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Understanding the Characteristics of Urban Road Crashes in Lagos Metropolis: Implications for Risk Reduction Strategies

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Abstract

This study interrogates ten years of road traffic crash statistics in Lagos state, with the goal of understanding the characteristics of the phenomena over time, the study examined the patterns of crash occurrence and casualty, time and days of the crash, and number of vehicles involved. Secondary data for the period 2013 to 2022 were obtained from FRSC, cleaned and processed. Using descriptive statistical methods with the aid of Microsoft Excel spreadsheet, pivot table, chart, frequency table, and graph, were used to analyse the Characteristics variables of road traffic crashes in metropolitan Lagos. The distribution pattern of crash and casualty was also tested using Mann-kandell trent analysis. Result revealed that the pattern of changes in both cases and causality have no significant monotonic trends, for the crash the line is slightly up (+6.2) and casualty a slightly downward trend (~-5.3) . Frequency of crash occurrence is relatively high in the morning hours of 0501 and 1300 hours throughout the years except for the year 2017, and Saturday followed by Thursday were days of high frequency of crash. Multiple crashes are predominantly high throughout the period. The findings indicate insignificant temporal variability in crash occurrence and casualty patterns, and morning period and weekend (Saturday) records highest frequency of crashes. it is therefore recommended that policy makers and road safety agencies should focus on road traffic crash risk reduction and intervention programmes in reducing the occurrence and casualty of road crashes with particular attention on morning period and weekend.

Keywords: Road Crashes, Causality, Crash Time, Crash Frequency

1. Introduction

Road traffic crashes are a global phenomenon with contributions from every location of the world; the trend and quantity of the data continue to be frightening as a cause of death and injuries world over. The statistics show about 1.3 million deaths and over 50 million injuries every year. The need to interrogate the statistics became apparent to be able to develop and identify root causes and understand the nature and characteristics for effective countermeasures.

An evidence-based counter measured is advocated in the UN Decade of Action plan on Road Safety (2021-2030), similarly, the safe system approach. Effective road safety management is tied to the first pillar of the action plan i.e. establishment of a lead agency in road safety management in every member state, with the core responsibility of collating and analysing of road safety data for effective monitoring and management of road safety situation across the globe. In Nigeria road safety statistics are collected, collated and analysed by both state and federal agencies, which include the Federal Road Safety agencies, the Police, the state traffic management agencies and National Bureau of Statistics (NBS). Most of the agencies present reports of road safety statistics at different interval, yearly, quarterly and or monthly and with complex data structure, depending on the accident data collection format.

This study focuses on the pattern and frequency of occurrence, time of crash and number of vehicles involve in crashes within Lagos state, with a view to understanding the nature and characteristic of the phenomenon in the state. Lagos is chosen for the study because of its significant contribution to the national statistics in terms of number of crash cases recorded in the last decades. Every state of the federation contributed to the frightening road traffic crash record, and among the leading regions is Lagos state, when the number of occurrences and total casualty are considered, however, the fatality of the crash in Lagos are relatively low compared to some northern states and the like of Oyo, Osun, Ondo, and Ogun in the southwestern zone of Nigeria (Iyanda, 2018; Bombom *et al.*, 2022). Road transport data published by NBS (2020) revealed a total of 542 road traffic crash cases with 1031 causalities of which 117 deaths in 2019. In the year, Lagos state was the 4th leading region in the country, while FCT Abuja, Kaduna, and Ogun were leading respectively. Subsequent years have also shown a continuous increase in the number of cases except the year 2020 which was affected by the restriction of movement imposed by the Covid-19 pandemic. The

FRSC, (2021) attributed the leading causes of increased road traffic crashes in the state to over speeding, brake failure, and dangerous driving.

