
Road Traffic Accidents in Port Harcourt, Rivers State: Pattern of Injuries That Caused Death, Risk Factors, Anatomical Sites Affected, and Autopsy Findings

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ABSTRACT

Background: Road traffic accident (RTA) is one of the commonest causes of death among the healthy population and it's among the leading cause of death due to human errors. Globally, it has contributed significantly to reducing the workforce as well as increasing the family expenditure on preventable health conditions. It is grossly underreported with no clear data on annual death reports, especially in most developing countries.

Objectives: To determine the rate of death from a head injury due to road traffic accidents, risk factors; the commonly injured anatomical regions and immediate cause of death from autopsy examination of victims.

Methods: This was a prospective longitudinal study in which 86 victims with CORONER FORM D were sampled recruited for the study. Primary data were obtained using the Crash Report Form (CRF) from the Federal Road Safety Corps, oral interviews from deceased relatives and security personnel who brought the victims, and subsequently, Coroner form D was used to obtain /record the findings of autopsy examination. Data was analysed using Statistical Product and Service Solutions (SPSS) version 25.0 (Armonk, NY).

Results: The rate of death from a head injury due to RTA in Port Harcourt was 48.84%. The mean age of victims examined at autopsy was 28.61 ± 9.22 with a modal age group of 20-29. Majority of the victims were males [52(65.82%)], passengers [36(42%)], had superficial autopsy [32(37.20%)], multiple injuries [40 (46.51%)]. The commonest cause of immediate fatality was head injury (48.8%) followed by haemorrhage and shock 31(36.1%). Over speeding was the most common human risk factor (50%), followed by sleep/fatigue (10%). The commonest mechanical and environmental risk factors identified were brake failure and burst tyres (8%), and potholes (6%) respectively.

Conclusion: The commonest cause of death among victims of RTA in Port Harcourt, Rivers State, Nigeria is head injury. Over speeding, sleep/fatigue, brake failure and burst tyres and pot holes are the risk factors for RTA in Port Harcourt. Measures targeted at controlling these risk factors would help reduce morbidity and mortalities associated with RTA.

KEY WORDS: Road traffic Accident; Injuries; Autopsy; Port Harcourt; Rivers State

ARTICLE DETAILS

Published On:
03 March 2022

Available on:
<https://ijmscr.org>

INTRODUCTION

A road traffic accident is one of the commonest and avoidable causes of death in our environment, the world at large[1] and

of public health importance [2]. The challenges of road traffic accidents (RTA) cannot be over-emphasised as various aspects of the physical, social and economic environment are

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adversely affected [3]. Despite the global hazards/risks associated with RTA, it is still neglected by Government, health practitioners, decision-making bodies and policymakers and not given as much attention as it should. Following the industrial revolution of the 19th century which resulted in fundamental changes in the transport sector and provided more flexibility of direction, speed and timing, road traffic accidents have assumed an upward swing taking their tolls on both human and material properties[4, 5].

Concerns of the spate of fatal car accidents compelled stakeholders into road safety management including the United Nations Assembly to seek alternative means of curbing fatalities on the road. On May 11 2011, the UN adopted the period 2011-2020 as the UN decade of Action for Road Safety with the goal of stability and then reducing global road fatalities by 2020. According to the UN, lives would be saved through the decade of action for road safety[4, 6].

Worthy to note that after the UN declaration in 2011, the Federal Road Safety Commission (FRSC), which was established through Decree 45 of 1988 and empowered to reduce mishaps on the road, set out to adopt and domesticate the UN action plan by developing several programmes suitable for every road user[6, 7]. Despite concerted efforts in reducing fatal car accidents, Africa and indeed Nigeria remained one of the worst hits; Nigeria as the most populous black nation in the world has a total land mass area of 910,771square kilometres and a human population of over 170 million with a high level of the vehicular population estimated at over 8 million and a poor road network has suffered from loss of manpower and economy due to road traffic accident[6].

