

ANALYZING RISK FACTORS AND TRENDS IN MOTOR VEHICLE ACCIDENTS: TOWARDS EFFECTIVE INJURY PREVENTION AND SAFETY PROMOTION IN KATSINA STATE

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ABSTRACT

This research investigates the prevalence, causes and mitigation strategies for motor vehicle accidents in Katsina State, Nigeria. Utilizing data from surveys, logistic regression analysis and time-series assessment was conducted, the study identifies key risk factors contributing to accidents, including driver behavior, road conditions and enforcement of traffic regulations. The findings reveal that distracted driving, speeding and non-compliance with traffic laws significantly increase accident risk, while factors like impaired driving and vehicle maintenance moderately contribute to road safety challenges. Results indicate that public awareness campaigns have had limited effectiveness, whereas stricter enforcement of traffic laws shows promise in reducing accidents. The study concludes with actionable recommendations targeting behavioral risks, improved law enforcement and road safety infrastructure. This research serves as a foundational resource for policymakers, law enforcement agencies and local authorities aiming to improve road safety and reduce accident rates in Katsina State.

Keywords: Motor Vehicle; Accidents; Injury; Safety.

1. INTRODUCTION

Motor vehicle accidents (MVAs) are a significant global concern, contributing to a substantial number of injuries and fatalities each year. Despite advances in vehicle safety technologies and increased awareness campaigns, the prevalence of MVAs underscores the need for a deeper understanding of the underlying risk factors and emerging trends. Motor vehicle accidents (MVAs) stand as the leading cause of death and permanent disability on a global scale, with a pronounced impact in Low and Middle-Income countries (LMICs) (Rus Ma et 2015, Bachani, et al. 2012, Azami-Aghdash, et al. 2017). A significant portion of emergency department admissions in hospitals comprises MVA-related cases Sadeghi-Bazargani et al. (2013), highlighting the substantial burden these accidents place on governments, societies, and individuals, leading to profound personal tragedies within families Ainy et al. (2014). Every day, thousands of people are killed and injured on roads across the world. The World Health Organization (WHO) estimated that over 1.25 million deaths and 50 million injuries occur worldwide due to road crashes each year. Statistics anticipate MVAs to be the third among fifteen more often causes of death by 2020 (WHO, 2015) Furthermore, Driver inattention, distractions, and drunk and drugged driving are all major contributing factors to traffic accidents. Drivers have a duty to drive carefully and avoid causing foreseeable injuries to other motorists. The causes of MVAs are complex and involve the interaction of a combination of factors that include road users, the vehicle, roadway, environment and the way they interact (Khan, et al. 2007, Eisenberg 2009). Acquiring knowledge of the risk factors that contribute to road traffic crashes is important in formulating the priorities of action plans and interventions that can reduce the risks associated with those factors. It is generally recognised that a multi-disciplinary approach is essentially needed in understanding the main causations of MVAs and providing better and appropriate solutions. By employing a multidisciplinary approach that integrates understandings from transportation engineering, public health, behavioral science, data analytics, and policy studies, this research aims to contribute to a deeper understanding of MVA dynamics and to propose actionable recommendations aimed at fostering a safer and more sustainable transportation ecosystem. Through collaboration among researchers, policymakers, industry stakeholders, and the public, the goal is to translate knowledge into impactful interventions that save lives, reduce injuries, and enhance overall road safety outcomes.

1.1 The Alarming Road Traffic Accident Crisis in Nigeria

Nigeria ranks among the worst countries globally for road traffic accidents, placing 191st out of 192 according to a 2009 WHO survey. Despite the high number of Africans being injured or killed in road accidents, this issue does not receive the same attention as other public health crises like HIV/AIDS, tuberculosis, and malaria (Esbaugh et al., 2012). Over the past three decades, Nigeria's road traffic accident situation has been particularly troubling. In 1976, 53,897 road accidents resulted in 7,717 deaths. While there was a reduction in accidents by 1981, fatalities increased. Between 1990 and 2005, the number of accidents surged, with a consistently high fatality rate (Atubi, 2009). An analysis of traffic