Much research has investigated the traffic situation in Nigeria and in Lagos state in particular, Iyanda (2018) investigated the distribution of accident severity in Nigeria, the study found that between 2012 and 2016, Lagos state was one of the states with low (0.2339-0.3722) road crash severity rate. Similarly, Daniel et al (2017) studied the spatial epidemiology of road traffic crashes and mortality in Nigeria for a period of nine years (2007-2015) and found that Lagos state has 3.4/100,000 population of road crashes and a mortality rate of 2.7/100,000 population during the period. Bombom *et al.*, (2022) in a study of the underlying pattern in road traffic crash fatality rate in Nigeria between 2005 and 2018, discovered that Lagos state has a 0.52 fatality rate per crash which is the lowest among the states of the federation. The study further established that for 14 years Lagos has been second to Abuja in the number of recorded crashes with 10128 cases. During the period Lagos recorded an average of 5270 deaths, which is below the mean rate of 8900 per year, and came to a distant 7th position in the ranking of states with road traffic crash fatality.

Several studies have identified key variables in the studies as having significant influence on the crash fatality. Islam and Hernandez, (2013a) identified the importance of time of crash as a significant factor of crash severity and developed a models for a five-time period in a day i.e. – early morning, morning, mid-day, afternoon and evening. Similar to this, other authors identified time period of crash as workdays and non-workdays, (Fulu, Danping, and Yongqing, 2025)) and sunny and winter period (Ping z., et al, 2024) as contributors to crash severity. Shuguang et al (2022) in an experimental investigation identified vehicle type, number of vehicles as single or multiple vehicle accident as most influential factor of crash severity.

Over the years, the road safety situation in Lagos state has improved through the government's attention in the sector which focused on three major areas, namely the development of transport sector policy and strategies; commissioning of urban transport projects and the preparation of Lagos state strategic transport master plan 2010-2020. (LAMATA, 2013). Among so many interventions are, the establishment of Lagos drivers' institutes, the establishment of Lagos State Traffic Management Authority (LASMA), the establishment of urban transport management authority (Lagos Metropolitan Transport Authority LAMATA) and the Bus Rapid Transit (BRT), and road/intersection improvement projects that cut across the state. This study therefore seek to interrogate road crashes data to see whether these measures as put in place by the state has improve over time the road safety situation in Lagos state, with the objectives, of examining the pattern/trend of road crashes and casualties, and analysing the characteristics of the Road Traffic Crash (RTC).

2. Methodology

Lagos metropolitan area is the centre of socio-economic activities, and the administrative core of the state also falls within the area. Before now, Lagos was the federal capital territory city until 1990, when it was moved to Abuja, the national structure and presence are still very much around, given the seaport, airport, international conglomerate, and concentration of industries. The state and indeed the metropolitan area is the national transport hub which is referenced beyond the shores of the country and Africa in general.

Over the years the population of Lagos has continuously increased, with an average of 600,000 yearly (Olusina and Ajanaku, 2017), the commuting population is about 10 million producing over 20 million trips daily (LAMATA, 2013), creating a dense traffic situation that often results in traffic congestion with resultant effect also on road traffic crashes.

Lagos state is located in the south-west of Nigeria, approximately Lagos central location is on latitude 6.52440N and longitude 3.37920E The state is the commercial hub of the nation through which regional and international freights and passenger traverse to other landlocked regions and nations in the sub-Sahara Africa. With population of over 25 million residence and additional transit population of over 5 million daily (Lagos State Government, 2023). Movement within the state is largely relies on road transport, which carries about 2 million commuters daily (LAMATA 2022).

Road traffic crashes data for the period 2013 to 2022 were obtained from operational records of Federal Road Safety Corps (FRSC) Lagos state command, cleaned by checking for repeated entries, and incomplete sets of data which were removed. The cleaned data were reconciled with the online published data both by Nigeria Bureau of Statistics Report and FRSC Annual Reports to validate it. The data obtained for this study were analysed using descriptive statistical methods. Descriptive statistics is adopted for the analysis of the crash characteristics using a Microsoft Excel spreadsheet, pivot table, chart, frequency table, and graph. . The characteristics variables such as time of the crash, type of crash, and days of the week the crash occurred, and number of vehicles involved were analysed. Similarly, Mann-kendall statistics was used to test the significant of the crash pattern. These methods were adopted to give a general understanding of the crash characteristics in metropolitan Lagos.

