

Are the Aetiologies of Traumatic Injuries Changing in Nigeria? Evidence from the Emergency Department of a Referral Hospital in Southwest Nigeria

Abstract

Background: Traumatic injuries are a serious public health problem. The burden of these injuries is increasing globally, and there is evidence that the pattern is changing. **Objective:** The study had two objectives. The first was to determine the aetiology and clinical spectrum of trauma in a teaching hospital. The second was to determine whether these have changed compared with previous reports from the region. **Materials and Methods:** Between September 2017 and August 2018, data from injured patients who presented consecutively to the accident and emergency department at the Federal Teaching Hospital Ido-Ekiti, Nigeria, were prospectively collected using a trauma data form and analysed. **Results:** Road traffic crashes (RTCs) caused 75.6% of the injuries, and motorcycle crashes accounted for more injuries than all the other major causes of injuries combined. Compared with previous studies from the same hospital, assault has risen to the second position, whereas falls have fallen to the third position as causes of traumatic injuries. The Injury Severity Scores (ISS) of the patients ranged from 1 to 75, with a mean score of 7.01. The mortality rate was 2.5%. Time to treatment: odds ratio (OR) = 3.25 (1.1–10.0), ISS: OR = 1.172 (1.07–1.28), age: OR = 1.097 (1.013–1.188), and systolic blood pressure: OR=1.07 (1.106–1.025) were the significant predictors of mortality. No patient was transported to the hospital in an ambulance. **Conclusion:** The pattern of trauma in the subregion is changing as the proportion secondary to RTCs and motorcycle crashes is higher than previously reported studies from the area. The implication of this finding for the prevention of RTCs is discussed.

Keywords: Motorcycles, Nigeria, road traffic crash, semi-urban, trauma

Introduction

As well as being a major financial burden worldwide, trauma is also the leading cause of death and disability between 16 and 45 years.^[1]

In 2003, it was estimated that more than 10 people died every minute from trauma-related causes in both developed and developing countries.^[2] This is more than the deaths from HIV/AIDS, malaria, and tuberculosis combined.^[2] The developing countries bear most of this burden because about 9 out of every 10 trauma-related deaths occur in these countries where preventive measures are poor and health facilities are not adequate to meet the challenges of traumatic injuries.^[3,4] While the phenomenon seems to be waning in developed countries, trauma-related disability and mortality continue to be a growing problem in developing countries, where mortality from

road crashes is anticipated to nearly double between 2000 and 2020.^[3] Most deaths from traumatic injuries are secondary to road traffic crashes (RTCs), which account for more than 1.2 million deaths worldwide each year.^[5] Adeloje and Odeku^[6] predicted in 1970 that road traffic injuries will become a major public health concern in the coming years in Nigeria. This prediction has been confirmed nearly 50 years later by a slew of experts who have determined that road traffic accidents are the top cause of trauma in Nigeria.^[7-9]

Most high-income countries (HICs) have effectively implemented preventative measures such as enhanced road networks, traffic management, and vehicle safety measures. These methods have aided in the reduction of road crashes and the morbidity and mortality associated with their injuries in HICs.^[4,10] However, the majority of low–middle income countries (LMICs) remain on an epidemiologic transition curve, in

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which the increase in the burden of injuries caused by rapid motorization, inadequate road and traffic infrastructure, and road user behaviour is not matched by an increase in the capacity to deal with them.^[10,11]

There is a need for local research to document injury causes, patterns, and circumstances of occurrence, and this will enable policymakers to adopt and adapt appropriate preventive measures for preventing injuries.

We hypothesized that the proportion of traumatic injuries due to road traffic accidents in our study would be higher than that in previous studies from the same location. This historical comparison may help identify knowledge gaps in injury prevention and serve as a foundation for future research.

Materials and Methods

This was a prospective cross-sectional study carried out at the Federal Teaching Hospital Ido-Ekiti in Southwestern Nigeria over 1 year from September 2017 to August 2018. Ido Ekiti is the headquarters of the Ido-Osi Local Government Area of Ekiti State, Nigeria. It is a nodal town with major roads linking the southwest with the northwest passing through it. It has a population of about 200,000 and the main occupation in the town are farming, trading, and artisan work. The only mode of public transport in the town is commercial motorcycles.