Trauma, which is the most common outcome from RTA, has been termed the neglected disease of modern society. It is among the leading causes of death in all age groups. Each year it is estimated that about 5.8 million people worldwide die as a result of trauma, resulting from RTA with 90% of these deaths occurring in middle and low-income countries. This represents about 10% of the world's deaths, more than the deaths recorded for malaria, tuberculosis and HIV/AIDS combined [8, 9]. In Africa, death due to road traffic accidents has been on the increase over the last three decades. According to the 2015 global status report on road safety, Africa has the highest fatalities on roads worldwide at 26.6% per 100,000 populations in 2013[5, 10].

In Nigeria, injuries and deaths resulting from RTA are on the rise[11-13]. It constitutes the 3rd leading cause of death generally, and the leading cause of trauma death. It is estimated that about 80 billion naira is lost to RTA annually[2, 5, 14]

Death resulting from trauma (due to RTA), is prevalent in victims below the age of 45 and depends on the organ or anatomical site affected. This age bracket happens to represent the most active and productive segment of society

and this subsequently has a negative effect resulting in a social, economic and psychological imbalance as survivors tend to lose their economic relevance due to challenges resulting from trauma arising from RTA.

Collating data from trauma mortality due to RTA is a useful tool that could be utilised by policy makers and agencies in formulating policies that would address accident prevention and management. Such policies could be in the enforcement of the use of seat belts, crash helmets and safety gadgets by automobile users.

Many researchers have looked at road traffic accidents from the perspective of their risk factors, prevalence, statistics, cost and burdens. However, only a few if any have studied road traffic accidents from the perspective of injuries/impact in the body which results in death. Port Harcourt records a greater percentage of death from RTA with (over 50%) linked to motorcycle accidents[2, 15]. With an increasing number of accident cases in Port Harcourt, this study is aimed at assessing the patterns of injuries resulting in death amongst victims of Road Traffic Accidents in Port Harcourt; to determine the rate of death, risk factors, common anatomical sites of injury, and immediate cause of death from the autopsy.

MATERIALS AND METHODS

The prospective longitudinal study was carried out in Port Harcourt, Rivers State of Nigeria. Rivers State is one of the thirty- six (36) states of Nigeria. It is located in the southern part of Nigeria in the Niger Delta region. It consists of twenty-three (23) Local Government Areas and three hundred and nineteen (319) political wards. The population of the state is five million, five hundred and twenty-two thousand, five hundred and seventy-five (5,522,575) persons based on the National Population Commission's census report of 2006. Rivers State occupies an area of 37000 square kilometres. It is bounded to the South by the Atlantic Ocean, to the North by Imo and Abia State, to the East by Akwa Ibom State and to the West by Bayelsa and Delta State. Each shore forms part of the West African coastline. Over a third of the state is occupied by water with a low land stretching from Bonny in the South to Ndoni in the North.

Port Harcourt is the capital city of Rivers State. Port Harcourt is an industrial and commercial city with a lot of economic activities with the majority of her citizens as civil servants, businesses men and women. As the oil and gas capital of Nigeria, Port Harcourt is transverse by three major busy roads - the East-West Road, the Port Harcourt -Aba express road and the Port Harcourt-Owerri Road and a host of other internal state roads. There are two teaching hospitals in Port Harcourt, one federal and one state-owned, an international airport, seaports and refineries. The major means of transportation is via taxis, buses, tricycles and private vehicles.

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The study population consists of all deceased from road traffic injuries within the period of study irrespective of their age, sex, marital status, religion, occupation and educational status.

Inclusion criteria were: All those that died due to road traffic accident within the time of the study that had Coroner form D served and autopsies done; all deceased bodies that were included in the road traffic crash report form and had an autopsy done.