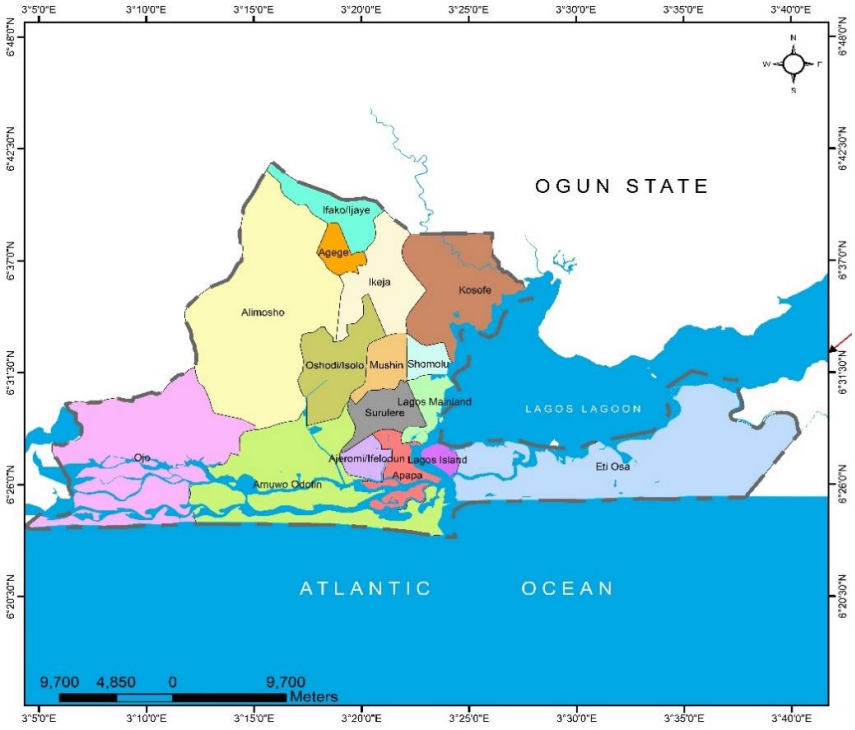


Figure 1: Map of Lagos state, showing the Local Government Areas
Source: Ajala 2024

3. Data Presentation

Summary statistics for ten (10) year period (2013-2022) were analysed and organized under three sub-headings, pattern of crashes occurrence and casualty, time and days of the crash, and number of vehicles involved.

3.1 Pattern Road traffic crashes occurrence and casualty for yearly interval of 2013-2022

A temporal analysis of the road traffic crashes for ten years is presented in Table 1, the data revealed the percentage changes in the number of occurrences and casualty over the years. The years 2015, 2019, and 2020 recorded an increase with a higher percentage (115 percent) in 2019, while 9.2 percent and 7.2 percent were recorded in 2015 and 2020 respectively. Other years within the period recorded a decrease in the cases at varying proportions ranging from 0.3 percent to 20 percent. Similarly, the period presents an inconsistent pattern of casualty record. In 2015 casualty increased by 7.4 percent and the trend continued in 2016 (11.0 percent), by 2019 the peak was recorded (145 percent) and dropped to 14.2 percent and no changes between 2021 and 2022 was recorded. For other years, a decrease in casualty was recorded, 2014 had a decrease of 23.9 percent, while 2017 and 2018 recorded 11.8 percent and 27.6 percent decrease respectively. Year 2020 recorded the highest 51.4 percent decrease in casualty, and by the close of the year 2022, no changes was recorded. The pattern of changes in both cases and casualty have similar trends, the peak increase both in cases and casualty was recorded in 2019, and the peak decrease in 2020. The line graph in Figure 2 revealed that at the close of 2022 road crash occurrence is reducing while the casualty remains constant.

