies that are supposed to be used for other economic activities. Lack of use of car seat belts, lack of use of helmets by motor bike riders, use of cars without airbags, alcohol and drug abuse by road users are all negative behaviours accounting for these fatal injuries in the state.

Conclusion and Recommendation

The major finds from this study revealed that no data were available on the cost of damage to vehicle, medical costs, output loss of family members becoming carers and other intangible costs. It does not include the potentially disastrous impact of losing the main wage earner in a family. This basically has a multiplier effect particular on economic activities of the Bauchi state in particular and the Nigeria economy in general.

- i. Proper records should be kept on damage to vehicle, medical cost and the actual number of person involves fatal or serious cases. This will make it easy to calculate the economic impact of road crashes on the Nigerian economy.
- ii. Driver and Traffic Safety Education should be offered as a pre-requisite to the issuance of driving licenses in Bauchi state DTSE should be offered in Primary and Post-primary schools and Tertiary Institutions in whole state.
- iii. It should be made compulsory in Bauchi state that it is only drivers that have passed through a series of driver and traffic safety tests that are issued drivers licenses.
- iv. All vehicles in the state should be thoroughly inspected for roadworthiness before registration and then allow to ply the roads.

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