The participants were consecutive trauma patients who presented at the Accident and Emergency (A&E) unit of the hospital during the study period. The A&E has 20 beds and treats all emergency cases with the exception of paediatric birth injuries and non-trauma-related obstetric emergencies, which are treated on different wards. The patients were followed up for up to 2 weeks following their presentation at the A&E.

Approval was obtained from the Federal Teaching Hospital Ido-Ekiti Research and Ethics Committee for the study. When patients arrived at the A&E, they were triaged by the on-duty nurses and given initial treatment by emergency doctors. They were then reviewed by orthopaedic registrars, and their findings recorded into the study proforma. The proforma was created to extract information on the following subjects: patient's biodata, mechanism of injury, the injury sustained, vital signs, treatment, and outcome in the A&E department after 2 weeks. The rider's alcohol intoxication was determined via a clinical evaluation for indicators of alcohol intoxication such as slurred speech, alcohol breath, decreased attentiveness, and memory lapses, as well as bystander testimony. The Glasgow Coma Scale (GCS) and the Paediatric Glasgow Coma Scale (PGCS) at presentation were also recorded on the proforma for adults and children below 5 years, respectively. The PGCS is a more reliable instrument for the assessment of mental state in the non-verbal paediatric patients.^[12,13]

The Injury Severity Score (ISS) was calculated using the AIS 90 methodology.^[14,15] ISS scores greater than 15 were

classified as severe injuries. Data were analysed using IBM SPSS 25.^[16] In addition to descriptive statistics for univariate variables, a logistic regression model was fitted to assess the effect of eight predictors on mortality. Predictors for the model were chosen on the basis of literature review. An enter selection was done to fit the model, and standard techniques for model checking were done (the *P*-value for the Hosmer–Lemeshow goodness of fit test was 0.423 and the analysis of variance was 0.021). The statistical significance for all the tests was inferred at *P* < 0.05.

In the 3 years leading up to the study, the average number of trauma patients seen per year in the hospital's Accident and Emergency department was 1023. This has more than sufficient power for the logistic regression (we calculated a sample size of 500 using the " $n=100+50i$ " formula in which *i* is the number of independent variables in the model^[17]) and the tests of association statistics (we calculated a sample size of 384 using the Bartlett formula with 95% confidence interval and 5% margin of error^[18]).

Results

There were 1118 trauma patients seen in the A&E during the study period. This accounted for 25% of all patients seen in the A&E during the study period. Males outnumbered females by a ratio of 2.9:1. The mean age \pm SD of all patients was 34.0 ± 17.8 years. Table 1 shows the sociodemographic characteristics of the patients.

Table 1: Demographic variables

	Frequency (N = 1118)	Percent
Age (years)		
1–10	94	8.4
11–20	150	13.4
21–30	310	27.7
31–40	236	21.1
41–50	158	14.1
51–60	72	6.4
61–70	56	5.0
> 70	42	3.8
Sex		
Male	834	74.6
Female	284	25.4
Religion		
Christian	932	83.4
Muslim	186	16.6
Occupation		
Student	322	28.8
Trader/farmer	282	25.2
Civil servant	216	19.3
Artisan	130	11.6
Motorcyclist	60	5.4
Driver	36	3.2
Retired	20	1.8
Pre-school/infant	14	1.3
Others	38	3.4

RTCs were responsible for 848 (75.5%) of the injuries, with assault accounting for 96 (8.5%), fall accounting for 90 (8.1%), sport accounting for 25 (2.2%), burn and gunshot injuries accounting for 20 (1.8%) each, and industrial accidents accounting for the remaining 19 (1.7%).

The median arrival time in the hospital after injuries was 2 h (interquartile range: 1–5.6 h), and only 788 (70.5%) arrived within 6 h of sustaining their injuries. Four hundred and sixty-eight (55.2%) patients who sustained injuries from RTCs were brought to the hospital by Federal Road Safety Corps/Police (FRSC/P), 296 (34.9%) passers-by/good Samaritans, and 84 (9.9%) by relatives/self. All the patients brought to the hospital by the FRSC/P were conveyed in pick-up trucks, and those brought by the others were in commercial taxicabs or buses. Ambulances were not used to transport any of the patients to the hospital.

Table 2 shows the relationship among age, gender, and injury mechanisms. RTCs were the most common in the age group of 21–30 years, whereas assault was the most common in the age group of 11–20 years. Falls were the most common among people over the age of 70, whereas sports injuries were the most common among children.