Table 1 Frequency of Road Traffic Crashes Occurrence and Casualty (2013-2022)

Years	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Cases	237	228	249	245	204	163	352	290	311	310
%	-	-3.8	9.2	-1.6	-16.7	-20	115	-17.6	7.2	-0.3
Casualty	1889	1437	1544	1728	1523	1102	2701	1312	1498	1498
%	-	-23.9	7.4	11.9	-11.8	-27.6	145	-51.4	14.2	0

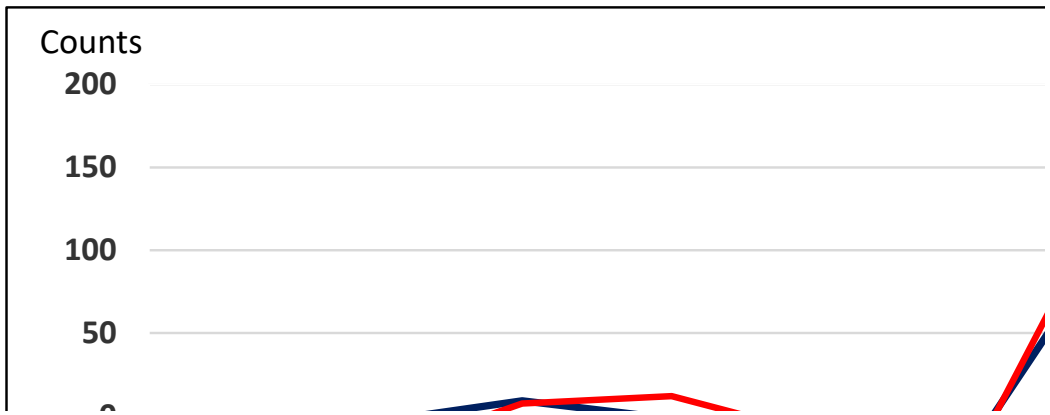


Figure 2 Crash cases and Casualty

The mann-kendall test result presented in Table 2, revealed that there is no significant monotonic trend, either upward or downward, the trend has no definite pattern, for the crash the line is slightly up (+6.2), but not a consistent trend. Casualty present a fluctuating trend with no clear upward or downward trend over the decade, with a slightly downward trend (~-5.3). From this analysis it shows that there is no significant pattern, this, of cause may mean that the existing measures have not been able to influence a risk reduction neither a worsen situation.

Table 2: Mann-kendall test results

Variables	P-Value	Sen's Slope	Remark
Crashes	~0.52 > 0.05	~+6.2/year	No significant monotonic trend
casualty	~0.71 > 0.05	~-5.3	No significant monotonic trend

3.2 Time and days of road traffic crashes in metropolitan Lagos

The time period was grouped into three, namely the early morning period denoted by a.m. for the period of 0501 hours to 1300 hours, the second group is denoted by p.m. which covers between 1301 hours and 2100 hours, while the last period is denoted by m.n. (Mid-Night) covers the time between 2101 hours and 0459 hours. Table 3 revealed that the frequency of crash occurrence is relatively high in the morning hours of 0501 and 1300 hours throughout the years except for the year 2017, where the afternoon hours recorded 116 cases. Similarly, the pattern revealed that the number of occurrences in the three-time period fluctuated with a relatively low rate of difference, the a.m. period recorded the highest number of occurrences followed by the afternoon period, while the mid-night period recorded a low occurrence throughout the years. This observed pattern in the time of the crash is relative to the volume of traffic during the individual periods.

Table 3 Time of road traffic crash occurrence (2013-2022)

Years	Crash Time			
	AM (0501-1300hrs)	PM (1301-2100hrs)	MN (2101-0501hrs)	Total
2013	119	99	19	237
2014	114	91	23	228
2015	127	89	33	249
2016	130	78	37	245
2017	49	116	39	204
2018	91	55	17	163
2019	172	133	47	352
2020	148	99	43	290
2021	158	115	38	311
2022	173	102	35	310

The distribution of crash events between days of the week is presented in Table 4, the pattern does not show a significant difference in the number of occurrences between days of the week. For the seven-year data (2016-2022) that are available on the FRSC record, different years recorded the highest frequency of crashes on different days. The year 2016 and 2019 has the highest frequency on Wednesday and Monday respectively, the years 2017 and 2020

have it on Thursday, while the years 2018, 2021, and 2022 recorded the highest frequency on Saturday. It may not be surprising that Saturday has the highest frequency because the day is dedicated to social activities in this part of the world and as such the activity may induce road crashes.

