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ORIGINAL ARTICLE

An Epidemiological and Biochemical Perspective on Motorcycle Road Traffic Accidents

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ABSTRACT

Background: Motorcyclists are prone to injuries due to road traffic accidents causing a high burden on health department.
Objectives: To access the burden and pattern of injuries associated with motorcycle related road traffic accidents in the Emergency department of Sheikh Zayed Hospital Rahim Yar Khan.
Methodology: A Total of 372 patients of road traffic accident were included in this cross sectional study from 1st March 2023 to 31st August 2023. The study was conducted in the Emergency department of Sheikh Zayed Hospital, Rahim Yar Khan. Data was collected by filling a questionnaire after interview of patients. Frequency of motor cycle related injuries and their pattern were noted. Informed consent was taken. Data was coded and analyzed by using SPSS version 27.
Results: Total Injured patients included in the study were 372, out of which 87.4% were males and 12.6% were females. 44.5% of the injured falling within the 18-34 years of age range. The study shows that 35.5% injured were uneducated and not following proper safety measures.
The majority of injured (65.1%) sustained major trauma, Involving head injuries and limbs fractures. The high proportion of major trauma causes burden on health system.
Conclusion: Major causes of accidents in motorcyclists were not following safety measures, over speeding, not wearing helmets and poor enforcement of traffic laws. Observance of safety precautions, strict adherence to traffic rules and regulations are mandatory to avoid any possible accident. A national effort is required for the prevention of accidents to conserve human life and the financial resources of the country.
Keywords: Motorcycle, RTA, Trauma, Helmet, Burden

INTRODUCTION

Every year the lives of approximately 1.19 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability. Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years. Road traffic accidents have become 8th leading cause of death among all age groups. Two-Thirds of road traffic fatalities occur among people of working age (18-59 years), Males are typically 3 times more likely to be killed in road crashes than females[1].

A survey shows that the majority of drivers (30.46%) believe that water trucks are commonly involved in RTAs. Additionally, 22.34% of respondents think that LTV like small cars are involved, 13.43% believe city HTV like buses are involved, and 9.52% perceive cargo vehicles to be associated with RTAs. The remaining (24.25%) believe that luxury cars, mini-buses, and motorcycles are involved in RTAs. Furthermore, 165 respondents (approximately 42.6%) believe that RTAs primarily occur at night, while 103 respondents (approximately 26.6%) think that RTAs mainly happen at noon. Additionally, 55 respondents (about 14.2%), 35 respondents (approximately 9.0%), and 29 respondents (about 7.5%) believe that RTAs mostly occur in the morning, evening, and afternoon, respectively in school and office timings. Another international research shows that motorcycle Accidents Accounted for 14% of All Traffic Deaths. Motorcycle riders account for 14% of all traffic facilities despite the fact only 3% of all registered vehicles are motorcycles[2]. Motorcycle crashes also account for 17% of all occupant fatalities and 3% of all injuries to vehicle occupants.

Motorcycle riders are 28 times more likely to die and four times more likely to be injured in an accident. 83000 Motorcyclists Were Injured in 2021. There were 5,932 Motorcyclists Killed in 2021. 2021 was a bad year for motorcycle riders. A total of 5,932 were killed in fatal traffic accidents. This was the highest number of motorcycle accident deaths since the Fatality Analysis Reporting System was first started in 1975. Motorcycle Accident Injuries Have Increased by 1% Over the Last Decade. Although there has been a dramatic increase in fatalities in motorcycle accidents, there has not been a corresponding increase in motorcycle accident injuries. In 2011, 81,706 motorcyclists were hurt in collisions compared with 82,528 injured victims in 2020. This reflects just a 1% rise in the number of injuries resulting from motorcycle crashes over the past decade. Motorcycle Fatalities and Road traffic accident (RTA) fatalities account for a significant number of unnatural deaths in Pakistan. Road accidents in Pakistan have taken a horrible toll in the last 10 years. According to reports, 15 people are killed daily in road, traffic accidents (RTA) in the country. Among these, accidents due to motorcycle have a significant contribution. Motorcycle riders account for 14% of all traffic facilities despite the fact only 3% of all registered vehicles are motorcycles. Motorcycle crashes also account for 17% of all occupant fatalities and 3% of all injuries to vehicle occupants.

