Journal of Academic Research in Economics

Volume 11 Number 2 July 2019

ISSN 2066-0855

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ACCIDENTS RATES AND VEHICULAR BRANDS FOR SUSTAINABLE TRANSPORTATION IN NIGERIA: A CASE STUDY OF MINIBUSES CRASHES IN ONDO STATE

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Abstract

There is a steady increase in the vehicular accidents on the trunk roads in Ondo State. A large number of these accidents involve commercial minibuses, many of which results to high causality and fatality rates. This study sets out to assess the cases of accidents rates in Ondo State bearing in mind the vehicular brands involved in these accidents to ascertain if there is any prevailing trend involving any set of or any particular brands. To do this, accidents records of the Ondo State Command of the Federal Road Safety Commission and that of the Reports of the Accident Investigation Unit of the Traffic Department of the Ondo State Command of the Nigeria Police Force were considered between the 2008 and 2018. The results showed that most Toyota Mini Buses were involved in most accidents cases recorded in the Ondo State. This does not say that these vehicles were less engineered. However, the high level of involvement can be tied to the large scale use of this brand. The study revealed that Toyota minibuses are most prominent on roads in Ondo State for commercial passenger road transport operations and as such were involved the most in Road Transport Accidents (RTAs). A model of probability of involvement was developed, which means that with a given knowledge of cases of RTAs in any given year in Ondo State, one can confidently predict the number of any vehicular type or brand that could be involved in RTAs in the given year or period. Human errors led to most of the RTAs.

Keywords: Road Transport Accidents; Commercial Minibuses; Vehicular Brands; Commercial Passenger.
JEL Classification: R41.

1. INTRODUCTION

Transport is an essential activity in the lives of virtually everyone living in any urbanised settlement. Cities roads are now, more than ever, dotted with cars this has been made possible because of a greatly improved world standard of living as against what was obtainable about two decades ago (Federal Road Safety Commission, 2016). This positive development has its negative attributes. One notable negative attribute is increased accidents rates. Increased rates of vehicular accidents can be linked to the increase in registered number of cars (Jayaratne and Kumarage, 2005). The resources (people, goods, raw materials and finished products) are constantly in motion over time to where they will have maximum valuation. Transport makes these happen and plays a great role in linking suppliers and consumers. It bridges the gap between them and foster interaction amongst geographical locations. Road vehicles serve the purpose of movements on land. The usage of these vehicles and its interactions with other components of geographical locations sometimes generate a form of error that often results in road traffic accidents.

The occurrence of traffic accidents have become the leading cause of sudden deaths of people of different age grades across the world. An annual death of about 1.2 million people and 50 million injuries occurs as a result of road traffic accident (World Health Organization, 2004; Bin Islam and Kanitpong, 2009). The WHO (2004) stated that, road traffic accident death scale is comparable to deaths from malaria and tuberculosis. It was further stated that over 85% of these occur in the developing countries. This implies that road traffic accident imposes a huge burden on developing countries. In developing economies, poor people, namely pedestrian, cyclists and motorcyclists are usually vulnerable to RTC, due to lack of adequate traffic separation and high traffic intense traffic. Eighty percent of all fatalities in Kenya are pedestrians and passengers in mass transit. Similar situation can be found in Mumbai (India), where 78% of road fatalities were pedestrians (World Health Organization, 2004).

In Nigeria, Road Traffic Accident (RTA) at first seems relatively unimportant when compared to other problems that cause death like poverty, drugs, disease and hunger. A careful analysis and studies on the causes of death in a number of countries throughout the developing world revealed that Nigeria ranks among those with highest death and fatalities caused by RTA in the world and (Balogun, 2006). Lagos, Kano, Ogun, Oyo, Kaduna, Niger, Edo and Delta States have individual state fatality average that exceeds the national average of 11 per 100,000 populations as seen from other studies. It was also found that one person would be killed every 47 minutes, and that an accident occurred every 10 minutes in Lagos State between 1990 and 2004 (Federal Road Safety Commission, 2005). All these show that RTA has become a serious national malaise and the cost is colossal. It should be noted that the increase in traffic flow is being experienced without a commensurate increase in road construction (Musa, 2017). The growth in the rate of occurrence of RTAs is rather synonymous with the growth of the Nigeria gross

domestic product. The weakest growth rate of Nigeria's GDP was recorded in second quarter of 2018 at 1.5 percent (year-on-year) since 2004. (Moya, 2018). Focus on RTAs and the severities of them are on the rise as accident severity has gained notable attention of many reserachers (Luby, Hassan, Jahangir, and Rizvi, 1997; Quddus, Noland, & Chor, 2002; Yamamoto and Shankar, 2004; Chang and Wang 2006; Sze and Wong 2007; Savolainen and Mannering, 2007; Milton, Shankar, & Mannering, 2008; Chimba and Sando, 2009; Macharia, Njeru, Muli-Musiime and Nantulya, 2009; Theofilatos, Graham, and Yannis, 2012; Stephens and Ogwude, 2015; Musa, 2017).

