

ORIGINAL ARTICLE

## Outcome of Adolescent Bike Riders after Road Crash with and without Safety Measures in a Developing Country

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### ABSTRACT

**Background:** Road traffic crash is of growing public health importance worldwide contributing significantly to the global disease burden. There is paucity of published data on road traffic crashes in our local circumstances. This study was carried out to describe the outcome in patients of traumatic brain injury after road traffic crash in our local setting and provide baseline data for establishment of preventive strategies for the well being of adolescent bike riders.

**Methods:** This was a prospective hospital based study of road traffic crash victims carried out at Department of Neurosurgery, Jinnah hospital Lahore from January 2015 to December 2015. After informed consent from patients or their attendants, all patients were consecutively enrolled into the study. A total of 1490 patients were enrolled in the study who presented in emergency after road crash and only the bike riders were observed for the outcome. Data was collected using a pre-tested questionnaire and analyzed using SPSS computer software version 15.0.

**Results:** A total of 1490 road traffic crash victims were studied. All patients were male. The patients ages ranged from 12 to 57 years with the mean and median of 22.5 and 26 years respectively. The patients were divided into five groups as GROUP-A 10-20yrs age, GROUP -B 21-30yrs, GROUP -C 31-40 yrs, GROUP-D 41-50yrs and GROUP-E 51-60yrs. Regarding the vehicle only bike was included. Number of patients in group A was 340 (22.8%), group B 650 (43.6), group C 80 (5.3), group D 320 (21.4%) and group E 100 (6.7%). Regarding the mechanism 618 (41.4%) patients came after bike skidding, 636 (42.6%) patients came after bike with bike crash and 236 (15.8%) patients came after bike with other vehicle crash. Among total number of patients 216 (14.4%) were those having severe traumatic brain injury (STBI). Mortality rate among STBI was 106 (49.07%). The highest mortality was noticed in group C was 37.7% and in group A (adolescent patients) was 24.5% and this was significant ( $P < 0.001$ ) whereas regarding the outcome according to Glasgow outcome scale, Grade 5 was observed in 63.6% and Grade 4 & 3 in 13.02% & 14.4% respectively and Grade 2 in 1.7% of the patients. The stratification of patients was also done regarding the severity of injury and their outcome according to GOS. It showed that in group A 22.03% patients with mild TBI had GOS 5 & 6.78% with moderate TBI had GOS 5. Regarding severe TBI of group A 15.38% patients had GOS 2 & 24.53% had GOS 1 which was highest in all groups, same stratification was done for other groups as well which showed that the outcome in group A is devastating and its results are comparable with the elder age groups.

**Conclusion:** Road traffic crashes constitute a major public health problem in our setting and contribute significantly to unacceptably high morbidity and mortality especially for youth. Urgent preventive measures in the form of helmet wearing for bike riders and enforcement of traffic rules targeting at reducing the occurrence of road traffic crashes is necessary to reduce the morbidity and mortality resulting from these injuries. There should be uniform implementation of traffic rules and regulation of motorcycle industry all over the country.

**Keywords:** Road traffic crashes (RTCs), Traumatic brain injury (TBI), Glasgow outcome scale (GOS).

**Abbreviations:** RTCs: Road Traffic Crashes. TBI: Traumatic Brain Injury. GOS: Glasgow Outcome Scale. STBI: Severe Traumatic Brain Injury.

## **BACKGROUND**

It has been predicted that by 2020, road traffic injuries will rank as high as third among causes of disability adjusted life years (DALYs) lost.<sup>2,5,6</sup> Road traffic crashes (RTCs) are a major cause of misery, disability and death globally, with a disproportionate number occurring in developing countries.<sup>1-3</sup> The problem is increasing at a fast rate in developing countries due to rapid motorization and other factors.<sup>4</sup> In addition, while low-income and middle-income countries already account for more than 85% of all road traffic deaths in the world, the upsurge in the number of vehicles per inhabitant will result in an anticipated 80% increase in injury mortality rates between 2000 and 2020.<sup>5</sup>