The analysis of RTC injuries showed that motorcycles were responsible for the trauma in 474 (55.9%) cases, cars/taxis in 200 (23.6%) cases, minibuses and buses in 158 (18.7%) cases, trucks in 12 (1.4%) cases, and other types of vehicles in 4 (0.5%) cases. Only 15 (3.2%) of the 474 motorcyclists who were injured were wearing helmets, and they were all injured as riders, not as passengers. A total of 406 (47.9%) people were injured as passengers, 288 (34.0%) as drivers (including motor vehicle and motorbike crashes), and 154 (18.1%) as pedestrians. Passengers were 33.8 ± 15.6 SD years old, drivers were 35.8 ± 12.9 SD years old, and pedestrians were 33.25 ± 23.15 SD years old.

Anatomical distribution of the injuries showed that multiple body regions were injured in 405 (36.2%) patients, the lower limbs alone in 176 (15.7%), the upper limbs in 90 (8.1%), head including the scalp and the face in 128 (11.4%), and patients with spine, chest, abdominopelvic, and perianal

injuries made up the remaining 319 (28.6%). Overall, 1510 injuries were recorded and their characteristics were as follows: skin wounds (747, 49.5%), fractures (316, 20.9%), head injuries (128, 8.5%), chest injuries (104, 6.9%), abdominopelvic injuries (88, 5.8%), spine injuries (41, 2.8%), dislocations (30, 1.9%), perianal and urethral injuries (22, 1.5%), burns (20, 1.3%), crush injuries to the limb (8, 0.5%), and traumatic amputation of the limbs (6, 0.4%).

Most of the fractures were closed (216, 68.4%), whereas the rest were open (100, 31.6%). The tibia is the most common site for both close fractures (80, 26.0%) and open fractures (54, 54%). Other sites for fractures include femur (68, 21.5%), humerus (61, 19.3%), radius/ulna (49, 15.5%), ankle (44, 13.9%), and carpal, metacarpal, and metatarsal fractures (12, 3.8%).

A total of 128 patients had head injuries, with 42 (32.8%) being severe (GCS: 3–8); 48 (37.5%) being moderate (GCS: 9–12), and 38 (29.7%) being mild (GCS: 13–15). There were 43 spinal injuries recorded.

The patients' ISS scores varied from 1 to 75, with a mean of 7.01. Seven hundred and twenty-eight (64.8%) had mild injuries, 270 (24.8%) had moderate injuries, and the remaining had severe injuries. RTCs were responsible for 88.2% of severe injury victims.

Outcome after 2 weeks' admission in the A&E showed that 604 (54%) patients were treated and discharged home, 374 (33.5%) were transferred to the wards, 12 (0.01%) were transferred to the ICU, 58 (5.2%) discharged themselves against medical advice, 42 (3.7%) were referred to other hospitals, and 28 (2.5%) died. RTCs were responsible for 85.7% of the deaths.

Patients who had significant head injuries or multiple injuries had a far higher chance of dying than those who did not have those injuries [Table 3]. Similarly, 36.4% of motorcycle accident victims with head injuries died, compared with only 0.4% of those who did not [odds ratio (OR): 128.5, *P* = 0.001].

Table 2: Association among age group, gender, and causes of injury

Variable	RTC <i>n</i> (%)	Assault <i>n</i> (%)	Burns <i>n</i> (%)	Industrial <i>n</i> (%)	Fall <i>n</i> (%)	Gunshot <i>n</i> (%)	Sport <i>n</i> (%)	Total <i>N</i> (%)	<i>P</i> -value
Age group									<0.001
1–10	51 (54.3)	9 (9.6)	2 (2.1)	1 (1.1)	16 (17.0)	0 (0.0)	15 (16.0)	94	
11–20	106 (70.7)	22 (14.7)	0 (0.0)	0 (0.0)	12 (8.0)	2 (1.3)	8 (5.3)	150	
21–30	259 (83.5)	21 (6.8)	4 (1.3)	7 (2.3)	11 (3.5)	6 (1.9)	2 (0.6)	310	
31–40	191 (80.9)	20 (8.5)	2 (0.8)	9 (3.8)	8 (3.4)	6 (2.5)	0 (0.0)	236	
41–50	119 (75.3)	12 (7.6)	6 (3.8)	1 (0.6)	16 (10.1)	4 (2.5)	0 (0.0)	158	
51–60	58 (80.6)	4 (5.6)	2 (2.8)	0 (0.0)	6 (8.3)	2 (2.8)	0 (0.0)	72	
61–70	38 (67.9)	4 (7.1)	2 (3.6)	1 (1.8)	11 (19.6)	0 (0.0)	0 (0.0)	56	
>70	26 (61.9)	4 (9.5)	2 (4.8)	0 (0.0)	10 (23.8)	0 (0.0)	0 (0.0)	42	
Gender									0.042
Male	637 (76.4)	72 (8.6)	16 (1.9)	14 (1.7)	60 (7.2)	20 (2.4)	15 (1.8)	834	
Female	211 (74.3)	24 (8.5)	4 (1.4)	5 (1.8)	30 (10.6)	0 (0.0)	10 (3.5)	284	

