

Pattern of Injuries in Fatal Motorcycle Accidents Seen in Lagos State University Teaching Hospital: An Autopsy-Based Study

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Abstract

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BACKGROUND: Deaths from motorcycle accident injuries have remained a major public health issue in Nigeria over the years.

AIM: The study is to determine the age and gender distribution of the victims and to identify the cause of death and the anatomical pattern of injuries seen.

METHODOLOGY: This is a 5-year autopsy-based study of all motorcycle accident deaths seen in Lagos State University Teaching Hospital between December 2009 and November 2014. The data were retrieved from autopsy reports, hospital case notes extracts from police diary and were analysed using SPSS version 20.

RESULTS: Motorcycle accidents accounted for 156 (2.8%) of all the autopsies done (5,661), and 156 (18.4%) of all Road Traffic Accidents (RTA) autopsies (849) performed over the study period, with a male: female ratio of 6:1. The peak age of victims was 31-40 years (30.9%). Head injuries accounted for most (41.4%) of the injuries seen, and the majority of the victims died of craniocerebral injury 53 (50.7%).

CONCLUSION: This study showed that males in the fourth decade of life are the major victims of motorcycle accident death. The majority of the victims were the rider of the motorcycle. Most of them died of the craniocerebral injury.

Introduction

Two-wheeled vehicles are increasing in number across the world especially in developing countries because compared to other vehicles, motorcycles are relatively cheap to own and operate [1]. The mobility, speed and ease of circumventing road traffic hold ups and its ability to navigate through difficult terrains have made the motorcycle a popular means of transportation in major cities and remote areas in Nigeria [1, 2]. The poor state of the roads in the country and the inefficiency of the public transportation system, as well as worsening vehicular congestion and increasing unemployment, are major reasons for the thriving motorcycle transport industry [3]. Increasing use of motorcycles for private and commercial purposes has also been reported in other African countries such as Ghana, Uganda and South Africa [4-6].

Road traffic accident ranks among the leading causes of death in the world; it is projected to become the second leading cause in 2020 after Ischaemic Heart disease [7]. The World Health Organisation (WHO) in its Global status report on road safety 2013, states that 1.24 million people die annually on the world's roads [8]. Compared with passengers on other types of vehicles, motorcyclists are 35 times more likely to die in a road traffic accident per distance travelled [8]. Mortality due to road traffic injuries in Africa is among the highest in the world; it accounts for 28.3 deaths per 100,000 population. In Nigeria, the population burden of road traffic accident is estimated to be 41 per 1000 population, and motorcycle injuries account for over half of road traffic injuries [9]. Motorcyclists are particularly vulnerable to injury because there is little or no protection provided in the event of a crash [10]. Factors such as helmet wearing, use of alcohol and other drugs, inexperience of riders and poor driver training, conspicuity of the motorcycle

and rider, issues of licensure and ownership, riding speed, and risk taking behaviour of riders have been identified as contributory factors to the increased risk of fatal motorcycle crashes [11].

Injury to the head is the leading cause of death in fatal motorcycle crashes [2, 4, 5, 12, 13]. In an autopsy based study in India, Sharma et al reported the following pattern of head injuries; scalp injuries (84.3%), skull fracture (73.1%), subdural haemorrhage (73.8%), subarachnoid haemorrhage (71.6%), cerebral contusion/laceration (58.9%), cerebral oedema (45.5%), epidural haemorrhage (32.8%) and intracerebral haemorrhage (20.9%) [12].

In a study in California USA, Kraus et al. reported that among fatally injured motorcycle accident victims, head injury constituted 56% [13]. In another autopsy study, Wyatt reported that skull fracture with brain stem laceration accounted for 16.6% of unsurvivable head injuries seen in motorcycle crash victims [14]. The most common head injuries are concussions, followed by brain contusions or haemorrhage, facial fractures, and skull fractures [14].

Chest and abdominal injuries are also commonly seen in fatal motorcycle accidents [2, 15]. Some studies have also reported a high frequency of lower extremity injuries which commonly includes fractures of the long bones as well as soft tissue and vascular injuries [2, 4, 5, 16]. Injuries to the spine and the pelvis have also been reported in fatally injured victims of motorcycle crashes [2, 17, 18].

This paper aims to determine the epidemiology of motorcycle accidents and the forensic analysis of the patterns of injuries in fatal motorcycle accidents in Lagos, Nigeria.

