

Injury-Fatality Patterns and Socioeconomic Impacts of Road Traffic Crashes: A Comparative Analysis Across Nigerian Urban Centers.

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Abstract- Road traffic crashes (RTCs) remain a major global public health and socioeconomic problem, with a disproportionately high burden in low- and middle-income countries such as Nigeria. Despite the critical role of road transport in supporting economic and social activities, RTCs continue to cause substantial mortality, morbidity, and economic losses, thereby undermining national development and productivity (World Health Organization, 2023; World Bank, 2022). Globally, over 1.19 million deaths occur annually from road crashes, alongside millions of injuries that often result in long-term disability and reduced quality of life (WHO, 2023). Nigeria contributes significantly to this burden due to rapid urbanization, increasing motorization, weak enforcement of traffic regulations, and inadequate emergency response systems (Inah et al., 2025; Ogboeli et al., 2026). The occurrence and severity of RTCs are influenced by interacting human, vehicular, and environmental factors. In Nigerian urban centers, high population density, poor road infrastructure, traffic congestion, and risky driving behaviours such as speeding and reckless overtaking increase crash risks (Eneh, 2023; Afolabi et al., 2025). However, mortality outcomes are not determined solely by crash frequency, but also by crash severity and systemic factors such as emergency response time, trauma care capacity, and access to medical services (Odusola et al., 2023; Onwurah & Ihueze, 2022). This highlights the need to conceptualize RTCs as both transportation and public health emergencies. RTCs also impose significant socioeconomic burdens through direct medical costs and indirect losses such as reduced productivity, disability, and income disruption, particularly among economically active populations (World Bank, 2022; WHO, 2023). These impacts often

push affected households into financial hardship and deepen existing socioeconomic inequalities, especially in low-income communities with limited access to healthcare and social protection (Afolabi et al., 2025; Virginia Transportation Research Council, 2024). Although spatial and temporal variations in RTC patterns have been reported across Nigeria, few studies have conducted comprehensive comparative analyses across multiple urban centers to simultaneously examine crash frequency, severity, and socioeconomic impacts over time. This study therefore, addresses this gap by investigating injury-fatality patterns and socioeconomic impacts of RTCs across selected Nigerian urban centers from 2015 to 2024.

Keywords: Road Traffic Crashes, Injury-Fatality Patterns, Socioeconomic Impact, Nigerian Urban Centers, Road Safety.

I. INTRODUCTION

1. Background to the Study

Road traffic crashes (RTCs) remain one of the most serious public health and development challenges globally. RTCs refer to collisions involving vehicles, pedestrians, or other road users on public roads that result in injury, death, or material damage (World Health Organization (WHO), 2023; Ogboeli et al 2026). Each year, an estimated 1.19 million people die as a result of road crashes, while millions more sustain injuries that may lead to long-term disability and reduced quality of life (World Bank, 2022).

Despite the essential role of road transport in economic and social activities, its safety outcomes remain deeply concerning, especially in low- and middle-income countries where the majority of deaths occur, even though they account for fewer vehicles globally (WHO, 2023). In Nigeria, evidence shows that road traffic crashes are shaped by a combination of human behavior, vehicle conditions, and road environment factors, making them a persistent public safety challenge (Inah et al., 2025; Ogboeli et al., 2026).

The causes and consequences of RTCs in developing countries are complex and interconnected. Rapid urbanization, weak enforcement of traffic laws, poor road infrastructure, and inadequate emergency response systems all contribute to the high burden of crashes (United Nations Road Safety Collaboration (UNRSC), 2023). In Nigeria, studies have also shown that transportation cost fluctuations and road usage patterns influence exposure to crash risks, particularly in congested urban areas (Adeleke & Iyanda, 2024; Afolabi et al., 2025). Furthermore, spatial and temporal analyses indicate that crash occurrences vary significantly across regions and time periods, reflecting differences in traffic density, road conditions, and mobility patterns (Odusola et al., 2023; Odukoya et al., 2024; Ogboeli et al., 2026). These findings reinforce the understanding that road traffic crashes are not random events but are influenced by structural and environmental conditions.