Table 3: Odds ratio of traumatic brain injury and multiple injuries vs. mortality

	Died, <i>n</i> (%)	Survived, <i>n</i> (%)	Total	Unadjusted odds ratio (CI)	<i>P</i> -value
Head injury					
Yes	22 (14.7)	128 (85.3)	150	27.6 (11.8–62.3)	<0.001
No	6 (0.6)	962 (99.4)	968		
Multiple injuries					
Yes	20 (4.9)	385 (95.1)	405	4.5 (2.0–10.5)	<0.001
No	8 (1.1)	705 (98.9)	713		

Table 4: Mortality among motorcyclists with severe traumatic brain injuries

Variable	<i>B</i>	Odds ratio (CI)	<i>P</i> -value
Injury-presentation-interval (in h)	1.176	3.25 (1.1–10.0)	0.04
Injury Severity Score	0.159	1.172 (1.07–1.28)	<0.001
Age	0.092	1.097 (1.013–1.188)	0.023
Systolic blood pressure	0.063	1.07 (1.106–1.025)	0.001
Multiple injuries	0.71	2.04 (0.15–26.8)	0.589
Glasgow Coma Scale	0.254	1.31 (0.59–1.01)	0.054
Alcohol	2.04	7.70 (0.43–136.8)	0.165
Cause	–704	0.50 (0.11–2.2)	0.356

Logistic regression was performed to assess the impact of several factors on mortality [Table 4]. The model was statistically significant ($P < 0.001$), indicating that the model could differentiate between patients who died and those who survived. The model explained between 13.2% (Cox and Snell R^2) and 81.1% (Nagelkerke R^2) of the variance in mortality and correctly classified 99.4% of the cases. Four of the independent variables contributed to the model in a statistically significant way (injury-presentation-interval, ISS, age, and systolic blood pressure). The strongest predictor of mortality was injury-presentation-interval. It has an OR of 3.25, which means that for every hour delay in bringing the patient to the hospital, the odds of the patient dying increased by 3.25 times.

Discussion

While some of the findings in this study, such as injury prevalence, sex involvement, modal age of involvement, and mortality, are similar to or within the ranges of findings in other studies,^[19–24] there are some distinct patterns in the findings in this study, which may indicate a changing pattern in the epidemiology of traumatic injuries in our study location.

The first is the role of RTCs in the mechanism of traumatic injuries. RTC was the most common cause of injury in this study, as it was in most hospital-based studies from the developing world.^[7,8,19] However, the proportion of injuries due to RTCs (75.8%) is one of the highest ever reported. In Nigeria, the proportion of injuries caused by RTC has gradually increased over time. A 50-year study of all traumatic injuries in Nigeria found that the proportion of trauma caused by RTCs climbed from 37.5% in the decade and a half before 1980 to 72.3% in 2000–2009, with an overall mean of 54%.^[7] This contrasts with research from the

UK and the USA, which found a decline in the importance of RTCs as a cause of hospital visits and admissions.^[25,26] The implication of this finding is considerable. It suggests that a high proportion of hospital visits in this study could have been avoided if there had been no RTCs, resulting in a decrease in death, injury, grief, and economic costs to people and the government. As a result, the government should place a high priority on the prevention of RTCs in the country.