A minimum sample size of 86 was used. This was calculated using the Cochran formula,

$$\text{Sample size}(n) = \frac{Z^2 \times P \times Q}{E^2}$$

Where n = Minimum sample size

Z= Standard normal variate at 95% confidence interval =1.96

P= Prevalence of 5.7% (derived from the previous study in Jos, Nigeria)⁵⁶

Q= 1-P =0.943

E = Margin of error set at 5%

Substituting we have

$$n = \frac{3.8416 \times 0.057 \times (1-0.057)}{0.0025} \\ n = 82.5$$

Data was collected for the dead as they are brought in or as they occur.

Autopsy procedure: Thorough autopsies which involved external and internal examinations were done with the body lying supine. On external examination, the bodies were cleaned; pallor, cyanosis and external injuries were carefully noted and documented such as tyre marks, impact sites, open and closed fractures. On internal examination, midline Y-incisions were made and body cavities opened up, haemorrhages, ruptured viscus and fractured bones were noted, using the modified Virchow technique, organs were removed one after the other and carefully examined for lacerated injuries and or crushed injuries which were documented with special emphasis on fatal injuries.

Data collection: Data were collected using the coroner form D from which information such as age, sex, tribe, religion, occupation, marital status, medical cause of death and anatomic region of injury were obtained. Additional information was collected from the Crash Report Forms of the Federal Road Safety Corps (FRSC) in which date, time of the accident, cause of accident, vehicle and collision type were sorted out, where cause of accident was due to speed; speed was calculated using the formula $v = \sqrt{20l}$

$$v = \sqrt{20l}$$

Where v = speed, l = skid marks obtained at the scene of the accident

The Nigerian Highway Code for speed limit is 100 kilometres per hour for vehicles on highway and expressways and 50 kilometres per hour for intra-city vehicles, above this limit, is termed over speeding. Other information such as the lifestyle of the deceased, existing medical conditions (e.g., hypertension, diabetes) and history of alcohol or substance abuse were obtained by interviewing relatives of the deceased were possible.

Data were also collected at autopsy examinations at the University of Port Harcourt Teaching Hospital and Rivers States University Teaching Hospital, in which the body of the dead was classified into different anatomical regions (head and neck injuries, chest injuries, abdominopelvic injuries, fractures and haemorrhages) to assess the affected sites or combinations of sites that led to death at autopsy examinations. Fluids from the vitreous humour of the eye and the ventricular chambers of the heart were sent for chemical analysis for any drug or alcoholic beverage overdose. The blood alcohol level greater than 0.05g (50mg in every 100ml) of blood is termed drunk driving.

Data were carefully coded as numbers and entered into an excel sheet for accuracy and easy analysis and then entered into the Statistical Package for Social Science (SPSS) version 25.0 (Armonk, NY) software for analysis. Categorical variables were analysed using descriptive statistics (i.e., frequency and percentages) while continuous variables were summarised as mean with standard deviation (symmetrical data)

Ethical approval to carry out this study was obtained from the ethical committee of the University of Port Harcourt Teaching Hospital before the commencement of the study. Consent for autopsy was obtained from relatives. Coroner Forms D were made available by the state coroner. Deceased relatives were also assured that findings of the outcome would be made available only to the police or family relatives.

RESULTS

Table 1 shows the sex and age characteristics of study participants. A total of 86 victims of RTA underwent autopsy examination. Of these, 55 cases (64%) and 31 cases (36%) were males and females respectively; giving a male to female ratio of 2:1. Of the 86 cases, only 65 of them had their ages stated and the mean age \pm SD was 28.61 ± 9.22 . The modal age group was 20-29 years range (the 3rd decade of life) followed by the 30-39 years range (Table 1).

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Table 1. Sex and age distribution of the study subjects

Variable	Category	Frequency	Percentage
Sex (n=86)	Male	55	64.0
	Female	31	36.0
Age (n=65)	Minimum	3	
	Maximum	56	
	Mean ± SD	28.61 ± 9.22	
	Under 10	13	15.1
	10-19	10	11.6
	20-29	18	20.9
	30-39	15	17.4
	40-49	7	8.1
	≥ 50	2	2.3
	Unknown	21	24.4

The majority of the deaths occurred among passengers 36 (42%), followed by drivers of vehicles, trucks and tricycles 25 (29%) and pedestrians constitute 18(21%) (Figure 1).