Human factors contribute approximately 85% to road traffic accident (Aaron and Strasser, 1900). Balogun (2006) also reported approximately 90% contribution of human factors to road traffic accident in Nigeria. To appreciate RTA in Nigeria one might need to compare what happens here with elsewhere. Yet International comparison can be misleading if not treated with caution. This is because the difference could arise from such factors as difference in traffic composition. In Nigeria, majority of those moving do so by road, particular for short and mid-range distances, whereas, in Europe and the Americas, most movement are done by using rails and air modes.

Aside the human factors, other factors contributes to RTAs (Bin Islam and Kanitpong, 2009; Stephens and Enyinda, 2014; George, Athanasios, and George, 2017). Causes of road include one, or more than one of the following factors: human factors; vehicle factors; road and environmental factors (Aaron and Strasser,1990; AUSTROADS, 1994; Balogun and Abereoje, 1992; Luby *et al*., 1997; Mock, Amegashie, and Darteh, 1999).

Majority of travellers between cities, states and regions in Nigeria do so by road. In the 1980s, 1990s, and early 2000s, most of these movements were done with road coaches, but there has been a decline in the use of coaches as there is now a shift to minibuses. Musa (2017) attributed the shift to reduced consolidation times for minibuses when compared with coaches; easier detour and avoidance of bad roads and congested spot by minibuses as against the big sized coaches and the faster transit times for minibuses. He also added that the capital outlay to purchase coach is large and that can be used to get a couple of minibuses.

The diversion to minibuses have resulted to a new market being formed and that market has experienced a large boost on the perceived supernormal profits that existed and consequently attracted more players as noted by Stephens and Enyinda (2014). This mean, there now exist the probability of more accidents involving minibuses (Musa, 2017).

Road Traffic Accident (RTA) by its nature is unplanned and unexpected. RTA according to Jha, Srinivasa, Roy, and Jagdish, (2004) is deemed to have occurred on the road when it involved two or more objects, one of which must be a vehicle.

In Nigeria, the use of automobiles has increased so greatly and this when checked poor road and lack of adequate intermodal connectivity makes the nation to

be a candidate for high rate of RTAs. The increase in affluence and motorization has made Nigerian roads more susceptible to RTAs, which has in turn made compliance to safety regulations difficult and their enforcment a big challenge (Stephens and Ogwude, 2015)With the increase in the use of minibuses as against coaches for conveyance of traffic (passengers in particular) has made the likelihood of RTAs also high particularly for commercial road passenger operations. The same cannot be said of technologically advanced countries where the RTA indices are reducing despite the increase in mobility (Oskam, Kingma, & Klasen, 1994).

Research objective

This study therefore explored the cases of RTAs in Ondo State with the view to identifying the most common vehicular types, models or brands involved in accidents and ascertaining the degree of severity and fatality of such RTAs linked to these identified brands or model of minibuses involved in the RTAs.

Significance of the study

The significance of the study will among others lies in revealing the links between RTA cases in Ondo State and the types of brands/models of vehicles used in commercial road passenger transportation. This will help fleet managers of commercial road passenger service operators to be guided in their choice of vehicular brands in their asset management.

Theoretical foundations

RTAs involves more males than females. Jha *et al*. (2004), recorded 83 percent of accident victims to be male and the remaining 17 percent to be female in their study. This might not be unrelated to the fact that more men drives than do women, particularly for commercial road passenger operations in developing economies that accounts for more than 75 percent of world pouplation (George, Athanasios, & George, 2017). When Ross (2002), combined risk, he noted that average SUVs are not as safe as most cars, while pick-up trucks are least safer than any other types (this could be because of the fact that the loads carried behind can become weapons with great momentum on in motion. Human factor was adjudged as one of the factors that made SUVs less sfae than minivans because they are most likely to be driven by young males in more dangerious manner, while the minivans would most likely have less young male drivers (Ross, 2002; alao see George, Athanasios and George, 2017). However, there was no evidence that driver age or sex distribution increases the risk of average SUV compared to the risk of the average midsize car or a smaller car model. Other studies on RTAs with vehicle types in mind include Davis and Truett (2000) and Kahane (1997)

George, Athanasios and George (2017) in their study of road accident severity per vehicle type used the following approaches: the volume of fatalities dived by the total volume of involved vehicles; the volume of severe injuries divided by the total volume of involved vehicles; the volume of slight injuries divided by the total volume of involved vehicle; and the development of accident of separate accident severity models were developed for each type of vehicle. The effects of various parameters such as crash type and weather conditions on accident severity

for each type of vehicle (car, moped, motorcycle, bus and truck) were identified by the team. It was observed that good weather condition and night accidents increase severity and crash types are consitently affecting accident severity. This is not strange as people take the good weather for granted and drive at higher speed than what they would have done in poor weather, gain extra confidence and be a little relaxed during good weather. On the other hand, night driving reduces visibility and increases the likelihood of RTAs even when the drivers are more cautious.

Anderson and Johnson (2014) in their study of RTAs in Western Region, Ghana observed that most vehicles involved in accidents were privately owned, followed closely by commercial vehicles. It was noted that most RTAs occurred around the festive periods. This agrees with the study of Musa (2017) in Ondo State, Nigeria. However, it was also noted that type of vehicles involved in accidents and the time of occurrences are not dependent. This, however, is contrary to the assertion by Musa (2017) that we have more minibuses involvement in RTAs during festive periods (time dependent).

