

## COMMERCIAL BICYCLIST INJURIES IN KISUMU CITY, KENYA: AN EPIDEMIOLOGY OF A NEGLECTED PROBLEM

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**ABSTRACT:** *Background:* Commercial bicycling has become a popular mode of transportation in Kenya, in both rural and urban areas since early 1990's. In Kisumu city, however, its related injuries cause significant morbidity and mortality. Many road users have viewed their presence in the roads as the cause of congestion, confusion, fear, and decreased safety in the roads in the road system.

*Objectives:* The primary objectives were; to determine demographic characteristics of the commercial bicyclists, magnitude and characteristics of road traffic crashes and injuries involving commercial bicycling.

*Methods:* Cross-sectional descriptive study involving review of medical and traffic police records in New Nyanza Provincial General Hospital, Kisumu District hospital, and Traffic police station records departments respectively, was used to status of bicyclist crashes and injuries in Kisumu City. Hospital and police records were reviewed to determine road traffic crashes and injuries involving commercial bicyclist for a period of one year, 1<sup>st</sup> January 2008 to 31<sup>st</sup> December 2008. Information about injury disposition, severity, outcome of injuries were entered in designed forms.

*Results:* A total of 209 patients were treated for bicycle-related injuries in both hospitals and 64 cases were recorded in police records. The age group most affected in road trauma involving bicyclists was 21-30 years accounting for 32.1%. 45.9% were pedestrians hit by bicyclists, 46.9% of the bicycle related casualties reported by the traffic police were slightly injured, 28.1 % were seriously injured and 25% were fatal cases. Of the fatal cases 56.3% were passengers carried by bicyclists, 25% were pedestrians knocked by bicyclists and 18.7% were bicycle riders. 9.3% of injuries occurred in major roads within the city. The majority of casualties in police derived data were adults aged above 16 years (78.2%).

*Conclusion:* The high prevalence of bicycle related cases calls for a review of the local situation so that concerted efforts are made to design coordinated and effective interventions for commercial bicyclists. The age group most commonly affected in road trauma involving bicyclists was 21-30 years. Over three quarters of the patients who sustained bicycle related injuries were aged below 40 years and were mainly males.

Cut wounds were most commonly sustained followed by head injuries, dislocations, fractures while lacerations and contusions are sustained less. Most of those who died sustained head injuries.

**KEYWORDS:** Commercial bicycle, fatalities, Injuries, Casualties, Injury disposition, injury outcome, severity, morbidity, burden

### INTRODUCTION

Road traffic crashes and injuries constitute a major health, economic and developmental challenge to developing countries, especially those in Africa. Each year, an estimated 1.2million people are killed in road crashes and 50 million injured worldwide<sup>1</sup>. Road traffic injuries are currently ranked 9<sup>th</sup> among the leading causes of disease burden, in terms of disability adjusted life years (DALYS) lost.<sup>1</sup>

There are about 800 million bicycles in the world, twice the number of cars<sup>2</sup>. In Asia alone, bicycles carry more people than do all the world cars. Nonetheless, in many countries, bicycle injuries are not given proper recognition as a road safety problem and attract little research<sup>2</sup>. In Beijing China, about a third of all traffic deaths occur among bicyclists<sup>3</sup>. In India, bicyclists represent up to 21% of road users fatalities, the second largest category after pedestrian<sup>4</sup>. China is one of the developing countries where public policy until recently has encouraged the use of bicycles as a form of commuting<sup>5</sup>. Kisumu city has approximately 14000 commercial bicycles. In the United States, there are 67 million bicyclists who ride approximately 15 billion hours per year<sup>3</sup>. Each year, approximately 750 persons die from injuries due to bicycle crashes and over 500,000 persons are treated in emergency departments. While over 90% of deaths from bicycle-related injuries are caused by collisions with motor vehicles<sup>4</sup>, these collisions cause less than 25% of non-fatal head injuries. Head injury is by far the greatest risk posed to bicyclists, comprising one-third of emergency department visits, two-thirds of hospital admissions, and three-fourths of deaths.

Accident studies in USA show clearly that motorists were judged to be solely at fault in only 28% of car-bicycle collisions, cyclists solely at fault in 50% collisions and both were at fault in 14%<sup>6</sup>. In Kenya no such information has been documented.

