ROAD TRAFFIC CRASHES IN ONDO STATE, NIGERIA A SPATIAL AND TEMPORAL ASSESSMENT (2015–2024)

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Abstract

Road traffic crashes (RTCs) represent a major public health and developmental challenge, particularly in low- and middle-income countries (LMICs), which account for over 90% of global road traffic fatalities. In Nigeria, RTCs are a leading cause of death and disability, especially among youth aged 5–29, with significant implications for human capital and economic productivity. This study addresses a critical gap in localized data by examining the spatiotemporal patterns, severity, and fatality outcome of RTCs in Ondo State, Nigeria, from 2015 to 2024.The study employed retrospective data from the Federal Road Safety Corps (FRSC). A total of 3,316 crashes were recorded, with a significant temporal increase noted in the latter part of the study period. A key finding was the unusually high fatality-to-injury ratio of 1.38:1, starkly contrasting with global average and indicating severe crash outcomes and deficiencies in emergency response systems. The study confirms that RTCs impose a multifaceted burden, exacerbating poverty and hindering development. The results underscore the urgent need for data-driven road safety policies, advocating for a "Safe System" approach that emphasizes safer roads, vehicles, and post-crash care. Targeted interventions are essential to reduce fatalities, mitigate economic losses, and enhance mobility safety in the region.

Keywords: Road Traffic Crashes (RTCs), Spatial and Temporal Analysis, Public Health Policy

1.0 Introduction

1.1 Background to the study

Road traffic crashes (RTCs) represent a global public health crisis and a significant development challenge, particularly in low- and middle-income countries (LMICs). The scale of this issue is staggering, with the World Health Organization (WHO) reporting over 1.19 million deaths annually, making RTCs a leading cause of death worldwide (WHO, 2023). An additional 20 to 50 million people sustain non-fatal injuries, many of which result in long-term disabilities, placing an immense burden on healthcare systems and individuals alike (Peden et al., 2020). The human toll is disproportionately felt in LMICs, which, despite possessing a small fraction of the world's vehicles, account for

more than 90% of global road traffic fatalities (WHO, 2020a). This demographic inequity is further underscored by the fact that RTCs are the leading cause of death for individuals aged 5 to 29 years, a demographic crucial for future economic and social development (WHO, 2020a).

The economic repercussions of RTCs are as devastating as the human ones. Globally, these crashes cost national economies an estimated 3% of their Gross Domestic Product (GDP) (WHO, 2020a). In many LMICs, this economic drain can be even higher, sometimes exceeding the total amount of official development assistance they receive (WHO, 2020a). The total global economic cost is estimated at approximately $1.85 trillion annually, a figure that reflects not only direct costs like medical expenses and property damage but also indirect costs such as lost productivity due to premature death and disability (Blincoe et al., 2002; Elvik, 2000). The financial burden is compounded by the loss of skilled labour and the psychological trauma inflicted upon victims, their families, and communities, creating a cycle of poverty and hardship (Jacobs, Aeron-Thomas, & Astrop, 2000).

Nigeria's road safety situation serves as a stark microcosm of this global crisis. With an estimated road fatality rate of 39.8 deaths per 100,000 population, the country significantly exceeds the global average, placing it among the nations with the highest road traffic crash mortality rates in the world (WHO, 2020b). The Federal Road Safety Corps (FRSC), Nigeria's lead agency on road safety administration and management, provides national data that paints a sobering picture. For instance, in 2023, the FRSC reported 4,736 fatalities from 10,617 crashes, representing a slight decrease in both crashes and fatalities compared to previous years (FRSC, 2024). However, these national figures often mask significant regional variations and the underlying severity of individual incidents. This highlights a critical need for localized, granular data to inform targeted interventions.