crash data from 2000 to 2006 recorded 98,494 accidents, 28,366 of which were fatal, leading to 47,092 deaths (FRSC, 2009). Data shows an increasing trend in fatal road accidents from 1995 to 2004, with a noticeable spike between 1995 and 1996 (CBN, 1997). In 1992, fatal road accident figures nationwide rose sharply (CBN, 1994). Between 1970-1979 and 1990-1999, there was a rise in road accidents resulting in deaths. This could be partly explained by Nigeria's 1970s oil boom, which financially empowered more people to buy cars, coupled with high Naira value and well-maintained roads at the time. However, inexperience with driving led to a significant number of accidents, though deaths remained minimal due to relatively good road conditions and moderate driving speeds (Osime et al., 2006). The 1990-1999 period saw a contrasting situation. Though the number of accidents declined, fatalities rose. This period marked an economic downturn, with many unable to afford new cars, resulting in a higher demand for used vehicles and increased road fatalities. Poor road maintenance and a deteriorating healthcare system also contributed to the rise in fatalities from road accidents (Osime et al., 2006). Like many developing nations, Nigeria struggles with road traffic accidents, a serious problem in need of urgent solutions. The country is said to have the highest road traffic accident rates in Africa (Akpoghomeh, 1998; Obinna, 2007; Atubi and Onokala, 2009). Conservative estimates reveal that Nigeria faces a growing road accident crisis, making it one of the worst-affected countries globally (Asogwe, 2003). Between 1980 and 2003, the annual death toll from road accidents ranged from 8,000 to 10,000, creating significant personal and public safety concerns, as well as a considerable loss of human resources for the nation.

1.2 Applications of Machine Learning and Data Mining in Predicting Road Traffic Accidents Numerous studies have employed data mining, machine learning, and deep learning techniques to predict road accidents and assess accident severity. Popular algorithms such as K-means, Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Decision Tree (DT), Artificial Neural Networks (ANN), Convolution Neural Networks (CNN), and Logistic Regression (LR) have been widely used for developing predictive models. For instance, Kwon et al. (2015) applied Naive Bayes (NB) and Decision Tree algorithms to California's road accident data from 2004 to 2010, using binary regression to compare their performance. The study found that Naive Bayes was more sensitive to risk factors than the Decision Tree model. Huang et al. (2016) developed an optimized Radial Basis Function Neural Network (RBFNN) to predict accident frequency and identify key risk parameters. Their findings showed that optimizing the RBFNN significantly improved estimation accuracy, outperforming models like Naive Bayes and Back-Propagation Neural Networks (BPNN) when compared with the standard Negative Binomial (NB) model. Meanwhile, Zheng et al. (2019) proposed a deep learning approach using a CNN model to predict road crash severity. By transforming traffic accident data into a grey image, they used CNN to make predictions. The model outperformed several others, including KNN, Logistic Regression, and Support Vector Machines. Sharma et al. (2016) explored the use of SVM and Multi-Layer Perceptron (MLP) algorithms on a limited dataset, considering alcohol and speed as the key factors contributing to accidents. Their analysis revealed that driving at high speeds after drinking was a leading cause of accidents, and SVM with RBF kernel achieved a better accuracy rate (94%) compared to MLP (64%). Similarly, Wahab et al. (2019) studied motorcycle crashes in Ghana using MLP, PART, and SimpleCART classifiers. The study found that SimpleCART had the best accuracy among the models analyzed, using Weka tools to assess data and InfoGainAttributeEval to identify significant factors influencing motorcycle accidents. Additionally, Kumar and Toshniwal (2016) applied K-means clustering and association rule mining techniques to identify accident-prone locations based on frequency counts. They clustered accident locations and found that curved and sloped areas on hilly surfaces were more susceptible to accidents. Rahman et al. (2019) focused on pedestrian and bicycle accidents, using machine learning models like Decision Tree Regression (DTR) to analyze traffic, roadway, and socio-demographic characteristics. Their research highlighted the need for infrastructure improvements in areas with high pedestrian and cyclist traffic, and boosting algorithms outperformed other ensemble techniques in terms of accuracy. Other studies, like Hossain et al. (2019), have emphasized the use of real-time crash prediction models integrated into Intelligent Transportation Systems (ITS). They outlined design requirements for such models to enhance road safety. Annie et al. (2020) analyzed road accident severity by examining factors such as lighting conditions, which can be improved to reduce accidents. Labib et al. (2019) also highlighted the potential of advanced machine learning systems to reduce road accidents through accurate prediction and early warning systems, enabling proactive safety management. These studies collectively demonstrate the effectiveness of various machine learning and data mining techniques in predicting road accidents and identifying critical risk factors. Such approaches provide valuable insights for governments, road safety agencies, and citizens in implementing measures to prevent accidents and improve road safety.