This study will differ from others before it, as it attempts to examine RTAs and link the probabilities of occurrence to brands of minibuses used for commercial road passenger operations in Ondo State. It will also attempt to link fatality and severity rates to brands/model of these minibuses in use.

2. METHODOLOGY

A combination of qualitative and quantitative analysis was adopted to form the design for the research. This was to enable a coherent integration of components logically, to effectively address the research problem. The types of data and methods of data collection as well as techniques for data analysis were explicitly spelt out to form the design for the study. In addressing the specific objectives of this study, the research design was fashioned to determine the make and models of mini buses with frequent cases of accidents in Ondo State. This was achieved by reviewing databases of the FRSC of accident/incident records in Ondo State over an eight-year period starting from 2008-2015 (Federal Road Safety Commission, 2016). The collected data were secondary data. The research is also designed to examine major causes of the minibuses accidents in Ondo State and attempts to link the causes to brands or models of these buses. Data for this objective were obtained from the FRSC database and they too were secondary. To address the last specific objective, the research made use of the FRSC data to calculate the percentage level of casualty and degree of severity of the RTA in Ondo State. Casualty is the number of persons on-board that got at least an injury, while the severity is the number of persons killed amongst the casualties.

Ondo State of Nigeria is the study area and was created on the 3rd February 1976 from the former Western State by the then Federal Military Government of Nigeria, with Akure as the State capital. There are eighteen Local Government Areas in the State with most of its population residing in the urban centres spread across the State. The state spread over an area of about 15,500 square KM, and a density of

220 per square KM. Ondo State lies between latitude 5º45' and 7º52'N and longitudes 4º20' and 6º5'E. Edo (northeast) and Delta (southeast) States bound Ondo state on the east, on the west by Ogun (southwest) and Osun (northeast) States, on the north by Ekiti (northwest) and Kogi (northeast) States and to the south by the Bight of Benin and the Atlantic Ocean. The 2006 census indicates that Ondo State has a total population of about 3,440,000 people. Ondo State located in the humid tropical region of Nigeria, with abundant rainfall for most of the year. From December through to February, the cooler dry continental air from the northeast prevails. It rains from March to October (National Bureau of Statictics, 2010).

The targeted population of the study takes the list of recorded mini buses that had been involved in road traffic accident across various segments of roads in Ondo state from the year 2008 – 2015.

The sample frame and size for the study covered the actual range and number of road traffic accidents across locations in Ondo State with specific cases of the involvement of mini buses in accidents. The study adopted stratified sampling technique in the extraction of data from the records of FRSC Ondo State Command. The need for the adoption of the technique is to ensure that only accident cases involving mini buses from the records of FRSC are used for the study. The technique was used such that the overall records of road traffic accidents were classified by vehicle types, where mini buses form the target data for the study. Pictorial evidences of each case of RTAs were observed to ensure that models or brands of vehicles were not mistaken for those of others.

The data collected were analysed based on the objectives of the study. The study made use of both descriptive and inferential statistics to analyse the data for the achievement of the stated objectives. The descriptive statistics include frequency, percentages, mean and probability.

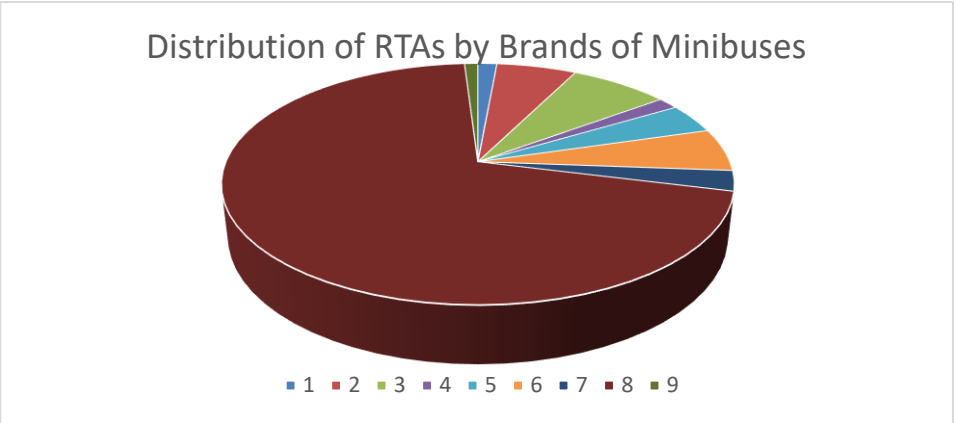
The study covers a period of eleven (11) years (2008- 2018), based on this time frame, the data is considered as adequate for the investigation especially as they were generated on annual basis in space and time. It covers different climatic and environmental conditions for the purpose of observing how they affect RTA in the study area. The accident records were those generated and documented by the FRSC Ondo state command. The records of RTA covering all categories of mini buses makes and models in Ondo state during the period under study were obtained and use for analysis. The ranges of vehicles make and model were premised on the availability of reliable, accurate data and in the manner in which they were recorded over the years, since they are historical data.

3. RESULTS AND DISCUSSION OF RESULT

3.1. VEHICLE TYPES INVOLVED IN RTA AND FREQUENCY

It should be noted that some vehicle make and models may be prone to having accidents as a result of their engineering designs and frameworks. This study

makes an attempt to highlight the various vehicle types which are mostly involved in RTA in Ondo state.



