The Burden of Non-communicable Disease in Low-Income Countries: A Retrospective Analysis of Casualty Department Injury Patterns in Moshi, Tanzania

By

Erica Casey

Duke Global Health Institute
Duke University

Date: _____

Approved:

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Charles Gerardo, Supervisor

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Nathan Thielman

_____
Florida Muro

Thesis submitted in partial fulfillment of
the requirement for the degree of Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Traumatic injuries represent a significant and growing public health concern in the developing world. Unintentional injuries, in particular, road traffic injuries, contribute significantly to the increasing number of injury victims in low-income countries. The incidence and types of injuries, their impact on patients, families and the broader health care system in the countries of East Africa has received limited attention in public health research. This study examines the number, types, mechanism, and short-term outcomes of injuries in a casualty department patient population at a referral and consultant hospital in the Kilimanjaro Region of Tanzania.

A retrospective chart review of patients presenting to the casualty department at Kilimanjaro Christian Medical Centre was performed. A standardized trauma registry form was used for data collection from the medical records. The study demonstrates that a substantial minority of patients presenting to a Tanzanian referral hospital's casualty department have sustained injury. These data give a consistent and more robust picture of the patient demographics, mechanisms of injury, injury patterns, and patient outcomes from similar settings. Development of a prospective trauma registry will allow for a better understanding of injuries in the Kilimanjaro region, leading to more effective and focused interventions in injury prevention, pre-hospital systems development, and hospital care.

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1. Introduction

1.1 Background

Non-communicable diseases, in particular, injury related disorders, represent a significant and growing disease burden in the developing world. In many low and middle-income countries, injuries now represent one of the leading causes of death in the adult population.[1] Five of the top fifteen causes of mortality in adults aged 15 to 29 years now result from injuries. Estimates of long-term morbidity, as defined by disability associated life years (DALY) resulting from injuries are likewise significant and higher than morbidity caused by either cardiovascular conditions or malignancies in low-income countries, as classified by the World Health Organization (WHO).[2] The impact of injury on children is likewise significant, with UNICEF estimates of childhood mortality attributing more than 90% of injury related fatalities to events in low and middle-income countries.[3]

Road traffic injuries (RTI) result in nearly half of all injuries that occur annually worldwide. They alone consistently rank among the top ten leading causes of disease burden worldwide.[4] An estimated 1.2 million people were killed in road traffic related injuries in 2002 and as many as ten times that had non-fatal road traffic injuries.[5] In 2004, RTI ranked ninth and are projected to increase to the third leading cause by the year 2030. Furthermore, the burden of injury related disease is inequitably distributed globally and as such RTI has become a major public health policy concern in low-income countries.[6,7,8,9,10] While low and middle-income countries comprised only 32% of the world's vehicle ownership in 2000, they accounted for more than 85% of the global

burden of motor vehicle fatalities and 90% of DALY.[7] Increasing numbers of vehicle owners in low-income countries without commensurate improvements in road conditions or pedestrian walkways are likely to compound the disparities between risk of RTI in these settings compared to high-income countries.[11] Indeed, RTI related mortality rates are over thirty times higher in low-income countries compared to those in most high-income countries and fatality rates in children aged 0 to 14 years in low and middle-income countries are an average of six times that of their same aged counterparts in high-income countries.[12]

Likewise, the financial impact of road traffic injuries in low-income countries, not only for individuals who may suffer long term disability, but for the society as a whole, are disproportionately high. The total economic costs amount to as much as 65 billion U.S. dollars, more money than low-income countries receive in total annual financial assistance.13] Injuries pose a significant burden on hospital services; in one Kenyan study, for example, injured patients accounted for between 45 and 75% of surgical ward admissions.[14]

Injury disparities exist, not only between countries, but also across age, gender, and socioeconomic strata within countries. For example, in a Tanzanian study comparing rural and urban populations, 74% of rural survey respondents, versus 28% of urban, reported an injury in the prior year.[15] Furthermore, because RTI typically impact younger adults between 15 and 44 years of age, economic losses due to inability to work and loss of wages can be significant. Because males tend to compose the majority of individuals who are involved in RTI, injuries resulting in ability to work potentially

impact, not only the individual, but also their dependents who are the sole income generators for a family.