The second point, which is still about RTCs, is the relative importance of motorcycle crashes as a cause of RTCs. Motorcycle crashes caused more traumatic injuries than all other major causes of traumatic injuries put together. This is in keeping with the trend of motorcycle injuries in Nigeria. Motorcycle crashes were responsible for 36.3% of all injuries in Nigeria between 2001 and 2010, up from 6.2% in the 1970s.^[7] As a result, the 55.6% recorded in this study fits with the growing trend of motorcycle crashes as a course of traumatic injuries. Furthermore, the study found that helmet usage was quite low. This is concerning because numerous studies have shown that helmets play a very important role in the prevention of head injuries.^[27] To lower the incidence of motorcycle crash-related head injuries, the government must enforce the country's current toothless helmet regulation.

The third point is the rise of assault to the second place as a cause of traumatic injury visits to hospitals. Over the years, and in several studies, falls have been the second most common cause of traumatic injuries in studies from across the country.^[7,19] A 50-year review of the pattern of injuries across Nigeria showed fall and assault as the second and third leading causes of traumatic injuries across most of the country apart from the northeast and south-south regions of the country, respectively.^[7] There were a number

of possible causes of the rise of assault to the second place in this study. The first explanation could be that the study took place during an electioneering campaign season, when there were clashes among political parties. There were also some communal clashes over land/boundary disputes between communities within the catchment areas of the hospital. Finally, during the study period, there were conflicts between competing groups of road transport workers over leadership of their union. Civil conflicts are known to distort the pattern of trauma and cause spikes in the incidence of trauma.^[28]

The mortality rate in this study was 2.5%, which is within the worldwide range of 0.5–6%.^[5] Head injuries and multiple injuries accounted for more than two-thirds (71.4%) of the deaths. The most important predictor of mortality was the time to treatment. This was similar to findings from Columbia in which time to treatment was a prognostic factor.^[15] Nearly a third of the patients in this study arrives at the hospital more than 6 h after sustaining their injuries. One of the primary reasons for this may be the absence of a proper pre-hospital care system in the setting of the study. In addition, none of the patients in this study was brought by ambulance to the hospital. Previous studies from the same geopolitical zone showed that only 4–5% of trauma patients were transported to the hospitals with ambulances.^[29,30] However, the hospitals in those studies were in more urban areas, and most of the patients transported with ambulances were referrals from other healthcare facilities. Ambulance services are critical components of pre-hospital services, and the lack of such services in the study's settings may have contributed to the late presentations of many cases as well as the mortality observed in the study.

As a predictor of in-hospital mortality, the ISS has received conflicting reviews.^[28] One of the problems with ISS is that incomplete patient evaluation can lead to underestimation of patients' injuries, which can have a significant impact on its utility. This is all too common in LMICs where there are no trauma registries, and documentation is poor due to a lack of facilities to fully investigate patients. There is no perfect trauma score, and it has been argued that improving data collection which should in turn improve registry data accuracy and completeness would make most trauma scoring system more useful.^[15,31]

Given that the mortality rate found in this study is comparable to that observed in other countries, does this suggest that the level of care provided to the patients in this study is comparable to that provided in developed countries? According to available evidence, up to 80% of injury-related deaths occur before patients arrive at a healthcare facility in many resource-poor countries.^[4] In such settings, most patients with severe injuries would have died before reaching hospitals, and the mean ISS of the patients who made it to the hospitals would have been higher than it should have been. This is probably the case in

this study as no patient was transported to the hospital in an ambulance, and close to one-third of the patients arrived in the hospital more than 6 h after sustaining their injuries.

The main limitation of this study is that it is hospital-based. Many trauma patients in Africa may not go to the hospital. Therefore, patients who go to other hospitals, traditional practitioners, or those who do not receive any treatment will be missed. Because patients with less severe injuries are also more likely to treat themselves at home than those with severe injuries; the study may overestimate both injury severity and causes. In the same vein, individuals who died at the scene of injury or before arriving at the hospital are also missed, resulting in an underestimation of injury fatalities.

Conclusion

Our study had shown that RTC was the leading cause of traumatic injuries in our setting. As a result, actions aimed at preventing RTCs may aid in lowering the rate and severity of RTCs. Enforcing existing laws on speed limit, as well as the use of crash helmets and seatbelts, would help to lower the severity of injuries in RTCs. Finally, improving the quality of emergency services such as the training and employment of paramedics and development of trauma systems in our subregion could help to improve injury outcomes.

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Conflicts of interest

There are no conflicts of interest.

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