Table 2 shows the sex distribution of the victims RTA. Most [52 (65.82%)] of the deaths occurred in males compared to females (Table 2).

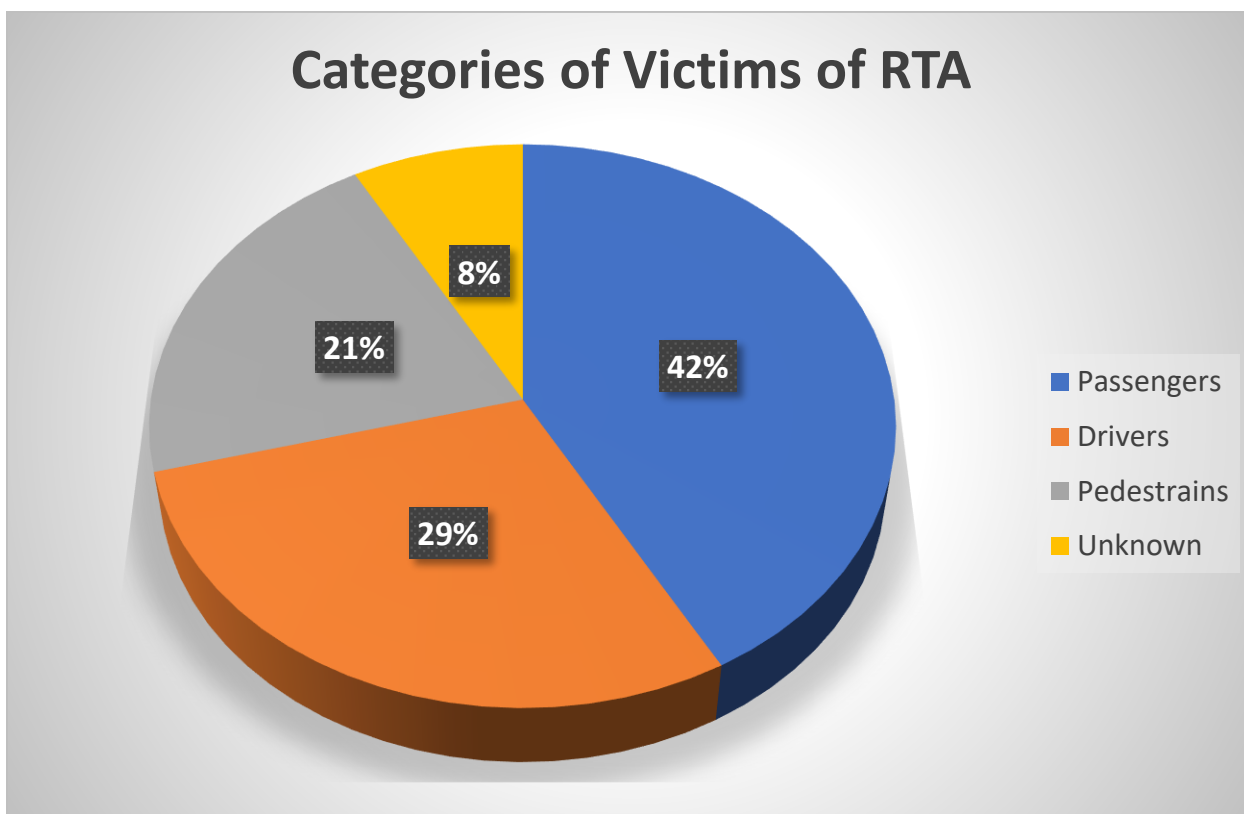


Figure 1. Categories of victims of road traffic accidents

Table 2. Sex distribution based on categories of victims

Categories of Victims (n=79)	Sex		Total
	Males (%)	Females (%)	
Passengers	17(47.2)	19(52.8)	36(100)
Drivers	23 (92.0)	2(8.0)	25(100)
Pedestrians	10(55.6)	8(44.4)	18(100)
Total	52 (65.8)	27(34.2)	79 (100)