Pakistan is a developing country in Asia and there is an alarming rise in road traffic crashes. It is due to the proliferation of roads, which are often in poor states and also, a phenomenal increase in the number of motor vehicles, many of which are old, and not road-worthy. The increasing use of motorcycles particularly for commercial service is a source of concern in this regard because motorcycles cause many more fatal road crashes than other vehicles worldwide. As motorcycles are relatively unsafe vehicles, the riders must be considered as unprotected vehicle users and their injuries are usually severe.<sup>8</sup>

There is a rapidly spreading motorcycle industry due to cheaper prices of the spare parts, because there are so many local manufactures without any proper legislative measures, they are assembling motor cycles in small so called home factories. As a result of which motorcycles are available at door step and without any proper legislative documentation. Another trend in Lahore and its nearby cities is to sale motorcycles on easy down payments, as a result of which number of motorcycles on roads is daily on a rise. There is disregard for the traffic rules in our society and poor enforcement of traffic safety regulations along with the apathy of traffic police. Majority of the bike riders don't follow the traffic rules as most of them are unaware of them due to lack of proper scrutiny while issuing them the driving license. Moreover the non licensed drivers add their part in road traffic crashes. To be effective, policies on availability of motorcycles, traffic safety, licensing authority and neurosurgical care in developing countries must be based on local evidence and research, and designed for the particular

group and economic circumstances found in developing countries.<sup>9</sup>

The reasons for the high burden of road traffic crashes in developing countries are: growth in the numbers of motor vehicle, poor enforcement of traffic safety regulations; inadequacy of health infrastructure, and poor access to health care.<sup>2,7,10,11</sup>

Injuries related to road traffic crashes contribute significantly to the number of trauma admissions at Jinnah Hospital Lahore, resulting in a significant number of deaths depleting resources including consumables and the health worker time. However, despite this burden, there is little, if any, published information on RTCs in our local circumstances and the public policy responses to this problem have been mute, probably because of lack of local data regarding the problem. This study was conducted in order to provide data to policy makers and other stakeholders who may wish to undertake interventions to improve road safety, healthcare, motor vehicle registration, licensing authority, traffic safety regulations enforcement and public awareness in the country.

The aim of this study was to highlight the age groups presenting with motorcycle road traffic crash especially adolescent ones who are now continuously on a rise, the mechanism of road crash and outcome of these bike riders injury in our setting. The study provides basis for establishment of prevention strategies for the sake of our youth and new generations.

## **METHODS**

### **Study Setting and Design**

This was a prospective hospital based study of road traffic crash patients of all age groups and gender presenting to the Accident and Emergency (A&E) department of Jinnah Hospital Lahore between January 2015 and December 2015. Jinnah Hospital Lahore is a 1200-bed, tertiary care and teaching hospital and its neurosurgery department is 60 bedded including 8 beds Neuro Critical Care unit and 8 beds High Dependency Unit.

### **Study Subjects**

Subjects for the study included all bike riders (only riders), both gender age from 10 – 60 years who presented after road traffic crash victims only with trau-

matic brain injury. Patients with polytrauma were excluded. Patients between 10 – 60 years age of both gender were divided into five groups, irrespective of injury severity. Patients who failed to give proper information and those who had no relative to consent for the study were included after consent from the Deputy Medical Superintendent on duty. Recruitment of patients to participate in the study was done at the A & E Department. Patients were screened for inclusion criteria and those who met the inclusion criteria were, after informed consent were consecutively enrolled into the study.

All study patients were first resuscitated in the A & E department according to Advanced Trauma Life Support. From the A & E department patients planned for neurosurgical intervention were operated in emergency operation theatre and rest of the patients were treated in emergency room and later on shifted to Neurosurgery ward or Neuro ICU for further treatment. Variables studied included demographic profile (age and sex), mechanism of injury, severity of injury and preventive precautions in the form of helmet. Outcome variables were according to the Glasgow outcome scale i.e. mortality and further stratification of Glasgow outcome scale according to age groups was also done. The severity of injury was determined using the Glasgow Coma Scale (GCS): severe (GCS 3 – 8), moderate (GCS 9 – 12) and mild (GCS 13 – 15). Depending on the type of injury, the patients were treated either conservatively or by surgery. All patients were followed up till discharge or death. This information was collected using a pre-tested questionnaire.

