Original Article

Profile and Economic Impact of Motorcycle Injuries Treated at a University Referral Hospital in Kigali, Rwanda

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ABSTRACT

Background: Motorcycle injuries constitute a major public health problem in developing countries, leading to significant disability and straining healthcare resources. We aim to present the basic epidemiology of motorcycle injuries presenting to an urban referral hospital in Rwanda and to evaluate patient outcomes and associated costs arising from injuries sustained on motorcycles.
Methods: We conducted a retrospective cross-sectional study of motorcycle injury patients presenting to Kigali Teaching University Hospital from January-December, 2011. Patients were identified through review of ward registers and trauma registries and stratified into 3 groups based upon length of stay. A representative sample of 269 patients was randomly selected from each group for financial analysis. Data were collected from patient medical, police, and financial records as well as patient interviews. Cost analysis was based upon the standard road accident cost conceptual framework. Data were collected using Epi data 3.1, Excel and analyzed using SPSS 16.
Results: A total of 269 motorcycle accident files were examined. Males were more affected than females with sex ratio F:M;1:6.72.Youths were more involved in motorcycle accident (53.2%) than other age group(16-30 years) .The majority of Motorcycles victims were motorcyclists, (30.86%), businessmen (20.45%) and students (11.53%). Motorcycle-vehicle (41.61%) was the first cause of motorcycle injuries then motorcycle-pedestrian (30.86%).Helmet use was 92.75%.Head injuries and fractures were the predominant diagnoses (82.15%).About 46.7% had pre-hospital care. The mean hospital stay was 15.43 days, and 38.3% spent more than 15 days in hospitalization. Permanent disability was confirmed in 11.5% (n=31), and mortality was 10.4% (n=28). The total economic cost was estimated at US$1,236,207.31 with 39.40% (US$487,030.30) due to loss of labor and 21.76% due to direct medical costs (US$269,000.84).
Conclusions: Motorcycle injuries create a substantial disability and cost burden in Kigali, Rwanda. Prevention and early treatment should be promoted to decrease the morbidity and financial burden.

Keywords : Motorcycle injuries - prevalence - management - outcome - injury pattern - Helmet - accident - related cost - casualty - Rwanda

INTRODUCTION

Road traffic injuries are a major cause of worldwide death and disability with a disproportionate number occurring in developing countries(David D. Clarke et al,2004) [1]. Road traffic injuries constitute a major but neglected public health problem and exert a substantial adverse impact on the economy and health services of low income countries (LIC) (Phillipo L. Chalya et al,2010). The World Health Organization(WHO) has previously reported that approximately 1.2 million people are killed and 50 million are injured annually(WHO,Programmes and projects,2007). Road traffic injuries in developing countries particularly affect the productive (working) age group and children (Nantulya V.et al, 2003). Among children aged 0-14 years, the number of fatalities per 100,000 populations in low income countries is at least five times greater than in high income countries(Nantulya V. et al.,2003; J.Kigera) [5, 6]. Road crashes are the second leading cause of death globally among young people [3, 7, 8].
The annual costs of road traffic crashes in low income and middle-income countries are estimated to be between US$65-100 billion, which is more than the total annual amount received in development aid by those same countries [7,9]. The estimated costs as a percentage of the Gross National Product (GNP) in most African countries range from about 0.8% in Ethiopia, 1% in South Africa, 2.3% in Zambia , 2.7% in Botswana to almost 5% in Kenya [7].

Some studies have estimated various forms of costs of motorcycle accidents mostly in developed countries: medical cost, productivity losses and loss of quality of life [10]. Some studies also cover legislation of helmet use and its cost savings [11, 12]. There is lack of cost data on road traffic accidents and in particular motorcycle accidents from developing countries [10].
Motorcycles, commonly referred to "Moto-taxis," are one of the most commonly used public transport modes in Kigali, Rwanda. The number of motorcycles in Kigali has increased dramatically in the last few decades. Between 1994 and 2010 the average growth rate of motorcycles in Kigali was about 10 per cent per year according to the Rwanda National Police report and It is estimated that over 50,000 Rwandans youths are involved in the motorcycle business [13]. Motorcycles are a quick means of transport especially for short distances in cities and towns and they are licensed to carry only one passenger at a time, but it is not uncommon to see motorcycles carrying two passengers or excessive cargo and not adhering to the regular traffic regulations followed by other vehicles which is the cause of most road traffic accidents [14]. Even in developed countries with low morbidity and mortality rates from motorcycle injuries, the risk of dying from a motorcycle crash is 20 times higher than from a motor vehicle crash [15]. While motorcycles seem to be an essential part of the Rwandans' daily lives, they also seem to cause many injuries and drain the national economy.Limited statistics

