

Impact of Transportation Methods and Injury Severity in Trauma Victims: Insights from Federal Tertiary Hospitals in Nigeria.

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ABSTRACT

Introduction: Trauma remains a leading cause of morbidity and mortality among young populations globally, with Nigeria being no exception. This study examines the relationship between transportation methods and injury severity among trauma victims. **Materials and Methods:** This study was carried out using the data obtained from 24 Federal Tertiary Hospitals across three geopolitical zones in Nigeria. **Results:** Among the 4,851 trauma cases analyzed, public taxis and private cars emerged as the most common means of transportation to healthcare facilities. However, the data revealed a concerning trend: patients transported by ambulance were associated with more severe injury outcomes. Logistic regression analysis further confirmed that those conveyed by ambulance had significantly higher odds of experiencing severe injuries. This counterintuitive finding underscores the urgent need to rethink and improve pre-hospital care in Nigeria. **Conclusion:** The study advocates for the development of a robust and well-coordinated Emergency Medical Services (EMS) infrastructure that can better serve trauma victims and potentially alter these severe outcomes. By shedding light on these critical issues, the findings aim to inform policy development and strengthen trauma care systems, particularly in low- and middle-income countries (LMICs) where such improvements are most needed.

Keywords: Trauma patients, Transportation methods, Injury severity, Emergency medical services (EMS), National Trauma Registry

INTRODUCTION

Trauma is one of the major public health concerns globally, trauma is among the main causes of morbidity and death worldwide [1]. Trauma injuries make over 9% of all deaths worldwide, hence, trauma is the fifth most common cause of death worldwide, according to the World Health Organisation [2]. Reducing the mortality and morbidity associated with injuries requires efficient trauma management. The form of transportation used to deliver patients to healthcare facilities is one of the key elements of trauma management since it can greatly affect the speed and quality of treatment received [3], victims who sustain severe injury (fracture, spinal cord, etc.) would require a well-qualified ambulance to safely deliver them to a health facility in order to reduce worsening their conditions [4]. In many high-income countries, well organised Emergency Medical Services (EMS) are essential to ensuring that trauma victims receive timely and proper care, which results in better outcomes [5]. However, in low- and middle-income countries (LMICs) such as Nigeria, EMS infrastructure is frequently undeveloped, resulting in variation in the methods of transportation used by trauma patients. Especially for individuals with fractures and severe

spinal cord injuries, this variation in moving the from the point of incident to the health facility can affect the degree of damage as poor transportation method and delays in treatment may worsen the original trauma [6]. The varied geographic and socioeconomic topography of Nigeria presents unique challenges for trauma care delivery. The EMS system of the LMICs is still under development; therefore, many people depend on non-specialised methods of transportation such as private vehicles, taxis, and public transport to reach healthcare facilities [7]. These of methods of transportation might lack the necessary equipment to support the trauma victim and medical care required to stabilise patients during travel, perhaps resulting in worsening the victim's condition before reaching the health facility and treatment outcomes than specialist ambulance services. The National Trauma Registry was established by the Federal Ministry of Health and Social Welfare Nigeria to enable the Ministry to tactically gather and examine samples of trauma cases statistically within a specific time frame. The analysis of the trauma registry data will highlight areas needing growth, the success of current management strategies, and the trends of trauma damage. The collected data include trauma victims who visited the selected health facilities within the period of June 2023 until December 2023. The pilot phase of this trauma registry consists of 24 Federal Tertiary Hospitals gathered across three geopolitical zones—North Central, North West, and South West—in Nigeria. Among the data collected is thorough knowledge on patient demographics, injury circumstances, first and definitive treatment, and outcomes. This study focuses on analysing the modes of transportation used by trauma patients and their correlation with injury severity. Understanding these correlations can inform policy and infrastructure development to enhance trauma care delivery in Nigeria. Prior research has shown that timely and appropriate pre-hospital care is crucial for improving trauma outcomes [8]. By examining the data from the Trauma Registry, this study aims to highlight the importance of EMS and the need for improved pre-hospital care infrastructure in Nigeria. The purpose of this research is to determine the distribution of different modes of transportation used by trauma patients in Nigeria, analyse the correlation between the modes of transportation and injury severity and provide recommendations for improving pre-hospital care and EMS infrastructure based on the findings. This paper will contribute to the growing body of literature on trauma care in LMICs and provide valuable insights for policymakers, healthcare providers, and researchers working to improve trauma outcomes in Nigeria.