Material and Methods

This study is a 5-year retrospective descriptive post-mortem study of victims of all the 156 fatal motorcycle accidents seen at the Lagos State University Teaching Hospital (LASUTH), Ikeja, Lagos, from December 2009 to November 2014. LASUTH is a leading tertiary institution in Lagos, South-West Nigeria, located in Ikeja central zone of Lagos and provides medical services to inhabitants of Lagos, Nigeria's commercial capital and contiguous states.

In Lagos State, deaths from accidents are reportable, and bodies of victims are deposited in the LASUTH morgue which is the main designated centre for coroner's autopsies. All deaths due to motorcycle accidents, being coroner's cases are usually accompanied by a duly signed order from a Coroner, requesting for an autopsy to be performed on the body. The coroner's papers contain information such

as the name of the deceased (if known), sex, age, and residential address, place where the body was found and a report of the accident as documented in the extract from the police diary. Also, family members sometimes provide bio-data of the deceased as well as other useful information concerning the circumstances of death. The records of all deaths resulting from motorcycle accidents were extracted from the autopsy registers; further information was recovered from autopsy reports, hospital case notes, where applicable, extract from police diary.

The subjects in this study were the dead motorcycle riders, pillion passengers, and pedestrians hit by motorcycles and include those brought in dead and those who died within a period of 30 days of hospitalisation as applicable in the United States of America, Australia, United Kingdom, New Zealand and France [19] consisting of 59 brought in dead patients as well as the 83 who died in the hospital out of which 77 of them died within the first 24 hours of admission.

The pattern of injuries was classified according to the various anatomical regions namely: head, thorax, abdomen, upper extremities, lower extremities, pelvis and the spine.

The data retrieved were analysed using the IBM Statistical Package for Social Sciences (SPSS) version 20, and the results were presented in percentages, tables, pie charts and bar chart.

Results

A total of 156 of the cases were deaths due to motorcycle accidents out of 5,661 autopsies performed in the Department of Pathology and Forensic Medicine, LASUTH over the study period of 5 years from December 2009 to November 2014, the incidence of motorcycle accident deaths seen at autopsy is 2.8%. This also represents 18.4% of the 849 autopsies done for deaths due to Road Traffic Accidents (RTA). Fourteen cases were excluded due to incomplete data and, remaining 142 cases used for this study.

Table 1: Table showing gender and age of victims

| Parameter | Number | Percentage |
|---------------------|--------|------------|
| Gender | | |
| Male | 122 | 85.9 |
| Female | 20 | 14.1 |
| Age category(years) | | |
| 1-10 | 4 | 2.8 |
| 11-20 | 9 | 6.3 |
| 21-30 | 37 | 26.1 |
| 31-40 | 42 | 29.6 |
| 41-50 | 29 | 20.4 |
| 51-60 | 11 | 7.8 |
| Above 60 | 10 | 7.0 |

There were 122 (86%) males and 20 (14%)

females with Male: Female ratio of 6:1. The peak age group was 31- 40 years with 42 (29.6%) cases followed by 21-30 years group with 37 (26.1%) cases. Only 4 cases and 10 cases were seen in the extremes of life which are (Table 1).

Table 2: Table showing age distribution within gender

| Age Category in years | Gender (%) | | Total |
|-----------------------|--------------|-------------|--------------|
| | Male | Female | |
| 1-10 | 1 (0.8%) | 3 (15.0%) | 4 (2.8%) |
| 11-20 | 7 (5.7%) | 2 (10.0%) | 9 (6.3%) |
| 21-30 | 33 (27.0%) | 4 (20.0%) | 37 (26.1%) |
| 31-40 | 37 (30.3%) | 5 (25.0%) | 42 (29.6%) |
| 41-50 | 27 (22.1%) | 2 (10.0%) | 29 (20.4%) |
| 51-60 | 9 (7.4%) | 2 (10.0%) | 11 (7.7%) |
| Above 60 | 8 (6.6%) | 2 (10.0%) | 10 (7.0%) |
| Total | 122 (100.0%) | 20 (100.0%) | 142 (100.0%) |

Table 2 shows that most deaths among both genders occurred in the 31-40 years age group; this is followed by the 21-30 years group. For males, the least incidence of motorcycle accident death occurred in the 1-10 years age bracket (0.8%), while females in the 11-20 years, 41-50, 50-60 and above 60 years age groups all have the same incidence rate of 10% which were the lowest observed for females in the study.