Studies in both high and low-income countries suggest disparities in economic status and likelihood of sustaining unintentional injury.[8] Likewise, per capita income by country has been demonstrated to correlate significantly with risk of death from RTI and as a predictor of future trends in RTI mortality.[16] Factors including population density, poorly maintained housing developments, longer travel distances both to work or health-care facilities have been suggested as contributing to the higher proportion of injuries in impoverished populations in low-income countries.[10, 17] Research in the United States has consistently demonstrated increased likelihood of sustaining injury and furthermore of injury related death in lower income and education segments of the population when controlling for factors such as age, race and gender.[18, 19] In low-income countries, pedestrians in low-income countries are consistently more likely to suffer death in road traffic accidents. In Kenya, more than 70% of RTI deaths involved pedestrians.[20] The use of inadequately maintained public walkways or overcrowded public transport vehicles has been correlated with lower education levels, suggesting that individuals with lower socioeconomic status are more at risk for road traffic related injuries.[6]

Despite the disproportionate numbers of death and disabilities caused by injuries in low and middle-income countries, the burden of disease resulting from these events has been largely under-recognized until recently.[21] Moreover, the lack of consistent reporting of injuries leads to significant underestimates of the morbidity and mortality

these events have in many low-income countries.[22] Inadequate mechanisms for reporting combined with poor access to emergency medical care or inability to afford medical evaluation after an injury are likely important contributors to this phenomenon. For example, according to the WHO, less than 5% of RTI victims were transported in an ambulance to a nearby hospital for emergency medical care.[23] Few studies have been performed in low-income countries, in particular in sub-Saharan Africa, which characterize the mechanisms of injury as well as the types of injury sustained in these events. Early data on the epidemiology of injury in East Africa, and specifically in Tanzania, is just emerging and the full scope of the problem is not yet well understood.[15]

Effective injury prevention, patient care and rehabilitation all require a prior understanding of injury epidemiology in order to develop an effective response. William Haddon's concept of the 'epidemiological triangle', illustrating the interactions between the host (injury victim), the agent (type of transport) and the environment (access to pre-hospital care) suggests that conceptualization and research of these key interactions will be essential to developing appropriate injury prevention strategies in low-resource settings.[24]

Injury risk factors such as the high proportion of non-motorized vehicle usage and high-density populations proximal to roadways make prevention methods in low-resource settings a unique challenge. As a result, prevention mechanisms applicable to higher-resource settings may will be ineffective in reducing injury related morbidity and mortality in these settings.[25] Establishing hospital-based data collection systems, as

recommended in the World Health Organization injury surveillance guidelines, may contribute to a fuller understanding of injuries in low-income countries and potential mechanisms for prevention and improved medical services.[26, 27] An improved understanding of injury mechanisms will help contribute to the body of current evidence that key interventions such as seat belt or helmet use laws or development of safe walkways for pedestrians may have significant impact on the burden of injuries in low-income countries.[28] This study evaluates the magnitude and scope of injury related disorders in the population presenting to the casualty department in a large consultant and referral hospital in northern Tanzania.

1.2 Study Design

We performed a retrospective chart review of patients presenting to Kilimanjaro Christian Medical Centre (KCMC) Casualty Department with traumatic injuries. This study received Duke Institutional Review Board exemption from review, KCMC Ethics Committee approval and exemption from review by the Tanzania National Institute of Medical Research.

1.3 Setting

Tanzania is situated in the East African region, bordered in the north by Kenya, in the west by Uganda, the Democratic Republic of Congo, Rwanda, and Burundi, and to the south, Zambia, Malawi, and Mozambique.