In terms of population impact, road traffic crashes disproportionately affect economically active individuals and vulnerable road users such as pedestrians and motorcyclists. Research indicates that road traffic injuries constitute a significant proportion of trauma cases in Nigerian health facilities, with many resulting in severe disability or death (Afolabi et al., 2025). Vulnerable road users remain at higher risk due to limited protective infrastructure and unsafe traffic environments in urban centres (Alatishe-Muhammad et al., 2026; WHO, 2022). Evidence from Nigeria also shows that delays in emergency response and limited trauma care capacity contribute significantly to poor survival outcomes following crashes (Odusola et al., 2023; Onwurah &

Ihueze, 2022; Ogboeli & Nimame, 2026; Obadina et al., 2026). These challenges highlight gaps in both preventive and emergency road safety systems.

The socioeconomic burden of RTCs is substantial and continues to affect households and national economies. Globally, road traffic injuries result in significant economic losses through healthcare costs, productivity reduction, and infrastructure damage (World Bank, 2022; WHO, 2023). At the household level, affected families often experience financial hardship due to medical expenses and loss of income, especially when victims are breadwinners (International Transport Forum, 2022; WHO, 2023). Nigerian studies further confirm that road traffic crashes place a long-term financial strain on households, particularly in cases involving severe injury or disability (Afolabi et al., 2025; Ogboeli et al., 2025). These impacts extend beyond individuals, affecting community productivity and overall economic development.

Another important dimension is inequality in road safety outcomes. Evidence shows that individuals in lower-income communities face higher exposure to crash risks due to poor road conditions, inadequate transport systems, and limited access to safety infrastructure (Virginia Transportation Research Council, 2024; World Bank Group, 2022). In Nigeria, spatial studies reveal significant differences in crash distribution across urban centres, reflecting variations in infrastructure quality and traffic management systems (Odusola et al., 2023; Ogboeli et al., 2025). Additionally, limited road safety awareness among disadvantaged populations increases their vulnerability to crashes (WHO, 2023; African Union Commission (AUC), 2022). This highlights the link between road safety and broader socioeconomic inequality.

Vulnerable road users such as pedestrians and motorcyclists continue to experience the highest burden of injuries and fatalities, particularly in densely populated urban areas. Many of these crashes are associated with risky driving behaviors such as speeding, distraction, and poor road design (WHO, 2022; Alatishe-Muhammad et al., 2026). Nigerian evidence also shows that motorcycle-related crashes

remain a major contributor to trauma cases in hospitals (Afolabi et al., 2025; Onwurah et al., 2025). Furthermore, road safety improvements often benefit higher-income groups more than lower-income populations, thereby widening inequality in safety outcomes (World Bank, 2022; Virginia Transportation Research Council, 2024). This reinforces the need for inclusive and equitable road safety strategies.

Overall, road traffic crashes are not merely transportation issues but complex public health, social, and economic challenges that require coordinated intervention. Effective reduction of RTCs depends on stronger enforcement of traffic laws, improved infrastructure, enhanced emergency response systems, and targeted protection for vulnerable road users (WHO, 2023; United Nations Road Safety Collaboration, 2023). Nigerian studies further emphasize the importance of data-driven planning and spatial analysis in understanding crash patterns and designing interventions (Onwurah & Ihueze, 2022; Odusola et al., 2023; Ogoeli et al., 2024). Without such integrated efforts, RTCs will continue to impose heavy human and economic costs on society (World Bank, 2022; African Development Bank, 2023). It is against this background that this study examines injury-fatality patterns and socioeconomic impacts of road traffic crashes across selected Nigerian urban centers.