Figure 1 shows that majority of the victims 67 (47.2%) were Motorcycle riders, followed by pillion passengers who accounted for 48 (33.8%), while the remaining 27 (19.0%) of the victims were pedestrians.

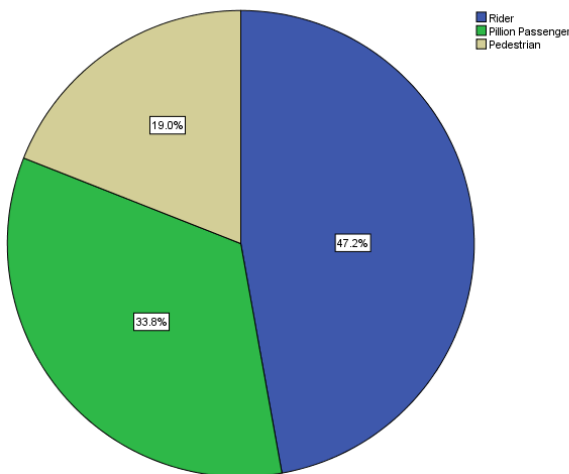


Figure 1: Pie chart showing status of the motorcycle accident victims at the time of accident

The bar chart shows that craniocerebral injury was the cause of death in the majority of the victims, 72 (50.7%), while septicaemia accounted for only 6 (4.2%) of all deaths.

Analysis of head injuries shows that skull fracture was the commonest form of injury seen (32.7%), which comprises fracture of the vault (19.5%) and fracture of the base of the skull (13.2%). This was followed by abrasions and lacerations to the scalp and face, which accounted for 30.5% (Table 3).

Table 3: Table showing analysis of head, chest and abdominal injuries

| Region | Number of injuries | Percentage |
|---|--------------------|------------|
| Head | | |
| Abrasion/laceration | 116 | 30.5 |
| Skull fracture (vault) | 74 | 19.5 |
| Skull fracture (base) | 50 | 13.2 |
| Intracranial haemorrhage | 84 | 22.1 |
| Brain injuries (contusion and laceration) | 56 | 14.7 |
| Total | 380 | 100.0 |
| Thorax (chest) | | |
| Abrasion/laceration | 36 | 29.3 |
| Lung laceration | 22 | 17.4 |
| Heart laceration | 5 | 4.3 |
| Vascular (aorta and jugular) | 3 | 2.2 |
| Rib fracture | 58 | 46.7 |
| Total | 124 | 100.0 |
| Abdomen | | |
| Abrasion/laceration | 44 | 51.5 |
| Liver laceration | 14 | 16.7 |
| Splenic laceration | 12 | 13.6 |
| Kidney laceration | 6 | 7.6 |
| Bowel perforation | 9 | 10.6 |
| Total | 85 | 100.0 |

Abrasions were the commonest injury seen in the upper and lower extremity, followed by fracture of the humerus and ulna and tibia and fibula respectively. The majority of pelvic injuries were fractures (58.1%), while 41.9% were vascular injuries. Fracture of the thoracic vertebrae was the most frequent spinal injury seen (Table 4).

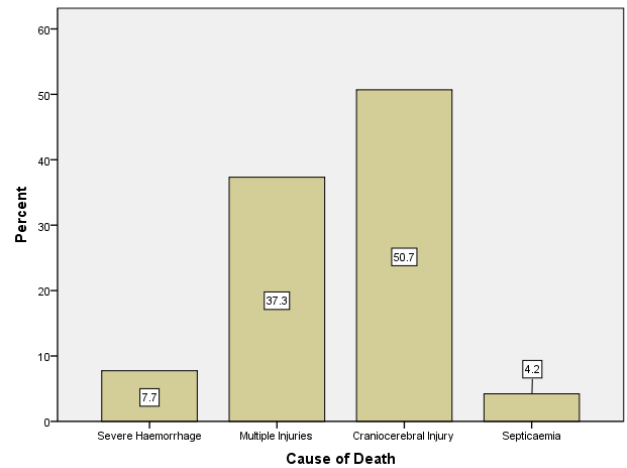


Figure 2: Bar chart showing cause of death

Discussion

The peak age group for motorcycle accidents death in this study was 31-40 years. This age group is older than the peak age group of 20-30 years reported by Nwadiaro et al. in Jos and Solagberu et al. in Ilorin [2, 16]. Studies in Ghana, Uganda and South Africa also showed a peak age group of 20-30 years [4-6]. The plausible reason for the higher rate of motorcycle accident deaths among individuals in the 31-40 years seen in this study compared to others may be because majority of the active unemployed people in Nigeria are in 31-40 years age group, and many of

them migrate to Lagos from different parts of the country to venture into commercial motorcycle riding to eke a living for themselves.