The causes of RTCs in Nigeria are multifaceted and deeply interconnected, forming a complex web of human, infrastructural, and systemic factors. Human factors are frequently cited as the primary contributors, including reckless driving, over speeding, distracted driving (e.g., mobile phone use), fatigue, and non-adherence to traffic laws (Oludare & Adeyemi, 2014). Infrastructural deficiencies also play a significant role. Poor road design, inadequate signage, lack of proper maintenance, and insufficient lighting contribute to hazardous

driving conditions (Oluwadiya et al., 2016). Furthermore, the lack of effective enforcement of traffic laws, coupled with a nascent and often delayed emergency response system, exacerbates the severity of crash outcomes (Ogundana & Akogun, 2017). Despite the wealth of national-level data and analyses, a critical gap exists in localized, sub-national research that can provide a nuanced, context-specific understanding of the problem. While national statistics are essential for broad policy formulation, they often fail to capture the unique temporal, spatial, and socio-economic dynamics of RTCs within specific states or local government areas. This deficiency in localized data hampers the ability of policymakers and public health officials to design and implement effective, evidence-based interventions tailored to the specific needs and challenges of a given region.

To address this significant research gap, this study aims to provide an evidence-based analysis of RTCs in Ondo State, Nigeria, over a ten-year period from 2015 to 2024, based on data availability. By focusing on a specific geopolitical context, the study will meticulously analyse temporal and spatial patterns of RTCs, examine casualty severity, and fatalities imposed by these incidents. This research is underpinned by a deep understanding of the multifaceted nature of RTCs, as explored through a review of the conceptual perceptions and key causal factors in the Nigerian context. The insights gained will contribute to a more nuanced national discourse on road safety and provide policymakers with the necessary information to design effective, targeted interventions that can ultimately save lives and reduce the devastating socio-economic costs of road traffic crashes in Ondo State and beyond.

1.2 Aim and Objectives of the study

The aim of this study is to assess Road traffic crashes in Ondo state, Nigeria, with a view to find appropriate solution to road crashes in Ondo state and Nigeria in general

The specific objectives are to;

i. assess the temporal trend and yearly variations in the occurrence of road traffic crashes in Ondo State.
ii. examine the spatial distribution of road traffic crashes across selected urban centres in the state.
iii. assess the severity and casualty patterns of RTCs (fatal, serious, and minor).

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iv. provide policy recommendations aimed at reducing the frequency and severity of road traffic crashes.

1.3 Research Questions

- What are the temporal trends and yearly variations in road traffic crashes in Ondo State?
- How road traffic crashes are spatially distributed across the major urban centres?
- What is the level of severity and casualty outcome of these crashes?
- What strategies can be developed to improve road safety in Ondo State based on the findings?

1.4 Research Gap

While several studies have examined road traffic crash in Nigeria. There remains a gap in understanding the specific dynamics of spatial and temporal dimension of RTCs at state level, most especially in Ondo state. The existing literature often values in aggregate national data. Local existing change in crashes indicates the frequency, severity, and causes.

The study therefore, seeks to fill the gap by providing and developing temporal analysis of RTCs Ondo state using FRSC official data

2.0 Literature review

2.1 Causal Factors and Conceptual Perceptions of Road Traffic Crashes in Nigeria

Road traffic crashes (RTCs) constitute a significant and escalating public health crisis in developing countries, a trend that starkly contrasts with the steady decline in fatalities observed in technologically advanced nations (Nantulya & Reich, 2002; Oskam et al., 1994). This disparity is driven by a complex interplay of factors including rapid motorization, inadequate infrastructure, and unsafe behaviours among road users. While developed countries have seen a reduction in RTCs since the 1960s, Africa faces a grim forecast. Projections from 1990 estimated that road accident fatalities in Africa would surge from 59,000 to 144,000 by 2020, a staggering 144% increase (WHO, 2018). This review delves into the primary causes of RTCs in Nigeria—human, vehicular, and environmental factors—and explores the profound economic and social burdens they impose on individuals and the nation.