Table 4 Days of Road Traffic Crash Occurrence for the yearly interval 2016-2022

Years	Days of The Week							
	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
2016	27	17	25	39	26	33	31	198
2017	25	32	30	28	35	27	27	204
2018	17	24	25	28	15	26	28	163
2019	51	60	50	36	49	48	58	352
2020	40	30	34	43	49	45	48	290
2021	33	45	47	41	42	43	60	311
2022	39	44	35	43	40	53	56	310

3.3 Number of vehicles involved in road traffic crashes in metropolitan Lagos

An attempt is made here to classify the crash event by the number of vehicles involved, four types of crashes were identified from the data, namely, single-vehicle crashes, multiple-vehicle, and motorcycle crashes as well as pedestrian crashes. For all the years under review, multiple crashes are predominantly high, closely followed by single-vehicle crashes, except the year 2017 which recorded higher occurrences of single-vehicle crashes. Similarly, motorcycle/tricycle crashes were very prominent throughout the period, the peak of motorcycle crashes was during the period (2020 – 2021) of its ban from the Lagos highways. A few pedestrian crashes were also recorded, many of which were recorded as hit-and-run crashes, and the peak of pedestrian crash was recorded in the year 2022. Figure 3 shows the relative occurrence of crash types for the years 2013 to 2022.

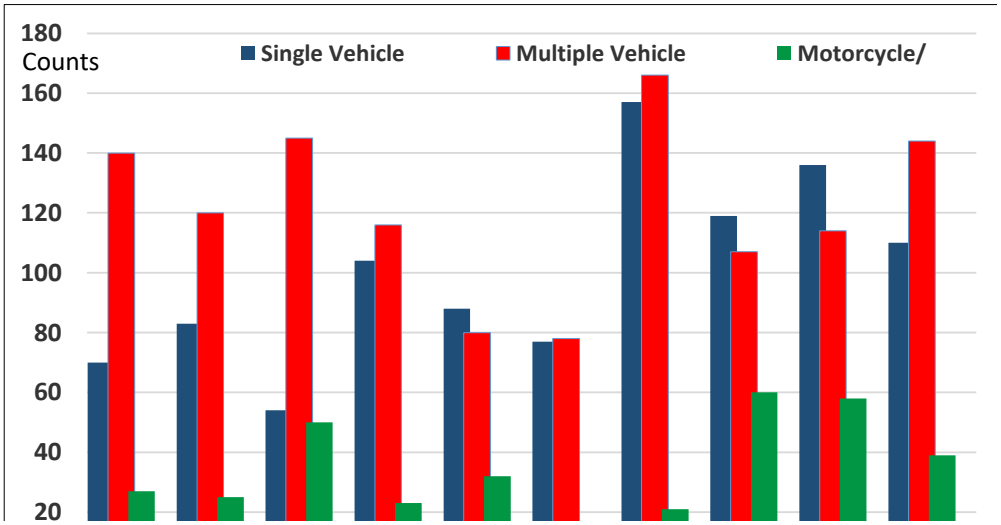


Figure 3 Type of Road Traffic Crashes (2013-2022)

4. Discussion of Findings

Road traffic crash occurrence is considered in this study for a ten (10) year period, compared with the total casualties over the period (2013-2022). The result revealed that the frequency and pattern of both the crash and casualty follow a similar pattern (No significant monotonic trend), with an observed decreasing trend in most years, 2014, 2016, 2017, 2018, 2020, and 2022, a peak in 2018 and 2020 (-20 and -17.6 percent) respectively, likewise the casualty. The year 2020 also presented the peak reduction (-51.4 percent), which may not be unconnected with the restriction of movement imposed by COVID-19 in the year.