Figure 1: Map of Tanzania

Currently 4 consultant specialty hospitals and 17 regional hospitals on the mainland serve a population of over 37 million people. KCMC, located in Moshi, Tanzania, is the third largest hospital in the country, with 500 inpatient beds, and serves as the referral hospital for northeastern Tanzania. In the KCMC Casualty Department, with 6 beds and one resuscitation room containing 2 additional beds, over 15,000 patients are evaluated annually. During the seven months reviewed in the study, approximately 10,622 adult and pediatric patients were evaluated in the department. According the casualty department charting 1224 patients, or 11.6% of the total, presented with injury related complaints. The majority of patients were referred from hospitals, clinics, and

dispensaries in the Kilimanjaro region, for a variety of reasons, including primary surgical or orthopedic care, worsening condition, or due to complications occurring during hospitalization at another facility; 66 different health sites were documented as the transfer facility in the patient's medical record.

1.4 Selection of Patient Records

The casualty department maintains a logbook of every patient presenting for care. All patients presenting to the department with traumatic complaints, as defined by the International Classification of Disease 9th revision (ICD-9): External Causes of Injury E800-E929 and E950-E999, were subject to chart review. Patient records initially identified in the casualty department logbook were excluded from the subsequent analysis if the complete medical record could not be located for review.

1.5 Data Collection

Data abstraction was performed using a standardized data collection form (Appendix A). A second independent abstractor reviewed fifteen percent of the patient charts. To ensure inter-rater reliability, Cohen's kappa coefficients were calculated for each category of the data abstraction tool. Kappa coefficients ranged from 0.985 to 1, indicating near exact agreement between the two reviewers.

The type of injury was initially identified from entries in the casualty department medical record. Of the 10,622 patients presenting to the department during the time period, 1224 patients were identified with injury diagnoses. Two hundred twenty-one patients were excluded from the study if the complete medical record was missing or, if on reviewing the medical record, the patient did not have documentation of injury. After

exclusion of the subset of patients with missing documentation, 1003 medical records were subsequently reviewed.

Mechanism of injury, site of injury by organ system, disposition and outcomes of patients were then documented in the data collection form after review of the complete medical record. Only injuries related to the initial trauma were recorded in the data collection forms, while complications secondary to hospitalization or return visits were not included for analysis. If an injury was suspected based on the casualty logbook documentation, but not definitively identified in the medical record, then it was recorded as no injury. Mortality was defined as a trauma related death prior to arrival to the hospital, death prior to hospital admission and while in the casualty department, or death during hospitalization.

2. Results

2.1 Patient Demographics

During a seven-month time period, dating January 1, 2010 to July 31, 2010, 10,622 patients presented to the casualty ward at KCMC for evaluation and treatment. One thousand two hundred and twenty four patients were identified from the casualty department records with an injury related diagnosis, representing 11.5% of all casualty department visits.

Table 1: Patient Demographics (N = 1003)

Average Age of injured patients: Male (years)	33.1
Average Age of injured patients: Female (years)	39.1
Injuries: Male (As % of total charts reviewed)	73.4%
Injuries: Female (As % of total charts reviewed)	26.6%
Injuries: < 5 years of age (As % of total charts reviewed)	3.6%
Injuries: 5 to 14 years of age (As % of total charts reviewed)	11.5%
Injuries: 15 to 44 years of age (As % of total charts reviewed)	57.8%
Injuries: 45+ years of age (As % of total charts reviewed)	27.1%

Of the 1224 patients initially identified in the casualty records, 1003 medical charts were subsequently reviewed for the study. Two hundred and twenty-one patients were not included for review due to missing medical records or incorrectly documented medical record number. When comparing age, gender, mechanism of injury and organ

system injured, the two hundred twenty one patients with missing medical records were similar to those of the 1003 patients with records available for review.

The mean age of the 1003 injured patients in the population was 34.7 ± 19.9 years (SD). The average injured patient age was younger if male, at 33.1 years, compared to females whose average age was 39.1 years. Males and individuals aged 15 to 44 years represented the largest number of injuries presenting to the hospital for evaluation, at 73.4% and 57.8% respectively.

2.2 Common Injury Mechanisms

Injuries secondary to RTI represented the largest proportion of traumatic events in the patients presenting to the casualty department for medical care.

