

Patterns of Injury Associated with Motorcycle Accidents in Upper Egypt

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ABSTRACT

Introduction and aim of the work: Motorcyclists are about three times more likely than car occupants to be injured in a crash, and 16 times more likely to die. This study was an exploratory one to assess the magnitude of the problem of motorcycle accidents in Upper Egypt, to detect the common patterns of injury associated with these accidents and to suggest the possible counter measures in order to reduce the morbidity and mortality of these fatal injuries in our community. **Patients and methods:** This observational prospective study included data of patients with motorcycle related injuries who were admitted at the Causality Department of Sohag University Hospital, Sohag, Egypt in the period from May 2012 through December 2012. **Results:** 76 patients (72 (94.7%) males and 4 (5.3%) females) were admitted with motorcycle related injuries caused by 63 motorcycle accidents. The mean age was 24.8 ± 12.72 years. The majority (N=53; 69%) were < 30 years. The commonest time of the accidents was around the peak hours of the day (12 pm – 5:59 pm) where 32 (50.8%) accidents occurred. The majority (N=21; 42%) of drivers were young adults but only one (4.8%) of them had a license. All adolescent (N=13; 26%) drivers had no license. The most common cause of accidents was collision between a motorcycle and a car in 30 (47.6%) cases; the drivers themselves were the most commonly injured riders in 50 (65.8%) cases. Neurosurgical injuries were the commonest in 39 (51.3 %) of cases. Forty five (59.2%) of cases had single system injury and 31 (40.8 %) had multiple system injury. The majority (N=43; 56.6 %) of patients had good outcome with complete cure, while 31 (40.8 %) had complicated outcome and 2 patients died. **Conclusion:** Motorcycle use is becoming popular in Upper Egypt and but its related injuries constitute a major neglected emerging public health problem. The young adult males in their reproductive and productive age group are commonly affected. The pre-hospital care of trauma patient was the most important factor in determining the ultimate outcome after the injury. Trauma victims require a precise, rapid and systematic approach to initial evaluation in order to ensure their survival. The majority of motorcycle injuries are preventable, and the safety measures are highly recommended.

Key words: Trauma, road-traffic accidents, motorcycle-related injuries.

INTRODUCTION

Motorcycles are undertaken as a form of recreation and leisure in the developed countries, however they emergence as common means of transport in Asia and Africa. The annual production of motorcycles in the world is put at about 45 million with the growth rate in Africa, being between about 12-30%.^{1,2}

The motorcycle is relatively cheap, enables its rider to navigate narrow streets or roads unsuitable for cars and to thread through traffic snarls in urban areas.³ Also, the absence of pedestrian walkways increases the vulnerability of child pedestrians to motorized vehicles.⁴

Motorcyclists are often untrained and unlicensed, and may have little or no regard for traffic rules or safety. They commonly drive too

fast and overload their motorcycles with passengers or goods in an opportunistic commercial transport system.³

Motorcyclists are about three times more likely than car occupants to be injured in a crash, and 16 times more likely to die.⁵ Contrary to a car crash, in a motorcycle crash, the riders often not only absorb all kinetic and compressive energy resulting from the crash but also ignore safety measures making them more vulnerable to accidents.^{6,7} According to WHO, even in developed countries where morbidity and mortality rates from motor-cycle accidents are low, the risk of dying from a motorcycle crash is twenty times higher than a motor vehicle crash.⁸

This study was an exploratory one to assess the magnitude of the problem of motorcycle accidents in Upper Egypt, to detect the common

patterns of injury associated with these accidents and to suggest the possible counter measures in order to reduce the morbidity and mortality of these fatal injuries in our community.

PATIENTS AND METHODS

This observational prospective study included all patients with motorcycle related injuries who were admitted at the Causality Department of Sohag University Hospital, Sohag, Egypt in the period from May 2012 through December 2012.

After approval of the ethical committee of our institution, all data of the patients including demographic data, and full details of the accidents and injuries and their management options were recorded in each patient's sheet. Careful medical history and details of the accident as regard its nature, place, time, position of the riders and use of protective measures were obtained from patients themselves, their relatives or eye witnesses.

All patients were managed according the trauma protocol of our institution. The primary survey, first aid and resuscitation measures were done according to ABCDE management protocol. After stabilization of the patients and secondary survey, the necessary laboratory investigations and imaging modalities were requested according to the suspected injuries.