A study done in Kenya using police records compiled for 10 years (1986-1995) shows that cars were responsible for 41.3% of accidents, lorries and buses responsible for 3.1%, pedal cycle 3.9% and animals and handcrafts were responsible 1.61% of the accidents<sup>7</sup>.

A recent global road safety project (GRSP) study shows that about 10% of global road deaths in 1999 took place in sub-Saharan Africa where only 4 percent of global vehicles are registered, conversely, in the entire developed world, with 60% of all globally registered vehicles, only 14% of road deaths occurred<sup>8</sup>. However, given the widely recognized problem of under reporting of road deaths in Africa; the true figures are likely to be much higher, as the police reported road fatalities represent only the tip of the pyramid. The WHO estimates that 190,191 road traffic injuries occur in sub-Saharan Africa annually<sup>9</sup>.

As in other developing countries, males are over involved in road traffic crashes and account for 67% of those killed<sup>10</sup>. This can partly be explained by their greater exposure to traffic as drivers and as frequent travelers in motor vehicles for work and leisure activities. Females are involved mainly as passengers and pedestrians. In Botswana, for instance, a recent study showed that females accounted for as high as one-third of all pedestrian fatalities<sup>8</sup>. The incidence of bicycle related injuries varies between countries. This is partly due to factors such as road design, the traffic mix, climate and cultural attitude. Over 75% of fatal bicycle injuries are due to head injury<sup>11</sup>. Among children, bicycle crashes are the leading cause of head injury<sup>12</sup>.

Most bicycle related injuries occur to the upper or lower extremities, followed by the head, face, abdomen or thorax and neck<sup>13</sup>. Most of the injuries involve superficial trauma such as "abrasions road rash" contusions and lacerations<sup>14</sup>.

Commercial bicycling has become a popular mode of transportation in Kenya, in both rural and urban areas since early 1990's. In Kisumu city, however, its related injuries cause significant morbidity and mortality. Many road users have viewed their presence in the roads as the cause of congestion, confusion, fear, and decreased safety in the roads in the road system<sup>15</sup>. Bicyclists and pedestrian also non as non motorized are among the most vulnerable road users and represent an important group to target for reducing road traffic injuries. Bicyclists have especially poor safety behaviour when compared to other road user groups

The massive influx of bicycles in the city has led to major conflicts within the existing transportation channels. Hence a major challenge to both the City and the traffic police department today is how to tackle the large number of accidents and integrate this economic activity into the urban transport while minimizing user conflict and ensuring safety<sup>15</sup>. There is a significant absence of information in the literature regarding the nature of bicyclist crashes, especially those involving commercial bicyclist. However more focus is on motorcyclists.

The objective of this study was to determine the demographic profile of victims of, magnitude and characteristics of road traffic crashes and injuries involving commercial bicyclists.

## METHODS

This was a cross sectional study involving review of records of bicycle related injuries presenting to two major government hospital providing accident and emergency service in Kisumu city. This city has an estimated population of 970000.

Data were also obtained from traffic police records.

**MEDICAL RECORDS**

The study was conducted from the main records office after obtaining approval and permission from the administration of the participating hospitals. A review of records was carried out at New Nyanza Provincial Hospital and Kisumu District hospital at the records office. New Nyanza Provincial Hospital lies along the Kisumu –Kakamega road. It is the largest Hospital in the region which not only serves people from Nyanza province but also People from Western and some part of Rift Valley. This hospital is a Level 5 referral hospital located by the lakeside city of Kisumu. Kisumu is Kenya's third-largest city and shares a common heritage with Nairobi and Mombasa as having developed from a port into a city with the construction of the Uganda Railway under the East Africa Railways and Harbors Corporation. The 450-bed capacity hospital is the largest hospital in Kenya's Nyanza province and sits right at the shores of Lake Victoria, the largest fresh water lake in Africa. Like other provincial general hospitals in Kenya, it is the best equipped in terms of resources and personnel to handle the more complex medical cases in the immediate region. Referrals within the region from District and Mission hospitals are referred to this hospital and on the Kenyatta National Hospital from this hospital. In terms of electives, this hospital offers wide exposure to clinical experience in dealing with tropical and infectious diseases, with a high prevalence of malaria, HIV/AIDS-related and opportunistic diseases such as tuberculosis. It has a casualty department with high traffic and students can also work in the wards related to internal medicine, pediatrics, obstetrics and gynecology and surgery. Kisumu District Hospital, located approximately one kilometer from New Nyanza Provincial General Hospital, has 150 beds capacity with two medical wards. Approximately 20-25 patients are admitted daily. The two hospitals were chosen in this study because they are both public hospitals and the services provided are relatively inexpensive as compared to private hospitals. Most road traffic crash victims are taken to the public hospitals.