Over speeding was the most common risk factor for RTA in Port Harcourt; accounting for 50% of cases (Figure 2) The

most common risk fact for RTA identified was over speeding [43 (50%)]. Human factors (67%) in the causation of RTA

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include over speeding (50%), drunk driving (7%) and fatigue/sleep (10%). Environmental factors were mainly due

to potholes and constituted 6%. Mechanical faults were mainly burst tyres and failed brake 7 (10%) each.

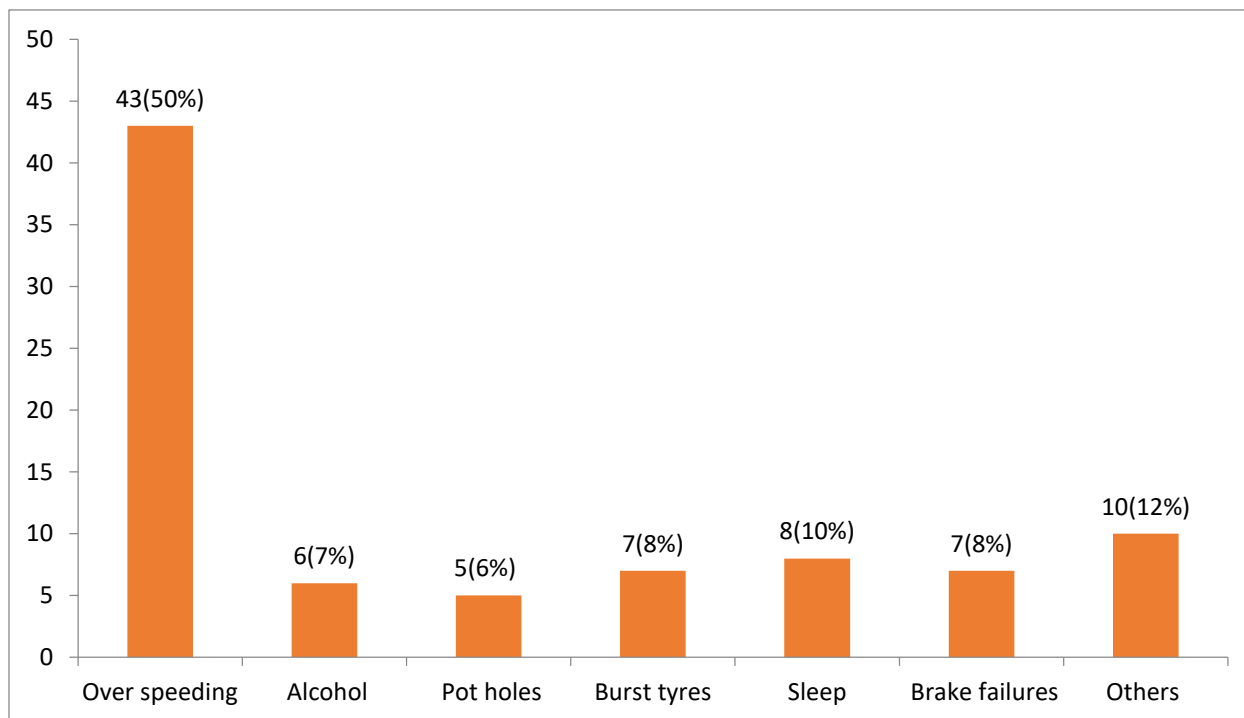


Figure 2. Risk factors for RTA in Port Harcourt.

Table 3 shows the distribution of RTI according to different parts of the body. The majority of the study subjects had multiple injuries 40 (46.51%). This was followed by head, neck and spinal injuries 28(32.55%). Of the 18 pedestrians that had multiple injuries, 16 had injuries to their head, neck,

the limb while 2 had abdominal, pelvic and limbs injuries. Twelve (12) of drivers had multiple injuries especially to the head and limbs, while 10 passengers had multiple injuries to the head, chest and limbs.