MATERIALS AND METHODS

Trauma cases gathered during the pilot phase of the National Trauma Data Registry in Nigeria are retrospectively analysed in this paper. The Federal Ministry of Health and Social Welfare started the registry in order to methodically compile and examine data on acute trauma cases among a few chosen Federal Tertiary Hospitals (FTHs). The preliminary phase of this data gathering comprises trauma cases form the FTHs in three geo political between the period specified above. The hospitals chosen from these regions depend their trauma case management ability. Data were obtained using a modified form of the WHO trauma data collecting instrument. Fields for demographics, circumstances surrounding the trauma, presenting conditions, aetiology, body region affected, vital signs, first care, definitive care, complications, imaging reports, interventions, and outcomes constituted part of the data collecting instrument. The data capture is for each patient presented to the Accident and Emergency (A&E) department with acute trauma injury of the selected hospital. The data collection officers were responsible for retrieving patient folders/records and electronic health records from the hospital's record departments and IT units for the specified timeframe The study covered all patients of all ages that presented at the health facility with acute trauma requiring admission to the hospital. The data included demographic details (age, sex, nationality, occupation), method of transportation to the hospital, chief complaints, presenting conditions, etiology of injury, body regions affected, vital signs at presentation, initial and definitive care provided, complications, imaging studies and results, interventions performed, and patient outcomes (e.g., discharge status, admission to ICU, mortality). The data collected was transformed into a CSV format and exported into statistical analysis software (SPSS). Using ER disposition as a proxy for injury severity, the main goal of the analysis for this paper is to investigate the association between the mode of transportation and the severity of injuries.

RESULTS

Descriptive Statistics

The data comprises 4,851 records of trauma patients. The most common method of transportation was taxis (38.0%), followed by private cars (29.1%) and ambulances (16.3%). The most common ER disposition was admission to the ward (43.1%), followed by discharge (23.5%).

Cross-tabulation and Chi-square Tests

Cross-tabulations between transportation modes and ER dispositions were performed as shown in Figure 1, and chi-square tests were used to determine statistical significance. The results indicated significant associations between the mode of transportation and ER disposition.

Chi-square Test Results

- **Chi-square statistic (χ^2):** 233.08
- **P-value:** $4.15e^{-24}$

These results indicate a significant association between the mode of transportation and ER disposition ($P < 0.05$).

Visualization of Heatmaps and Bar Charts

Heatmap of Transportation Modes vs ER Dispositions and Injury Severity of Trauma Patients

Are shown in Figures 1 and 2 respectively.

Multivariate Analysis

(i) Correlation Matrix

The correlation matrix between the mode of transportation and severe injury (using ER disposition as a proxy for injury severity) is shown in Table 2. The correlation coefficient between the mode of transportation and severe injury is -0.059, indicating a weak negative correlation.

(ii) Logistic Regression Analysis

Logistic regression was performed to adjust for potential confounders such as age and sex and to determine the independent effect of transportation mode on severe injury outcomes as shown in Figure 3.

DISCUSSIONS

A total of 4,851 were collected and analysed, looking at the descriptive statistics, out 4,851 records, taxis were the most common method of transportation (38.0%) used in conveying trauma patient to health facility, followed by private cars (29.1%) and ambulances (16.3%). Most patients were admitted to the ward (43.1%), while others were discharged (23.5%), with few experiencing severe outcomes like ICU admission (3.1%) or passing away (6.2%). These numbers highlight how important transportation is in deciding how severe injuries are and what medical treatments one might need [9].

The heatmap of transportation means vs. ER dispositions and the bar chart for injury seriousness show

visual details of the relationship between these variables. The heatmap (Fig 1.0) indicates that patients transported by taxis and private cars are more regularly admitted to the ward, while those transported by ambulances have more severe outcomes, such as ICU admissions and deaths. This indicates that ambulances are usually utilised for more serious injury situations where quick and thorough medical attention is needed, which is not supposed to be so. Accident victims may sustain a severe internal injury like a fracture or acute spinal cord injury, but the victim might not sustain a physical injury; transporting such a patient to the hospital with a vehicle that is not properly equipped might result in a more severe situation [3, 10, 11, & 12]. The bar displaying injury severity helps visualize how ward admissions and discharges typically happen more often compared to severe cases like ICU stays and fatalities. It makes sense that more serious cases lead to these severe outcomes and the type of transportation used is crucial in such situations. Cross-tabulations were performed to study the connection between transportation methods and ER dispositions. Accordingly, the chi-square tests showed a strong link between these variables, with a chi-square statistic of 233.08 and a p-value of $4.15e-24$, showing a significant correlation ($P < 0.05$). Table 1.0 shows the way ER dispositions are distributed among several method of transportation. This important correlation studied the ways in which various transport choices affect patient outcomes and injury severity. For instance, the statistics shows that patients taken by ambulance typically have more severe injuries, implying that these patients were most likely in more critical condition at the time of transportation. The correlation matrix between the mode of transportation and severe injury (using ER disposition as a proxy for severity Table 2.0) shows that they are weakly negatively correlated (-0.059). Although this suggests minimal direct relationship, the logistic regression analysis sheds more-light on how and independent effect is created in resulting severe injury cases across transportation modes. Negative correlation coefficients for private car, public transport and taxi means that the odds of severe injury outcomes are lower than those in ambulances suggesting that ambulances seem to be used more often in cases with a higher degree of severity [13]