II. THEORETICAL FRAMEWORK OF THE STUDY

1. Haddon Matrix Theory (Haddon, 1970)

Haddon (1970) developed the Haddon Matrix to analyze injury prevention by examining the interaction between human, vehicle, and environmental factors across three phases: pre-crash, crash, and post-crash. The framework systematically identifies risk factors and intervention points before, during, and after road traffic crashes. It emphasizes that injury outcomes are not random but result from modifiable conditions across these dimensions. In this study, the theory is relevant for explaining how driver behavior, vehicle conditions, road infrastructure, and emergency response systems collectively influence injury-fatality patterns and

socioeconomic impacts across Nigerian urban centers. It supports structured analysis of crash causation and severity.

2. Systems Theory of Road Safety (Elvik, 2009)

Elvik (2009) applied Systems Theory to road safety, conceptualizing RTCs as outcomes of interactions within a complex socio-technical system involving road users, vehicles, infrastructure, enforcement agencies, and policy environments. The theory emphasizes that crashes occur due to system failures rather than isolated human error. It promotes a holistic approach to safety management where improvements in one component influence overall system performance. In this study, the framework is relevant for explaining variations in crash frequency and severity across Nigerian urban centers by highlighting how differences in infrastructure quality, enforcement efficiency, and emergency response systems shape crash outcomes and socioeconomic impacts.

3. Risk Homeostasis Theory (Wilde, 1982)

Wilde (1982) introduced Risk Homeostasis Theory, proposing that individuals maintain a target level of perceived risk and adjust their driving behavior accordingly. When safety measures improve, drivers may engage in riskier behavior, offsetting potential safety gains. The theory explains why some safety interventions may not proportionally reduce crash rates. In this study, it is relevant for interpreting behavioral risk patterns such as speeding, reckless driving, and compliance variability across Nigerian urban centers. It helps explain why crash frequency may not directly correlate with mortality outcomes, as driver risk adaptation and behavior significantly influence injury severity and fatality patterns.

III. MATERIALS AND METHODS

This study was carried out in major urban centers across Nigeria, including Lagos, Abuja (FCT), Kano, Kaduna, Oyo, Rivers, Edo, Enugu, Anambra, and Abia States. These urban centers are among the most densely populated and economically active regions in the country, characterized by high traffic volumes, rapid urbanization, increasing vehicle ownership, and intense transportation activities. Consequently, they

experience substantial occurrences of road traffic crashes (RTCs), worsened by poor road infrastructure, weak enforcement of traffic regulations, traffic congestion, risky driving behaviors, and limited emergency response capacity. These factors collectively make RTCs a major public health, transportation, and socioeconomic challenge in Nigeria.

The study adopted a retrospective descriptive and comparative research design covering a ten-year period (2015–2024). This design enabled the assessment of temporal trends, interstate variations, injury-fatality patterns, and the socioeconomic implications of RTCs across selected Nigerian urban centers.

A mixed-methods approach involving both secondary and primary data sources was employed to provide comprehensive insight into the burden of RTCs. Secondary data were obtained primarily from the Federal Road Safety Corps (FRSC), as well as relevant state transport management and emergency response agencies. The data included annual records of total crashes, injuries, fatalities, casualties, and persons involved in RTCs across the selected urban centers.

Primary data were collected through the administration of structured questionnaires designed to assess public perceptions of the socioeconomic impacts of RTCs. The questionnaire focused on issues such as medical expenses, income loss, productivity reduction, household financial hardship, dependency burden, and perceived adequacy of government support following crash incidents.

A multistage sampling approach was adopted for questionnaire administration. First, purposive sampling was used to select the ten major urban centers due to their high traffic density and documented RTC burden. Thereafter, respondents were selected using convenience and stratified sampling techniques across the selected states to ensure representation of different population groups, including drivers, commuters, transport workers, traders, civil servants, and residents frequently exposed to urban traffic conditions.

A total of 250 questionnaires were distributed across the selected urban centers, out of which 236 valid responses were retrieved and used for analysis, representing a response rate of 94.4%. The inclusion criteria comprised adults aged 18 years and above who had resided or worked within the selected urban centers for at least one year and possessed reasonable knowledge or experience regarding road traffic conditions and crash impacts within their locality.