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are available from the Rwandan Police registers, and while they provide the number of injured people, they do not say anything about diagnosis and other relevant information on trauma patterns or costs [16].

This study was aimed at determining the epidemiology of Motorcycles injuries seen at University Teaching Hospital-Kigali (UTH-Kigali) and assessing their outcome then estimating the cost of each injured person from the time of accident to time of fully recovery from injury.

METHODS

Study Site and Population

A retrospective, cross-sectional study done at Kigali Teaching University Hospital in the Department of Emergency Trauma hospitalization wards. Kigali Teaching University Hospital (KTUH) is a public referral Hospital in Kigali town of 560 beds, with 25% of beds in Surgery.The target population was all patients who were confirmed to have been involved in a road traffic accident (RTA) caused by a motorcycle during the period of twelve months from January 1st to December 31st 2011.An accident was deemed to have involved a motorcycle if the patient was hit by a motorcycle, was a passenger, pedestrian or a rider of a motorcycle involved in an accident. All patients were resuscitated at Emergency and Accident Unit according to the Advanced Trauma Life Support (ATLS) and then further investigations performed and taken to surgical wards, Intensive Care Unit or operating room for management. Variables studied included age, sex, occupation, category of victims (rider, passenger or pedestrian), occupation of victims, mechanism of injury (motorcycle-vehicle, motorcycle-pedestrian ,motorcycle alone),mode of transportation (ambulance, private car, police), injury arrival interval, helmet use, Severity of injury, kind of injury(Diagnosis), investigations done (radiological findings),Length hospital stay(LOS),Cost made up by Causality related cost(Medical Cost, Out of Pocket-expenditure ,Loss of Labor Cost, Funeral Cost, Intangible cost) and Accident related cost(Property Damage Cost, Administration Cost). Outcome was measured by death and disability.

A stratified sampling technique according to length hospital stay (LOS) was used then a proportionate random method. A cost analysis method was also conducted in order to calculate the economic cost of motorcycles injuries according to Gross Output Method (Asian Bank,2003) . All relevant documents, namely trauma registries, patient files, accountability reports, insurance company reports and police reports were consulted as well as personal information from patients and attending physician by deep interview. A Questionnaire was used to collect information.

Data analysis

Data was entered using Epidata 3.1 and Excel softwares and analyzed using SPSS software 16.0.The data was presented in tables. A p-value of 0.05 was considered statistically significant.

Table1: Estimation method of cost components according to Gross Output of road accident victims (Asian Development Bank, 2003)