Human factors are arguably the most critical and controllable factor in the ethology of RTCs. As the initiator of any journey whether as a driver, passenger, or

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pedestrian—an individual bears a degree of responsibility for road safety. A significant majority of accidents are directly attributable to human error or negligence. The most glaring examples include driving under the influence of alcohol or drugs. The voluntary consumption of these intoxicating substances impairs judgment, reaction time, and coordination, leading to a high proportion of crashes worldwide (Trivede & Rawal, 2011). Beyond intoxication, drivers may fail to ensure their vehicles are roadworthy, neglect to adhere to basic safety regulations like using seatbelts, or engage in dangerous practices such as speeding and using mobile phones while driving. In many developing countries like Nigeria, the absence of stringent laws and a lack of enforcement exacerbates these issues. Regulations that are common in advanced nations, such as mandatory use of seatbelts and child restraints, are often either non-existent or are poorly enforced, rendering them ineffective. This systemic failure to enforce safety measures allows unsafe behaviours to persist, contributing significantly to the high incidence of RTCs in Nigeria.

While human error is a primary cause, the condition of vehicles themselves also plays a critical role. A vehicle operator is responsible for the mechanical integrity of their machine, but this responsibility is often shared with state agencies tasked with ensuring roadworthiness. In Nigeria, the establishment of the Federal Road Safety Corps (FRSC) in 1988 was intended to professionalize and improve upon the previous efforts of the Vehicle Inspection Officers (VIOs). However, despite the induction of dedicated personnel and special marshals, the FRSC has, at times, been criticized for falling into patterns of ineffectiveness or corruption, similar to its predecessor. The government, as the ultimate body responsible for establishing and maintaining the machinery for law enforcement, has a duty to ensure these agencies are effective and free from political influence. The economic climate also plays a role; in recent times, the widespread use of motorcycles ("okadas") as a primary mode of transportation in Nigerian cities has become a concern. These motorcycles, along with pedestrians, are considered vulnerable road users who lack the physical protection of cars, often sustaining severe, multiple injuries in crashes.

The physical state of roads is another major contributor to RTCs, particularly in developing countries. Roads that are poorly built or inadequately maintained become significant hazards. In Nigeria, many roads

are littered with deep potholes, creating unpredictable and dangerous driving conditions. Additionally, obstructions such as broken-down vehicles and illegally dumped garbage frequently block roads, forcing drivers to take evasive actions that can lead to accidents. The absence of clear, well-maintained road signs further compounds the problem, making it difficult for drivers to navigate safely. The government is responsible for building and maintaining these infrastructures, and their neglect directly contributes to the high rate of RTCs. The poor quality of roads not only increases the risk of accidents but also accelerates vehicle wear and tear, creating a vicious cycle of safety risks.

The consequences of RTCs in Nigeria are staggering. The country's road accident death rate, estimated at 162 deaths per 100,000 population, is alarmingly high, far exceeding the global average of 22 deaths per 100,000 (Ogbodo & Nduoma, 2011; Sukhai Jone et al., 2011). The financial toll is immense, consuming valuable resources that the country can ill afford to lose. The direct costs include medical treatment, property damage, and legal fees, while indirect costs encompass lost productivity due to fatalities and long-term disabilities. The victims are often in the economically productive age group of 18-50 years, and their deaths or injuries create a profound social burden on their families, who must shoulder medical bills and cope with the loss of a primary breadwinner. This burden extends beyond the immediate family to relations and friends, creating a ripple effect of financial and emotional strain. The lack of robust data and funding for injury prevention further hampers efforts to combat this burgeoning crisis, which has seen an increasing trend in reported fatal accidents over the past few decades (Atubi, 2012; Central Bank of Nigeria, 1997). This review highlights the critical need for comprehensive strategies that address all three dimensions of the problem human, vehicular, and environmental to mitigate the devastating impact of RTCs on Nigerian society.