The questionnaire instrument was structured using a 4-point Likert scale ranging from Strongly Agree (SA) to Strongly Disagree (SD). To ensure content validity, the instrument was subjected to expert review by specialists in transportation studies, public health, and disaster risk management. A pilot study involving 20 respondents outside the selected study population was conducted to assess clarity, consistency, and suitability of the questionnaire items.

The socioeconomic burden of road traffic crashes (RTCs) was estimated using a modified Human Capital Approach (HCA), which evaluates the direct and indirect economic losses associated with crash-related injuries, fatalities, disability, and productivity reduction. Direct costs included estimated hospitalization expenses, emergency medical treatment, rehabilitation, transportation, and trauma care expenditures associated with RTC victims. Indirect costs comprised productivity losses resulting from temporary or permanent disability, premature mortality, caregiver burden, and income losses among affected households. Cost estimations were derived using secondary economic indicators from previous Nigerian and international road safety studies, WHO road injury costing frameworks, transportation economic reports, and available public health expenditure estimates. The calculations were adjusted to reflect approximate economic conditions within the 2015–2024 study period. Due to limitations in accessing detailed patient-level medical expenditure records, insurance claims, disability-adjusted life year (DALY) data, and inflation-adjusted longitudinal costing datasets, the economic burden estimates presented in this study should be interpreted as indicative approximations rather than exact national cost valuations. The estimated

economic burden, therefore, provides a broad indication of the substantial public health and socioeconomic implications of road traffic crashes across Nigerian urban centers.

Reliability testing of the instrument was conducted using Cronbach’s Alpha reliability analysis, yielding a coefficient value above the acceptable threshold of 0.70, indicating satisfactory internal consistency and reliability of the questionnaire items.

Data analysis involved both descriptive and inferential statistical techniques using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as frequencies, percentages, means, ratios, tables, and charts were used to summarize and present the data. Comparative analyses were conducted across the selected states to identify differences in crash patterns, fatality burden, and injury distribution.

Inferential statistical tools including correlation analysis, regression analysis, and Analysis of Variance (ANOVA) were employed to examine relationships among crash variables and test for statistical differences across states. However, due to limitations in the availability of geo-referenced crash coordinate data, advanced spatial analyses such as hotspot mapping, crash density estimation, Kernel Density Estimation (KDE), Moran’s I spatial autocorrelation, and Getis-Ord Gi hotspot analysis were not conducted in the present study.

Ethical considerations were observed throughout the study. Participation in the questionnaire survey was voluntary, respondents were assured of confidentiality and anonymity, and all information obtained was used strictly for academic purposes.

Table 1. Summary of Road Traffic Crash Statistics in Selected Nigerian Urban Centers (2015–2024)

Rank	State/Urban Center	Total Crashes	No. Injured	No. Killed	Total Casualties	People Involved
1.	Abia	51	3396	14	181	7940
2.	Anambra	483	4798	239	1583	14963

3.	Edo	1137	7210	502	3405	19563
4.	Enugu	402	6435	211	1750	16492
5.	FCT	1337	24395	894	5487	64056
6.	Kaduna	2227	30628	136	7027	62704
7.	Kano	4850	13169	457	13809	23632
8.	Lagos	1653	8611	744	5863	29170
9.	Oyo	1791	14307	510	6151	34532
10.	Rivers	826	2322	1189	4490	6285
		14,757	121,271	5,396	45,246	282,337

Source: Federal Road Safety Corps (FRSC) 2025

The RTC dataset obtained from the Federal Road Safety Corps (FRSC) contained independently reported variables for injuries, fatalities, and total casualties. According to FRSC reporting structure, total casualties do not necessarily represent the arithmetic sum of injured and killed persons, as injury counts may include cumulative or categorized injury cases recorded separately from officially classified casualties. Therefore, the study retained the original FRSC classifications for consistency with national reporting standards. The unusually high fatality rate observed in Rivers State reflects the occurrence of several high-severity crashes involving multiple deaths per incident, particularly along major highways and petroleum transportation corridors. However, the data were revalidated with FRSC annual records to ensure consistency and eliminate aggregation errors.