Table 4: Table showing analysis of extremity, pelvic and spinal injuries

| Region | Number of injuries | Percentage |
|---|--------------------|------------|
| Upper limb | | |
| Humeral fracture | 8 | 8.3 |
| Ulna/radius fracture | 1 | 1.1 |
| Abrasion/laceration | 87 | 90.6 |
| Total | 96 | 100.0 |
| Lower limb | | |
| Femur fracture | 22 | 13.2 |
| Tibia/fibula fracture | 30 | 17.9 |
| Vascular (femoral vessel - 5) (tibia vessel - 7) | 12 | 7.2 |
| Abrasion/laceration | 103 | 61.7 |
| Total | 167 | 100.0 |
| Pelvis | | |
| Fracture | 25 | 58.1 |
| Vascular | 18 | 41.9 |
| Total | 43 | 100.0 |
| Spine | | |
| Cervical fracture | 1 | 4.5 |
| Thoracic fracture | 9 | 40.9 |
| Lumbar fracture | 6 | 27.3 |
| Spinal cord transection | 6 | 27.3 |
| Total | 22 | 100.0 |

A huge majority of motorcycle accident victims in this study were males (86%). This is similar to the findings in studies done in Jos (82.7%), and Ilorin (88.4%) [2, 16]. An overwhelming male preponderance of between 87.9% and 90.8% were reported in studies in other parts of the world [12, 20]. This globally reported male preponderance among victims of motorcycle accidents might be attributable to the fact that males are the bread winners of families in most developing countries, and are therefore more likely to take to commercial motorcycle riding to make ends meet. Sharman B. R et al in India opined that motorcycle accident deaths among females were mainly due to the act that nearly all female pillion riders sit sideways with both legs to the left of the vehicle because the common mode of dress, the sari, prevents them from sitting astride and they do not wear helmets [12].

The majority of the victims were motorcycle riders (47.2%), followed by the passengers (33.8%) and then the pedestrians (19.0%). The increased likelihood of motorcycle occupants (riders and pillion passengers) to die in the event of a crash is because there is no protection over the inherently unstable motorcycle, and the full impact of a crash is transmitted to the occupant resulting in a likely fatal outcome especially in those who do not adhere to safety measures. The high susceptibility of pedestrians to motorcycle accident injuries seen in this study may be because there are no designated pedestrian walk ways in many roads in Lagos, and as such pedestrians walk along the road thereby exposing them to impact from a motorcycle in the event of a crash.

This study showed that the head was the most commonly injured part of the body in victims of fatal motorcycle accidents seen at autopsy. Head injury accounted for 41.4% of all the injuries seen. This finding is similar to that of Nwadiaro et al. who

reported that head injury constituted 40.1% of the injuries in a clinical-based study in Jos [2]. Studies in Ghana by Kudebong et al. and Uganda by Kigera and Naddumba also showed that head injury was the commonest type of injury, accounting for 32.2% and 20.0% respectively [4, 5]. The smaller figure reported in Ghana and Uganda when compared to this study may be due to a higher level of helmet use in those countries. Heydari et al. in a study in the Fars province in Iran observed that the head was the most frequently injured site (87.8%) [21]. They opined that helmet use among motorcycle occupants was very low in that area and that may readily explain this high level of head injury seen in that study.

The most common thoracic injury in this study was rib fracture (46.7%). This is close to 40.3% reported by Sharma in Northern India [12], and 45.9% reported by Kraus et al. in the US [15].