After obtaining information for all road traffic injuries and crashes from the hospital records, files and summarized information in Ministry Of Health (MOH 504) and (MOH 268) forms for those injured because of involvement of commercial bicyclists in one way or another were retrieved so as to characterize the crashes and injuries and ascertain the magnitude. The following data were extracted;

- i. Time,
- ii. Date of injuries and crashes,
- iii. Diagnosis (e.g. head injury) and
- iv. Outcome (dead discharged having fully recovered, referred).

The reports, compiled by the health information system was based on data submitted quarterly by some health facilities and was found to be grossly incomplete and imprecise with respect to demographic characteristics and nature of injury.

**POLICE RECORDS**

The department is served with a well-coordinated network of officers who investigate reported road crashes. The vehicles involved in crash/accidents are not supposed to be taken away from the scene until information about the crash is recorded. This should be done by entering the details in an accident report forms but always recorded in registers. In practice many details are left out (Odero, 1995).

The Kenya police routinely collect and store data on crashes involving personal injuries or fatality. Police reports are the single most comprehensive source of data on traffic crashes in Kenya, as they are collected by every police station using standard forms and submitted to police headquarters for collation and analysis. Files and P41 forms containing information on crashes recorded from January, 2008 to December, 2008 were reviewed and with the help of one police officer a pre-designed forms were filled by two survey assistants who were deployed for this purpose. The following data were extracted and recorded; Crash severity (whether fatal, serious, or slight), category of road user affected, vehicle involved and causes of crashes, mainly attributed to Human error, vehicle defects and traffic environment as judged by the investigating officers.

**ETHICAL CLEARANCE**

The study was reviewed and cleared by Institutional Research and Ethics Committee (IREC) from Moi University/Moi Teaching and Referral Hospital. Thereafter permission was sought in writing from the medical Superintendents of the two hospitals and police commandant. They were also requested to assign one of the officers concerned with records to assist in data collection.

**DATA ANALYSIS**

The quantitative data were entered into SPSS version 10 programme. Data were edited to check for discrepancies and errors. The data were analyzed using various statistical tests. Descriptive statistics were done, cross tabulation, Chi square tests and ANOVA test were performed. The data were summarized in the tables and graphs, upon which the references were drawn.

**RESULTS**

**DEMOGRAPHIC CHARACTERISTICS**

A total of 209 patients' files for both inpatients (98) and outpatients (111) who attended the hospital during the period January to December 2005 were retrieved. This was 45.8% of all road traffic injuries treated during the period January 2005 to December 2005. The age range of patients was 5-70 years with a mean of 33 years. The age group most commonly affected in road trauma involving bicyclists was 21-30 years (32.1%); over three quarters of the patients were aged below 40 years. Males were affected in 82.3% of the cases and females 17.7% giving a male to female ratio of 4.6:1. Of the total number of casualties from bicycle related injuries pedestrian comprised 45.9%, bicyclists (22.8%), drivers (2.1%), passengers (11.2%) as shown in Table 1.

*Table 1. Demographic characteristics*

<b>Characteristic</b>	<b>No.</b>	<b>%</b>
<b>Age</b>		
0-10	12	5.7
11-20	46	22
21-30	67	32
31-40	40	19.1
41-50	40	19.1
51-60	17	8.1
>60	3	1.4
<b>Sex</b>		
Male	172	82.3
Female	37	17.7
<b>Road user category</b>		
Bicyclists	22	22.8
Driver	2	2.1
Passenger/Occupant	11	11.2
Pedestrian	45	45.9
Total inpatients	98	46.9
Outpatients	111	53.1
Total	209	100

**CAUSE OF INJURY INVOLVING BICYCLISTS AMONG HOSPITAL ADMISSIONS.**

The majority of those injured by bicyclists were pedestrian, they accounted for 45.9%; 15.3% were collisions involving other bicyclists; 12.3% were collisions involving motorized vehicles including lorries, matatu and tricycle; 11.2. % fell off while carried by bicyclist after a crash with another bicycle, while 8.1% lost control and were injured.