	Cost Components	Estimation of Costs
	Causality Related Cost	
1	Intangible cost (i.e., pain, grief and suffering (PGS))	Calculated as a percentage of lost labor output (i.e., 20%). Following similar approach by the Asian Development Bank (Asian Development Bank, 2003), intangible costs will be estimated as 20% of the total lost labor cost.
2	Lost labor output (productivity losses)	*Accident victims and caregivers:* Calculated by multiplying the number of days of work lost due to the accident by each accident victim and caregiver by the average daily wage rate. *Fatalities:* For fatalities and permanent disabilities the calculation will be performed over the rest of their expected productive working life and discounted to an equivalent present value.
3	Medical costs	*In-patient cost*: This will be obtained by multiplying the estimated total number of in-patient motorcycle accident cases with the average in-patient treatment cost. *Out-patient cost:* This will be obtained by multiplying the estimated total number of outpatient motorcycle accident cases with the average outpatient treatment cost. The summation of in-patient and out-patient cost gives total medical cost.
4	Out-of-pocket expenditure	*Out-of- pocket expenditure*: This will be computed by multiplying the average out of pocket expenditure incurred by patients by the estimated number of motorcycle accident cases.
5	Funeral cost	The estimated funeral cost will be obtained by multiplying the average funeral performance cost with the estimated number of deaths.
	Accident Related Cost	
6	Property damage cost	*Motorcycle repair cost*. The average cost of repair of motorcycle will be multiplied by the estimated number of victims whose bikes will be damaged. *Motor cycle replacement cost*. This will be computed by multiplying the average cost of replacing a motorcycle with the estimated number of motorcycles that will be damaged beyond re-pairs. *Cost of lost valuables*. The cost of valuable items lost will be computed by multiplying the average cost of valuable item lost by victims at the time of the accident with the estimated number of victims who lost items. The total property damage cost will be thus obtained by summing the motor cycle replacement cost, repair cost and the cost of valuable lost items.
7	Administration costs	*Insurance cost:* This is made up of average insurance claim paid to insured accident victim multiplied by the number of motorcycles insured. *Police Investigation cost*: The police investigation cost will be obtained by estimating the gross hourly wage rate of a police officer multiplied by the number of reported annual accident motorcycles. As well as the estimated cost of other resources such as fuel, communication and stationary used during the investigations. The sum of the insurance cost and police investigation cost constitutes the total administration costs.

Ethical approval for the study was obtained from the Kigali Teaching University Hospital Ethical Review Committee. Hospital administration and study subjects were also assured of their confidentiality, data safety and appropriate data usage. There were no known risks associated with the use of this data and there was no conflict of interest.

RESULTS

During the study period, 1232 road traffic injuries were reported at emergency department. Motorcycle injuries accounted for 73.05% (900 cases) of all traffic injuries.A totals of 269 motorcycle accident files have been examined. The patients' ages ranged from 1 to 81 years with a mean of 28.65 years, SD (Standard Deviation) of 13.646 and a peak incidence of 16-30 (53.2%) years. The sex ratio was M: F: 6:1. Motorcyclists were the most injured (46.8%) followed by pedestrians (28.6%) and motorcycle passengers (24.5%). Only 3.0% of patients involved in motorcycle accidents were reported to use alcohol or drugs during the accident. There was no statistically significant association between motorcycle accidents and alcohol or drug use ($p > 0.05$). Of 192 motorcyclists and passengers, only 7.25% were not wearing helmets at the time of injury. About 91.08% of patient involved in motorcycle accidents during the period of our study had health insurance and the majority was insured by community insurance (79.93%). About 69.1% of all accidents occurred during the day and 30.9%occured during the night. Peak hours were between

6-9 am and 5-6pm.

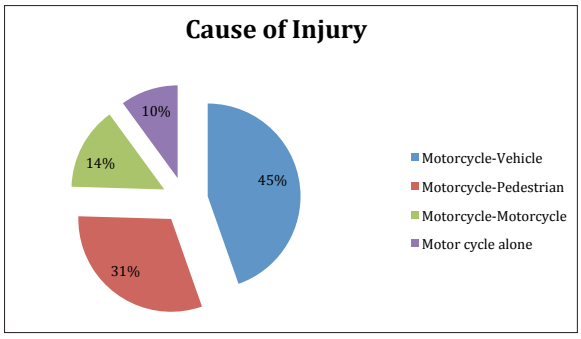


Figure 1: Cause of injury

comparison to other causes, motorcycle-vehicle was the commonest cause of accident and accounted for 41.61%(120/269) of the MCIs received at the Emergency Department during the study period followed by motorcycle-pedestrian with 83 cases(30.86%). Motorcycle-motorcycle formed 14.50%(39/269) of all victims and injuries caused by motorcycle alone(loss of control) were 27 cases(10.04%).