3.0 Methodology

This study employed a mixed-methods approach to investigate the causes, and effects and control measures to road traffic crashes (RTCs) in Ondo State, Nigeria. This research design was chosen to provide a comprehensive analysis, integrating both quantitative data from official records and qualitative insights from direct fieldwork to create a robust and holistic understanding of the problem.

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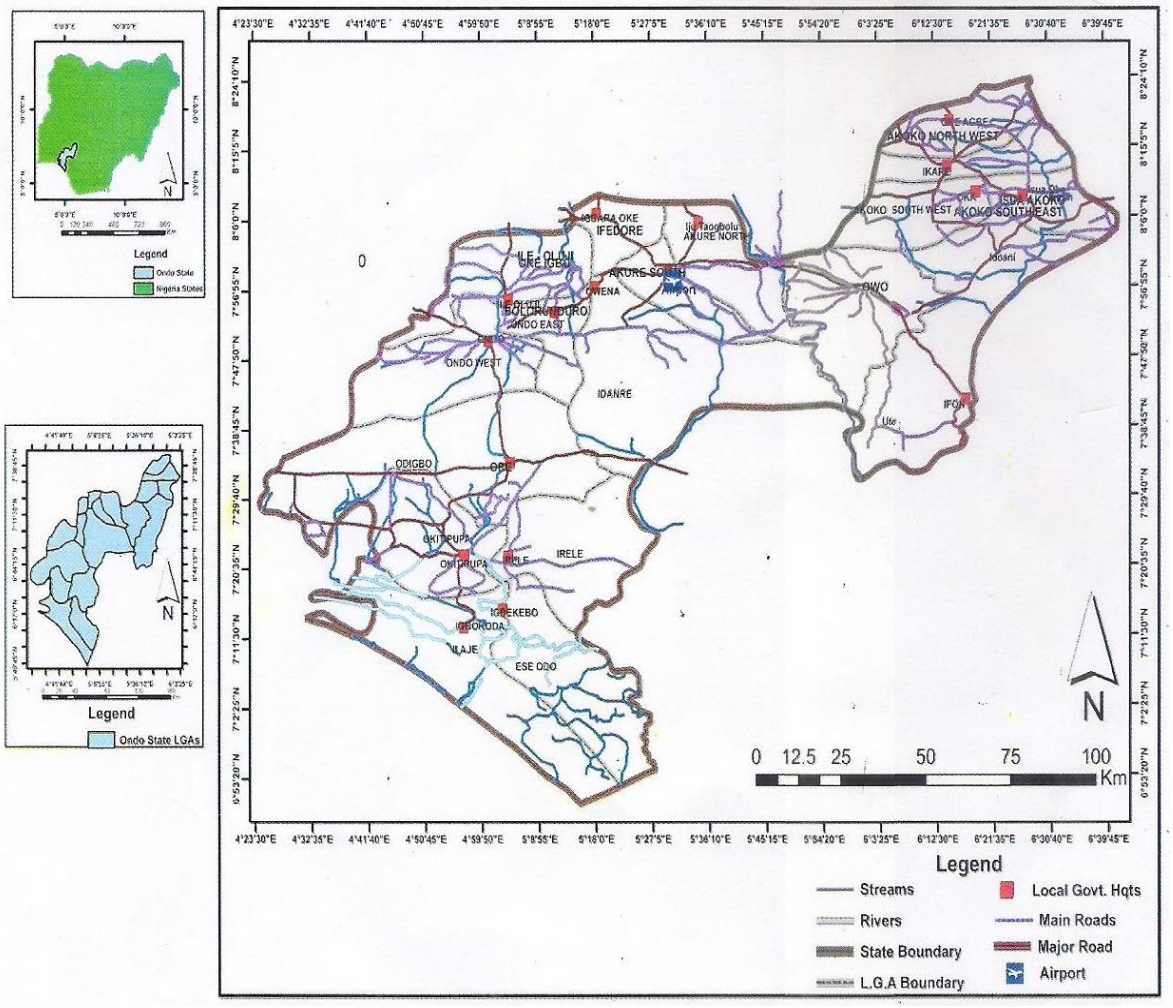
3.1 Study Area