Table 2: Mechanism of Injury by Age Group (Years)

Mechanism of Injury	<5	5 to 14	15 to 44	45+
RTI (n= 432)	1.6%	4.4%	67.3%	26.6%
Assault (n= 146)	0.7%	3.4%	79.5%	16.4%
Fall (n= 289)	4.9%	25.1%	33.4%	36.6%
Burn (n= 22)	45.5%	9.1%	31.8%	1.4%
Blunt Injury (n= 38)	0.3%	23.7%	52.6%	21.1%
Bite (n= 14)	0.0%	7.1%	78.6%	14.3%
Laceration (n= 15)	0.0%	28.6%	57.1%	14.3%
Poisoning (n= 13)	15.4%	15.4%	46.2%	23.1%
Other (n= 39)	0.0%	0.0%	66.7%	33.3%

Four hundred-thirty two patients, or 42.9%, reported involvement in an RTI as the antecedent cause of injury. Injuries related to a fall and secondary to an assault were the second and third most common mechanisms reported, 28.7% and 14.5%, respectively.

Categorization of RTI by road traffic user suggests that motorcyclists and pedestrians were the two most common populations impacted by these events. In this study, motorcyclists were involved in 24.5% of RTI whereas pedestrians accounted for 17.8% of injury victims (Table 4). 38.7% of the road traffic related injury subjects did not have adequate documentation in the medical record to determine the precise mechanism of injury. Development of prospective trauma registries that would include documentation of mechanism of injury by road user type could provide more information about trends in road traffic usage and on changes in injury patterns in low-income settings.

Table 3: Road Traffic Injuries by Road User Type (as % of all RTI)

Road User Type	% of Total RTI
Private Vehicle	7.6%
Public Transport Vehicle	3.5%
Motorcycle	24.5%
Bicycle	7.9%
Pedestrian	17.8%
Unknown	38.7%

Patients aged 15 to 44 years represented the highest proportion of injuries for all categories except falls and burns. Falls were more common in patients over 45 years of age, representing 36.6% of fall related injuries, whereas burns were most common in the under 5 year age group. Categorization of injuries by gender indicates a distinctively

male majority for nearly all types of injuries. Males accounted for 77.3% of RTI as victims compared to the 22.7% of traffic related injuries in females.

Table 4: Mechanism of Injury by Gender (% of total injury type)

Mechanism of Injury	Male	Female
Road Traffic Injury (n= 432)	77.3%	22.7%
Assault (n= 146)	82.9%	17.1%
Fall (n= 289)	64.7%	35.3%
Burn (n= 22)	59.1%	40.9%
Blunt Injury (n= 38)	81.6%	18.4%
Bite (n= 14)	42.9%	57.1%
Laceration (n= 15)	73.3%	26.7%
Poisoning (n= 13)	46.2%	53.8%
Other (n= 39)	69.2%	30.8%

Likewise, 82.9% presenting to the hospital with injuries secondary to assault were men, whereas 17.1% of females reported assault. Injuries secondary to bite wounds and poisoning were exceptions, with slightly more women than men suffering from these events.

2.3 Injuries by Organ System

Evaluation of organ system injured demonstrates a significant pattern of isolated head and neck or extremity injury. Head injuries accounted for 20.5% of isolated injuries and were involved in 14.8% of patients suffering multi-organ system injury.

Table 5: Injury by Organ System (Isolated vs Multi-Organ System Injury, % of Total Injuries)

Organ System	Isolated injury	Multi-system injury
Head and Neck (n=352)	20.5%	14.8%
Chest (n=117)	4.3%	8.8%
Back (n=23)	1.0%	2.4%
Abdomen (n=53)	2.8%	3.2%
Pelvis (n=61)	1.1%	3.7%
Genito-urinary (n=7)	0.0%	0.7%
Spine (n=14)	1.2%	0.2%
Extremity (n=573)	45.1%	12.7%
Unknown (n=20)	2.0%	-

Likewise, injured extremities accounted for almost half (45.1%) of all isolated traumatic injuries and 12.7% of multi-organ system injuries. Injuries to the trunk (chest, abdomen, back or pelvis) contributed to patient morbidity, though to a lesser extent than head or extremity injuries, accounting for 9.2% of isolated injuries and 18.1% of multi-organ system injuries.