Keys	1	2	3	4	5	6	7	8	9
	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
Involvement in RTAs	10	42	52	11	28	40	19	490	7

Figure 1. *Vehicle Types involved in RTA in Ondo From 2008 - 2015*

Source: FRSC Ondo State Command, 2008 – 2018

The study therefore found that Toyota buses dominate the rate of accidents in Ondo state (See Figure 1). The fact that Toyota vehicles dominated accident rates does not imply faulty engineering design but that various models of Toyota buses are being used by majority of the drivers for commercial purpose in Nigeria as various brands and models of Toyota buses dominate the roads of Nigeria.

Other vehicle types (minibuses) involved in RTA across road networks in Ondo state include Fiat, Ford, Mazda, Mitsubishi, Nissan, Peugeot, Suzuki, and others (Mercedes Benz, Dodge Caravan, and Hyundai). Toyota minibuses sure dominates the road passenger transport operations market for medium and long range services in Nigeria.

The model for the probability of involvement prediction is:

$$P_{InRTA}=P_{InFiat}+P_{InFord}+P_{InMazda}+P_{InMitsibishi}+P_{InNissan}+P_{InPeugeot}+P_{InSuzuki}+P_{InToyota}+P_{Iners}$$

Where: P_{InRTA} is the total occurrences of RTAs in involving commercial minibuses in Ondo State which is (699/699) = 1 and P_{InFiat}; P_{InFord}; $P_{InMazda}$; $P_{InMitsibishi}$; $P_{InNissan}$; $P_{InPeugeot}$; $P_{InSuzuki}$; $P_{InToyota}$; $P_{InOthers}$ are probability of involvement of the vehicular types or brands as indicated.

$$1_{InRTA}=0.014_{InFiat}+0.060_{InFord}+0.074_{InMazda}+0.016_{InMitsibishi}+0.040_{InNissan}+0.057_{InPeugeot}$$

$$+0.027_{InSuzuki}+0.701_{InToyota}+0.010_{InOthers} \quad \text{Equation 1}$$

Therefore, in any accident involving commercial minibuses that happened on Ondo State's roads, the probability of involvement of Toyota Minibuses is 0.701 chances out of 1.000.

3.2. CAUSES OF ROAD TRAFFIC ACCIDENTS INVOLVING MINI BUSES IN ONDO STATE

Accidents do not occur in space without a cause or combination of causes. This implies that all accidents are as a result of the actions and inactions of drivers and other road users, and reactions of or with environmental and mechanical items or issues.

Table 2 presents the accident rates as caused by various factors in Ondo state. It is evident from the Table 2, that majority of the accident cases recorded that have involved mini buses across road networks in Ondo State were as a result of speed violation (32 percent), wrongful overtaking (20 percent) and dangerous driving (17 percent). It is not surprising that Toyota minibuses had the most share of RTAs for commercial operations.

This implies that actions and inactions of drivers form the major cause of accidents (79 percent) involving mini buses in Ondo state. These causes are without doubt related to drivers' behaviour. This implies that the attitude of drivers while on steering goes a long way to influence the rate of accidents on roads because these are human factors that leads to accidents. It is not a coincidence that Toyota Minibuses had the largest share of brands of minibuses involved in speed violation (79 percent), wrongful overtaking (87 percent), dangerous driving (83 percent) for RTAs. It was noted that majority (75 percent) of Toyota minibuses in use for commercial road passenger services in Nigeria were bought brand, which could have given their drivers some impetus to throw caution to the wind and driving with less safety consciousness (see Table 3).

Table 1. *Probability of Involvement in RTAs by Vehicular Types/Brands*

Frequency and Probability	Vehicular Type/Brands									Total
	Fiat	Ford	Mazda	Mitsu bishi	Nissan	Peugeot	Suzuki	Toyota	Others	
Involvement in RTAs	10	42	52	11	28	40	19	490	7	699
Probability of involvement (P_{in})	0.014	0.060	0.074	0.016	0.040	0.057	0.027	0.701	0.010	1.000

Source: Computed by authors from extracts from FRSC data (2018)

Table 2. *Causes of RTA and frequency*

Cause of RTA	Frequency	Percentage Share	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
BR	8	1	1	0	2	1	1	1	0	2	0
BF	41	6	1	1	9	1	3	0	1	24	1
SV	226	32	1	21	2	2	3	13	4	179	1
DI	10	1	0	0	1	1	1	2	1	3	1
F	13	2	1	1	1	1	2	2	1	4	0
LC	32	5	0	0	16	1	4	2	0	9	0
MD	19	3	0	1	2	0	3	4	1	8	0
RO	26	4	2	3	1	0	2	1	3	14	0
TB	54	8	0	2	13	1	3	9	1	25	0
WO	141	20	2	1	1	0	5	4	3	123	2
DD	117	17	1	10	2	2	1	1	1	98	1
O	12	2	1	2	2	1	0	1	3	1	1
Total	699	100	10	42	52	11	28	40	19	490	7

Keys: BR-Bad Roads; BF-Brake Failure; SV-Speed Violation; DI-Driving under Influence of alcohol or drugs; F-Fatigue; LC-Loss of Control; MD-Mechanical deficient vehicle; RO-Road Obstruction; TB-Tyre Burst; WO-Wrongful Overtaking; DD-Dangerous Driving; O-Others