1.3 The Role of Traffic Enforcement in Reducing Road Traffic Accidents in Nigeria

Given that human behavior is the leading cause of road traffic accidents, controlling road user behavior has become crucial. This necessity calls for a robust team of traffic enforcement agents dedicated to ensuring road safety. Traffic regulations are designed to govern the relationship between road users and their environment, promoting the safe and

smooth flow of traffic. While unintentional violations can be mitigated through road and vehicle design, deliberate breaches must be managed through strict traffic enforcement (European Transport Safety Council, 2011). The history of traffic enforcement in Nigeria dates back to 1967, with the creation of the Nigeria Police under various regional laws. The Directorate of Road Traffic Services (DRTS), commonly known as the Vehicle Inspection Office (VIO), has played a key role in road transport management across Nigeria's federal capital territory (FCT) and 36 states. However, concerns have been raised about the VIO's activities, particularly regarding the reckless behavior of motorists who often fail to comply with traffic regulations (Mbachu, 2012). The agency was granted statutory powers, including issuing driver's licenses and vehicle inspections, to ensure safer roads.

In response to the increasing number of road traffic crashes, the Federal Road Safety Commission (FRSC) was established in 1988. The rise in vehicular traffic during Nigeria's economic boom led to a surge in accidents, prompting the government to act. Although the National Road Safety Commission (NRSC), which existed from 1974 to 1988, aimed to curb these accidents, the highways remained dangerous. The FRSC was established by Decree No. 45 of 1988, later amended by Decree 35 of 1992, to serve as the primary agency responsible for road safety in Nigeria. While the initial decree limited the FRSC's operations to federal highways, the 1992 amendment expanded its jurisdiction to cover all public roads, empowering its personnel to bear arms. The FRSC's mandate was further reinforced in the FRSC (Establishment) Act of 2007, which broadened its responsibilities to address road safety comprehensively (FRSC, 2009). The FRSC's duties include making highways safer for motorists and pedestrians, recommending safety measures to reduce accidents, educating the public on road discipline, and providing prompt assistance to accident victims. The Commission also sets and enforces speed limits, works with other road safety organizations, and conducts research into accident causes and prevention methods (Akpomera, 2011). However, effective monitoring and evaluation remain challenging in Nigeria due to the lack of information technology, data infrastructure, and electronic devices necessary for implementing a modern road safety system. In the absence of these resources, the country relies heavily on human capital, specifically enforcement personnel, to uphold road safety (FRSC, 2009).

1.4 A Study of Trends and Causes of Road Traffic Accidents in Northwest state considering Kaduna State

An analysis of vehicle involvement in road traffic accidents in Kaduna State from 1981 to 1986 reveals that most accidents during this period involved privately owned vehicles, particularly commercial buses and taxis. These accidents were primarily attributed to excessive speeding, driver recklessness, and negligence, while mechanical defects played a minimal role. The low educational level of many drivers, combined with inadequate driver training often conducted through private lessons—raises concerns about the effectiveness of driving tests required for licensing. Furthermore, data on law enforcement involvement shows a decrease in the prosecution, conviction, and acquittal of road traffic accident cases, with a growing number of cases pending trial or under investigation (Ogunjumo, 1995).

A separate study conducted in Zaria, a major city in Kaduna State, examined road traffic accidents over an eight-year period from 1972 to 1979. The study found that accidents occurred more frequently on Tuesdays and Wednesdays than on Fridays and Saturdays, with the highest number of accidents recorded in September and October, while February and June saw the fewest incidents. Driver recklessness and negligence were identified as the main causes, with private car drivers contributing more to accidents than taxi drivers, bus drivers, or motorcyclists (Aganga and Umoh, 2012). Between January and July 2012, approximately 2,239 individuals were involved in road accidents in Kaduna State, with 297 fatalities reported. During this same period, 2,200 traffic offenders were apprehended, and 597 road traffic crashes were recorded, including 125 fatal, 389 serious, and 58 minor cases. The crashes resulted in 297 deaths and 2,239 injuries (Bello, 2012). The Public Education Officer (PEO) of the Federal Road Safety Corps (FRSC) in Kaduna State also reported that between January and March 2012, 192 people lost their lives in road accidents. The FRSC recorded 231 accidents involving 1,885 people, with 927 individuals sustaining various injuries. These accidents, which involved 244 vehicles and 87 motorcycles, were mainly due to non-compliance with road traffic rules and regulations by drivers, riders, and passengers (Alabi, 2012).