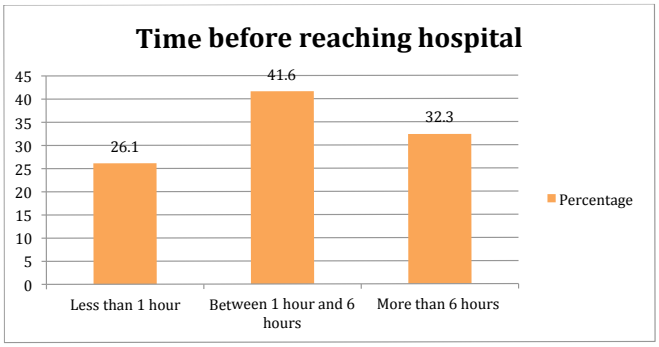


Figure 2: Time before reaching hospital

About 46.1% (124/269) of patients were referred from others hospital to CHUK by ambulance and 53.9% (145/269) of cases were transported from the scene of accident by ambulances.

The majority of patients arrived at the hospital between 1 and 6 hours (112/269, 41.6%) and about 32.3% were delayed more than 6 hours. More than 46% (128/269) of our patients had pre-hospital care by ambulance nurses or from prior treatment at a District Hospital. About 10% of patients were severely injured with multiple organ involvement, 81.8% (220/269) had one serious injury associated with small wounds and 8.2% had slight injury.

The most common complaints were loss of consciousness, headache, confusion, bleeding and functional impairment of limbs. The vast majority of patients (89.7%) sustained blunt injuries and the remaining eight (11.3%) sustained either penetrating or both penetrating and blunt. The most common body

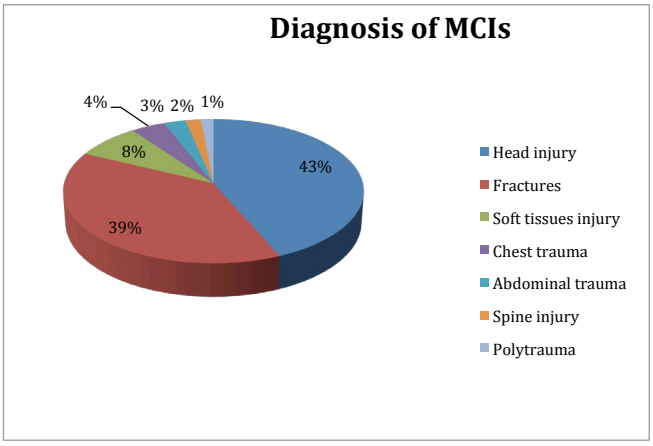
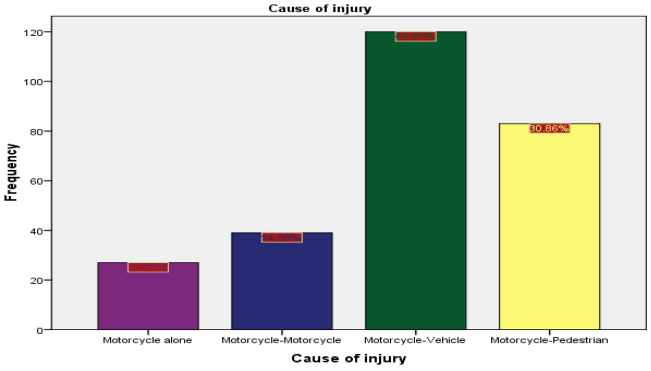