Plain radiographs of the chest, abdomen, pelvis and cervical spine and abdominal ultrasonography were done routinely in all haemodynamically stable patients. Computed tomography scanning was requested in certain cases depending on the nature of injury or injuries.

Conservative measures or surgical interference were undertaken according to the clinical evaluation, results of laboratory and imaging investigations and the decision of the consultant on duty. The patients were followed until discharge and their outcomes were recorded (either good outcome or complicated outcome). Morbidity and mortality were also recorded. All the recorded data were studied, tabulated and statistically analyzed using Statistical package for social science (SPSS) with P value considered significant if $P < 0.95$.

RESULTS

I) Demographic data:

In the period from May 2012 through December 2012, 76 patients (72 (94.7%) males and 4 (5.3%) females) were admitted at the Causality Department of Sohag University Hospital, Sohag, Egypt with motorcycle related injuries caused by 63 motorcycle accidents. The age of patients ranged from 2.5 to 77 (mean 24.8 ± 12.72) years. The majority (N=53; 69%) of patients were less than 30 years old (Fig. 1).

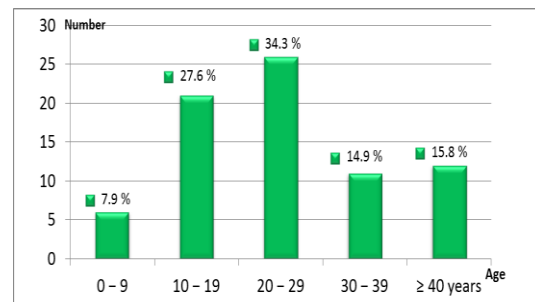


Fig. 1. Age groups of injured people in MCA.

The commonest time of the accidents was around the peak hours of the day (12 pm – 5:59 pm) where 32 (50.8%) accidents occurred, followed by late hours of the day (6 pm – 11:59 pm) where 23 (36.5%) accidents occurred (Fig. 2). Thirty six (57.1%) of the accidents had occurred on the high ways and 27 (42.9%) on the side ways.

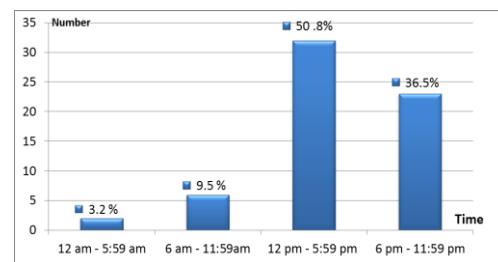


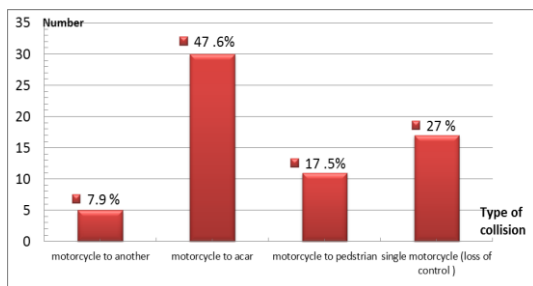
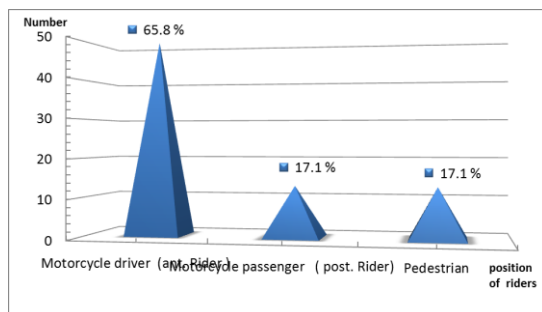
Fig. 2. Time of the accident.

The majority (N=21; 42%) of drivers were young adults (20-29 years) but only one (4.8%) of them had a license. All adolescent (N=13; 26%) drivers (10-19 years) had no license (table 1).

Table 1: Age groups of motorcyclists and their license status.