2.4 Common Types of Injury

Classification of injury type based on review of complete patient medical records, including radiologic studies, and intra-operative examination, indicated extremity injuries, in particular fractures, and traumatic brain injuries (TBI), to be the first and

second most common type of injuries, respectively. Fractures of the extremities occurred in 38.3% of injured patients, 77.2% of which were closed injuries.

Table 6: Injury Type (% Total Injuries)

Injury:	%
Traumatic brain injury (n=366)	36.4%
Traumatic brain injury w/ spinal fracture (n=2)	0.2%
Traumatic brain injury w/ extremity fracture (n=54)	5.4%
Traumatic brain injury w/ blunt injury – trunk (n=47)	4.7%
Traumatic brain injury w/ blunt injury – trunk / extremity fracture (n=44)	4.4%
Trunk injury (penetrating / blunt) w/o major organ system injury (n=89)	8.8%
Trunk injury (penetrating / blunt) w/ major organ system injury (n=30)	3.0%
Penetrating injury – (stabbing / gun shot wound) (n=28)	2.8%
Pelvic fracture (n=37)	3.7%
Extremity fracture (open) (n=88)	8.7%
Extremity fracture (closed) (n=298)	29.6%
Joint dislocation (n=13)	1.3%
Spine fracture w/o cord injury (n=7)	0.7%
Spine fracture w/ cord injury (n=11)	1.1%
Burn (n=33)	3.3%
Bite / Puncture wound (n=15)	1.5%
Crush wound / de-gloving injury (n=8)	0.8%
Laceration (n=87)	8.6%
Contusion (n=64)	6.4%
Strain / Sprain (n=16)	1.6%
Poisoning (n=17)	1.7%
Unknown (n=29)	2.9%
Other (n=6)	0.6%

TBI, including patients with intracranial hemorrhage and skull fractures, were documented in 33.2% of injured patients. Blunt trauma resulted in more injuries to the chest, abdomen, and pelvis and was the cause of 60% of organ system injuries, including lung contusions, hemo-pneumothoraces, solid organ injuries and visceral injuries. The majority of injuries, in 81% of patients, resulted from unintentional trauma.

of patients, resulted from unintentional trauma.

Table 7: Injury Intent (% of Injuries)

Injury intent	%
Unintentional	81.0%
Intentional	17.6%
Unknown	1.9%

2.5 Patient Outcomes

The majority of injured patients, 59.3% were admitted from the casualty outpatient department at KCMC to the hospital wards.

Table 8: Patient Disposition (% of Injured Patients)

Disposition	%
Treated and released	32.1%
Admission to hospital ward	59.3%
Admission to intensive care	5.6%
Hospital transfer	0.1%

A minority of patients, 5.6%, required admission to an intensive care unit. Thirty-two percent of injured patients were evaluated in the casualty department and subsequently were discharged to home without hospitalization. The average length of hospital stay was 13.5 days, however typically patient required hospitalization for less than one week (Table 9). The most frequent length of hospitalization was 2 days.

Table 9: Length of Hospital Stay (Days)

Length of hospital stay	Days
Average	13.5
Median	6
Mode	2

During hospitalization, 61.2% of patients required surgical intervention, while 36.3% received non-surgical care, including observation, monitoring, or general wound care. Death, either prior to arrival in the casualty department, or during hospitalization occurred in 5% of patients suffering from injuries.