Hence, it is necessary to investigate RTA fatalities in order to implement measures to reduce them. In the present study, we aimed to assess the detailed epidemiological characteristics of RTA fatalities by analyzing the data obtained from medico-legal autopsies performed at the Jinnah Postgraduate Medical Centre (JPMC) in 2019 and 2020. We assessed age- and gender-based variations in the pattern of RTA fatalities and determined the anatomical cause of death and sites of fractures among the fatalities.

More than 90% of road traffic deaths occur in low- and middle-income countries. Road traffic death rates are highest in the African Region and lowest in the European Region. Road traffic injuries cause considerable economic losses to individuals, their families, and the health system.

The safe system approach to road safety aims to ensure a safe transport system for all road users. This approach takes into account people's vulnerability to serious injuries and recognizes that the system should be designed to accommodate human error. The cornerstones of this approach are safe roads and roadsides, safe speeds, safe vehicles, and safe road users, all of which must

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be addressed in order to eliminate fatal crashes and reduce serious injuries. Speeding is also a major risk factor[3,4].

An increase in average speed is directly related both to the likelihood of a crash occurring and to the severity of the consequences of the crash. For example, every 1% increase in mean speed produces a 4% increase in the fatal crash risk and a 3% increase in the serious crash risk.

In the case of drink-driving, the risk of a road traffic crash starts at low levels of blood alcohol concentration (BAC) and increases significantly when the driver's BAC is ≥ 0.04 g/dl. In the case of drug-driving, the risk of incurring a road traffic crash is increased to differing degrees depending on the psychoactive drug used. For example, the risk of a fatal crash occurring among those who have used amphetamines is about 5 times the risk of someone who hasn't.

Non-use of motorcycle helmets, seat-belts and child restraints also contributes in fatality during RTA. Correct helmet use can reduce the risk of death in a crash by more than 6 times and the risk of brain injury by up to 74%.[3] Wearing a seat-belt can reduce the risk of death among vehicle occupants by up to 50%. The use of child restraints can lead to a 71% reduction in deaths among infants[2,5].

There are many types of distractions that can lead to impaired driving. The distraction caused by mobile phones is a growing concern for road safety. Drivers using mobile phones are approximately 4 times more likely to be involved in a crash than drivers not using a mobile phone. Using a phone while driving slows reaction times (notably braking reaction time, but also reaction to traffic signals), and makes it difficult to keep in the correct lane, and to keep the correct following distances.

Hands-free phones are not much safer than hand-held phone sets. Texting considerably increases the risk of a crash. Unsafe road infrastructure is also a key risk factor. The design of roads can have a considerable impact on their safety. Ideally, roads should be designed keeping in mind the safety of all road users. This would mean making sure that there are adequate facilities for pedestrians, cyclists and motorcyclists. Measures such as footpaths, cycling lanes, safe crossing points and other traffic calming measures can be critical to reducing the risk of injury among these road users. Safe vehicles play a critical role in averting crashes and reducing the likelihood of serious injury. There are a number of UN regulations on vehicle safety that, if applied to countries' manufacturing and production standards, would potentially save many lives. These include requiring vehicle manufacturers to meet front and side impact regulations, to include electronic stability control (to prevent over-steering) and to ensure airbags and seat-belts are fitted in all vehicles. Without these basic standards the risk of traffic injuries - both to those in the vehicle and those out of it is considerably increased.

Delays in detecting and providing care for those involved in a road traffic crash increase the severity of injuries. Care of injuries after a crash has occurred is extremely time-sensitive: delays of minutes can make the difference between life and death.

Improving post-crash care requires ensuring access to timely prehospital care, and improving the quality of both prehospital and hospital care, such as through specialist training programs.