Age group of the driver	Male				Total and percentage
	Have license		Don't have license		
	No.	%	No.	%	
0- 9 years	-	-	-	-	-
10- 19 years	-	-	13	100 %	13 (26%)
20-29 years	1	4.8 %	20	95.2 %	21 (42%)
30-39 years	5	71.4 %	2	28.6 %	7 (14%)
≥ 40 years	8	88.9 %	1	11.1 %	9 (18%)
Total	14	28 %	36	72 %	50 (100%)

The most common cause of accidents was collision between a motorcycle and a car in 30 (47.6%) of accidents, followed by loss of control in 17 (27%) (Fig. 3). The drivers themselves were the most commonly injured riders in 50 (65.8%) cases (Fig. 4).

**Fig. 3.** Causes of MCA.**Fig. 4.** Position of riders.

II) Investigations:

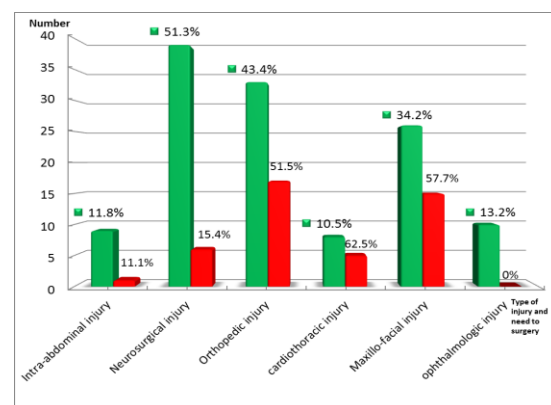
The routine laboratory investigations were done in all patients but only 15 (19.7%) of them had low hematocrite value less than 40%.

Plain radiographs were done in all patients. Bone fractures were detected in 32 (42.1%) patients and cardiothoracic injury in 8 (10.5%). No patients had abnormal finding in plain x-ray abdomen. Routine and FAST abdominal ultrasound was done in all patients. It revealed rim -to- small collection in 9 (11.8%) cases. Two

(2.6%) cases had liver contusion with small collection. Computed tomography was done in all (N=39; 51.3 %) cases with suspicious neurosurgical affection, 32 (82%) of them had abnormal findings. Three dimensional (3D) facial CT was done in all cases of suspicious maxillofacial fractures (N=26; 34.3%), 15 (57.7%) of them had abnormal findings.

III) Motorcycle related injuries and their management:

The commonest injuries were neurosurgical injuries being occurred in 39 (51.3 %) of cases; only 6 (15.4%) of them needed surgical intervention, followed by orthopedic injuries in 33 (43.4%) of cases; 17 (51.5%) of them underwent surgical fixation, then facial injuries in 26 (34.2%) of cases; 15 (57.7%) of them had surgical interference (Fig. 5).

**Fig. 5.** Patterns of injury and need to surgery in MCA.

Most (N=32; 42.1%) of the neurosurgically injured patients were treated conservatively and only 6 cases needed neurosurgical intervention; elevation of compound depressed fracture in 3, evacuation of extradural hematoma in 2 and fracture subluxation C1-C2 who refused the

operation in one. One patient had massive skull fractures and massive brain damage died in the ICU soon later on. The most common neurosurgical injury was closed head injury in 20 (26.3%) of cases (Table 2).

Table 2. Types of Neurosurgical injuries.

<i>Type of injury</i>	<i>No. of Patients</i>	<i>%</i>
Closed head injuries	20	26.3
Brain contusion	9	11.8
Fr. Base & petreous bone	8	10.5
Massive destruction of skull and brain	5	6.6
Post concussion	5	6.6
Cervical spine injuries	1	1.3
Mixed	18	26.3

Among the 17 (22.3%) cases that needed orthopedic operative intervention, 11 had internal fixation with plates and screws, 3 had fixation with K-wires and 2 needed fixations with interlocking nail. The most common orthopedic injuries were fractures of lower extremity in 23 (30%) of cases (Table 3).

Table 3. Types of Orthopedic injuries.

<i>Type of upper limb injury</i>	<i>No. of patients</i>	<i>%</i>
Fractured forearm	5	6.6
Fractured clavicle	4	5.3
Total injuries of upper limb	9	11.8
Type of lower limb injury		
Fractured femur	5	6.6
Fractured pelvis & acetapulum	1	1.3
Fractured knee or lower leg	9	11.8
Fractured foot & toes	8	10.5
Total injuries of lower limb	23	30

The most common facial injury was fractured facial bones in 15 (19.7%) cases (Table 4). The injuries were massive in 6 of them with pan facial trauma and one needed temporary tracheostomy which was removed later on with minimal complications. All patients needed surgical fixation by mini plates and screws and one patient died postoperative in the ICU. The remaining 11

(14.5%) patients underwent conservative treatment.