Source: FRSC Ondo State Command, 2008 – 2018

Table 3. *Percentage share of Minibuses brands involved in RTAs*

	Percentage Share								
	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
BR	13	0	25	13	13	13	0	25	0
BF	2	2	22	2	7	0	2	59	2
SV	0	9	1	1	1	6	2	79	0
DI	0	0	10	10	10	20	10	30	10
F	8	8	8	8	15	15	8	31	0
LC	0	0	50	3	13	6	0	28	0
MD	0	5	11	0	16	21	5	42	0
RO	8	12	4	0	8	4	12	54	0
TB	0	4	24	2	6	17	2	46	0
WO	1	1	1	13	4	3	2	87	1
DD	1	9	2	2	1	1	1	84	1
O	8	17	17	8	0	8	25	8	8

Keys: Rows in colour yellow are indicating vehicle-attributable causes of RTAs. BR-Bad Roads; BF-Brake Failure; SV-Speed Violation; DI-Driving under Influence of alcohol or drugs; F-Fatigue; LC-Loss of Control; MD-Mechanical deficient vehicle; RO-Road Obstruction; TB-Tyre Burst; WO-Wrongful Overtaking; DD-Dangerous Driving; O-Others

Source: Computed by authors from extracts from FRSC data (2018)

Some causes of RTAs can be tied to the vehicles as part of non-human factors. These are brake failure (6 percent), loss of control (5 percent), mechanical deficient (faulty) vehicles (3 percent), and tyre burst (8 percent) as shown on Table 3. With this information, it will not be out of place to check which vehicle type/brand had the most number of RTAs that are associated with vehicles. Already Toyota has been noted to contribute the highest to most RTAs caused by different attributes. Therefore, a look at the percentage share of vehicle-attributable causes with Toyota being the focal point revealed that if the brand indeed causes RTAs. Table 3 shows the percentage share of causes of RTAs taken up by Toyota minibuses.

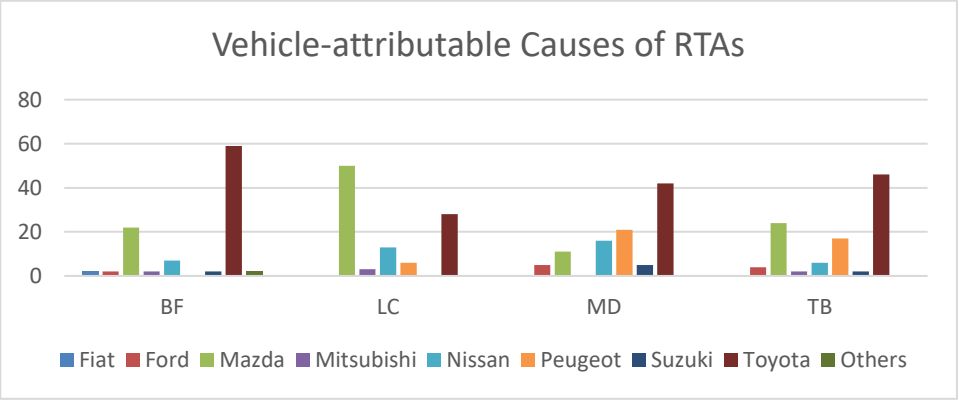


Figure 2. *Vehicle Types involved in RTA in Ondo From 2008 – 2015*

Keys: BF-Brake Failure; LC-Loss of Control; MD-Mechanical deficient vehicle; TB-Tyre Burst.
Source: FRSC Ondo State Command, 2008 – 2018

It can be seen that of the vehicle-attributable causes of RTAs, Toyota minibuses suffered the most RTAs except for Mazda minibuses that recorded higher values than Toyota minibuses. Peugeot minibuses also had a bad showing for mechanical deficient vehicle and tyre bursts. Mazda minibuses came either first or second alongside Toyota minibuses for showings in brake failure, loss of control, and tyre burst (see Figure 2).

3.3. CASUALTY AND SEVERITY LEVEL OF ROAD TRAFFIC ACCIDENTS INVOLVING MINI BUSES IN ONDO STATE

On the surface Toyota minibuses seems to have killed more people in Ondo State cases of RTAs involving commercially used road passenger minibuses (see Figure 3 and Table 4).

Table 4. Number of People Killed against Vehicles Types involved in Minibuses RTAs

Brand	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
Number Killed	5	19	81	4	31	45	16	557	16

Source: FRSC Ondo State Command, 2008 – 2018.