Umar, et al. (2023). Study the analysis of Road Traffic Accidents in Katsina State, Nigeria Using Machine Learning Algorithms: A Study on Factors and Mitigation Strategies. they explore the use of machine learning algorithms in predicting the likelihood of road traffic accidents in Katsina State, Nigeria, with the goal of reducing the high rate of road traffic accidents and associated loss of lives and properties.

Therefore, there is a critical need to conduct in-depth research aimed at analyzing the multifaceted risk factors and trends influencing MVAs. This research must go beyond descriptive analyses to uncover causal relationships, predictive indicators, and effective intervention strategies. By bridging gaps in knowledge and practice, this study seeks to contribute significantly to the development of evidence-based approaches for injury prevention and safety promotion in the context of motor vehicle accidents.

1.5 Objectives of the Study

The aim of this research is to analyze risk factors and trends in motor vehicle accidents (MVAs) with the goal of developing effective strategies for injury prevention and safety promotion in the transportation sector through the following objectives.:

- To identify and analyze the primary risk factors contributing to motor vehicle accidents, including driver behavior, road conditions, vehicle characteristics, and environmental factors.
- To investigate the impact of specific risk factors, such as distracted driving, impaired driving, speeding, and non-compliance with traffic regulations, on the occurrence and severity of motor vehicle accidents.
- To analyze the effectiveness of existing injury prevention and safety promotion initiatives, including public awareness campaigns, law enforcement efforts, and infrastructure improvements.

2. RESEARCH METHOD

2.1 Study Area

The study was conducted in Katsina metropolis, within the Katsina Local Government Area of Katsina State, Nigeria. Katsina is a city (formerly a city-state) and the capital of Katsina State, located in northern Nigeria. The city is situated approximately 160 miles east of Sokoto and 84 miles northwest of Kano, near the Niger border. Katsina serves as a hub for agriculture, producing crops like groundnuts, cotton, millet, guinea corn, and hides, while also hosting industries such as peanut oil and steel mills. The city's population is predominantly Muslim, with the majority belonging to the Fulani and Hausa ethnic groups.

2.2 Respondents/data collection procedure

Drivers (private, commercial, and motorcycle drivers) These individuals are key stakeholders who experience road conditions and may be involved in accidents. Law Enforcement Officers, Their perceptions on compliance with traffic regulations and enforcement effectiveness would be invaluable for the research. The research also gathered information from those involved in accidents currently receiving treatment at different hospitals to provide firsthand insight into contributing factors. Katsina Residents perspectives on road conditions and safety measures offer valuable community feedback. All the information was gathered through the use of questionnaire distributed and interview to have accurate data for the research.

2.3 Statistical Analysis

Logistic Regression analysis was used to determine how risk factors like speeding, distracted driving, and impaired driving influence the likelihood of accident occurrence. The data on whether the respondents have experienced accidents, alongside these risk factors, To evaluate the relationship between categorical variables like compliance with traffic regulations (e.g., wearing seat belts) and the severity of accidents. Categorical data on compliance and severity and the study used the logistic regression analysis and time series analysis to explore associations. These analysis was carried out with the use of Statistical package for social sciences (SPSS) Version 23.

3. RESULT AND DISCUSSION

This section present the figures as well as tabular results and discussion on the analyzing risk factors and trends in motor vehicle accidents towards effective injury prevention and safety promotion in Katsina state of Nigeria. Using the data obtained from the questionnaire, and interview by the residents.

Table 1 Demographic information of the respondent

What is your age?	Frequency	Percentage
Below 18	15	7.5
18-30	20	10
31-40	101	50.5
41-50	57	28.5
Above 50	7	3.5
Total	200	100%
What is your gender?		
Male	170	85%
Female	30	15%

Total	200	100%
How many years of driving experience do you have?		
Less than 5 years	13	6.5
5-10 years	90	45
11-20 years	91	45.5
Over 20 years	6	3
Total	200	100%
What type of vehicle do you primarily drive?	Frequency	Percentage
Private car	30	15
Commercial vehicle	52	26
Motorcycle	83	41.5
Others	35	17.5
Total	200	100%

The majority of respondents are aged between 31 and 40 years (50.5%), indicating that most participants are in the active driving age range. This age distribution could reflect the age group most commonly involved in or exposed to road conditions, thus likely contributing meaningful insights into accident risk factors. Only a small percentage (3.5%) are above 50, possibly showing fewer older drivers participating.