Figure 3: Proportion of final Diagnoses



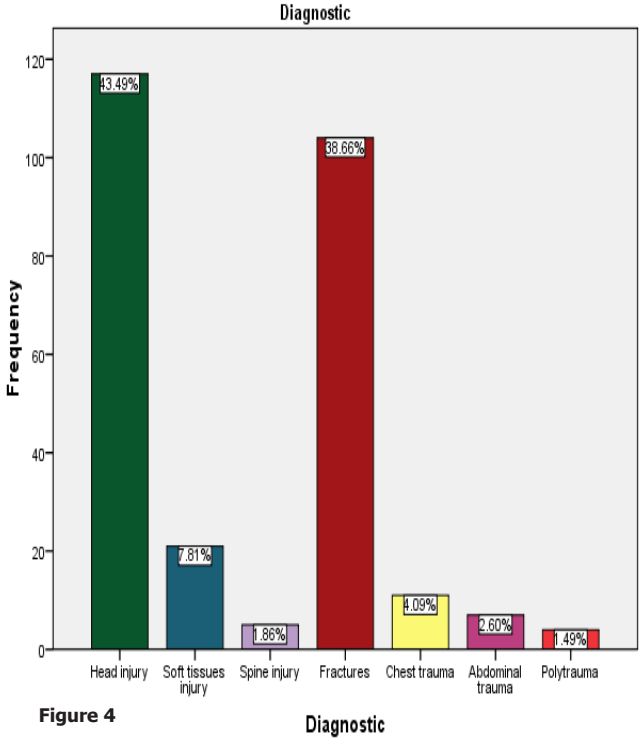


Figure 4

region injured were extremities and the head, affecting 104 (38.6%) and 117 (43.5%) patients, respectively. Soft tissue injuries only (bruises, laceration, abrasion and contusions) occurred in 21 injuries (7.8%) and fractures occurred in 104 injuries (38.6%). Musculoskeletal injuries were predominantly extremity fractures (96.1%), and most

commonly affected the lower extremities (77%).Closed and open fractures of upper extremities represented 11.7% of musculoskeletal injuries. Other fractures, including clavicles, and pelvic fractures occurred in 12.3% of cases. Of 117 patients with head injuries, 74(63.24%) patients had mild head injuries (Glasgow Coma Scale [GCS]: 13-15), 30(25.6%) had moderate head injuries (GCS: 9-12), and 13(11.1%) had severe head injuries (GCS: <8). No patient who was wearing a helmet at the time of accident sustained a severe head injury. Chest injuries represented 4.09 % (11 cases). There were 7 cases of abdominal injuries (2.60%); among them 4 were blunt abdominal injuries, 3 penetrating abdominal injuries. The penetrating abdominal injuries resulted in 2 spleen ruptures and 1 liver laceration. Spinal injuries accounted for 1.86% of patients. X-Rays were the most requested investigation. Both X-Rays and abdominal ultrasound were used in about 84.53% of all admitted patients. CT-scans were done in 10.41% of all patients. Other investigations done were FBC, Urea, Creatinine and blood cross matching in all operated patients.

Table 2: Proportion of Interventions carried out

Interventions	Frequency	Percentage
Initial resuscitation only	105	39.0
Open reduction and Ext. / Int. Fixation	84	31.2
Closed reduction / POP	35	13.0
Craniotomy	21	7.8
OR wound debridement	14	5.2
Laparatomy	5	1.9
Others	5	1.9
Total	**269**	**100.0**

About 80% of patients brought by ambulances underwent initial resuscitation with IV fluids prior to arrival at the Emergency, either at the site of accident or in District Hospitals. At Emergency and Accidental department 39.03% underwent initial resuscitation only. Closed reduction was done for 13.01% under general or local anesthesia. About 31.23% underwent open reduction as emergency or elective surgery either with external fixation for open fractures, or internal fixations for closed fractures. Deep and degloving wounds were debrided in 5.20%. Craniotomies were performed in 7.81% of 117 admitted head injuries patients. Other interventions included laparatomy, chest drainage, transfusion, local care and suture of small wounds, accounting for 3.72% of all patients.

The mean of Length Hospital stay was about 15.41 days with a minimum of 1 day and maximum of 120 days. About 45% of patients were admitted between 1-5 days, 16.8% of all patients were admitted between 6-14 days and 38.3% were admitted more than 15 days. More than 50% of all patients were consulted in Out Patient Department for follow up the month following the accident and most of them were fractures or head injuries.

Most patients admitted were treated and discharged after appropriate management (85.13%); only 2 patients were transferred to King Faycal Hospital for further management. Six patients (2.2%) died on arrival during delivery of first care, and about 7.4% of all patients died when they were in the E&A department and 3.7% were admitted to the Intensive Care Unit (ICU) for critical care. Complications during hospitalization occurred in 5.1% of patients, including 3.3% with surgical site infection, 1.1% with pressure sores and 0.7% with Deep Venous Thrombosis. Only 2 patients were diagnosed with osteomyelitis resulting from osteosynthesis materials. Amputation of lower limb was performed for 5 patients (1.85%). Permanent disability was confirmed in 31patients (11.5%) by medical reports and 14.9% of all patients were temporarily disabled.