If traffic laws on drink-driving, seat-belt wearing, speed limits, helmets and child restraints are not enforced, they cannot bring about the expected reduction in road traffic fatalities and injuries related to specific behaviors. Thus, if traffic laws are not enforced or are perceived as not being enforced, it is likely they will not be complied with and therefore will have very little chance of influencing behavior.

Effective enforcement includes establishing, regularly updating, and enforcing laws at the national, municipal, and local levels that address the above mentioned risk factors. It includes also the definition of appropriate penalties. Prevention must be done to avoid RTA incidents.

Governments must take action to address road safety in a holistic manner. This requires involvement from multiple sectors such as transport, police, health and education, as well as the private sector and civil society organizations. It requires actions that address the safety of roads, vehicles and all road users.

Effective interventions include designing safer infrastructure and incorporating road safety features into land-use and transport planning, improving the safety features of vehicles; enhancing post-crash care for victims of road traffic crashes; setting and enforcing laws relating to key risks, and raising public awareness.

The cause of death was head injury in 159 (64.6%) cases and multiple traumatic injuries in 65 (26.4%) cases. Injury to the chest, abdomen, and pelvis caused death in 11 (4.5%), nine (3.7%), and two (0.8%) cases, respectively. Assessment of the site of fractures revealed skull fractures to be the most common type of fractures (53%), followed by rib/sternal fractures (19%). Upper limb and lower limb fractures occurred in 10% and 9% of the cases, respectively, while pelvic and neck fractures occurred in 6% and 3% of the cases, respectively.

In addition to external trauma, road traffic accidents (RTAs) also result in internal biochemical and physiological disruptions. Injuries such as traumatic brain injuries, hemorrhages, and systemic inflammation often lead to metabolic imbalances that require laboratory confirmation and biochemical monitoring. Biochemical markers such as C-reactive protein (CRP), serum lactate, creatinine kinase (CK), and stress hormones like cortisol are essential in assessing injury severity, prognosis, and management planning[14]

Efforts need to be made at both government and individual levels to reduce RTA fatalities.

Objectives:

1 To identify and analyze the causes of motorcycle related road traffic accidents among the injured brought to Emergency Department of Sheikh Zayed Medical College Rahim Yar Khan.
2 To assess the impact and patterns related to age, gender, socioeconomic status and protective gear usage among the injured motorcyclists.
3 To provide the recommendations for prevention strategies aimed at reducing the incidence of motorcycle related accidents

METHODOLOGY

Study Design: This study was designed as a cross-sectional observational study to assess the burden of motorcyclist-related road traffic accidents (RTAs).

Study Setting: The research was conducted on injured of road traffic accidents presented or brought to the Emergency Department of Sheikh Zayed Hospital, Rahim Yar Khan.

Study Subjects: The study focused on individuals involved in road traffic accidents. Cases included those who were directly brought to the Emergency Department and those who presented on their own following an accident. The primary focus was on motorcyclist-related RTAs, but other road users involved in accidents were also documented for a comprehensive analysis.

Study Duration: Data collection spanned a total duration of 6 months, starting on 1st March 2023 to 31st August 2023

Sample Size: A total of 372 cases of road traffic accidents were included in the study. Among them, 292 were motorcyclists, further categorized into riders (189) and pillion riders (103). Additionally, 80 cases involved individuals from other modes of transport or pedestrians, allowing for a comparison between motorcyclist-related accidents and other types of RTAs.

Sampling Technique: A convenient sampling technique was employed for the study. This non-probability method was selected due to the nature of emergency cases, ensuring that every eligible patient presenting during the study period had an equal opportunity to be included in the research.

Inclusion Criteria: The study included all individuals involved in road traffic accidents, regardless of age, gender, or socioeconomic status.

1 Presented to the Emergency Department of Sheikh Zayed Hospital during the study period
2 Willing to participate and provided informed consent.

Exclusion Criteria:

1 All cases presented and brought to the Emergency Department with complaints unrelated to road traffic accidents.
2 Individuals involved in RTAs who were unwilling to provide informed consent to participate in the study.
3 Patients from other hospital departments or wards, except for the Emergency Department.