**Statistical Data Analysis**

Statistical data analysis was done using SPSS software version 15.0. Data was summarized in form of proportions and frequent tables for categorical variables. Continuous variables were summarized using mean, median, mode and standard deviation. P-values were computed for categorical variables using. A p-value of less than 0.05 was considered to constitute a statistically significant difference.

**RESULTS**

During the period under study, a total of 1490 road traffic crash victims were studied. All patients were male as our inclusion criteria was only bike rider and in our population there is trend of bike riding by males only. The patients ages ranged from 12 – 57 years with

the mean and median of 22.5 and 26 years respectively. The patients were divide into five groups according to their age. Group – A include 10 – 20 years Group – B include 21 – 30 years Group – C include 31 – 40 years Group – D include 41 – 50 years and Group – E include 51 – 60 years patients. Out of 1490 patients 340 (22.8%) were categorized in group A, 650 (43.6%) in group B, 80 (5.3%) in group C, 320 (21.4%) in group D and 100 (6.7%) in group E.

Group	Range of Age	Patients
A	10 – 20 years	340 (22.8%)
B	21 – 30 years	650 (43.6%)
C	31 – 40 years	80 (5.3%)
D	41 – 50 years	320 (21.4%)
E	51 – 60 years	100 (6.7%)

**Mechanism of the Injury**

As only bike riders were included in our study, so regarding the mechanism of injury 618(41.4%) patients had bike skidding, 636(42.6%) patients had bike with bike collision while 236(15.8%) patients had bike hit with other vehicle i.e. other than bike.

Mechanism of Injury	Total Patients: 1490
Bike Skidding	618 (41.4%)
Biek with Bike Collision	636 (42.6%)
Bike with other Vehicle Collison	236 (15.8%)

**Precautionary Measures**

Helmet use among motorcyclists as preventive measure was observed in 346 (23.25%) patients and no prevention was observed in 1144 (76.7%) patients. Group wise distribution of preventive measures was as follows:

Group A: Helmet prevention in 28 (8.3%) and no prevention in 312 (91.7%).

Group B: Helmet prevention in 56 (8.7%) and no prevention in 594 (91.3%).

Group C: Helmet prevention in 38 (47.5%) and no prevention in 42 (52.3%).

Group D: Helmet prevention in 154 (48.2%) and no prevention in 166 (51.8%).

Group E: Helmet prevention in 70 (70%) and no prevention in 30 (30%).

## Outcome of Adolescent Bike Riders after Road Crash with and without Safety Measures in a Developing Country

Group	Helmet Prevention	No Helmet Prevention
A	28 (8.3%)	312 (91.7%)
B	56 (8.7%)	594 (91.3%)
C	38 (47.5%)	42 (52.5%)
D	154 (48.2%)	166 (51.8%)
E	70 (70%)	30 (30%)

According to Glasgow coma scale patients were divided into three groups depending on the severity of injury. The Glasgow coma scale indicated that most of the patients 801 (53.7%) sustained mild head injury, 473 (31.7%) patients sustained moderate head injury and 216 (14.4%) patients had severe head injury. Forty (18.5%) patients who had severe traumatic brain injury