There is association between time taken for transport to hospital and outcome of patients involved in MCIs. Mortality was very low (0.37%) for patients who arrived in the hospital before one hour compared to patients admitted more than 6 hours after injury (3.71%). The patients admitted to the ICU increase considerably according to time before seeking medical care; ranging from0.37% of patients admitted before one hour to 1.58% of patients admitted in greater than 6 hours. Additionally, mortality rate was higher when the time delay to hospital was more than one hour ($p<0.05$).

Head injuries were present in 65% of all patient deaths and the majority of admitted patients in ICU were also head injuries patients. Among polytrauma patients 25.2% has died. Patients with fractures constitute 7.81% of operated patients.

Table 3: Economic cost of Motorcycles accidents

	Total(US$)	**Average cost per patient**	**Percentage**	**Proportion of costs**
Causality Related Cost				
Medical Cost	269,000.84	1000	21.76%	
Out of Pocket-expenditure	69,677.54	359.4	5.9%	
Loss of Labor Cost	487,030.30	1810.5	39.40%	
Funeral Cost	7,166.30	256	0.58%	
Intangible cost	53,790.52	199.9	4.35%	
Sub total	**886.665.50**	**3625.8**	**71.8**	**71.8**
Accident Related Cost				
Property Damage Cost	266,500.12	990.7	21.56%	
Administration Cost	83,041.69	308.7	6.72%	
Sub total	**266,500.12**	**1299.4**	28.28%	**28.2**
GRAND TOTAL	**1,236,207.31**	**4925.2**	**100**	**100**

The total economic cost of motorcycle accidents in Kigali was US$1,236,207.31 . This is made up of about 28.28% accident-related costs and 71.72% casualty-related costs. The accident-related costs totaling US$ 266,500.12 was made up of property damaged costs of 21.56% and administration costs of 6.72%. Whilst the casualty-related cost of US$886.665.50 was made up of labor output costs (39.4%), out-of-pocket expenditure

(5.9%), medical costs (21.76%), intangible costs (4.35%) and funeral costs (0.58%).The Loss of labor cost was estimated at US$487,030.30(39.40%) was the highest cost among other costs followed by medical cost estimated atUS$269,000.84(21.76%).The property damage cost was estimated at US$269,000.84(21.56%) and the lowest cost was the Funeral cost accounted 0.58%(US$7,166.30).

Medical costs depended on the number of days for hospitalization. Patients who spent more than 15 days in the hospital had significantly higher medical costs, from US$1000 to more than US$/2000 patient. Medical costs differ according to diagnosis. Costs are higher for head injury and fractured patients than for other kind of injuries. The medical cost was also dependent on type of intervention. Cost was especially high for craniotomies, open reductions and laparatomies and for those admitted to the ICU for extended periods of time.

DISCUSSION

In recent years, there has been a significant increase in the number of motorcycle accidents in Kigali City in parallel with increasing use of motorcycles as a commercial means of transport (Rwanda National Police report, 2010). Injuries related to motorcycle contribute significantly to the number road traffic injuries seen at Kigali Teaching University Hospital, affecting a significant number of lives and resources, including both consumables and the health worker time. The prevalence of motorcycle injuries in Rwanda was found to be73.05% (900 cases) during 2011 which is higher than 40.8% reported in 2004(E. Twagirayezu et al., 2008) .

The young adults are most involved in motorcycle accidents with mean age of 28.65 years with a peak in the 16 – 30 years group and this is similar to other countries in Lower and Middle Income (Galukande M. et al, 2006; Romao F. et al, 2003; Odero at al, 2003; Bikandou G.et. al, 1997; Bener. A et al, 2003).The WHO report that the high occurrences of motorcycles accidents among this group have been attributed to a wide range of activities engaged in by this class of people (WHO, 2010).

Males were more involved in accident than females with a sex ratio M: F of 6.27:1 and similar to other countries, developed or in developing (Galukande et al,2009; Bikandou G.et.al. ,1997; Romao F. et al,2003, Phillipo Chalya et al,2010; David D. Clarke et al, 2004). The prevalence of male involvement can be attributed to greater mobility of males and their greater role in Rwandan society.