The research was conducted in Ondo State, located in Nigeria's Southwestern geopolitical zone. The state covers an expansive 15,195 km² and had a projected population of over 4.3 million people in 2015. Situated between Latitudes 5°45' and 7°52'N and Longitudes 4°20' and 6°05'E (Figure 1), Ondo State is characterized by its high level of urbanization and a vast network of 3,167.4 km of roads. For the purpose of this study, the major urban centres of Akure, Ondo, Owo, and Ore were specifically selected. These cities were chosen because they serve as the state's commercial hubs, have high population densities, and are locations for specialized hospitals equipped to handle severe trauma cases, making them critical for both accident occurrence and victim treatment.

Figure 1: Study area Ondo State, Nigeria



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Descriptive statistics, such as frequency tables, means, and graphs, were used to summarize and present the data in an accessible format. To explore the relationships between variables and the validity of the research hypotheses, inferential statistical techniques were applied. Specifically, Analysis of Variance (ANOVA) was used to compare mean differences across various groups, while correlation coefficient was employed to determine the strength and direction of the linear relationship between factors such as accident frequency, severity, and identified demographic or infrastructural variables.

3.2 Data Collection

The study relied on both primary and secondary data to ensure a thorough investigation. Primary data was collected through fieldwork in selected motor/motorcycle parks and hospitals. This involved the administration of two distinct questionnaires. The first questionnaire was designed for commercial vehicle drivers and motorcycle riders, capturing their socioeconomic characteristics, driving practices, and direct experiences with road accidents. This instrument also sought to understand the perceived socioeconomic impacts of these crashes on their well-being. The second questionnaire was administered to RTC victims admitted to specialist hospitals in the four selected cities. This tool was used to gather first-hand information on the immediate causes of their accidents and the resulting socioeconomic burden on them and their families. Secondary data was procured from the Ondo State Command of the Federal Road Safety Commission (FRSC). A complete dataset of accident records from 2005 to 2014 was obtained, which included comprehensive details such as the total number of crashes, vehicles involved, casualties (persons killed and injured), and the common causes of accidents during this specific period.

3.3 Sampling and Analytical Techniques

A stratified sampling approach was used instead of other sampling methods, because stratifying sampling method in this contest was used to select both participants and data sources for the study which is more appropriate for the research. The sampling frame for primary data included key hospitals and inter-city motor parks within the four urban centres. The specific hospitals selected were the Ondo State Specialist Hospitals in Ondo, Akure, and Ore, as well as the Federal Medical Centre in Owo. These institutions were chosen due to their capacity and

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resources for managing accident victims. For the driver and rider survey, a 5% random sample of all registered drivers and riders was taken from the designated motor parks. For the victim survey, a 50% sample of all admitted RTC victims in each of the selected hospitals was included.

The data analysis involved a combination of descriptive and inferential statistical techniques to provide a comprehensive overview and test the study's hypotheses.

4.0 Results and Discussion

This section presents a detailed analysis of the road traffic accident data for Ondo State, Nigeria, from 2015 to 2024, and discusses these findings in the context of broader national and international research. The discussion directly addresses the study's objectives: to analyze temporal patterns, examine casualty severity, and explore the socioeconomic implications.