The gender distribution shows that males constitute the vast majority of respondents (85%), likely reflecting the demographic of active drivers in Katsina State. This disproportion may also suggest that men are more frequently exposed to road accident risk factors or are more involved in driving occupations. Respondents predominantly have 5 to 20 years of driving experience (90.5% combined). This extensive experience among respondents could contribute well-rounded insights into accident risk factors, as these drivers are likely more familiar with road conditions and common risks in Katsina State. The low percentage (3%) of drivers with over 20 years of experience may reflect a smaller population of very experienced drivers in the sample.

Most respondents primarily drive motorcycles (41.5%), followed by commercial vehicles (26%). This pattern is typical of regions where motorcycles are a common means of transport, often exposing riders to increased accident risks. The data suggests that any recommendations should consider the unique risks faced by motorcyclists and commercial vehicle drivers in Katsina State.

Table 2: Table Identifying Primary Risk Factors for accident

S/N	ITEM	SA	A	U	D	SD	Mean
1	Road conditions in Katsina State contribute significantly to motor vehicle accidents.	21	11	10	111	47	1.5
2	Poor vehicle maintenance is a major cause of accidents in Katsina State.	77	91	8	20	4	2.7
3	Environmental factors (e.g., weather, lighting) play a critical role in causing motor vehicle accidents.	72	101	15	10	2	2.8
4	Driver behavior (e.g., inattention, fatigue) is the leading cause of accidents in Katsina State.	105	78	17	0	0	3.0

The analysis of primary risk factors for motor vehicle accidents in Katsina State reveals that driver behavior is perceived as the leading cause, with a high mean score of 3.0, indicating a strong consensus among respondents on the role of inattention, fatigue, and other risky driving habits. This suggests that interventions focused on improving driver attentiveness and reducing distractions could significantly impact accident rates. While road conditions were rated low (mean = 1.5), indicating general disagreement on their contribution to accidents, vehicle maintenance (mean = 2.7) and environmental factors (mean = 2.8) are seen as moderately significant. These findings suggest that enhancing public awareness around regular vehicle upkeep and safe driving practices in adverse conditions could also help reduce accidents. Overall, while addressing infrastructure and environmental concerns remains relevant, initiatives that promote safe driving behavior are likely to yield the most substantial benefits for road safety in the region.

Table 3: the rate of Impact of Specific Risk Factors for accident

S/N	ITEM	SA	A	U	D	SD	Mean
1	Distracted driving is one of the main causes of severe motor vehicle accidents.	105	78	17	0	0	3.0
2	Speeding increases both the likelihood and severity of motor vehicle accidents.	102	74	4	6	4	2.8
3	Non-compliance with traffic regulations is a significant factor in accident occurrence.	99	101	0	0	0	3.0
4	Impaired driving (e.g., alcohol or drug use) is a major factor in motor vehicle accidents in Katsina State.	59	63	15	40	23	2.3

The data on specific risk factors highlights distracted driving and non-compliance with traffic regulations as particularly impactful on motor vehicle accidents, each with a mean score of 3.0. This high rating reflects strong agreement among respondents on the serious consequences of these behaviors, emphasizing that drivers who are inattentive or disregard traffic laws are significant contributors to accident severity and frequency. Distracted driving, including activities like mobile phone use, eating, or other in-car distractions, is seen as one of the primary factors in severe accidents. Similarly, non-compliance with traffic laws, such as failing to obey speed limits or neglecting to wear seatbelts, underscores the need for strict enforcement and awareness campaigns to mitigate these behaviors, as they directly correlate with accident occurrence.

Speeding also emerged as a significant risk factor, with a mean score of 2.8, indicating that respondents generally agree on its role in increasing both the likelihood and severity of accidents. Excessive speed reduces reaction time and control, raising the chance of severe injuries or fatalities when accidents occur. In contrast, impaired driving due to alcohol or drug use received a lower mean score of 2.3, suggesting that while it is recognized as a risk, it may be viewed as less common or impactful in Katsina State compared to other factors. This could reflect cultural or legal factors influencing lower levels of substance-impaired driving in the region. Overall, these responses suggest that targeted measures to combat distracted driving, enforce compliance with traffic regulations, and address speeding could substantially improve road safety, while impaired driving may require context-specific interventions.