61.9% of cases injuries who stayed in hospital for over 6 days were collisions of bicyclists with motorized vehicles. Of those knocked by a bicycle, 31.1% stayed in hospital for 1-3 days, 8.7% for 4-5 days. Of the patients who were admitted 27.5% stayed in hospital for 1-3 days, 17.3% stayed for 4-5 days, 15.3% for 6-8 days, 18.4% stayed for 9-11 days while 21.5% stayed in hospital for over 12 days. There was no significance difference in mean between cause of injury and the number of days taken in hospital. ANOVA= 0.785 P= 0.001(Table 2).

**BODY REGION OF INJURY**

The most frequently occurring injuries to cyclists were head injuries (39%) and upper extremity injuries (27%), followed by external injuries (15%) and injuries to the lower extremities (10%). Injuries to the upper extremities have shown an almost steady increase from 9% of all cyclist injuries. Head injuries accounted for the highest proportion of critical injuries (65%) and severe injuries (78%) to cyclists. Injuries to the lower extremities accounted for almost half of all serious injuries.

**NATURE OF INJURY BY PATIENT DISPOSITION AND OUTCOME**

Table 3 shows that, among the inpatients (98), cut wounds were most commonly sustained (24.5%). Head injuries accounted for 23.7%, and dislocations 15.3%, fractures constituted 12.3% while lacerations and contusions accounted for 14.2% and 10.3% respectively.

The pattern of diagnosis of type of injuries is reflected in the disposition / outcome pattern where the majority of the patients were treated and discharged (64.3%). Overall 20.4% of patients with bicycle related injuries died and 15.3% were referred. Of those who died, 60% sustained head injuries, 15% dislocations, 10% fractures, another 10% sustained cut wounds. Of those who were referred 40% sustained cut wounds, another 40% had sustained head injuries, 15.5% sustained fractures. Those who were treated and discharged sustained cut wounds accounted for 25.4%, lacerations (20.6%), contusions (15.8%), and fractures (12.8%).

There was significant relationship between diagnosis and outcome of the injuries (F=61.54 p= 0.000).

53.1% were outpatients accounting for the majority of injuries involving commercial bicyclists. All outpatients were diagnosed as having Soft Tissue Injuries (STIs). The actual diagnosis of injuries sustained could not be ascertained from the files, MOH 504 or MOH 268 forms because they were treated and went home with their treatment cards.

As shown in Table 4, 46.9% of the bicycle related casualties reported by the traffic police were slightly injured, 28.1 % were seriously injured and 25% were fatal cases. Of the fatal cases 56.3% were passengers carried by bicyclists, 25% were pedestrians knocked by bicyclists and 18.7% were bicycle riders. Of the serious injuries 44.4% were pedestrians, 36.6% were bicyclists and 19% were passengers. Of the slight injuries, 40% each were bicyclists and pedestrians, 13.3% were passengers while drivers involved were 6.7% in bicycle related crashes. There was significant relationship between casualty category and injury severity, (F= 52.2; p=0.001).

**Table 2. Cause of injury involving bicyclists among hospital admissions.**

Cause of injury	Number of cases	%
Pedestrian hit by a bicyclists	45	45.9
Head on collision by another cyclists	15	15.3
Bicyclist hit by matatu	5	5.1
Bicyclist hit by a lorry	4	4.0
Bicyclist hit fixed objects	7	7.2
Bicyclist hit by a tricycle	3	3.2
Fell down while carried by a cyclist after a crash with another	11	11.2
Lost control	8	8.1
Total	98	100