4.1 Temporal Patterns and Magnitude of Road Accidents

The study recorded a total of 3,316 road traffic crashes over the decade. A clear and concerning temporal trend emerged, as depicted in Figure 2 and detailed in Table 1. The percentage of accidents saw a gradual increase from 12.4% in 2015 to a peak of 13.9% in 2019, before a slight decline. The years between 2017 and 2020 were particularly critical, accounting for the majority of crashes (65.05%, n=1,571). This significant surge aligns with a number of factors, including population growth and increased motorization, which are recognized drivers of RTCs in many developing nations (Gbadamosi, 2005; Atubi & Gbadamosi, 2015). This finding is consistent with studies from other parts of Nigeria and the developing world, where rapid urbanization and a corresponding rise in vehicle ownership have placed immense strain on often-deteriorating road infrastructure, leading to a rise in accidents (Jacobs et al., 2000). The significant variation in the annual incidence of accidents was statistically confirmed by the Analysis of Variance (ANOVA), which yielded an F-value of 27.566 and a significance value of 0.000 ($p < 0.01$). However, the absence of a significant monthly variation ($p > 0.05$) suggests that other factors beyond seasonal or climatic changes are the primary drivers of these crashes, a finding that may differ from studies in regions with more pronounced seasonal weather patterns impacting road conditions (Olatunji, 2012). This points to a deeper issue of systemic failures, such as poor road

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maintenance and reckless driving, that persist throughout the year.

4.2 Accident Severity and Casualty Analysis

The analysis of accident severity, as shown in Table 1 and Figure 3, revealed that serious crashes constituted the largest proportion (54.16%, n=1,308), followed by fatal crashes (32.05%, n=774) and minor crashes (13.79%, n=333). The most alarming finding is the direct correlation between the years with the highest overall number of crashes and the years with the highest rates of serious and fatal crashes. This is a critical indicator of a worsening problem, signifying that an increase in accident frequency is accompanied by a greater likelihood of severe outcomes. This trend is a strong departure from the patterns observed in many developed countries, where improvements in vehicle safety and emergency response have led to a decrease in the severity of crashes even when the number of crashes remains stable (Peden et al., 2020). The high proportion of fatal crashes in Ondo State underscores the urgency of improving post-crash care and emergency response systems. The human cost is further highlighted by the total of 10,222 casualties recorded, consisting of 1,745 deaths and 8,744 injuries. The injury-to-fatality ratio of approximately 4.86:1 implies that for every person killed, nearly five others sustained injuries. This ratio is lower than the 15:1 average reported for developed countries, which is a testament to their more robust post-crash care systems (WHO, 2018). The high number of deaths relative to injuries in Ondo State suggests a critical need for faster and more effective emergency medical services

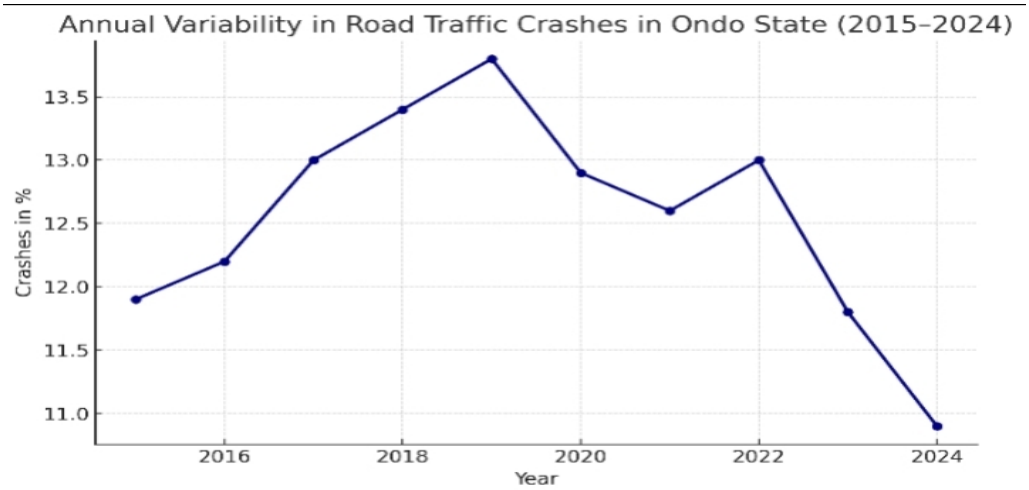

Figure 2: Annual variability in RTCs in Ondo state between (2015-2024)