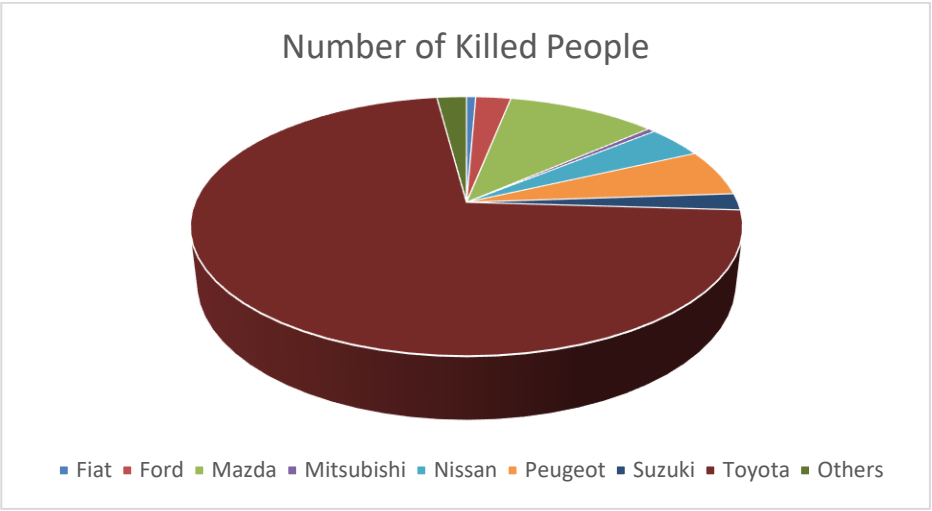


Figure 3. *Numbers of People Killed against Vehicle Types involved in RTA in Ondo From 2008 - 2015*

Source: FRSC Ondo State Command, 2008 – 2015

However, with closer examination of individual cases and aggregating the lots for each vehicular type or brand, it is obvious that it is not Toyota that will likely kill the most per cases of RTA. Nissan minibuses had an average of 3.44 people killed per RTA that it was involved in, which led to loss of lives. The Mitsubishi minibuses had the least number of people killed per RTA that it got involved in that led to loss of lives. Toyota surprising came third as shown on Figure 4 and Table 5.

The model for the probability of being killed prediction is :

$$P_{BiKRTA}=P_{BiKFiat}+P_{BiKFord}+P_{BiKMazda}+P_{BiKMitsibishi}+P_{BiKNissan}+P_{IBiKPeugeot}+P_{BiKSuzuki}+P_{BiKToyota}+P_{BiKOthers}$$

Where: P_{BiKRTA} is the total averages of killed people in RTAs in involving commercial minibuses in Ondo State which is (24.42/24.42) = 1 and $P_{BiKFiat}$; $P_{BiKFord}$; $P_{BiKMazda}$; $P_{BiKMitsibishi}$; $P_{BiKNissan}$; $P_{BiKPeugeot;}$ $P_{BiKSuzuki}$; $P_{BiKToyota}$; $P_{BiKOthers}$ are of probabilities being killed inside any of the vehicular types or brands as indicated involved in commercial minibuses RTAs in Ondo State.

The probability of being killed in a commercial minibus involved in RTAs in any given period in Ondo State can be derived from

$$1_{BiKRTA}=0.102_{Fiat}+0.130_{Ford}+0.133_{Mazda}+0.055_{Mitsibishi}+0.141_{Nissan}+0.084_{Peugeot}+0.131_{Suzuki}+0.131_{Toyota}+0.094_{Others} \quad \text{Equation 2}$$

Therefore, in any accident involving commercial minibuses that happened on Ondo State's roads, the probability of being killed in of Toyota Minibuses is 0.131 chances out of 1.000. The minibus brand with the highest probability of getting anyone killed is Nissan with a probability of 0.141.

However, it should be noted that all these brands have very low probability of killing passengers for any period of time as none is having values up to 0.50.

Table 5. *Average Numbers of People Killed against Vehicle Types involved in RTA in Ondo State*

Brand	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
Average killed	2.50	3.17	3.24	1.33	3.44	2.05	3.20	3.20	2.29

Source: FRSC Ondo State Command, 2008 – 2018.

Table 6. *Probability of being killed in a commercial minibus involved in RTA in Ondo State*

	Fiat	Ford	Mazda	Mitsubishi	Nissan	Peugeot	Suzuki	Toyota	Others
Average killed	2.50	3.17	3.24	1.33	3.44	2.05	3.20	3.20	2.29
Probability of being killed (P_{BiKRTA})	0.102	0.130	0.133	0.055	0.141	0.084	0.131	0.131	0.094

Source: Computed by authors from extracts from FRSC data (2018)

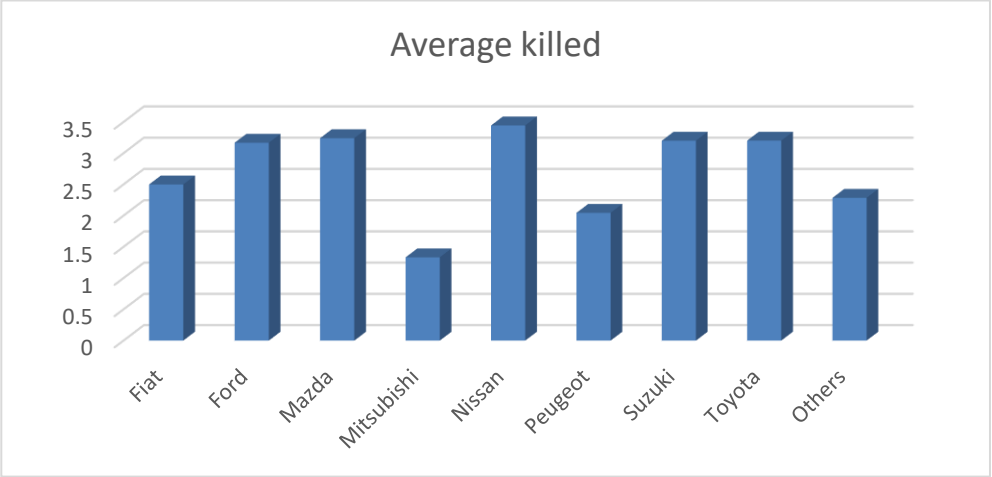


Figure 4. *Average Numbers of People Killed against Vehicle Types involved in RTA in Ondo From* 2008 - 2015