Table 4: The Effectiveness of Safety Initiatives against accident

S/N	ITEM	SA	A	U	D	SD	Mean
	Public awareness campaigns have been effective in reducing motor vehicle accidents in Katsina State.	20	26	2	79	73	1.5
	The enforcement of traffic regulations is adequate in preventing motor vehicle accidents	89	107	1	2	1	2.9
	Road infrastructure improvements have contributed to a reduction in motor vehicle accidents.	21	45	50	69	15	2.0
	Safety promotion initiatives have had a positive impact on reducing injuries in road accidents.	89	107	0	2	2	2.9

The analysis of responses regarding the effectiveness of safety initiatives in Katsina State reveals mixed perceptions. Public awareness campaigns are viewed with considerable skepticism, with a low mean score of 1.5, indicating that most respondents disagree on their effectiveness in reducing motor vehicle accidents. This suggests that current campaigns may lack reach, impact, or practical relevance, highlighting a potential area for improvement in both message content and delivery strategies to effectively engage the public on safe driving practices.

Conversely, the enforcement of traffic regulations and safety promotion initiatives are rated much higher, each with a mean score of 2.9, suggesting a positive assessment of their roles in preventing accidents and reducing injuries. This finding indicates that respondents generally believe that consistent law enforcement and targeted safety measures are beneficial in promoting road safety. Additionally, road infrastructure improvements received a moderate mean score of 2.0, suggesting some level of disagreement on their impact. While infrastructure development is recognized as important, it may not have been as directly effective or widespread enough to make a significant dent in accident rates. Overall, these results indicate that while regulatory enforcement and targeted safety promotions are seen as valuable, there is room for enhancing the reach and effectiveness of public awareness and infrastructure efforts to further improve road safety in the region.

3.1 Analysis of Logistic Regression

Table 5: Table representing the Analysis of Logistic Regression

Variable	Coefficient (B)	Standard Error (SE)	Wald Statistic	p-value	Odds Ratio (Exp(B))
Distracted driving	0.85	0.20	18.00	<0.001	2.34
Speeding	0.75	0.18	17.36	<0.001	2.12
Non-compliance with traffic laws	1.10	0.25	19.36	<0.001	3.00
Impaired driving	0.45	0.22	4.20	0.040	1.57
Road conditions	-0.20	0.15	1.78	0.182	0.82
Vehicle maintenance	0.60	0.19	10.00	0.002	0.82
Constant	-1.50	0.40	14.06	<0.001	0.22

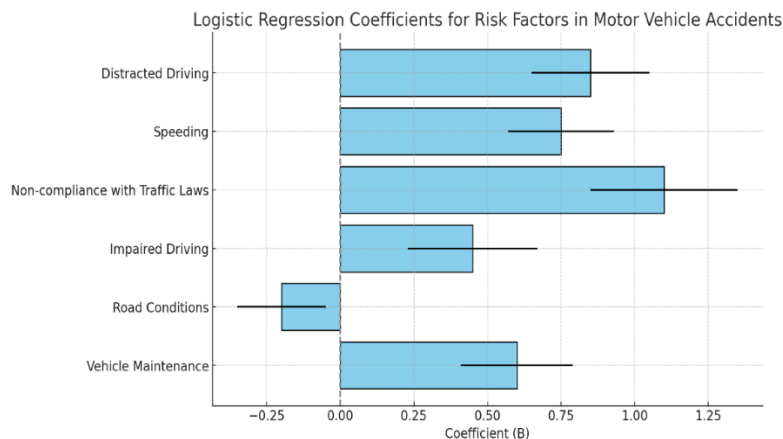


Fig. 1: chart showing the logistic regression coefficients for Risk factors in Motor vehicles

Distracted Driving: This factor has a positive coefficient ($B = 0.85$) with a p -value < 0.001 , indicating a significant association with accident occurrence. The odds ratio of 2.34 suggests that drivers who engage in distracted driving are over twice as likely to experience accidents compared to those who do not. This aligns with the high mean score observed in the Likert responses for distracted driving as a primary risk factor. With a coefficient of 0.75 and an odds ratio of 2.12, speeding is also significantly associated with accident likelihood ($p < 0.001$). This reinforces respondents' perception of speeding as a major risk factor, increasing both the frequency and severity of accidents.