Analysis of the pattern of abdominal injuries in this study showed that lacerations to the liver were the most frequent visceral injury (16.7%), followed by injuries to the spleen and kidney which accounted for 13.6% and 7.6% respectively. Bowel perforation constituted only 10.6%. This general pattern is similar to the observation by Sharma in India, who reported the following pattern of abdominal injuries; liver laceration (27.6%), splenic laceration (20.1%), kidney rupture (10.4%) and intestinal perforation (4.5%) [12]. Similarly, Kraus et al. in the U.S reported that liver laceration was the commonest type of intra-abdominal injury in a fatal motorcycle accident, representing 31.8% [15]. This was followed by spleen laceration, kidney laceration and intestinal perforation which constituted 21.8%, 9.1% and 1.1% respectively. The susceptibility of the liver, spleen and kidney to injury may be because these visceral organs are fixed and as such are susceptible to trauma which is transmitted through the relatively weak anterior abdominal wall. This observation calls for the need for the use of protective apparel for the trunk in motorcycle occupants.

Upper extremity injuries accounted for 10.5% in this study. This is very similar to the finding by Heydari et al. which was 9.8% [21]. This study showed that fracture of the humerus accounted for 8.3%, a figure very close to 9.7% reported by Sharma et al. in India [12]. Lower extremity injuries accounted for 18.2% of the injuries seen in this study, comparable with 14.8% reported by Heydari et al. [21]. On the other hand, Solagberu et al. reported that lower extremity was the most frequently injured part of the body in motorcycle accidents, representing 70.5% [16]. The reason for the higher figure reported by Solagberu et al. may be because the study was done on subjects in an orthopaedic surgery unit who were alive and being managed mostly for limb bone fractures. The reason for the high vulnerability of the extremity to injury in motorcycle accidents may be that the extremities are exposed, and as such, they are sites of impact during a crash. Injuries to the vertebral

spine accounted for only 2.4% of injuries in this study. This is similar to findings by Kraus [15] in the US and Heydari et al. [21] in Iran who reported incidences of 3.1% and 2.4 % respectively.

This study revealed that majority of the victims, 72 (50.7%) died of Craniocerebral injuries. This is consistent with the findings in some studies from within Nigeria and from other parts of the world with frequency ranging from 33.3% to 87.8% [21-23]. Although head injuries were seen in the majority of the victims, making it the most common pattern recorded, it only accounted for death in about half of the subjects. The head is perhaps the most vulnerable site of fatal injury in the event of a motorcycle accident, especially in the setting of poor compliance with helmet use. Nzegwu et al. in Benin City observed that none of the dead victims in their study wore a crash helmet at the time of the accident [24].

In conclusion, this study showed that the vast majority of victims who died from injuries sustained in motorcycle crashes were males, with a male to female ratio of 6:1. Most deaths from motorcycle accidents were seen in the 4th decade of life majorly the riders. Head injury was the most common injury sustained, and the craniocerebral injury was the major cause of death in motorcycle accidents.

The findings in this study bring to the fore, the fact that motorcycle accident injury deaths are a serious public health issue, and the demographics of the victims also calls for concern as these are mostly individuals that make up the majority of the nation's workforce. The fact that majority of victims die of head injuries also signals the need for more research efforts geared towards head protection for motorcycle riders and passengers. We also recommend that the government should create walkways to reduce the death by pedestrians.