**Table 3. Nature of injury by patient disposition and outcome**

Diagnosis	Outcome			
	Treated & discharged	Referred	Dead	Total/%
Cut wounds	16	6	2	24(24.5)
Lacerations	13	0	1	14(14.2)
Contusions	10	0	0	10(10.3).
Fractures	8	2	2	12(12.3)
Head injury	5	6	12	23(23.7)
Dislocation	11	1	3	15(15.3)
Total	63(64.3%)	15(15.3%)	20(20.4%)	98(100%)

**Table 4. Severity of injuries sustained and Casualty category**

Injury severity	Casualty category				Total
	Bicyclists	Drivers	Passengers/occupants	Pedestrian	
Slight	12	2	4	12	30(46.9%)
Serious	7	-	3	8	18(28.1%)
Fatal	3	-	9	4	16(25%)
Total	22(34.4%)	2	16(25%)	24(37.5%)	64(100)

**Table 5. Causes of road crashes involving commercial bicyclists in Kisumu City**

Factor	No.	%
Human factors	39	62.5
Road environment	10	15.5
Vehicle factors	8	12.5
Other factors	7	9.5
Total	64	100

**DAY WHEN THE INJURIES WERE SUSTAINED**

Most injuries involving bicyclists occurred on Fridays (31.3%) and Sundays (21.8%), while the lowest number of bicycle injuries occurred on Saturdays (4.8 %). Almost three quarters of the injuries occurred during weekdays (73.4%) and only 26.6% occurred on weekends.

At the same time, the majority of these injuries occurred during the day (6.00am-7.00pm) accounting for 67.4%, only 32.6% occurred at night (7.00pm-6.00am).

**DISCUSSION**

Findings from this study present an insight into the epidemiology of bicycle related injuries in Kisumu City as case study for Kenya. The high levels of bicycle related injuries as was recorded and reviewed from both medical and police records departments are very alarming. This was 45.8% of all road traffic injuries treated during the period January 2006 to December 2006. This is extremely high compared to those reported by other researches done on road traffic injuries which have shown that the proportion of all bicycle injuries ranges from 11 to 21%<sup>16</sup>. The burden to the society from this injury is substantial. It can be attributed to variable levels of exposure to specific environmental conditions as well as human behaviour. This could increase if no efforts are made to implement intervention strategies identified. This means that bicycle specific interventions are urgently needed rather than the currently generalized road accident prevention programmes.

The demographic profile of those injured according to this study was similar to the general road traffic injuries. Most of the patients were predominantly young male aged 11-30 years. The age group most commonly affected in road trauma involving bicyclist was 21-30 years. In the police derived data, the ages of those killed or injured are classified into two broad groups: Children under 16years and adults aged 16 years and above. In this study, majority of the casualties involving bicyclists were adults comprising of 78.2%. Statistics for 1983-1990 show that children accounted for 10% of all casualties. Between 14% and 19% of the juvenile victims were killed, while the case fatality rate of adults was lower (10-14%). Other reports indicate high involvement of young population in non-fatal crashes<sup>16</sup>. Unfortunately, police statistics are very often incomplete, since many collisions are not reported.

Injury severity is often used as a measure of health consequences of the road crashes; injury is classified on the basis of the information available to the police within a short time after the crash. Classification may not reflect results of medical examination and are largely influenced by whether a casualty is hospitalized or not. Injury is classified as fatal if death occurs on the spot or any time after hospitalization. There is no defined time interval, though the police mostly report only deaths that occur on the spot. This represents an under reporting of the actual number of road fatalities. The study revealed that majority of the casualties were slightly injured, 46.9%, others had serious injuries (28.1%) and 25% had fatal injuries. The survey done by the Ministry of Transport reported that 13.86% were fatal accidents, 38.89% were serious injuries and 47.19% were slightly injured for the period between 2001 to 2005<sup>17</sup>.

Many bicyclist injuries were reported from the hospital, 209 cases as compared with only 64 casualties from police data. Since the police only records only crashes that are reported and deaths occurring on the spot, this tends to underestimate

the true magnitude of road traffic casualties. The majority were outpatients who were only diagnosed as having soft tissue injuries. A large proportion of trauma victims are managed on outpatients' basis. This places considerable work load on the hospitals' outpatients departments in terms of the demand for sufficient medical supplies, facilities and personnel. This implies that significant amounts of time as well as the attention of the medical and nursing staff are likely to be diverted towards caring for trauma victims involving commercial bicycles at the expense of other patients. The actual diagnosis of the injuries sustained by out patients could not be precisely ascertained and described from their files because such information was written in their notebooks or treatment cards, which are not always retained within the hospital registry but are taken home with them after treatment.