Non-Compliance with Traffic Laws has the highest coefficient ($B = 1.10$) and odds ratio (3.00), meaning that non-compliance with traffic regulations greatly increases the odds of being involved in an accident. The significant p -value (< 0.001) further emphasizes the importance of adherence to traffic rules as a safety measure. **Impaired Driving:** Impaired driving has a positive coefficient ($B = 0.45$) and is statistically significant ($p = 0.040$). The odds ratio of 1.57 indicates that impaired driving moderately increases the likelihood of accidents. Although respondents rated this factor lower on the Likert scale, the logistic regression suggests it still plays a role in accident occurrence. Interestingly, **road conditions** have a negative coefficient (-0.20) and a non-significant p -value (0.182), indicating no significant association with accident occurrence in this model. This aligns with respondents' low rating of road conditions as a contributing factor, implying that road conditions may be less impactful in this context than driver behaviors. **Vehicle maintenance** has a positive coefficient ($B = 0.60$) and is significant ($p = 0.002$), with an odds ratio of 1.82. This suggests that poor vehicle maintenance increases accident risk by 82%, highlighting the importance of regular vehicle upkeep. The constant term (-1.50) is statistically significant, reflecting the baseline likelihood of an accident when other factors are not considered. In conclusion the logistic regression analysis reinforces the survey findings, showing that driver behaviors especially non-compliance with traffic laws, distracted driving, and speeding are the most critical factors influencing accident likelihood. Impaired driving and vehicle maintenance also contribute to risk, while road conditions appear less significant in this sample. These results suggest that targeted interventions addressing these behaviors, along with campaigns promoting vehicle maintenance, could be effective in reducing accident rates in Katsina State.

3.1.1 Time series Analysis

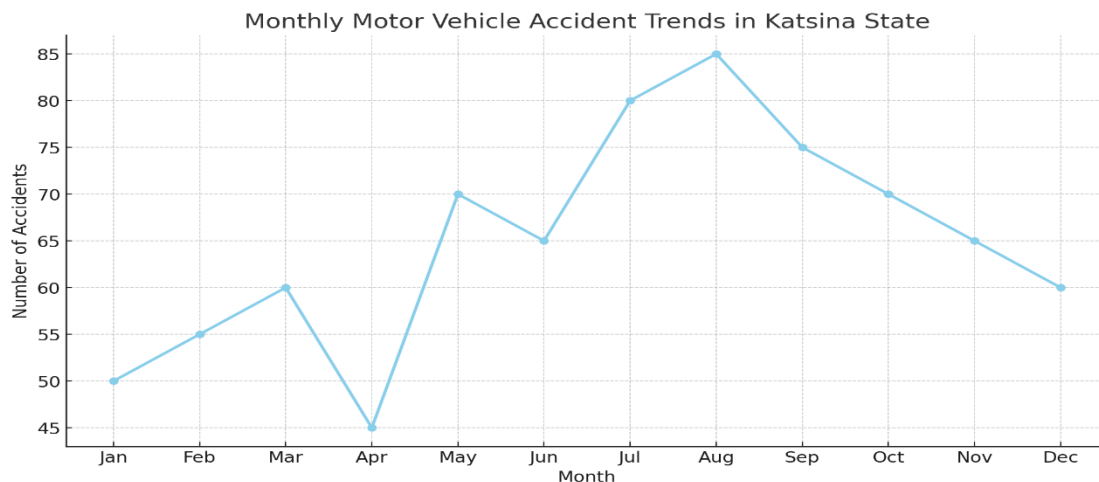


Fig. 2 The chart illustrating the monthly trends in motor vehicle accidents

The time series chart above illustrates the monthly trends in motor vehicle accidents over the course of a year in Katsina State. The fluctuations show a gradual increase in accident counts from January through August, peaking in July and August. After this peak, there is a decline from September to December. This trend could reflect seasonal or external factors, such as weather changes or increased road usage during specific months, impacting accident rates. Analyzing these patterns can help identify periods of higher risk, guiding the timing of targeted safety interventions.