In the logistic regression analysis (adjusted for age and sex), it shows that patients transported by ambulance have increased odds of severe injury outcomes (ICU or death) relative to those transported privately (private car, taxi, public transport). This is consistent with the idea that ambulances are generally used for more critically injured patients-that usually need to be treated fast and aggressively [14]. Age is a major determinant of the outcome prediction for severe injuries. The study reveals the odds ratio. 1.15 indicates that, for every unit rise in age category a person is at 15% more likely to be subjected to othering-based mortality against the reference level. This is consistent with the theory that following trauma older individuals are more prone to suffer from severe consequences [15, 16]

Sex was also not a significant predictor for severe injury outcomes, P-Value of 0.969 and odds ration of about 1. This suggests that the chances of expiring are nearly equal in male and female patients listed within this data. Severe injury outcomes differed significantly by method of transportation. For specific modes of transportation, the odds ratio was 0.85 (15% reduction in odds of expiring). This emphasises the relationship of method transport in trauma care and its outcomes. The current findings can guide health policy in the improvement of trauma care, especially for older patients and help to optimise transport services not only among severe injured patient because some server injuries might be internal therefore it highly recommended that all injured victims should transported by a stable- equipped ambulance. Improving transportation infrastructure and build capacity of community health extension worker to help is providing pre-hospital care access may prove effective; efforts to develop human resources trained in advanced trauma life support will benefit health services in response to trauma care.

CONCLUSIONS

Based on the findings of this study, it is evident that the method of transportation plays a critical role in determining injury severity and the subsequent medical outcomes for trauma patients. The analysis of 4,851 cases from 24 Federal Tertiary Hospitals in Nigeria highlights that while taxis and private cars were the

most common means of transport, patients conveyed by ambulances were significantly severe outcomes, such as ICU admissions or deaths. This trend suggests that ambulances are often reserved for the most critically injured patients, which aligns with their intended use but also underscores the need for better pre-hospital care and more widespread availability of appropriately equipped emergency vehicles.

The study's logistic regression analysis further confirms the increased odds of severe injury outcomes for patients transported by ambulance, particularly among older individuals, who are more vulnerable to severe consequences following trauma. The lack of significant differences in outcomes between male and female patients suggests that the method of transportation and patient age are more critical factors in determining injury severity.

These findings emphasize the necessity for a well-coordinated and adequately resourced Emergency Medical Services (EMS) infrastructure in Nigeria. Enhancing the availability of stable, well-equipped ambulances and training community health workers in advanced trauma life support could significantly improve outcomes for trauma patients, regardless of the severity of their injuries. This study provides valuable insights for policymakers aiming to strengthen trauma care systems and optimize transportation services, ultimately reducing morbidity and mortality rates in trauma cases.