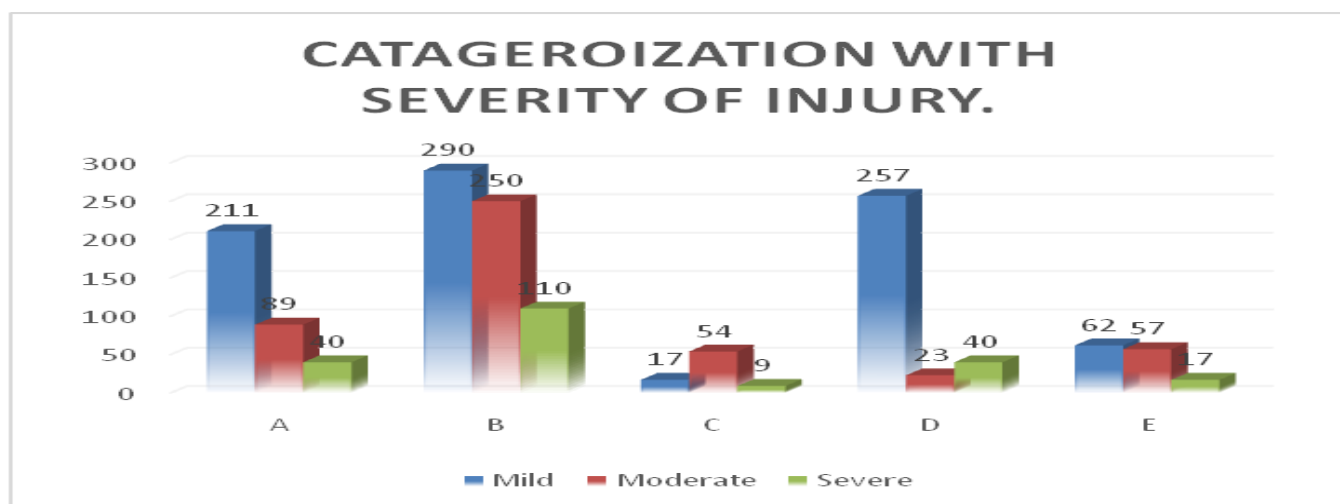
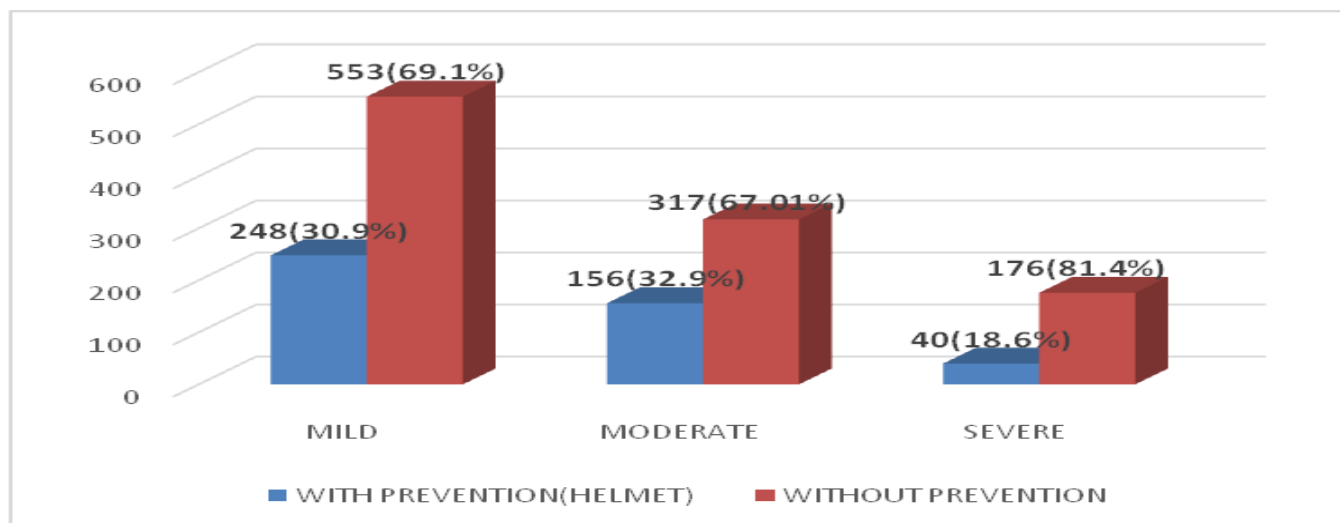
used preventive measures in the form of helmet while 176 (81.4%) patients of severe traumatic brain injury didn't use preventive measures i.e. helmet.