Pedestrians hit by bicyclists made up the largest proportion of road traffic injuries (45.9%). This was followed by bicyclists themselves who sustained injuries after collision that involved motorized vehicles or lost control. This study concurs with other road traffic injuries reported from both developed and developing countries where the majority of patients are pedestrians<sup>18</sup>. Several studies on road traffic injuries indicate that pedestrian are the most vulnerable and pay a heavy toll for their exposure to road traffic<sup>18</sup>. This study reaffirms the vulnerability of the pedestrians and bicyclists to road traffic crashes. This implies that road safety interventions should focus on both vulnerable groups and the context of crashes.

Cut wounds, head injuries, dislocations, lacerations, fractures are the most common injuries sustained by commercial bicyclists. The pattern of diagnosis of type of injuries is mirrored in the disposition / outcome pattern where majority of the patients were treated and discharged (64.3%). Those who died or referred were few. Most of those that died had head injuries. Head injuries occur in 22 to 97% of injured bicyclists often as a result of collision with a motor vehicle and are responsible for over 60% of all bicycle related deaths and the majority of long term disabilities<sup>19</sup>.

The predominance of males over female is also a worldwide trauma phenomenon. Because trauma affects males, the young population, it results in the loss of more working years than all other causes. The loss, pain, suffering or incapacitation of the young is tragic.

Most of injuries 59.3% occurred in major city roads compared to 21.9% on highway, round about and intersections 7.9%. This finding likely reflects the proportion of major road users (traffic mix) as well as the fact that high speed are possible on major city roads and highways with concomitant injury potential. In the study done in Kampala 59% of injuries occurred in a highway<sup>20</sup>.

The majority of the accidents occur during the day particular in the evening from 4.00pm to 7.00pm. This is particularly because most commercial bicyclists operate more during the day. Most of these occurred on Friday and Sunday and involve the pedestrian and bicyclists. This could be probably because these are the busiest days in Kisumu City. Such information is important for design of preventive strategies to curb the road carnage.

The study revealed that most victims sustained cut wounds followed by head injuries and majority of those admitted were discharged alive (64.3%).

## **CONCLUSION**

The study has provided data on the magnitude and characteristics of commercial bicycle related crashes and injuries. The high prevalence of bicycle related cases calls for a review of the local situation so that concerted efforts are made to design coordinated and effective interventions for commercial bicyclists. Commercial bicycle related injuries in Kisumu contribute 45.8% of all road traffic injuries among the patients who reported for treatment in hospitals. The results of this study were found to be generally consistent with other international studies in terms of the findings relating to the profile of cyclists, crash characteristics, injury severity and the most common types of injury. The majority of cyclists involved in crashes were young and predominantly male.

The study has revealed that injuries occur in major city roads, highway, roundabouts and intersections mainly during the day on weekdays particularly from 4pm-7pm.

The age group most commonly affected in road trauma involving bicyclists was 21-30 years. Over three quarters of the patients who sustained bicycle related injuries were aged below 40 years and were mainly males.

Cut wounds were most commonly sustained followed by head injuries, dislocations, fractures while lacerations and contusions are sustained less. Most of those who died sustained head injuries. The study is of its own kind in Kenya and due to the fact that it was restricted to only two hospitals, this may deny the study external validity necessary to project the findings to a wider population. Moreover, routine road traffic records generally lacked information on gender of the victims. Therefore, the sex-specific distribution of the affected casualties could not be established from police statistics. Some

characteristics of the injuries sustained by out patients could not be ascertained from their files because such information was written in their notebooks or treatment cards which are not always retained within the hospital registry. Nevertheless, there are possibilities that the situation in Kisumu City does not differ much from other parts of the country although the casualty figures may be lower in rural areas and small towns. It is therefore imperative that more comprehensive studies be undertaken to provide more information through a variety of data sources including population based survey and prospective studies in selected region and various hospitals.

The findings will help in stimulating interest among researchers, various government agencies and the public in this major health problem.

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