Table 10: Patient Outcomes (% of Total Injured)

Outcomes	%
Non-surgical care	36.3%
Surgical care	61.2%
Death during hospitalization	2.2%
Death	4.8%

3. Discussion

Injury prevention and improved quality of medical care for injured patients necessitates an understanding of the attributable mechanisms of injury and their resulting impact on patients, families and the broader health care system on which they depend. As injuries have become more significant causes of morbidity and mortality in the developing world, few mechanisms for improvement in data collection, primary prevention, or improved pre-hospital and hospital services have emerged.[29] Lack of resources in the health care sector in developing nations like Tanzania underscores the imperative of understanding the patterns of injury and the segments of the population most impacted, in order to appropriately allocate the limited funding currently available**.**

Our review of injuries in patients presenting to Kilimanjaro Christian Medical Centre, a referral hospital in Moshi, Tanzania establishes a significant pattern of injury in the population, which is consistent with reported injury patterns in other low-income countries.[15, 29-31] In our study, RTI was the major mechanism of injuries in patients presenting to the hospital, accounting for 42.9% of all injuries. This is within the range of similar studies in Uganda, Ghana and Tanzania. Previous studies in low-income countries have demonstrated significant numbers of RTI in these settings involving pedestrians and public transport users. Our study likewise suggests that pedestrians are injured in a significant number of RTI, but likewise highlights the growing number of motorcycle related RTI, accounting for 24.5% of RTI. The significant growth of motorcyclists on the roadways without commensurate regulations of speed control or helmet usage potentially explains the rising number of injuries in this road user

population. RTI accounted for almost half, 49.5% of the traumatic brain injuries in the patient population and specifically motorcycle accidents resulted in more TBI than any other mechanism of RTI. This has significant implications for the potential impact of specific interventions. Injury prevention efforts focusing on RTI, particularly enforcement of helmet usage, speed limit enforcement and provision of safe footpaths alongside roads are potentially important mechanisms for reduction of injury numbers.[32] The efficacy of these established interventions as well as the impact of pre-hospital systems development for injury could more easily be studied due to the large number of RTI. Falls and assaults were the second and third most common cause of injuries and are also likely high yield areas for intervention. Although burns accounted for a small percentage of patient injuries, they are of particular concern in children less than 5 years of age, who suffered 45.5% of all burns. This likewise represents another potential focus for prevention.

The patterns of injuries, which predominantly involve trauma to the head and extremities, underscore the need for prevention measures such as safer vehicle usage as well as potential for improving availability of medical services, specifically orthopedic and neurosurgical care. Traumatic brain injuries were documented as the second most common injury type in 33.2% of patients, after extremity fractures, which occurred in 38.3% of patients. Additionally, RTI accounted for the majority of the most severe injuries, 44.3%, as classified by the WHO, which correlated with the 43.6% of RTI related intensive care admissions or deaths in casualty or during hospitalization.

Our results likewise demonstrate the significant impact injuries have in males between the second and fourth decade of life. In our study, men accounted for 73.4% of the patients presenting to KCMC with injuries and 57.8% of patients were between the ages of 15 and 45 years. As injuries often result in significant morbidity with potential for long-term disability and inability to return to prior work activities, the impact on the individual and their family's socioeconomic status can be substantial.[12, 33] Pre-injury socio-economic status of the patient has been suggested as a determinant of injury risk in developing countries previously. However due to the retrospective nature of this study, definitive conclusions about socio-economic determinants of injuries and long term economic consequences cannot be adequately evaluated. Future prospective study of injuries in the Kilimanjaro region, potentially including measures of the financial impact, may provide additional information about the economic burden of injuries in the country and underscore the need for public health measures focusing on injury prevention.

The study has several limitations that may impact the results. The study is a retrospective chart review and the medical records may contain missing or incomplete information, particularly regarding the mechanism of injury. For example, in 16% of the charts reviewed, RTI was listed as the cause of injury, however no further description of the incident was described in the medical record. Therefore the contribution of RTI related to particular modes of transport, such as motorcycles, public transport vehicles, bicycles, or vehicle versus pedestrian cannot be completely assessed in this study.

KCMC is a referral hospital for the Kilimanjaro, Tanga, Arusha, and Manyara regions and thus often receives referrals or transfer patients from dispensaries, clinics,

and hospitals throughout the region, thus the results may not be generalizability to the overall population or other healthcare settings.