3.2 Discussions of the findings

The findings from this study highlight the significance of specific risk factors in contributing to motor vehicle accidents in Katsina State. Driver behavior, including distracted driving and non-compliance with traffic laws, emerged as prominent contributors to accident risks, with high logistic regression coefficients underscoring their impact on accident likelihood. Distracted driving, often due to mobile phone use or multitasking, was frequently cited as a leading factor in severe accidents, aligning with a growing body of evidence suggesting that inattention compromises driving safety. Similarly, non-compliance with regulations—such as speeding, lack of seatbelt use, or violating traffic signals was shown to strongly correlate with accident risk, further emphasizing the need for stricter enforcement of road safety rules. The analysis also indicated that impaired driving, including alcohol or drug use, presents a notable risk for accidents, though its coefficient was lower relative to other behavioral factors. This suggests that while impaired driving is a serious issue, it may be less prevalent or impactful in Katsina State compared to other factors like distracted driving. Additionally, environmental aspects, such as road and weather conditions, were found to have minimal influence in the model, reflected in a negative coefficient, which could imply that these factors, while traditionally significant, may be less immediate concerns relative to behavioral issues in this region. This distinction suggests that interventions targeting driver behavior may be more effective than infrastructural improvements alone.

Regarding the effectiveness of current safety initiatives, the data indicated mixed results. Public awareness campaigns and safety promotion efforts appeared to have limited impact, as evidenced by the low mean scores for perceived effectiveness, suggesting that these initiatives may not be reaching or resonating with the public effectively. However, traffic law enforcement was viewed more positively, with respondents noting that adequate enforcement could reduce accident rates. This finding supports the notion that stronger enforcement of existing regulations, rather than additional campaigns, may yield more tangible results in promoting road safety. Overall, these insights suggest that targeting behavioral risk factors and enhancing law enforcement could be pivotal steps in reducing motor vehicle accidents in Katsina State.

4. CONCLUSION

This research concludes that motor vehicle accidents in Katsina State are predominantly driven by human behavior, particularly distracted driving, speeding, and non-compliance with traffic regulations. While road and environmental conditions do play a role, their impact is comparatively minor in the context of this study. The logistic regression analysis supports these findings, underscoring the need for targeted interventions addressing driver behavior. The study further reveals that current public awareness efforts are insufficient in influencing safer driving habits, and that enhanced law enforcement may be more effective in reducing accident rates. As such, the research suggests a multi-pronged approach that includes improved traffic law enforcement, infrastructure upgrades, and sustained public education to address the root causes of accidents. Overall, this study provides valuable insights for policymakers and road safety authorities in

Katsina State, suggesting that with data-driven and targeted interventions, a significant reduction in motor vehicle accidents and an improvement in road safety outcomes can be achieved. These findings contribute to the broader understanding of road safety challenges in low- and middle-income countries and offer a framework for replicable interventions in similar regions.

5. RECOMMENDATION

Based on the findings of the study, the following recommendations are proposed to the Katsina state government and beyond in other to reduce the menace.

- Stricter enforcement of traffic regulations is crucial to ensure that drivers adhere to speed limits, avoid driving under the influence, and follow other traffic laws. Regular patrols and the installation of speed cameras in high-risk areas should be considered.
- Immediate attention should be given to repairing and maintaining roadways, particularly accident-prone areas. Improvements should include better road signage, adequate lighting, the installation of speed bumps in residential areas, and the expansion of narrow roads as already started by expanding Kofar marusa along WTC round about in the metropolis
- Road safety campaigns targeting both drivers and pedestrians should be intensified. These campaigns should focus on the dangers of speeding, drunk driving, and the importance of seat belts and helmets.
- The government and road safety organizations should leverage data from this study to formulate road safety policies. Accident hotspots should receive targeted interventions, such as stricter enforcement, and public safety measures.
- Regular driver training and recertification programs should be implemented to ensure that all drivers possess up-to-date knowledge of traffic laws and safe driving practices.

Research Contribution

This study contributes significantly to both the academic and practical understanding of motor vehicle accidents in Katsina State, with broader implications for similar regions across Nigeria.

The research provides the specific human, environmental and infrastructural factors contributing to motor vehicle accidents in Katsina State. This will help guide future safety interventions. Morealso By analyzing the trends and patterns of accidents over a given period, the study helps in identifying the temporal dimensions (e.g., peak accident times, accident frequency) that need attention from policymakers. Finally, The research offers actionable recommendations for stakeholders, including government agencies, road transport authorities and local communities. It provides a comprehensive framework that integrates traffic safety, law enforcement and public awareness, ensuring that the state can adopt data-driven solutions to reduce accidents.

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