Source: FRSC Ondo State Command, 2008 – 2018

On causes-by-causes basis, only Peugeot (3 killed) and Toyota (2 killed) minibuses recorded RTA for caused by bad roads. For brake failure cases, Fiat had one case it was involved in and one person was killed. Mazda (one involvement, 1 killed), Peugeot (two involvement, 2 killed), Suzuki (10 killed). Speed Violation resulted in most deaths in RTAs with 211 persons killed (see Table 6).

Table 6. *Causes-by-causes basis for number of killed people in RTAs using vehicle type/brands*

Vehicle Brand	Cause																							
	BR	BF		DD		DI		F		LC		MD		Others		RO		SV		TB		WO		
	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed	RTAs	Number killed
Fiat	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0
Ford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	12	0	0	3	5
Mazda	0	0	1	1	4	13	0	0	0	0	0	0	0	0	0	0	0	0	8	35	2	2	10	30
Mitsubishi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5
Nissan	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	8	0	0	3	8	1	10	3	4
Peugeot	1	3	2	7	4	10	0	0	1	2	0	0	0	0	3	4	1	3	10	11	0	0	2	5
Suzuki	0	0	2	10	1	4	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0
Toyota	1	2	4	12	29	94	3	3	0	0	10	67	3	11	25	70	6	16	54	132	15	45	39	109
Others	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	2	1	1	3	9	0	0	1	4
Total	2	5	10	31	40	123	3	3	2	3	10	67	4	12	32	86	9	21	81	211	18	57	62	162

Keys: Rows in colour yellow are indicating vehicle-attributable causes of RTAs. BR-Bad Roads; BF-Brake Failure; SV-Speed Violation; DI-Driving under Influence of alcohol or drugs; F-Fatigue; LC-Loss of Control; MD-Mechanical deficient vehicle; RO-Road Obstruction; TB-Tyre Burst; WO-Wrongful Overtaking; DD-Dangerous Driving; O-Others

Source: FRSC Ondo State Command, 2008 – 2018

4. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The study showed that against many study and the widely believed stand that bad roads are a major causal factor to RTAs, that bad roads caused the list of RTAs (about 1.15 percent) in Ondo State for commercial minibuses. The study revealed that Toyota minibuses are most prominent on roads in Ondo State for commercial passenger road transport operations and as such, was involved the most in RTAs. A model of probability of involvement was developed and that mean with a given knowledge of cases of RTAs in any given year in Ondo State, one can confidently predict the number of any vehicular type or brand that could be involved in RTAs in the given year or period.

It was also noted that the many other brands that had copied Toyota in this market segment were also erroneously categorized as Toyota. These were sieved out to make sure that other brands were not categorized as for another. The study also revealed that majority of the accident cases recorded to have involved mini buses across road networks in Ondo State were as a result of speed violation (32 percent), wrongful overtaking (20 percent) and dangerous driving (17 percent). This implies that human errors, actions or inaction led to most of the RTAs.

The study showed that for vehicle-attributable causes of RTAs, Toyota minibuses suffered the most RTAs and was prominent in cases that featured it. Peugeot minibuses also had a bad showing for mechanical deficient vehicle and tyre bursts. Mazda minibuses came either first or second alongside Toyota minibuses for showings in brake failure, loss of control, and tyre burst.

A model to predict the probability of being killed in any accident involving commercial minibuses that happened on Ondo State's roads over a period of time was developed and Nissan minibuses had the highest probability of getting anyone killed with a probability of 0.141.

In conclusion, we can say accidents are bound to happen but majority of them can be prevented if human aspects of road vehicle operations that leads to accidents are reduced or eliminated. The probability of being killed as calculated were drawn from the cases of RTAs that had people killed and not necessarily all the cases of RTAs observed over the study period. This therefore, implies that the probability of being killed were strictly for instances were lives were lost. However, for probability of involvement based on commercial minibuses being used for conveyance of passengers, the computations were done for all the cases of RTAs in the study period. Toyota minibus is the leading brand for commercial passenger services operations in Ondo State with a very high probability of being involved in RTAs but a very low probability of getting the passengers killed.

From the study, we recommend the following:

a. accident investigators should ensure that, should there be need to capture brands and models of vehicles involved in RTAs, they should record the correct brands of vehicles and other information;

b. more attention should be given to drivers, drivers' education and testing to reduce cases of RTAs as most were caused by human actions/inactions that could be controlled;

Acknowledgment: A big thank you to the Ondo State Command of Federal Road Safety Commission for making data available for this study.

REFERENCE

Aaron, J. E., & Strasser, M. K. (1900). *Driver and Traffic Safety Education.* London, New York: Macmillan.

Anderson, F. N., & Johnson, J. K. (2014). A Statistical Analysis of vehicle Accident Cases in Western Region, Ghana. *Mathematical Theory Modeling, 4*(13), 56-71.