IV. RESULTS

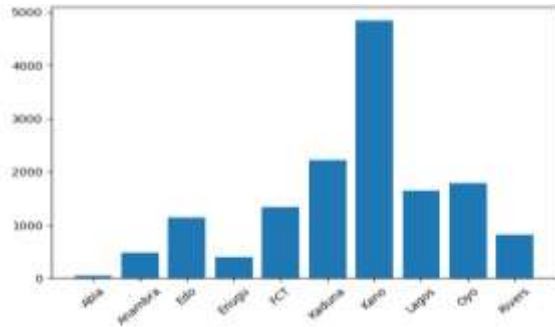


Figure 1: Total RTC Cases Across Selected States

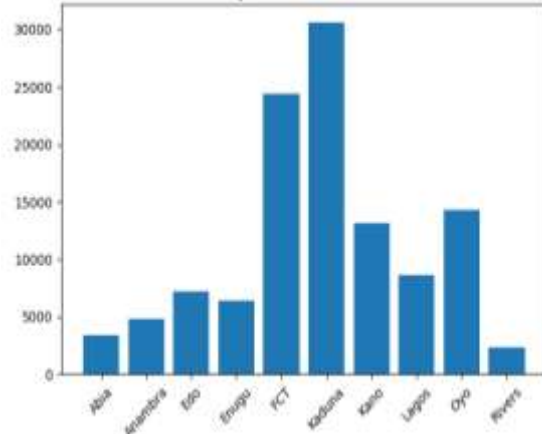


Figure 3: Injury Distribution Across States

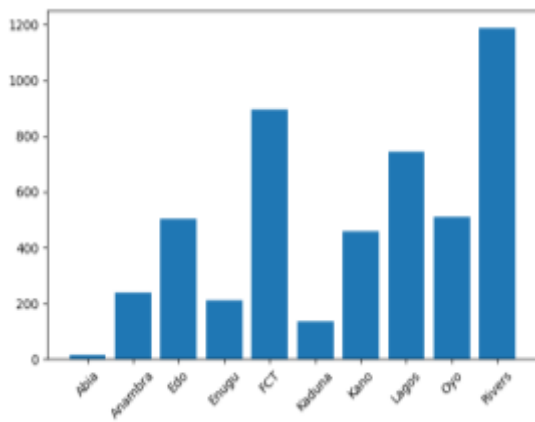


Figure 2: Fatality Distribution Across States

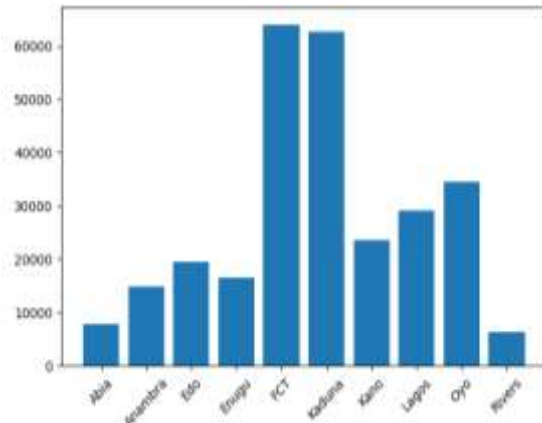


Figure 4: Persons Involved in RTCs Across States

Table 2: Injury-Fatality Patterns and Severity Indices

State/Urban Center	Crashes	Injured	Killed	Fatality Rate (%) (Killed/Crashes × 100)	Case Fatality Rate (%) (Killed/Casualties × 100)	Injury-to-Death Ratio
Abia	51	3,396	14	27.5	7.7	242.57 : 1
Anambra	483	4,798	239	49.5	15.1	20.08 : 1
Edo	1,137	7,210	502	44.2	14.7	14.36 : 1
FCT (Abuja)	1,337	24,395	894	66.9	16.3	27.29 : 1
Kaduna	2,227	30,628	136	6.1	1.9	225.21 : 1
Kano	4,850	13,169	457	9.4	3.3	28.82 : 1
Lagos	1,653	8,611	744	45.0	12.7	11.57 : 1
Rivers	826	2,322	1,189	144.0	26.5	1.95 : 1