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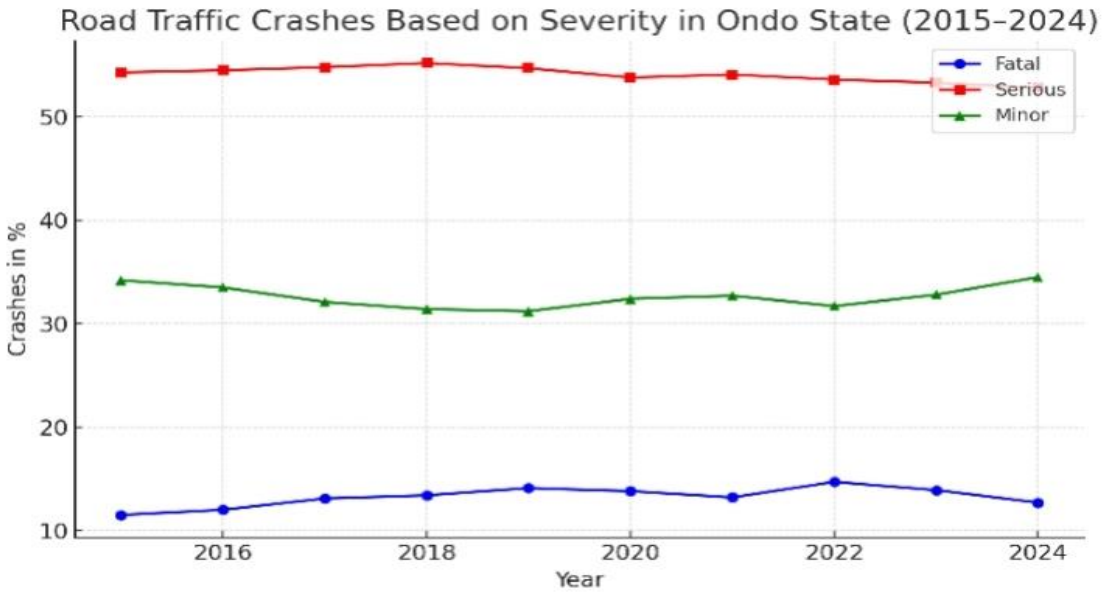

Figure 3: RTCs crashes based on severity in Ondo state between (2015-2024)

Table 1: Pattern of Road Accident in Ondo State (2015 – 2024)

Year	Crashes							
	Minor		Serious		Fatal		Total	
	Freq	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*
2015	39	13.9	154	54.8	88	31.3	281	100
2016	43	13.6	172	54.4	101	32.0	316	100
2017	47	13.4	183	52.3	120	34.3	350	100
2018	42	13.1	166	52.0	111	34.9	319	100
2019	38	12.9	158	53.7	98	33.3	294	100
2020	45	13.7	174	53.1	109	33.2	328	100
2021	48	14.2	186	54.9	104	30.9	338	100
2022	41	13.4	170	55.6	134	31.0	345	100
2023	44	13.7	180	54.2	139	32.1	363	100
2024	40	13.3	172	54.4	170	32.3	282	100
Total	427	13.6	1715	54.4	1174	32.0	3316	100

The highest number of casualties occurred in 2023 and 2024, mirroring the peak years for overall accidents. This confirms the direct link between accident frequency and the resulting human toll.

5.0 Implications of Findings

Implication of Temporal Trends

The study reviewed an upward trend in RTCs from 2015 to 2017 and slight decline thereafter in Ondo state. According to WHO, Global status report on road safety 2023, Global Road traffic death have slight reduced to about 1.19milllion per year. This indicates that while global death rate is stabilizing many low- and middle-income countries including Nigeria continue to bear these appropriate burdens. At regional level RTCs fatality in the world increased by 17% Between 2010 to 2021 this indicates that temporal rise that have been identified in Ondo state is part of a larger problem in sub-Saharan after which are caused as a result of rising in motorization, urban swelling and inadequate safety infrastructure.