Table 3. Distribution of injuries according to the anatomical regions of the body following RTA

Anatomical regions	Categories of victims			No of cases (%)
	Passengers	Drivers	Pedestrians	
Head, neck and spinal injury	10	18	0	28 (32.55)
Chest injury with ribs fracture	1	6	0	7(8.13)
Abdominal injury	2	2	0	4(4.65)
Pelvic injury	2	0	0	2(2.32)
Multiple injuries (including limbs)	10	12	18	40(46.51)
Others (from superficial autopsies)	3	2	0	5(5.81)
Total	28	40	18	86(100)

Eighteen (18) of the 28 that had combined head, neck and spinal injuries were drivers especially of tricycles and motorbikes, while 10 were passengers. Of the 7 victims with a chest injury, 6 were drivers and 1 was a passenger. Two (2)

drivers and 2 passengers had injuries to the abdomen with a laceration of the viscus.

Of the 86 cases that had an autopsy, 32 (15 females and 17 males), 29 (9 females and 22 males) and 25(9 females and 16

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males) were superficial (external inspection), full and limited (only a body compartment, usually head) autopsies respectively (Figure 3).

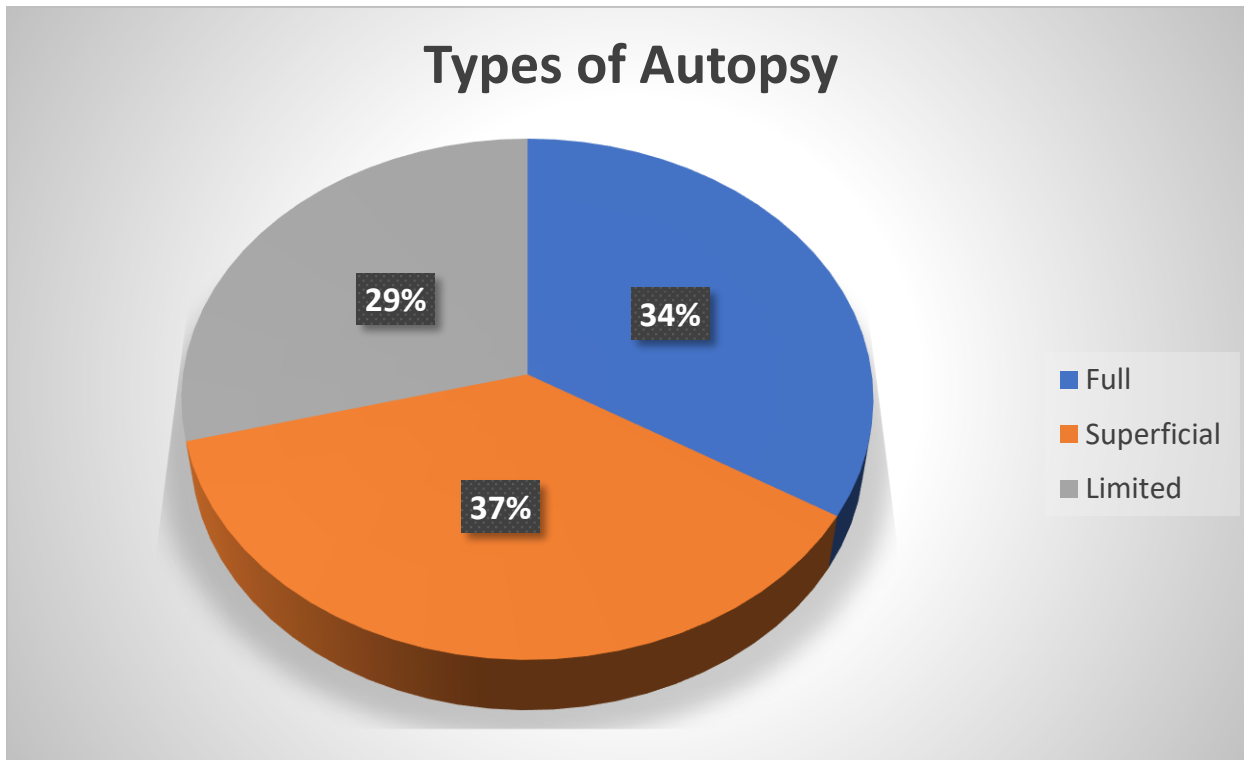


Figure 3. Types of Autopsies

With regards to the immediate cause of death, 42 cases (48.8%) were due to head injury. Of these, pedestrians were 12, drivers were 18 and passengers were 12 cases. Of the 31 cases of victims that died from haemorrhage and shock, 17

cases were passengers, 6 cases were drivers and 8 cases were pedestrians. Death due to asphyxia were 4 cases (1 driver and 3 passengers) [Table 4].

Table 4. The immediate cause of death following a road traffic accident

Variable	Frequency (n=86)	Percentage
Head injury	42	48.8
Haemorrhage and Shock	31	36.1
Asphyxia	4	4.6
Sepsis	2	2.3
Pulmonary embolism	1	1.1
Others	6	7.0

From autopsy, the most common individual organs injured was femur 12(16.9%) followed by tibia/fibular and ribs (8

cases each) while the least affected organs were the heart and ascending /descending colon 1 and 1 respectively (Table 4)

Table 4.4: Showing individual organs and tissues injured following RTA discovered during autopsies

S/N	Statement (n=71)	Number	Percentage
1.	Frontal bones fracture	6	8.45
2.	Fracture of the base of the skull	6	8.45
3.	Occipital bone	5	7.04
4.	Rib	8	11.27
5.	Lung laceration	3	4.22
6.	Heart	1	1.41
7.	Spleen	2	2.82