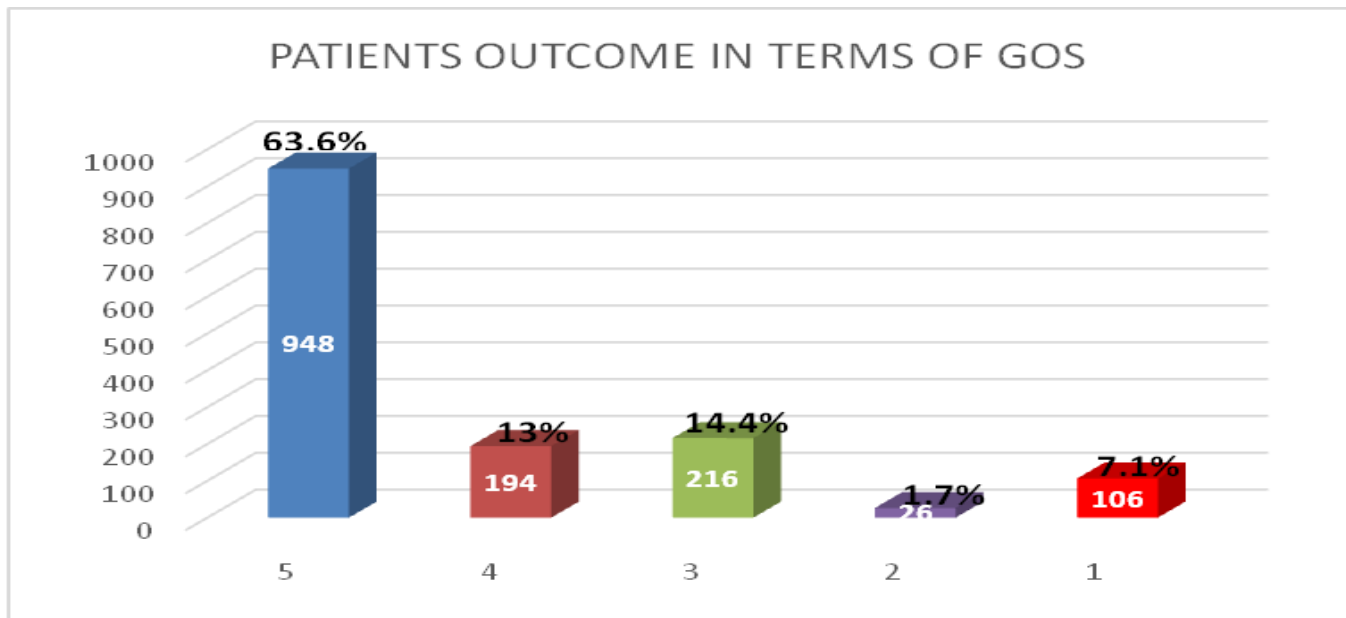
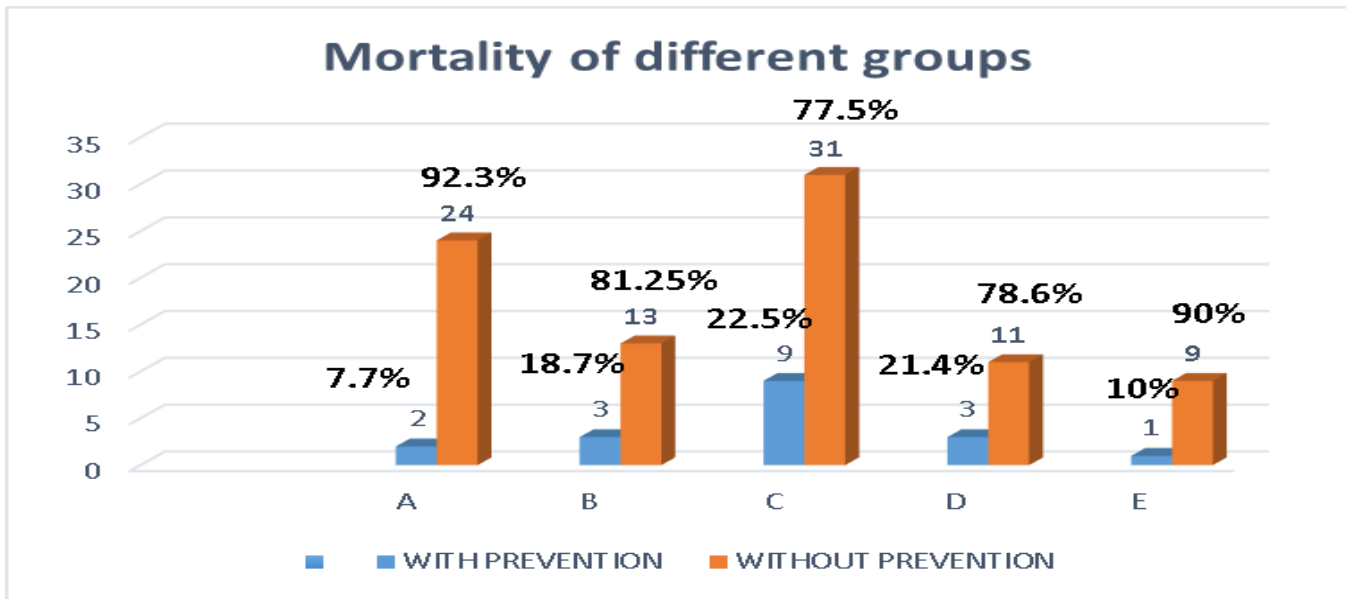
### SEVERITY OF INJURY