Therefore, policy makers in Ondo state must track crashes not to isolate local occurrence as part of national and regional challenges. The continuous monitoring and early warning system should be established to detect emerging upward and targeted intervention.

Implication of Severity and Casualties

The data reviewed that serious and fatal crashes constitute a significant portion of total RTCs shows crashes in Ondo state are more than mere occurrence they turned to high social and health burdens this is constant with studies in Nigeria and Africa that was reported high fertility to injury ratio in RTCs reflecting week emergency response delays in cares and sub-optima cost crash infrastructure (olatunji 2012, oladiya et.al. (2016).

By implication high investment in trauma system such as pre-hospital care, paramedics, ambulance services and strength medical facilities are important. Also crash mitigation strategy such as speed control, safe crossing must be explicitly aimed to reduce fatal and serious outcome but reduce the crash counts.

Implication by Spatial Distribution

(Onifade and musa 2023) in the studies of African region hotspots reviewed that spatial clustering of crashes is well dominated where crashes concentrated in high traffic urban corridors or junctions. The spatial concentration in Ondo state indicates that blanket state wide intervention may be

inefficient instead targeted corridor level engineering will likely yield higher return of investment.

The policy makers should design and implement road safety audits and corridor level intervention such as speed camera, median barrier, lightning and signage to identify Hotspots.

Implication by Casual Factors

It was observed that human behaviour e.g. over-speeding, fatigue, distraction is dominant contributor to RTCs followed poor state of roads and vehicles. This implies that enforcement, education and behavioural changes strategies must be centred to any policy response. Therefore, purely infrastructure will not be sufficient but strict compliance to the road users. Intervention strategies should include behavioural intervention e.g., drivers education, campaign, awareness and enforcement of speed limit

Recommendations

Based on the study's findings, a multifaceted approach is required to combat the road safety crisis. It is recommended that:

- Road safety education should be intensified through continuous public campaigns and integration into school curricula to target high-risk demographics.

- Law enforcement must be strengthened with modern tools and rigorous training to ensure the judicious and consistent enforcement of traffic laws
.

- The government should also prioritize significant investment in the construction and maintenance of road infrastructure, including the provision of dedicated lanes for vulnerable road users like cyclists and pedestrians.

- To address the high fatality rate, a robust post-crash care system is crucial, requiring investment in well-equipped emergency medical services and a dedicated emergency hotline. These efforts should be part of a broader "Safe System" approach, fostering inter-agency collaboration to create a safer and more resilient road transport environment.

Conclusion

This study has provided an evidence-based understanding of the road traffic crash (RTC) crisis in Ondo State, Nigeria, from 2015 to 2024, fulfilling its core objectives of analyzing temporal patterns, casualty

severity, and fatality implication. The findings reveal a deeply concerning and multifaceted challenge. The pronounced upward trend in both the frequency and severity of crashes, particularly in the latter part of the study period, indicates a system under immense strain. The alarmingly high fatality-to-injury ratio of 1.38:1, as noted in the abstract, starkly contrasts with global averages and points to critical deficiencies in both pre- and post-crash safety measures.The findings confirm that RTCs in Ondo State are not merely random incidents but a predictable consequence of a complex interplay of human, infrastructural, and systemic failures that persist year-round.

The implications of this research are profound and underscore the urgent need for a strategic, multi-pronged policy response. Traditional approaches focused solely on driver behaviour are insufficient. Instead, a "Safe System" approach, as advocated by global health bodies, is essential. This holistic framework emphasizes shared responsibility across all sectors—from government agencies to individual road users—to create a safer road environment. By providing localized, data-driven insights, this study offers a powerful tool for policymakers to move beyond broad national policies and design targeted, evidence-based interventions tailored to the specific needs of Ondo State. Ultimately, a concerted effort to address the identified weaknesses in road safety infrastructure, enforcement, and emergency response is the most effective path to mitigating the devastating human and economic costs of RTCs**.**

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