Table 4. Types of facial injuries.

<i>Type of facial injury</i>	<i>No. of patients</i>	<i>%</i>
Eye & eye lid injury	6	7.9
Mouth, lips & tongue injury	4	5.3
Fractured facial bones	15	19.7
- fr. One or two facial bones	9	
- Panfacial fr.	6	
Face edema, abrasions & lacerated wounds	10	13.2
Mixed injury	7	9.2

The most common chest injury was fracture ribs in 6 (7.9%) cases (Table 5). Intercostal tube drainage was needed in 6 (7.9%) patients; thoracotomy in one (1.3%) who was referred due to lack of places in ICU. The remaining 2 patients were managed conservatively.

Table 5. Types of chest injuries.

<i>Type of chest injury</i>	<i>No. of patients</i>	<i>%</i>
Internal injury	4	5.3
Fractured ribs or sternum	6	7.9
Surgical emphysema	2	2.6

The most common abdominal injury was minimal-to-mild intra-abdominal collection of unknown origin in 7 (9.2%) cases that were managed conservatively. Another two (2.6%) patients had liver contusion with abdominal collection; one of them who was haemodynamically unstable needed laparotomy and resection of lacerated left liver lobe, while the other underwent conservative treatment.

IV) Patterns of injury:

Forty five (59.2%) of cases had single system injury and 31 (40.8 %) had multiple system injury. The patterns of injuries in relation to the age, type of road user and the type of collision will be shown in (Tables 6, 7, 8).

Table 6. Patterns of injury in motorcycle accidents in relation to the type of road user.

System affected Type of road user	Head		Face		Chest		Abd.& pelvis		Extremities		Eye		Mixed	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Motorcycle drivers	24	31.6	18	23.7	6	7.9	5	6.6	21	27.6	6	7.9	19	23.7
Motorcycle passengers	9	11.8	4	5.3	1	1.3	1	1.3	5	6.6	3	3.9	7	7.9
pedestrians	6	7.9	4	5.3	1	1.3	3	3.9	7	9.2	1	1.3	5	6.6
Total	39	51.3	26	34.3	8	10.5	9	11.8	33	43.4	10	13.1	31	40.8

Table 7. Patterns of injury according to age groups of road users.

System affected Age group of road user	Head		Face		Chest		Abd.& pelvis		Extremities		Eye	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 9 years	5	6.6	1	1.3	--	--	2	2.6	1	1.3	1	1.3
0- 19 years	12	15.8	9	11.8	2	2.6	4	5.3	7	9.2	3	3.95
20-29 years	13	17.1	8	10.5	3	3.95	3	3.95	14	18.4	5	6.6
30-39 years	3	3.95	3	3.95	1	1.3	--	--	6	7.9	1	1.3
≥ 40 years	6	7.9	5	6.6	2	2.6	--	--	5	6.6	--	--
Total	39	51.3	26	34.2	8	10.5	9	11.8	33	43.4	10	13.1

Table 8. Patterns of injury according to type of collision.

System affected Type of accident	Head		Face		Chest		Abd.& pelvis		Extremities		Eye	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Motorcycle to another	2	2.6	2	2.6	--	--	1	1.3	4	5.3	3	3.95
Motorcycle to a car	20	26.3	12	15.8	3	3.95	3	3.95	16	21	2	2.6
Motorcycle to a human	6	7.9	4	5.3	1	1.3	3	3.95	7	9.2	4	5.3
Motorcycle loss of control	11	14.5	8	10.5	4	5.3	2	2.6	6	7.9	1	1.3
Total	39	51.3	26	34.2	8	10.5	9	11.8	33	43.4	10	13.1

V) Outcome of patients:

The majority (N=43; 56.6 %) of patients had good outcome with complete cure, while 31 (40.8 %) had complicated outcome and 2 patients died. The Patterns of outcome in motorcycle injuries and their relation to the type of road user were shown in Table 9.