The categorization of the patients according to the severity of injury revealed that severe traumatic brain injury was most common in group B i.e. 50.9% followed by group A & D 18.5%. The moderate traumatic brain injury was common in group B i.e. 52.8% followed by group A 18.8% and same trend was seen in mild traumatic brain injury patients, which showed that group A i.e. of adolescents patients is on a rise in all severity groups.

The overall mortality was 106 (7.11%).

The mortality rates in patients with mild, moderate





and severe injuries were 1.8% (02 deaths), 17.9% (19 deaths) and 78.3% (83 deaths) respectively. According to multivariate logistic regression analysis, these differences were statistically significant ( $P < 0.001$ ).

The mortality according to the age group was highest in group C 40 (37.7%) followed by group A 26 (24.5%) then group B 16 (15.09%) subsequently followed by group D 14 (13.2%) and group E 10 (9.4%) with lowest mortality rate.

#### Clinical Outcome

It was assessed with the help of Glasgow outcome

scale. It was observed that out of 1490, 948 patients (63.6%) had grade 5 according to GOS, 194 patients (13.02%) had grade 4, 216 patients (14.4%) had grade 3 while 26 patients (1.7%) had grade 2 and 106 patients (7.1%) had grade 1.

The stratification of age groups according to the Glasgow outcome scale and severity of injury was also done. It showed that all patients with severe traumatic brain injury i.e. 24.53% had GOS 1 while 22.03% of mild traumatic brain injury and 6.78% of moderate traumatic brain injury had GOS 5 which emphasized that as severity of injury increases the outcome of

## Outcome of Adolescent Bike Riders after Road Crash with and without Safety Measures in a Developing Country

patients deteriorate, same trend was observed in other groups as well.

### DISCUSSION

The majority of road traffic crash victims were young in their most productive years and showed a male preponderance. The young male preponderance in the present study is in accordance with findings reported in Tanzania, Rawanda & Nigeria.<sup>8,12,15</sup>

This group represents the economically active age and portrays an economic loss both to the family and the nation. The reason for high incidence of road traffic crash in this age group reflects their high activity levels and participation in high-risk activities such as reckless driving/riding, over-speeding, driving/ riding under the influence of alcohol and driving/riding without wearing any protective gears. Male predominance in this study is due to their increased participation in high-risk activities as well as due to social circumstances of our society whereas females are most of the time not allowed to ride the bike. The fact that the economically productive age-group were mostly involved demands an urgent public policy response.

Adolescents and young males were the ones mostly injured because of the rush through heavy traffic to get to their job place and to the school. Similar observation was noted in the previous studies by others.<sup>8,12</sup> Students are usually involved in road traffic crashes as they rush through heavy traffic to and from their schools. These school-age group children are usually very active and are often less supervised than pre-school age children. As students formed one of the largest groups of road traffic victims overall, an improved school transportation system may reduce the incidence of road traffic crashes. Businessmen are often involved in buying and selling which necessitates movement from one place to another. This often involves travelling with good purchased, and in order to maximize profits, they usually opt for the cheapest means of transport available such as motorcycles.