Furthermore, in a referral hospital setting, where more complex cases may be received, data may be skewed towards more severely injured patients. Conversely, limited access to pre-hospital care services potentially negatively impacts delivery of patients to health care centers with severe or morbid injuries. As such, many injury-related deaths may be unaccounted for in hospital records resulting in an underestimation of the true morbidity and mortality related to these events.

4. Conclusions

Our study demonstrates that a substantial minority of patients presenting to a Tanzanian referral hospital's casualty department have sustained injury. These data give a consistent and more robust picture of the patient demographics, mechanisms of injury, injury patterns, and patient outcomes from similar settings. Development of a prospective trauma registry will allow for improved documentation and thus a better understanding of injuries in the Kilimanjaro region, leading to more effective and focused interventions in injury prevention, pre-hospital systems development, and hospital care.

Appendix A: Tanzania Trauma Registry Form

Study ID Number: _____

Sex:
☐Male
☐ Female

Age (Date of birth): _____

Occupation: _____

Place where injury occurred: _____

Time of injury (Days prior to hospital arrival: _____

Patient arrival time to medical facility: _____

Mechanism of injury: (list as recorded in medical record or select appropriate category below):
☐ Road Traffic injury:
- ☐Private vehicle
- ☐Public vehicle
- ☐Motorcyclist
- ☐Bicyclist
- ☐Pedestrian

☐Gunshot / Stabbing
☐Fall
☐Bite
☐Burn
☐Assault

Injury intent:
☐Unintentional
☐Intentional
☐Unknown

Location of injury: (Check all that apply):
☐None
☐Head, neck, and face
☐Spinal Cord
☐Face
☐Chest
☐Abdomen
☐Pelvis
☐Urogenital
☐Extremity

Type of injury: (List as charted in medical record or check all that apply):
☐None
☐Bite
☐Burn
☐Cold-related (frost bite, frost nip, gangrene)
☐Concussion
☐Contusion
☐Fracture
☐Ingestion of toxic substance
☐Laceration
☐Paresis / Paralysis
☐Solid organ injury
☐Sprain / Strain

Systolic blood pressure on arrival: _____

Pulse rate on arrival: _____

Respiratory rate on arrival: _____

Neurological status on arrival:
☐Alert, no neurologic impairment
☐Responsive to verbal stimuli
☐Responsive to painful stimuli
☐Unresponsive

Patient disposition:
☐Treated and released
☐Death in the casualty ward
☐Admission to the hospital
☐Transferred to other facility

Outcomes:
☐Surgical intervention
☐Non-surgical care
☐Death
- ☐Prior to hospital arrival
- ☐In casualty ward
- ☐During hospitalization

Duration of hospitalization: (days): _____

Diagnoses during hospitalization: _____

Surgical interventions: _____

References

1. Norman R, Matzopoulos R, Groenewald P, Bradshaw D. The high burden of injuries in South Africa. Bull World Health Organ. 2007; 85(9): 695-702.

2. Mathers C. The Global Burden of Disease: 2004 Update. Geneva: World Health Organization; 2008.

3. Nantulya VM, Reich MR. The neglected epidemic: road traffic injuries in developing countries. BMJ. 2002; 324(7346): 1139-41.

4. Hazen A, Ehiri JE. Road traffic injuries: hidden epidemic in less developed countries. J Natl Med Assoc. 2006; 98(1): 73-82.

5. Forjuoh SN. Traffic-related injury prevention interventions for low-income countries. Inj Control Saf Promot. 2003; 10(1-2): 109-18.

6. Nantulya VM, Reich MR. Equity dimensions of road traffic injuries in low- and middle-income countries. Inj Control Saf Promot. 2003; 10(1-2): 13-20.

7. Nantulya VM, Sleet DA, Reich MR, Rosenberg M, Peden M, Waxweiler R. Introduction: the global challenge of road traffic injuries: can we achieve equity in safety? Inj Control Saf Promot. 2003; 10(1-2): 3-7.