About 91.08% of patient involved in motorcycle accidents during the period of our study had health insurance; most were insured by community insurance (79.93%). Only 8.92% did not have insurance. Currently under the political eye in Rwanda is for each to have medical insurance. According to the M. Aikins et al (2011) in the North of Ghana, about 90% of all motorcycles did not have health insurance and other studies were not specifying if patients were insured.

The majority of patients reached the referral hospital without a referral note from a District hospital (69.1%) and only 30.9% were referred from another hospital. This is a similar picture to those found in other countries like Kampala, Uganda (Galukande et al,2009) which reports about 96% of patients arrived without a referral note and 99% in Mwanza, Tanzania (Phillipo l. Chalya et al,2010).

Motorcyclists, Businessmen and students represented most of the patients injured. A similar observation was noted in Uganda, Nigeria and Ghana (Naddumba et al., 2002,Nzegwu et al.,2008, M. Aikinset al, 2011). Alcohol use was only reported in 3% of victims which is different from other studies done in developing countries.

In the present study, motorcyclists constituted the majority of motorcycle injury victims (46.8%). This is in agreement with other findings reported elsewhere (M. Aikinset al,2011;Nzegwuet al., 2008; David D. Clarke,2004), but in contrast with Naddumba (2006) and Odero W.(2003) who reported pedestrians as the majority of victims affected. In most cities of developing countries, pedestrian signs are either absent or not observed. This could be responsible for high rates of fatality among pedestrians.

Motorcycle helmets have been reported in literature to reduce the risk of head injuries and death (David D. Clarke et al, 2004; WHO reports,2005). However, studies have shown that helmet use in developing countries is low (M. Aikinset al., 2011). In the present study, helmet use was recorded in 92.75% which is higher than that reported in Uganda (17.5%), Benin and Nigeria (Galukande et al.,2009,Nzegwu et al.,2008).The only problem is the quality of helmet used in Rwanda as head injuries still very high in MCIs although no severe head injuries reported in this category. Arguments that have advanced opposition to helmet use include impaired rider vision, attenuation of critical traffic sounds, rider fatigue and increased neck injuries in the event of a collision (Dan Chisholm et al, 2012; Ghee et al, 1997). However, none of these alleged disadvantages have been supported by evidence.

The majority of injuries in the present study occurred during the day. This finding agrees with that reported of in Uganda, in UK, in Ghana and in Tanzania (Naddumba et al,2006;David D. Clarke ,2008; M. Aikinset al, 2011; Phillipo L. Chalya et al,2010).Increased rate of injuries during the day can be explained by increased traffic density as well as increased human activities in the city during the day time. Knowing the time of injury in trauma patients is important for prevention strategies and resource allocation.

The majority of patients arrived at the hospital relatively late (more than1 hour after injury).The delay in seeking medical care is likely to contribute significantly to morbidity and mortality among trauma patients (WHO report, 2010). The pre-hospital care of trauma patient has been reported to be the most important factor in determining the ultimate outcome after the injury (Advanced Trauma Life Support, 2010).Less than a half (46.7%) of our patients had pre-

hospital care delivered by nurses from Ambulances at the site of accident and more than 25% were brought in by relatives and police who are not trained in healthcare or patient transport which is common to many other developing countries. In the present study, the collision between motorcycle and motor vehicle was the most common mechanism of injury followed by collision between motorcycle and pedestrians and similar to other countries in East Africa (Solagrebu et al.,2006;Phillipo L. Chalya et al,2010;Galukande et al.,2009).The motorcycle-vehicle and motorcycle-pedestrian collisions occur commonly because the majority of the riders often ignore safety measures, making them more vulnerable to accidents with other motorized vehicles (Solagrebuet al., 2006). In addition, the absences of pedestrian walkways in most of the roads in Rwanda have pedestrians, thus increasing their vulnerability to all motorized vehicles.