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FIGURES

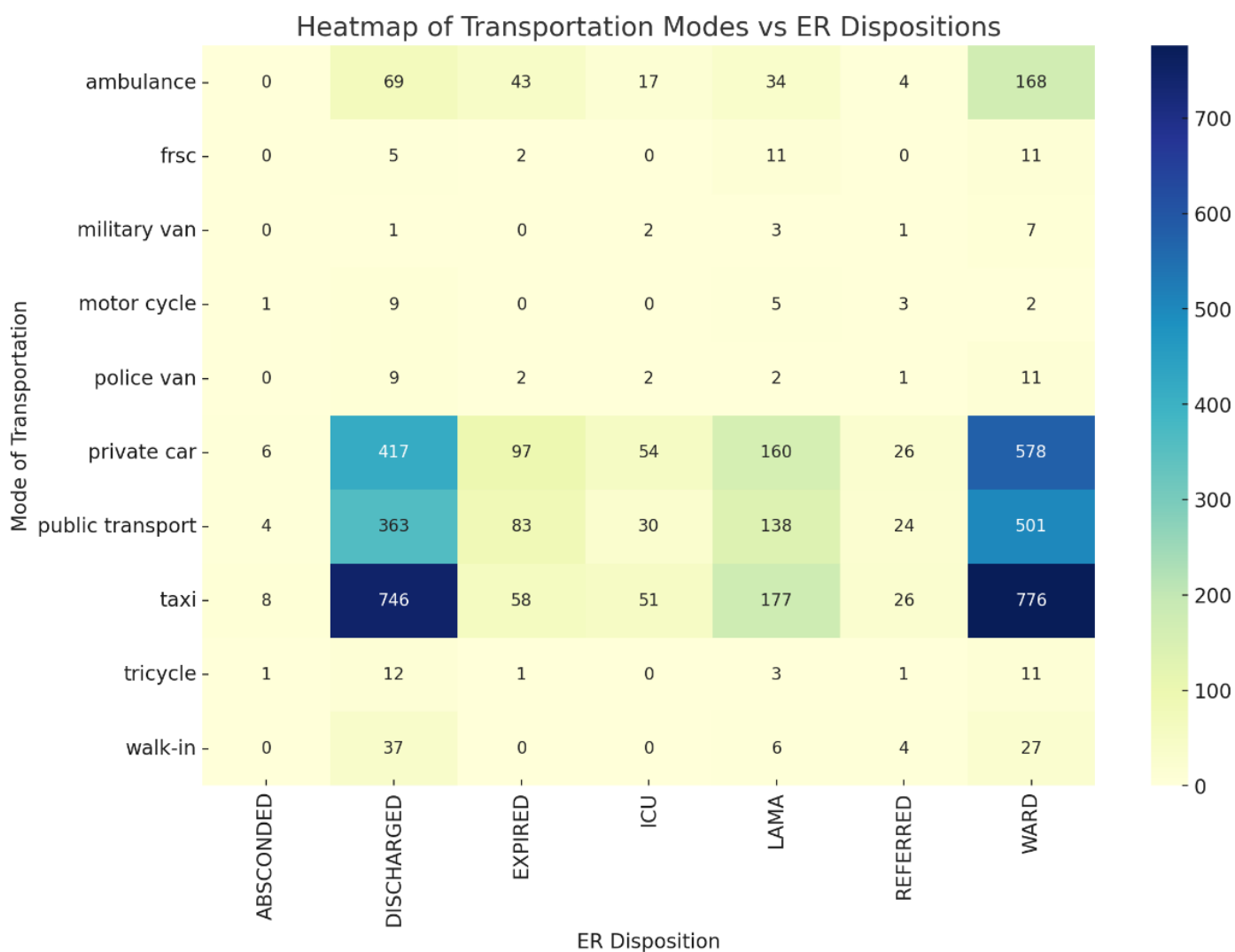


Figure 1: Heatmap of Transportation Modes vs ER Dispositions

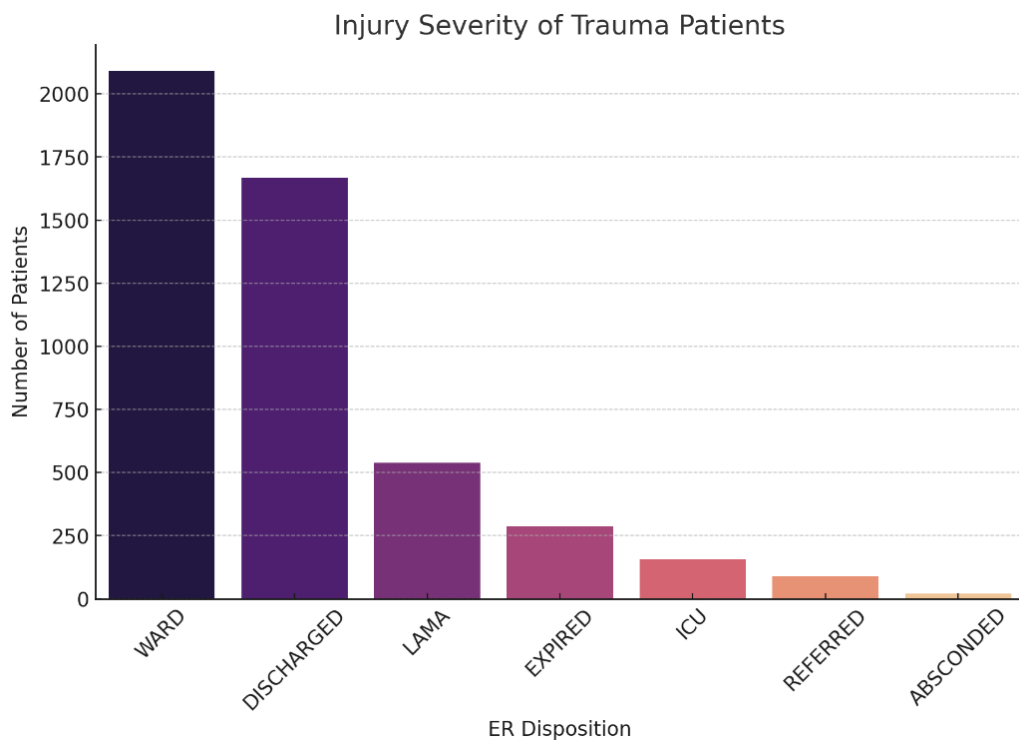


Figure: 2 Injury Severity of Trauma Patients

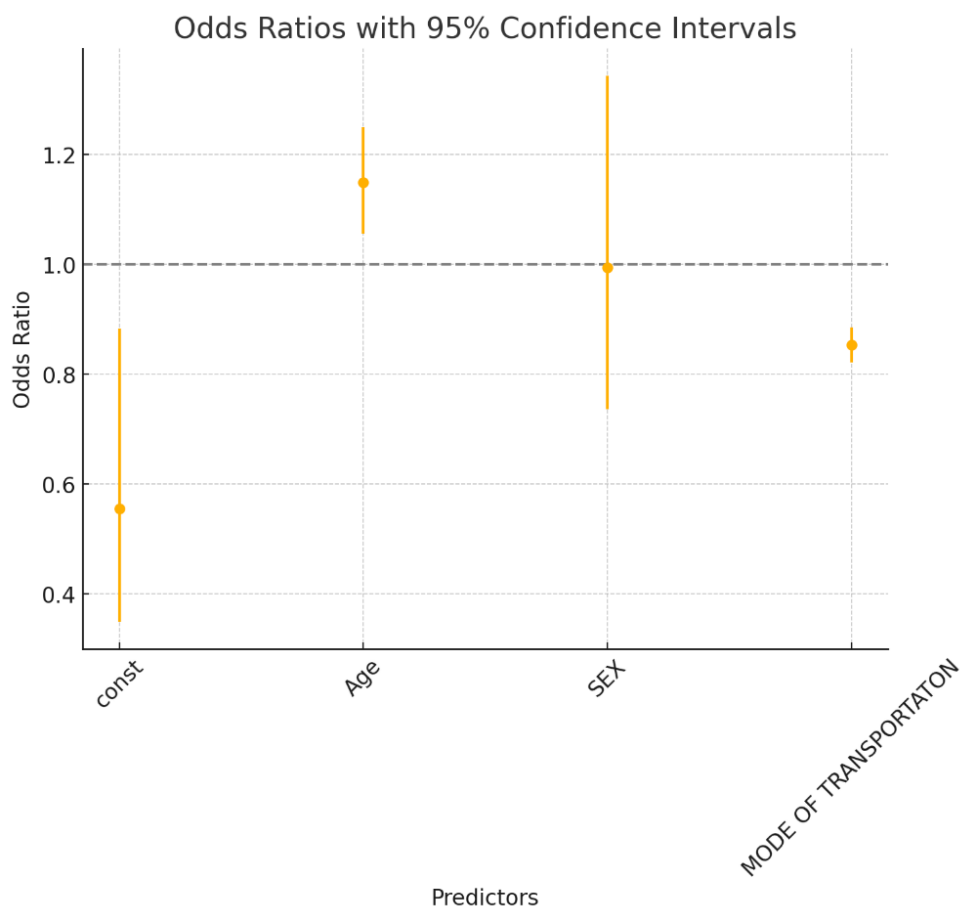


Figure: 3 Visualizing plot for Logistic Regression

TABLES

Table 1: Corrected Cross-tabulation between Transportation Modes and ER Dispositions

Mode of Transportation	Absconded	Discharged	Expired	ICU	LAMA	Referred	Ward
Ambulance	0	69	43	17	34	4	168
FRSC	0	5	2	0	11	0	11
Military van	0	1	0	2	3	1	7
Motor cycle	1	9	0	0	5	3	2
Police van	0	9	2	2	2	1	11
Private car	6	417	97	54	160	26	578
Public transport	4	363	83	30	138	24	501
Taxi	8	746	58	51	177	26	776
Tricycle	1	12	1	0	3	1	11
Walk-in	0	37	0	0	6	4	27

Table 2: Correlation Table

	Mode of Transportation	Severe Injury
Mode of Transportation	1	-0.059
Severe Injury	-0.059	1