In the same vein, the peak increase in road traffic cases as well as the casualty also falls in the same year, 2019, with a marked higher frequency and percentage increase. A remarkable decrease was recorded in 2018 for crash cases and casualties by 20 percent and 27.6 percent respectively before it peaked in 2019 and later dropped in 2020. This pattern of inconsistent fluctuation in road traffic crash occurrence and casualty has not shown a significant effect of road safety measures and interventions in the state such as enforcement of speed limit, monitoring by Law

enforcement agencies among others. These findings suggest that Lagos state could have a high number of cases and casualties in the future. The study of Bombom *et al.* (2022) earlier shows a similar result of an increase in road traffic crashes and casualties in Lagos state, as well as Olusina and Ajanaku (2017) who found that metropolitan Lagos has an increased crash than the outskirts.

The study also found that the morning period (0501-1300 hours) recorded the highest frequency of crashes throughout the years with relatively low number recorded in other periods. The pattern of crash distribution by periods revealed the intensity of traffic at different periods. In Lagos, morning-hour traffic presents the hustling and bustling nature of Lagos, where everyone wants to get to work or school within the same period, thus resulting in speeding, impatience, and shunting by drivers to evade the usual traffic congestion on Lagos roads. The morning period also presents a free road situation, where the traffic managers or traffic law enforcement operatives in charge of monitoring the road are also struggling in the traffic to make it to the duty post, and where intelligent traffic monitoring and management system is not available, road users disregard traffic rules. this may influence unsafe driving behaviour which could cause crashes. The study of Hosain, & Zaman (2021) and Abdulmanan *et al.*, (2018) have found that morning hours have the highest probability of higher crash occurrence, this is similar to the findings that highest frequency of road traffic crashes occurred in the Lagos metropolitan area in the morning hours.

The pattern of distribution of road traffic crashes among days of the week is higher on weekdays, because of higher obligatory trips that are expected to be made Monday through Friday, and a relief in the traffic intensity on weekends because of reduction in the travel demand for work and school journey. Many commuters avoid Lagos roads if the journey is not obligatory, especially on weekends. The findings of this study revealed different days of the week for each year, in no pattern, except Saturday which recorded the highest occurrence in three different years, other years present higher record for different days of the weekdays. Consistency of Saturdays in three different years revealed the preference place on the day for socials activities in this part of the world, social events are slated on Saturdays, and drivers and road users are more likely to be overjoyed, get intoxicated, and stressed out because of the social events/activities, these emotional states could affect behaviour on the road, which could induce road crashes. The findings of this study are different from what was obtained in the central-eastern of Qatar, in the study by Muhammed et al (2023), weekdays were found with a clustered high frequency of crashes, unlike Lagos where weekend recorded highest frequency. The differences obtained in the two studies may be due to regional disparity in socio-cultural characteristics of the two countries.

There is a high preponderance of single-vehicle crashes in the study area, though relatively low frequency compared to multiple crashes. Multiple crashes recorded a high frequency of occurrence with an average of two vehicles or more, it is understandable that an error committed by a driver is likely to affect another vehicle in the stream of traffic if not enough attention and space for manoeuvring is allowed. The high frequency of occurrence for single vehicle crash raised concern, about what are the causes. Earlier study has identified speeding as the singular most common cause of road crashes across the globe, and Nigeria and indeed Lagos state are not an exception. However, in all the years under review 2013-2022, multiple crashes and single crashes accounted for over 40 percent each, while the remaining less than 20 percent are shared between motorcycle and pedestrian crashes. These findings revealed the dominant use of vehicles and the restriction of motorcycle use in the Lagos metropolitan area.

5. Conclusion

In conclusion, the pattern of road traffic crashes in the Lagos metropolitan area is found to be inconsistent, time of crash, shows that early hours of the days are more prone to crashes. it is therefore recommended that policy makers and road safety agencies should focus on the time period for a strategic road traffic crash risk reduction and intervention programmes in reducing the occurrence and casualties of road crashes. In addition the following strategic recommendations will also contribute to the crash risk reduction; increased monitoring and enforcement by FRSC and LASTMA personnel during 5:00–13:00 hours; Increase automated speed enforcement during morning peak periods; Introduction of Saturday-focused road safety campaigns; Expand intelligent traffic management systems; Development of predictive crash monitoring systems; Establishment of a unified crash database that will integrate FRSC, LASTMA, and Police for effective monitoring and intervention programme.

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