Others studies have shown that musculoskeletal and head injuries are most common causes of morbidity and mortality in motorcycle injuries (Solagrebuet al., 2006; Naddumba, 200; 2008; Galukandeet al., 2009; Phillipo L. Chalya et al,2010). Injuries found in our study included soft tissue, fractures, head injuries, chest injuries, abdominal injuries and multiple injuries. An average of 82.11% of cases admitted had both head Injuries and fractures. This is comparable to that found in Uganda (Galukande et al,2009) and in the UK(David D. Clarke et al,2004). It is higher than what was found in Brazzaville (Bikandou G.et.al, 1997). Head injuries represented was the most reported diagnosis, followed by limb fractures in which the majority was lower fractures which is similar to what reported in others countries (Galukande et al,2009;Odero W.et al,2003; E.Twagirayezu et al, 2005). In the present study, no patient who was helmeted at the time of injury sustained severe head injury. This reflects helmet importance in prevention of severe head injuries among motorcycle injury patients, despite the quality of helmets a subject of doubt.

Patient management, including IV fluids or immobilization was started at the scene of accident when patients were brought by an ambulance. In our study about 46% of patients had initial resuscitation before reaching the hospital and about 40% of all fractures were immobilized before admission. Analgesics, anti-tetanus prophylaxis, immobilization were all performed at arrival to the hospital. Closed fractures were reduced orthopedically by closed methods and others required surgical interventions such as wound toilet and debridement, wound suturing, internal and external fixation, and craniotomy. About 1.5% of all patients had blood transfusion after the accident.

The length of hospital stay (LOS) has been reported to be an important measure of morbidity among trauma patients. Prolonged hospitalization is associated with an unacceptable burden on resources for health and undermines the productive capacity of the population through time lost during hospitalization and disability.

The mean of length of hospital stay (LOS) was 15.41 days with the minima of 1 day and the maxima of 120 days. Length of stay was dependent on kind and severity of injury. In the study done by in E.Twagirayezu et al (2005) in Kigali, found that 39.7% were hospitalized with an average of 8 days of LOS. The figures for the overall mean LOS in the present study were higher than that reported in Kampala (Kigera et al ,2006).Prolonged LOS in our study is partly attributable to presence of major trauma patients, severe head injuries and large number of patients with long bone fractures.

The overall mortality rate in this study was lower than that reported elsewhere for motorcyclists (WHO report, 2005; David D.et al,2004;Phillipo L. Chalya et al,2010). Factors responsible for high mortality in our study included extremes of age, non-helmeted patients, major trauma, severe head injury, need for ICU admission and need for ventilator support.

The estimated economic cost of motorcycle accidents in the present study was about US$1.236 million for 269 patients which represent about 5000$/patient and is enormous when compare to Rwandan GDP. The cost was made up by accident-related costs (28.28%) and casualty-related costs(71.72%). The accident-related costs consisted of property damage costs and administration costs .The casualty-related cost consisted of labor output costs (39.4%), out-of-pocket expenditure (5.9%), medical costs (21.76%), intangible costs (4.35%) and funeral costs (0.58%).The most significant cost component of accident-related costs was property damage, whilst the main cost drive of the casualty-related costs was lost of labor output. Above findings are similar with those in other studies in developing countries like Ghana and Indonesia (M. Aikins et al,2011; Widyastuti et al,2005).

The present study shows that medical cost is influenced by the kind of injury that the patient sustained and the length of hospital stay which is similar to results found in others study (Ghee, C.et al,1997,M.W. Jones-Lee et al,1981).

CONCLUSION

Motorcycle injuries constitute a major but neglected emerging public health problem in Kigali City. The young adult males in their reproductive and productive age group are commonly affected and males are more vulnerable than female. Riders, Businessman and students are the largest groups of motorcycle injury victims. Limb and head injuries are the most common types of injury sustained predisposing these patients to prolonged hospitalization and mortality.With further growth in the number of motorcycles and related accidents; the casualty cost is expected to increase significantly in the future. This would imply significant loss of productivity and quality of life to society at large.

We recommend that all motorcycle riders should complete the required course before becoming licensed as motorcyclist, pedestrians to be educated on Road traffic laws then to highlight pre-hospital care for better management of MCIs patients.

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