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8.	Liver	3	4.22
9.	Transverse colon	2	2.82
10.	Ascending and descending colon	1	1.41
11.	Ulna/radius	5	7.04
12.	Humerus	7	9.86
13.	Femur	12	16.90
14.	Tibia/fibular	8	11.27
15.	Pelvic bone	2	2.82

DISCUSSION

A total of 86 bodies met the inclusion criteria for this study in a year in Port Harcourt. The rate of death from RTA due to head injury in Port Harcourt was 48.8%. The high burden of death due to road traffic accidents is comparable to that seen in Jos Teaching Hospital [16]. The rapid expansion of Port Harcourt city with increased motorization and the poor public transport system could account for the increased rate of RTA recorded in the present study.

The mean age of study subjects was 28.61 ± 9.22 which is similar to the finding of research work done in South Africa [17]. The most common age group involved was 20-29 years followed by 30-39 years. This finding is consistent with those of other studies carried out in parts of Africa and Nigeria [15, 18, 19]. This may be attributed to the fact that these age groups venture out the most for trades, employment and studies and also have behavioural risk-taking abilities that predisposes to RTA. About 24% of the victims brought in either unconscious or dead by 'good Samaritans' or the police following a fatal accident were mainly young adults. Majority of death ($n=55$; 64%) occurred among males compared to females; ratio of approximately 2:1, this agrees with finding of previous study [20] however with varying ratios. This might be because males are more daring and outgoing than females. Also, most of the drivers 92% were males compared to females.

In this study, over speeding ($n=43$; 50%) was the most common human factor in the causation of RTAs. This however corroborates with that of the National Centre for Statistics and Information (NCSI) in Oman [21, 22] where over speeding was the leading risk factor for accidents.

Alcohol contributed to 7% of cases and was detected at autopsies where the victims had a large amount of alcohol in the stomach. Death due to alcohol is much lower in Europe and North America [23-25]. This is because the breath meter is not routinely used in the country. It may therefore be higher than earlier anticipated and may contribute also to over speeding and reckless driving.