AUSTROADS. (1994). *Road Safety Audit.* Sydney: AUSTROADS Publication.

Balogun, J. A., & Abereoje, O. K. (1992). Pattern of Road Traffic Accidents Cases in a Nigerian University Teaching Hospital between 1987 and 1990. *Journal of Tropical Medicine Hyg, 95*, 23-29.

Balogun, S. A. (2006). Spatio-Temporal Analysis of Road Traffic Accident in The Federal Capital Territory Unpublished Ph. D. Thesis, Department of Geography, FUT, Minna. *Unpublished Ph. D. Thesis, Department of Geography, Federal University of Technology, Minna*. Minna, Niger, Nigeria: Department of Geography, Federal University of Technology, Minna.

Chimba, D., & Sando, T. (2009). Neuromorphic Prediction of Highway Injuries Severity. *Advances in Transportation Studies, 19*, 17-26.

Davis, S. C., & Truett, L. F. (2000). *An Analysis of the Impact of Sport Utility Vehicles in the United States.* US Department of Energy, Office of Transportation Technologies. Washington, D. C.: US Department of Energy.

Federal Road Safety Commission. (2005). *Road Traffic Accidents (RTA) Summary*. Abuja: Federal Road Safety Commission.

Federal Road Safety Commission. (2016). *Road Traffic Accidents (RTA) Summary*. Akure: Ondo State Command, Federal Road Safety Commission.

George, Y., Athanasios, T., & George, P. (2017). Investigation of Road Accident Severity per Vehicle Type. *World Conference on Transport Reserach. 25*, pp. 2081-2088. Shanghai: Transportation Reserach Procedia (Science Direct). Retrieved from www.elsevier.com/locate/procedia

Jha, N., Srinivasa, D. K., Roy, G., & Jagdish, S. (2004.). Epidemiological Study of Road Traffic Accident cases: A study from South India. *Indian Journal of Community Medicine, 29*(1), 20-24.

Kahane, C. J. (1997). *Relationship between VehicleSize and Fatality Risk in Model Year 1985-1993 Passengers and Light Trucks.* US Department of Transportation. Washington, D. C.: National Highway Traffic Safety Administration.

Luby, S., Hassan, I., Jahangir, N., & Rizvi, N. (1997). Road traffic injuries in Karachi: The disproportionate role of buses and trucks. *Southeast Asian Journal of Tropical Medicine, 28*, 395-398.

Macharia, W. M., Njeru, E. K., Muli-Musiime, F., & Nantulya, V. (2009). Severe road traffic injuries in Kenya, quality of care and access. *African Health Science, 9*(2), 118-124.

Milton, J. C., Shankar, V. N., & Mannering, F. L. (2008). Highway accidents severities and mixed logit model: An exploratory empirical analysis. *Accident Analysis and Prevention, 40*, 260-268.

Mock, C. J., Amegashie, J., & Darteh, K. (1999). Role of commercial drivers in motor vehicle related injuries in Ghana. *Injury Prevention, 5*, 268-271.

Moya, S. (2018, 8 27). *Nigeria GDP-Growth-Annual*. Retrieved from Trading Economics: https://tradingeconomics.com/nigeria/gdp-growth-annual

Musa, T. (2017). *An assessment of the causal factors of high vehicle occupancy fatality rate in road traffic crashes involving minibuses in Akure metropolis,* (unpublished MTECH Dissertation). Akure: Department of Transport Management Technology, Federal University of Technology, Akure.

National Bureau of Statictics. (2010). *NBS Annual Data.* Abuja: NBS.

Oskam, J. J., Kingma, J., & Klasen, H. J. (1994). The Groningen trauma study: Injury patterns in a Dutch Trauma Centre. *European Journal of Emergency Medicine, 1*(4), 167-172.

Quddus, M. A., Noland, R. B., & Chor, C. H. (2002). An analysis of motorcycle injury and vehicle damage using ordered probit models. *Journal of Safety Reserach, 33*, 445-462.

Ross, M. (2002). *An analysis of traffic deaths by vehicle type and model.* Washington, D. C.: American Council for an Energy-Efficient Economy (ACEEE) Publications.

Savolainen, P., & Manering, F. (2007). Probabilistic model of motorcyclists' injury severities in single- and multi-vehicle crashes. *Accident Analysis and Prevention, 39*, 955-963.

Stephens, M. S., & Enyinda, C. A. (2014, July-December). Empirical analysis of road safety compliance in Nigeria: Prohibition of overloading. *Ikogho: A Multi-disciplinary Journal, 11*(3-4), 439-451.

Stephens, M. S., & Ogwude, I. C. (2015). Empirical analysis of road safety adherence in Nigeria: Seat belt use. *Scientific Journal of Risk Governance and Control, 5*, 2312-2722.

Sze, N. N., & Wong, S. C. (2007). Diagnostic analysis of logistic model for pedestrian injury severity in traffic crashes. *Accident Analysis Prevention, 39*, 1267-1278.

Theofilatos, A., Graham, D. J., & Yannis, G. (2012). Factors affecting accident severity inside and outside urban areas in Greece. *Traffic Injury Prevention, 13*(5), 458-467.

World Health Organization. (2004). *World report on road traffic injury prevention: Summary*. Geneva: World Health Organization.