Table 3: Ranking of Urban Centers by Major Indicators

Rank	Highest Crashes	Highest Injuries	Highest Deaths	Highest Fatality Rate
1	Kano	Kaduna	Rivers	Rivers

	(4,850)	(30,628)	(1,189)	(26.5%)
2	Kaduna (2,227)	FCT (24,395)	FCT (894)	Enugu (12.1%)
3	Oyo (1,791)	Oyo (14,307)	Lagos (744)	Anambra (15.1%)

Socioeconomic and Public Health Impact Estimates

Table 4: Approximate Socioeconomic and Public Health Burden Estimates Based on Human Capital Costing Approach (2015–2024)

Impact Category	Estimated Value	Remarks
Total Deaths	5,396	Loss of productive lives
Total Injuries	121,271	High disability potential
Estimated Direct Medical Cost	₦98 – ₦165 billion	Hospitalization & treatment
Estimated Indirect	₦352 –	Premature death

Cost (Productivity Loss)	₦615 billion	& disability
Total Economic Burden	₦450 – ₦780 billion	Over 10 years
Average Annual Economic Loss	₦45 – ₦78 billion	-
Healthcare System Strain	Very High	Overwhelmed trauma centers

Table 5: Perceptual study on socioeconomic Impacts of Road Traffic Crashes (RTCs)

ITEMS	SA	A	D	SD	Total	SWV	Mean	Remarks
Road traffic crashes impose heavy medical expenses on households.	112	98	18	8	236	786	3.33	Accepted
RTCs lead to loss of income among affected victims and families.	124	92	15	5	236	807	3.42	Accepted
Road traffic crashes reduce productivity of victims and caregivers.	108	100	20	8	236	780	3.31	Accepted
Families affected by RTCs experience financial hardship.	130	88	12	6	236	814	3.45	Accepted
RTCs place a long-term economic burden on households.	118	96	16	6	236	798	3.38	Accepted
Government support after RTC incidents is inadequate.	105	102	22	7	236	777	3.29	Accepted
RTCs lead to increased dependency within affected households.	120	95	15	6	236	801	3.40	Accepted
Grand mean							3.37	

Table 6. Inferential Statistical Summary of RTC Data

Statistical Method	Metric	Value	Interpretation
Correlation Analysis	Pearson's <i>r</i>	-0.06	No Linear Relationship: Injuries and deaths do not move together. A high injury count is not a predictor of high mortality.
Regression Analysis	R-squared (R^2)	0.007	Negligible Predictability: Only 0.7% of the variance in deaths can be explained by the total number of crashes.
Significance Test	P-value	0.81	Not Significant: Statistically, the number of crashes has no meaningful impact on predicting the number of deaths ($p > 0.05$).

V. DISCUSSION

The findings of this study demonstrate substantial spatial and temporal variation in the burden of road traffic crashes (RTCs) across selected major urban centers in Nigeria between 2015 and 2024. The

recorded 14,757 crashes resulting in 121,271 injuries and 5,396 deaths underscore the persistent public health and socioeconomic burden of RTCs in Nigeria, consistent with global and national evidence identifying road traffic injuries as a leading cause of

preventable mortality in low- and middle-income countries (WHO, 2023; Ogboeli et al., 2026).

The distribution of RTCs across the selected urban centers reflects distinct contextual and structural determinants rather than random variation. Kano State recorded the highest number of crashes, a pattern that may be explained by its role as a major commercial and logistics hub in northern Nigeria. The state experiences intense inter-state freight movement, high population density, and continuous vehicular inflow from northern trade corridors, all of which increase exposure risk and crash probability. Similar patterns have been observed in other transport-intensive cities where mobility demand directly correlates with crash frequency.