The poor nature of the road with pot holes on major roads were also major contributing factors to road traffic injuries and death. This study revealed that pot holes contributed about 6% of the risk factors, which is consistent with the work done in some other Nigerian cities [26, 27].

The distributions of anatomical sites of injury were such that all body parts are affected but the fatalities vary with head,

neck and the multiply injured ranked top in mortalities due to road traffic injuries. In this study, the multiply injured were 40 victims (46.5%) and closely followed by victims that had injuries to the head and neck region (32.5%). The findings are similar to that done in Ilorin [28] where multiple injuries occurred in 51.9% of the patients involving mostly the chest with other parts of the body but in contrast to that seen in Maiduguri and in India where head and neck were the most frequently injured anatomical region of the body (43.4%), followed by the extremities (37%) [29, 30].

Injury to the head accounted for half of all immediate death. Head injury as the major cause of death was noted by several other authors [14, 19, 29]. The lack of the necessary personnel and facilities to initially manage these victims at the scene of the accident may be a major contributory factor to these deaths. Also, most hospitals in Port Harcourt lack basic trauma care amenities and for those that have, affordability by victims who in most cases are conveyed to hospitals by sympathizers/ passers-by becomes difficult. Tricycle usually do not have a restraining gadget and most impacts to the head are usually catastrophic. These factors could have influenced the high rate of head injuries recorded in the present study.

The rate of death from a head injury was 48.8%. This is similar to the findings of other studies in Port Harcourt [19] and Jos [16]. Similar concordance is seen with several international studies done on this subject matter, however, on a smaller percentage [18, 31-33]. Since death from RTA is commonly associated with the head, it is instructive to enforce means and measures of protecting it while driving and establishment of trauma support centres.

Haemorrhage and shock accounted for a high number of ($n=31$; 36.12%) cases autopsied and was seen as the main cause of death following severe skeletal and soft tissue injuries from RTA, though, it is twice less common than that observed in Ile-Ife [27]. Despite the availability of a regional blood donor centre and other peripheral blood donor services in Port Harcourt, delays in getting to the hospital largely due to economic reasons and traffic jams may be responsible for this high level of carnage observed due to blood loss. The rate of death from sepsis was lower compared to head injury and haemorrhage shock. This might be due to improvement in the availability of antibiotics in our setting.

The unwillingness of the relatives of the diseased to give consent for autopsy and internal examination, as well as non-

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investigation of all cases of road crashes, were limitations to the study.

CONCLUSION

The prevalence of road traffic accidents is quite high in Port Harcourt with a male to female ratio of 2:1. Head injury is the commonest cause of immediate death among victims of road traffic injuries with a prevalence as high as 48.84% in Port Harcourt with about half of the victims (42 cases) with varying degrees of head injuries. Multiple injuries were seen in most cases studied. Over speeding is the most important risk factor noted in this study.

RECOMMENDATIONS

Death due to the fatal RTA is wholly preventable. As such, continuous education on predisposing factors such as alcohol intake, substance abuse, installation of speed limit monitoring devices by relevant authorities, ensuring zero potholes, punishing both commercial and private drivers who overload their vehicles and weekly publishing of mortality data from RTAs are some measures that would drastically reduce death due to this. Additionally, construction of good roads and repair of bad roads by the Government will assist in reducing mortalities from RTA due to bad roads. Next, the effective and efficient transport of injured victims as soon as possible to the nearest hospital is strongly advised. The teaching of skills, knowledge, understanding and behavioural patterns to enable road users to prevent accidents should be enforced to reduce trauma. Furthermore, the establishment of a regional trauma centre as it is with national hospital Abuja with trained neurosurgeons, the trauma support staff is highly recommended. The attitude of saving life first and paying medical bills later should be encouraged.

Finally, schools (kindergarten, primary and senior secondary) should never be built close to a major highway, where such is built, adequate signage, zebra crossing and speed bumps/regulations should be enforced.

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