Motorcycle use is becoming popular in Pakistan as

it has become a cheaper and easier mean of transportation in most cities. However their use is characterized by non-helmet riders and their passengers, passenger overload, lack of certified driver training and

A	Mild	Moderate	Severe	Total
5	208 (22.03%)	64 (6.78%)	0 (0%)	272
4	3 (1.55%)	14 (7.22%)	1 (0.52%)	18
3	0 (0%)	11 (5%)	9 (4.1%)	20
2	0 (0%)	0 (0%)	4 (15.38%)	4
1	0 (0%)	0 (0%)	26 (24.53%)	26
Total	211	89	40	340

B	Mild	Moderate	Severe	Total
5	287 (30.4%)	173(18.33%)	0(0%)	460
4	3 (1.55%)	53(27.32%)	43(22.16%)	99
3	0 (0%)	22(10%)	45(20.45%)	67
2	0 (0%)	2(7.69%)	6(23.08%)	8
1	0 (0%)	0(0%)	16(15.09%)	16
	290	250	110	650

C	Mild	Moderate	Severe	Total
5	17 (1.8%)	0(0%)	0(0%)	17
4	0 (0%)	10(5.15%)	0(0%)	10
3	0 (0%)	13(5.91%)	0(0%)	13
2	0 (0%)	0(0%)	0(0%)	0
1	0 (0%)	31(29.24%)	9(8.94%)	40
	17	54	9	80

D	Mild	Moderate	Severe	Total
5	190 (20.13%)	1 (0.1%)	0 (0%)	191
4	61 (31.44%)	0 (0%)	6 (3.09%)	67
3	6 (2.73%)	22 (10%)	18 (8.18%)	46
2	0 (0%)	0 (0%)	2 (7.69%)	2
1	0 (0%)	0 (0%)	14 (13.21%)	14
	257	23	40	320

valid licensing, over speeding and reckless driving, poor regulation and law enforcement and possible use of alcohol sometimes.<sup>7,8</sup> The availability of motorcycles on cheaper rates and even on easy down payments have resulted in their abundance. As a result of lack of regulation policy the number of manufacturers are on the rise and provide this dangerous mean of transportation at the door step. In Lahore and its nearby cities motorcycles on down payments are available in every town and street of the city. As a result of which there is always an increasing number of motorcycles on the road. Due to lack of legislation regarding the helmet usage the motor cyclists are the major burden of road traffic crash. Although in some areas of Lahore there is restriction of bike riding without helmet but that raises the question that in other areas who is going to enforce the preventive measures.

In this study, helmet use among motorcyclists was observed in 23.25% of the total patients. The same trend of non-usage of crash helmet and seat-belts was demonstrated in other studies.<sup>8</sup> The low incidence of helmet use among motorcyclist in this study reflects increased risks of severe trauma and head injuries in this region. This observation calls for preventive measures focusing on use of helmet.

The current study had a mortality rate of 7.11% which is lower than that reported in Rwanda by Twagirayezu *et al.*<sup>15</sup> In the present study high mortality was recorded in patients with severe head injury and in patients of group A & C i.e. 24.5% & 37.7% respectively.

The availability of cheaper motorcycles especially on cheaper down payments, lack of legislation regarding preventive measures, extremely deficient law enforcement, reckless driving, high activity levels, poor condition of roads has resulted in increasing incidence of adolescent bike riders road traffic crash culminating in loss of valuable lives of our youth. This leads to economic, social and emotional burden not only for the family but also for the nation.

## CONCLUSION

Road traffic crashes constitute a major public health problem in our setting and the young adult male in their economically productive age-group are mostly involved. Since the majority of road traffic crashes are preventable, enforcement of safety rules will help in

E	Mild	Moderate	Severe	Total
5	4 (0.42%)	4 (0.42%)	0 (0%)	8
4	0 (0%)	0 (0%)	0 (0%)	0
3	22 (10%)	48 (21.82%)	0 (0%)	70
2	0 (0%)	5 (19.23%)	7 (26.92%)	12
1	0 (0%)	0 (0%)	10 (19.23%)	10
	26	57	17	100

reducing the occurrence of RTCs. Awareness campaigns concerning safety rules targeting the high risk groups (young adult male, students and businessman) will also help in reducing the occurrence of RTCs. There is a need for regulating manufacturing and sale of motorcycles because the availability and cheaper down payments have resulted in their increase number. Usage by adolescent group is on a rise leading to their involvement in road traffic crashes and subsequently death or life long morbidities. Hence, there is a need for strict regulation, awareness and enforcement of law regarding motorcycle industry, driving license, usage of helmet and implementation of traffic rules.

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