8. R Booysen F. "Adding insult to injury": Poverty and injury in South Africa. Journal for Studies in Economics and Econometrics. 2004; 28(2): 13-22.

9. Soderlund N, Zwi AB. Traffic-related mortality in industrialized and less developed countries. Bull World Health Organ. 1995; 73(2): 175-82.

10. Suriyawongpaisal P, Kanchanasut S. Road traffic injuries in Thailand: trends, selected underlying determinants and status of intervention. Inj Control Saf Promot. 2003; 10(1-2): 95-104.

11. Lagarde E. Road traffic injury is an escalating burden in Africa and deserves proportionate research efforts. PLoS Med. 2007; 4(6): e170.

12. Odero W, Garner P, Zwi A. Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. Trop Med Int Health. 1997; 2(5): 445-60.

13. World development report 1993--investing in health. Commun Dis Rep CDR Wkly. 1993; 3(30): 137.

14. Atinga J. Spinal injuries in road traffic accidents and thoughts on prevention. Medicus. 1990; 9: 11 - 8.

15. Moshiro C, Heuch I, Astrom AN, Setel P, Hemed Y, Kvale G. Injury morbidity in an urban and a rural area in Tanzania: an epidemiological survey. BMC Public Health. 2005; 5: 11.

16. Kopits E, Cropper M. Traffic fatalities and economic growth. Accid Anal Prev. 2005; 37(1): 169-78.

17. Affeltranger BFT. Accidents and poverty in the developing world: a review of current research and thinking: Swedish Rescue Services Agency; 2005.

18. Loomis DP. Occupation, industry, and fatal motor vehicle crashes in 20 states, 1986-1987. Am J Public Health. 1991; 81(6): 733-5.

19. Singh GK, Yu SM. US childhood mortality, 1950 through 1993: Trends and socioeconomic diffferentials. Am J Public Health. 1996; 86(4): 505-12.

20. Odero W, Khayesi M, Heda PM. Road traffic injuries in Kenya: magnitude, causes and status of intervention. Inj Control Saf Promot. 2003; 10(1-2): 53-61.

21. 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(3): 157-62.

22. Ameratunga S, Hijar M, Norton R. Road-traffic injuries: confronting disparities to address a global-health problem. Lancet. 2006; 367(9521): 1533-40.

23. Peden M, Surfield, R. Sleet, D. et al. World report on road traffic injury prevention. Geneva: WHO; 2004.

24. Haddon W, Jr. Advances in the epidemiology of injuries as a basis for public policy. Public Health Rep. 1980; 95(5): 411-21.

25. Mohan D. Road safety in less-motorized environments: future concerns. Int J Epidemiol. 2002; 31(3): 527-32.

26. Injury surveillance guidelines. Geneva: World Health Organization; 2001.

27. World report on road traffic injury prevention. Geneva: World Health Organization; 2004.

28. Matzopoulos R, Myers JE, Jobanputra R. Road traffic injury: prioritising interventions. S Afr Med J. 2008; 98(9): 692-6.

29. Hsia RY, Ozgediz D, Mutto M, Jayaraman S, Kyamanywa P, Kobusingye OC. Epidemiology of injuries presenting to the national hospital in Kampala, Uganda: implications for research and policy. Int J Emerg Med. 2010; 3(3): 165-72.

30. Mock CN, Abantanga F, Cummings P, Koepsell TD. Incidence and outcome of injury in Ghana: a community-based survey. Bull World Health Organ. 1999; 77(12): 955-64.

31. Mock CN, Adzotor E, Denno D, Conklin E, Rivara F. Admissions for injury at a rural hospital in Ghana: implications for prevention in the developing world. Am J Public Health. 1995; 85(7): 927-31.

32. Razzak JA, Sasser SM, Kellermann AL. Injury prevention and other international public health initiatives. Emerg Med Clin North Am. 2005; 23(1): 85-98.

33. Cubbin C, Smith GS. Socioeconomic inequalities in injury: critical issues in design and analysis. Annu Rev Public Health. 2002; 23: 349-75.