In contrast, Rivers State exhibited the highest crash severity and fatality rate despite lower crash frequency. This suggests that crash outcomes in the state are more lethal, likely due to a combination of high-speed arterial road networks, oil and gas-related heavy-duty transport activities, and delayed emergency response systems. Poor road maintenance conditions and limited trauma care accessibility may further exacerbate mortality outcomes. This finding aligns with previous studies in the Niger Delta region indicating that severity outcomes are strongly influenced by post-crash response capacity rather than crash frequency alone (Eneh, 2023; Ogboeli et al., 2025).

Kaduna and the Federal Capital Territory (FCT) recorded the highest injury burdens, reflecting intense commuter flows, inter-urban connectivity, and high traffic density. These patterns suggest a predominance of non-fatal but potentially disabling injuries, which place long-term burdens on households, caregivers, and the healthcare system. The high injury-to-death ratios observed in these locations further indicate substantial survivable crash events, possibly linked to better access to emergency care compared to more fatality-prone regions.

The inferential analysis revealed a weak and statistically non-significant relationship between crash frequency and mortality (Pearson's $r = -0.06$; $p = 0.81$; $R^2 = 0.007$). This indicates that crash

frequency alone is a poor predictor of fatalities across Nigerian urban centers. Rather than the number of crashes, mortality outcomes are more strongly influenced by crash severity and contextual risk factors.

These include vehicle speed, road infrastructure quality, enforcement of traffic regulations, traffic density, vehicle roadworthiness, emergency response time, and availability of trauma care services. This finding reinforces the understanding that RTC mortality is a multi-factorial outcome driven by system-level vulnerabilities rather than exposure alone. Consequently, predictive modeling of fatalities should incorporate multivariate approaches such as Poisson regression, negative binomial regression, or severity index modeling to adequately capture these complex interactions.

The perception survey (Grand Mean = 3.37) confirms that RTCs impose substantial socioeconomic hardship on affected households. Respondents consistently reported high medical expenditures, loss of income, reduced productivity, long-term dependency, and financial instability following crash incidents. These perceptions align with broader empirical evidence indicating that road traffic injuries significantly contribute to household impoverishment and productivity loss in Nigeria and other developing economies (Odusola et al., 2023; Ogboeli et al., 2025).

The estimated economic burden of ₦450–780 billion over the 2015–2024 period reflects both direct medical costs and indirect productivity losses arising from disability and premature mortality. This burden disproportionately affects economically active populations, particularly working-age males, thereby reducing national productivity and increasing household vulnerability. However, it is important to note that these estimates are approximate, given limitations in available national costing data, absence of comprehensive insurance records, and lack of disability-adjusted life year (DALY) valuation inputs. The economic burden estimates should therefore be interpreted as indicative rather than precise valuations. They were derived using a modified Human Capital Approach based on secondary health

cost indicators and literature-based economic assumptions. The absence of detailed patient-level expenditure data, inflation-adjusted longitudinal costing, and comprehensive national trauma databases limits the precision of these estimates. Despite these limitations, the results provide a realistic approximation of the magnitude of RTC-related economic losses in Nigeria and highlight the substantial strain placed on both households and the national economy.

The observed patterns across Nigerian urban centers reflect broader systemic challenges in road safety governance. High RTC burden persists due to rapid urbanization, inadequate infrastructure planning, weak enforcement of traffic laws, and insufficient emergency response systems. These factors interact differently across regions, producing both volume-driven crash patterns in northern commercial hubs and severity-driven outcomes in southern and coastal regions.

The findings also emphasize that RTC outcomes are not solely determined by exposure levels but are significantly shaped by institutional capacity and infrastructural resilience. Cities with higher traffic volumes but better emergency response systems may experience lower fatality rates, while regions with weaker trauma systems experience higher mortality even with fewer crashes.