References

- Aderamo AJ, Olatujoye S. Trends in motorcycle accidents in Lokoja, Nigeria. *Eur Int J Sci Technol.* 2013; 2: 251-261.
- Nwadiaro HC, Ekwe K.K, Akpayak IC, Shitta H. Motorcycle injuries in north central Nigeria. *Niger J Clin Pract.* 2011; 14: 186-189. <https://doi.org/10.4103/1119-3077.84012> PMID:21860137
- Olubomehin OO. The development and impact of motorcycles as means of transportation in Nigeria. *Res Humanities and Soc Sci.* 2012; 2: 231-239.
- Kudebong M, Wurapa F, Aikins M. Economic burden of motorcycle accidents in northern Ghana. *Ghana Med J.* 2011; 45: 135-142. PMID:22359418 PMCid:PMC3283097
- Kigera JNM and Naddumba EK. Patterns of injuries after road traffic crashes involving Bodabodas. *Ann Afr Surg.* 2010; 5:12-15. <https://doi.org/10.4314/aas.v5i1.53705>
- Dall G. The incidence of motorcycle accidents in South Africa-an alarming increase. *SA Med J.* 1983; 64: 161-163. PMID:6867894
- World Health Organisation. 10 facts on global road safety [Internet]. Available from: <http://www.who.int/features/factfiles/roadsafety/en/>. (Cited 2014, May 4)
- National Highway Traffic Safety Administration. Traffic Safety Facts 2007: Motorcycles. National Highway Traffic Safety Administration. Washington DC; Report No: DOT HS 810 990, 2007.
- Labinjo M, Juillard C, Kobusingye OC, Hyder AA. The burden of road traffic injuries in Nigeria: results of a population-based survey. *Inj Prev.* 2009; 15: 157-62. <https://doi.org/10.1136/ip.2008.020255> PMID:19494094
- Kerns T, McCullough CA. An analysis of Hospitalised motorcyclists in the state of Maryland based on Helmet use and outcome. National Highway Traffic Safety Administration, Washington DC, 2008; Paper No 09-0061.
- Lin LR, Kraus JF. A review of risk factors and pattern of motorcycle injuries. *Accid Anal Prev.* 2009; 41: 710-722. <https://doi.org/10.1016/j.aap.2009.03.010> PMID:19540959
- Sharma BR, Gupta N, Sharma AK, Sharma S. Pattern of fatal motorised two-wheeler crash injuries in Northern India: is safety helmet adequate prevention? *Trends in Med Res.* 2007; 2: 27-36. <https://doi.org/10.3923/tmr.2007.27.36>
- Kraus JF, Rice TM, Peek Asa C, McArthur DL. Facial trauma and the risk of intracranial injury in motorcycle riders. *Ann Emerg Med.* 2003; 41:18-26. <https://doi.org/10.1067/mem.2003.1> PMID:12514678
- Wyatt JP, Donnell JO, Beard D, Busuttill A. Injury analysis of fatal motorcycle collisions in Scotland. *Forensic Sci Int.* 1999; 104: 127-137. [https://doi.org/10.1016/S0379-0738\(99\)00104-8](https://doi.org/10.1016/S0379-0738(99)00104-8)
- Kraus JF, Peek-Asa C, Cryer HG. Incidence, severity and patterns of intra-thoracic and intra-abdominal injuries in motorcycle crashes. *J Trauma.* 2002; 52: 548-553. <https://doi.org/10.1097/00005373-200203000-00022> PMID:11901334
- Solagberu BA, Ofoegbu CKP, Nasir AA, Ogundipe OK, Adekanye AO, Abdurahman LO. Motorcycle injuries in a developing country and the vulnerability of riders, passengers and pedestrians. *Inj Prev.* 2006; 12: 266-268. <https://doi.org/10.1136/ip.2005.011221> PMID:16887951 PMCid:PMC2586788
- Oberoi SS, Aggarwal KK, Bhullar DS, Kumar R. Pattern and distribution of injuries in fatal two-wheeler accidental cases. *J Punjab Acad Forensic Med Toxicol.* 2010; 10: 11-13.
- Emejulu CJ, Ekweogwu C, Nottidge T. The burden of motorcycle related neurotrauma in South-East Nigeria. *J Clin Med Res.* 2009; 1: 013-017.
- Lin MR and Kraus JF. Methodological issues in motorcycle injury epidemiology. *Accid Anal Prev.* 2008; 40: 1653-1660. <https://doi.org/10.1016/j.aap.2008.05.005> PMID:18760092
- Carasco CE, Godinho M, Barros MB, Rizoli S, Fraga GP. Fatal motorcycle crashes: a serious public health problem in Brazil. *World J Emerg Surg.* 2012; 7:S5. <https://doi.org/10.1186/1749-7922-7-S1-S5> PMID:23531421 PMCid:PMC3424925
- Heydari ST, Maharlouei N, Foroutan A, Sarikhani Y, Ghaffarpassand F, Hedjazi S et al. Fatal motorcycle accidents in Fars province in Iran: a community based survey. *Chin J Traumatol.* 2012; 5: 222-227.
- Department of Planning, Transportation and Environment. Road Traffic Accident Statistics 2005, City of Johannesburg, 2007.
- Department for Transport. Reported Road Casualties Great Britain: 2010 Annual Report. Department for Transport, London, UK, 2011.
- Nzegwu MA, Aligbe JU, Banjo AAF, Akhiwu W, Nzegwu CO. Patterns of morbidity and mortality amongst motorcycle riders and their passengers in Benin City, Nigeria: one year review. *Ann Afr Med.* 2009; 7: 82-85. <https://doi.org/10.4103/1596-3519.55675>