Table 9. Patterns of outcome in motorcycle injuries and their relation to the type of road user.

Outcome Type of road user	Good out come		Complicated out come		Death		total
	N.	%	N.	%	N.	%	
Motorcycle drivers	31	62 %	18	36 %	1	2 %	50
Motorcycle passengers	3	23%	10	77 %	-	-	13
Pedestrians	9	69.2 %	3	23.1 %	1	7.7 %	13
Total	43	56.6 %	31	40.8 %	2	2.3%	76

The morbidities were related to the neurologic system in 18 (23.7%) of cases, severe facial disfigurement in 9 (11.8%), orthopedic affection in 8 (10.8) and cardiothoracic affection in one (1.3%). Seven (9.2%) patients had multiple system morbidity. There were two mortalities, one (1.3%) case due to initial severe brain damage and the other was due to severe facial injury with panfacial fracture and failed to recover postoperatively.

DISCUSSION

Motorcycles are one of the most dangerous forms of motorized transportation. Due to small size of their vehicles, motorcycle riders represent a vulnerable group of road users.⁵ The description of the motorcycle as the most dangerous of all motorized vehicle for transportation can be attributed to its nature and design e.g. absence of airbags to reduce impact in the event of a collision and therefore riders and passengers alike are vulnerable victims of road traffic crashes.¹

Motorcycle use is becoming popular in Upper Egypt as it has become a cheaper and easier means of transportation in most cities. In recent years, there has been a significant increase in the number of motorcycle accidents with increasing use of motorcycles as a commercial means of transport. However, the public policy responses to this problem have been muted, probably because of lack of local data regarding the problem. In Upper Egypt the problem was somewhat more complex and many other factors increase the magnitude of the problem; the badly designed narrow roads, lack of infrastructure, low socioeconomic standards, absence of traffic police especially after revolution of 25th January and tendency of many people to break laws as misinterpretation of freedom.

Males are more often exposed to traffic as drivers; they travel longer distances to work and are more often involved in use of automobile as leisure activities.⁹

In our study, 72 (94.7%) of the injured patients were males. Motorcycle riding in this area is almost exclusively men, most of whom do it for commercial purposes. The young male preponderance (69%) in this study agreed with findings reported elsewhere.^{7,10-13} High occurrences of motorcycle accidents among this group have been attributed to a wide range of

activities engaged in by this class of people. They are more likely to have reasons to move from one place to another. They represent the active group that participate in high risk-taking activities such as recklessness driving, over-speeding and overloading their motorcycles, and riding without wearing any protective means.⁹

Motorcyclists are usually vulnerable to motorcycle accidents in that the majority of them are driving and exceeding the speed limit. Alcohol and drug usage causes carelessness and loss of concentration as well as over speeding and neglecting to use safety equipment such as helmet. In the present study, motorcyclists constituted the majority (N=50; 65.8%) of motorcycle injury victims. This was in agreement with other findings reported elsewhere,^{11,13,14} but in contrast with Naddumba and Okeniyi et al, who reported pedestrians as the majority of victims affected.^{7,10} This may be due to that high percentage of motorcycle accidents in our study occurred on high ways, between a motorcycle and a car or a single motorcycle loss of control. The young age of motorcyclists and lack of driving license in our study may be additional causes. Among all the 50 motorcycle drivers included in this study only 14 (28%) had license, and 36 (72%) didn't have license.

Motorcycle helmets have been reported in literature to reduce the risk of death and head injuries.^{15,16,17} However, studies have shown that helmet use in developing countries is low.^{18,19}

In the present study, crash helmet use was recorded in 0 % among motorcyclists and their passengers in agreement with other findings reported elsewhere in Kampala, in Lagos, Nigeria, in Benin City and in Uganda.^{12,14,20,21} However, Catherine et al in Victoria reported high incidence of helmet use in 53% of patients.²²

These differences in the rate of helmet use imply different attitudes to helmet wearing and reflect differences in awareness of factors contributing to crash occurrence and injury severity related to motorcycle accidents between these countries and poor enforcement of traffic laws. The reasons for non-compliance were not specifically studied but may include the cost of the helmet, ignorance, a cultural disposition toward lawlessness, fatalism, insufficient educational campaigns, and/or recreational drug use, which has been associated with non-compliance.²³ Other arguments that have been

advanced in 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.^{11,24} However, none of these alleged disadvantages have been supported by evidence.