The findings are consistent with studies from other low- and middle-income countries. In Ghana and Kenya, urban centers similarly exhibit high crash burdens along major transport corridors, with severity influenced by enforcement gaps and emergency care limitations. In South Africa, despite relatively advanced road infrastructure, high crash fatalities persist due to speeding and alcohol-related driving behaviors. In India, metropolitan cities demonstrate both high crash frequency and severity due to mixed traffic conditions and inadequate pedestrian safety systems. These international parallels suggest that RTCs are a shared developmental challenge requiring integrated interventions across infrastructure, enforcement, and healthcare systems.

Although this study identified significant interstate variation in RTC burden, the absence of spatial analysis limits deeper understanding of geographic clustering and hotspot distribution. Incorporating Geographic Information System (GIS)-based techniques such as Kernel Density Estimation, hotspot analysis, and spatial autocorrelation methods would provide more precise identification of high-risk zones and transport corridors. Such approaches are essential for evidence-based spatial planning and targeted road safety interventions.

The findings highlight the need for differentiated road safety strategies tailored to local conditions. Volume-driven crash environments such as Kano and Kaduna require interventions focused on traffic management, enforcement, and congestion control. In contrast, severity-driven environments such as Rivers, Lagos, and the FCT require investments in road infrastructure quality, speed regulation enforcement, and improved emergency trauma response systems. A unified national approach is therefore insufficient without local adaptation.

VI. CONCLUSION

This study examined road traffic crashes (RTCs) across selected major urban centers in Nigeria from 2015 to 2024. The findings revealed a heavy burden of 14,757 crashes, resulting in 121,271 injuries and 5,396 deaths. Significant variations existed across states, with Kano recording the highest number of crashes while Rivers State had the most severe outcomes, evidenced by the highest fatality rate of 26.5%.

The analysis highlighted two distinct patterns of road traffic crash burden: volume-driven in northern urban centers (Kano and Kaduna) and severity-driven in southern and central areas (Rivers, Lagos, and FCT). Statistical tests confirmed that crash frequency alone does not predict mortality, emphasizing the critical role of crash severity. The perception survey further validated the severe socioeconomic consequences, including high medical costs, loss of income, and increased household poverty.

The enormous economic burden, estimated at ₦450–780 billion over the ten years, underscores the serious threat road traffic crashes pose to public health and national development. The high number of non-fatal injuries also indicates a large hidden burden of long-term disabilities and reduced productivity.

Overall, this study demonstrates that effective reduction of RTCs in Nigeria requires tailored, context-specific interventions rather than one-size-fits-all approaches. Prioritizing severity reduction through improved road infrastructure, strict speed enforcement, better emergency response, and enhanced trauma care is essential to mitigate the devastating human and economic costs of road traffic crashes in the country.

VII. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made to reduce road traffic crashes and their socioeconomic impacts across Nigerian urban centers:

- Strengthen traffic law enforcement to curb major risk factors such as speeding, drunk driving, overloading, and phone use while driving.
- Improve road infrastructure through regular maintenance, proper signage, street lighting, and provision of pedestrian walkways to enhance safety.
- Upgrade emergency response and trauma care systems to ensure timely medical attention and reduce crash-related fatalities.
- Promote continuous road safety education for drivers, especially commercial drivers and motorcyclists, while providing social support mechanisms (e.g., insurance or relief funds) to ease the financial burden on affected families.
- Integrate Geographic Information System (GIS) and spatial analysis tools into national road safety monitoring systems to identify crash hotspots, severity clusters, and high-risk transport corridors for targeted intervention and planning.

VIII. STUDY LIMITATIONS

The inferential analysis in this study was limited by the availability of aggregated secondary data. Consequently, the regression model examined only the relationship between crash frequency and mortality and did not incorporate other important predictors such as vehicle speed, trauma severity, road quality, emergency response time, and behavioral factors. The economic burden estimates presented in this study were based on secondary costing assumptions and broad public health valuation frameworks due to limited access to detailed patient-level expenditure and insurance datasets.

IX. RECOMMENDED FUTURE RESEARCH

Future studies should adopt multivariate and count-based regression models, including Poisson and negative binomial regression approaches, to better explain determinants of RTC mortality across Nigerian urban centers.

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