The finding that most of injuries in the present work occurred during the day time agreed with reports coming from similar African countries like Uganda, Rwanda and Tanzania.^{10, 13,25} 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 patient is important for prevention strategies.

In the present study, the collision between a motorcycle and a motor-vehicle was the most common mechanism of injury being encountered in 30 (47.6%) accidents. Similar trend was also reported by Solagrebu et al and Twagirayezu et al.^{11,25} The motorcycle-vehicle collisions occurred commonly because the majority of the riders often ignored safety measures, making them more vulnerable to accidents with other motorized vehicles.^{19,11} In addition, the absence of pedestrian walkways in most of the roads has increased the vulnerability of pedestrians to all motorized vehicles.

Trauma caused by motorcycle crashes is extensive, expensive and increasing. Previous studies have shown that musculoskeletal and head injuries are the commonest causes of morbidity and mortality in motorcycle injuries, attributing the latter to the neglected use of motorcycle helmets; a situation seen in most developing countries.^{10-13,26}

In our work, the commonest injuries were neurosurgical injuries being occurred in 39 (51.3 %) of cases; followed by orthopedic injuries in 33 (43.4%) of cases; then facial injuries in 26 (34.2%) of cases. These head injuries including facial and ophthalmologic injuries among drivers and passengers of this study could be prevented by only using a helmet.

The pre-hospital care of trauma patient has been reported to be the most important factor in determining the ultimate outcome after the injury.

Most of our patients didn't have pre-hospital care; as a result the majority of them were brought in by relatives who were not trained on how to take care of patients during transportation. This observation was common to many other

developing countries. The lack of advanced pre-hospital care and ineffective ambulance system for transportation of patients to hospitals are major challenges in providing care for trauma patients in developing countries.

Trauma victims require a precise, rapid and systematic approach to initial evaluation in order to ensure their survival.²⁷ Primary evaluation, called ABCDE rule or ABCS evaluation, includes: A, airway maintenance and cervical spine control B, breathing and ventilation C, circulation and haemorrhage control D, disability and neurological status E, exposure / environment control.²⁸ Traditional plain radiographic imaging of the injured patient includes trauma bay portable chest, pelvic, and lateral cervical spine radiographs. The focused abdominal sonogram for trauma (FAST) complements the portable chest and pelvis films.²⁹ The Computed Tomography (CT) scan is the definitive radiographic study in most patients with trauma. CT imaging of the abdomen, pelvis, chest, and head is the most sensitive and accurate noninvasive diagnostic tool for identifying soft tissue injury.³⁰

The majority (N=43; 56.6 %) of patients in our study had good outcome with complete cure, while 31 (40.8 %) had complicated outcome. Only 2 patients had died in this study; the cause of death was directly related to the injury itself causing severe brain damage in one patient and failure to recover postoperatively in the other patient due to massive panfacial fracture.

In conclusion, motorcycle injuries constitute a major but neglected emerging public health problem in Upper Egypt. The young adult males in their reproductive and productive age group are commonly affected. Head and limb injuries are the most common types of injury sustained predisposing these patients to prolonged hospitalization and mortality.

Since the majority of motorcycle injuries are preventable, the following safety measures as suggested by Naddumba, in Kampala, Uganda are highly recommended: (i) protective gear to include a helmet, eye and face protection, long pants, gloves, boots and a durable long-sleeved jacket; (ii) restriction of alcohol and drug consumption before operating a motorcycle; (iii) strict enforcement of traffic laws and regulations; (iv) headlights to be kept on all the time during motorcycle riding; and (v) all motorcycle riders'

should undertake course before being licensed as motorcyclists.¹⁰

In addition, making the road safety, supporting the infrastructure, and preparing special tracks for the pedestrians for their walking and crossing the roads are other important safety measures.

Finally, this study appeared small and probably did not show the true picture of the problem. It might not be representative of the population since it was based on one tertiary hospital and some patients would have been taken to other primary and secondary health facilities. In addition some might have not visited the hospital at all because of perceived notion that the injuries are minor.

However, the data collection method was well coordinated through collaboration between the staff of the medical records department and doctors to avoid any possible errors.

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