Data Collection Method: Data was collected using a structured, predesigned questionnaire. The questionnaire included sections covering the demographic characteristics of the patients, the circumstances leading to the accidents, details of injuries sustained, and outcomes. Information was gathered through direct interviews with patients or their attendants after obtaining informed consent.

All data collection strictly adhered to the inclusion and exclusion criteria to maintain the integrity and reliability of the research.

Data Analysis: The collected data was entered and coded by using SPSS version 27 for statistical analysis. Numerical variables, such as age and income, were analyzed and presented using measures of central tendency and dispersion, including mean, median, mode, and range. Categorical variables, such as gender, occupation, socioeconomic status, and education level, were summarized using frequencies and percentages.

RESULTS

This study was conducted among the patients that were injured due to Road Traffic Accidents and were presented to the Emergency Department of Sheikh Zayed Hospital, Rahim Yar Khan.

It was a descriptive cross-sectional study which was carried out from 1st March 2023 to 31st August 2023. A total of 372 responses were collected from patients presenting to the Emergency Department of Sheikh Zayed Hospital, Rahim Yar Khan through a manual questionnaire form. Data analysis was done using SPSS version 27.

Table 1: Age distribution among patients

Age	Frequency	Percentage
<12 Years	30	8.1
12-17 Years	51	13.7
18-34 Years	169	45.4
35-64 Years	106	28.5
65 & Above	16	4.3
Total	372	100

Table-1 shows the age distribution among n=372 patients of RTAs. Note that the age group of 18-34 years, n=169(45.4%) was more commonly involved in road traffic accidents than other age groups.

Table 2: Education level of the patients of road traffic accidents

Education	Frequency	Percentage
Uneducated	132	35.5
Primary	113	30.4
Secondary	75	20.2
Graduate	40	10.8
Masters & above	12	3.2
Total	372	100

Table-2 shows the education level of the patients of road traffic accidents. Majority of them were uneducated, n=132(35.5%) followed by those who has primary education, n-113(30.4%).

Table-3 represents the frequency and percentage of cause of accidents. Most of them were due to not following safety measures, n=64(21.9%) while others were due to other driver's error. n=60(20.5%) and over speeding. n=60(20.5%).

Table 3: Frequency and percentage of cause of accidents

Cause of accident	Frequency	Percentage
Driver's error	28	9.6
Other driver's error	60	20.5
Not following safety measures	64	21.9
Mechanical defect	16	5.5
Motocycle modification	4	1.4
Over speeding	60	20.5
Road defects	40	13.7
Cell phone use	19	6.5
Drugs intoxication	1	0.3
Total	292	100

DISCUSSION

The objective of the study was to find the prevalence and causes of motorcycle accidents among injured of Road traffic accidents presented in Emergency Department of Sheikh Zayed Hospital, Rahim Yar Khan.

In Pakistan, gender plays a significant role in Road Traffic Accidents (RTAs), with male drivers being more likely to be involved in accidents than female drivers. According to statistics, male drivers account for 80-90% of RTAs, while female drivers account for only 10-20%.

The highest distribution was among the age group 18-34 years accounting for 45.4% of the total. Second most vulnerable age group ranged from 35-64 years accounting for 28.5% of the total accidents. People under the age of 18 account for 21.8% of the injured, while those over the age of 65 account for 4.3%. In a study conducted by Hameedi et al, Critical Analysis of Accidents involving Motorcyclists in Punjab, also depicted a similar finding, that majority of the drivers were in the younger age groups, with 49.2% between 30-39 years of age, followed by 29.6% in the 20-29 age group. Majority (35.5%) of the respondents were uneducated while 30.4% were primary graduates and a very few had a Master's degree or above accounting for 3.2% of the total.

According to our results, majority (78.5%) of the RTA injured were riding motorcycle. Cars or other automobiles accounted for 11.3% of the vehicle involved in road traffic accidents. Others include bicycles, animal carts (3%), phatta rickshaw (7.3%) and pedestrians. Data from National Highway and Motorway Police and Road Safety Association of Pakistan shows that motorcycles account for 60% of RTA fatalities, while cars account for 25%, and trucks and buses for 10%. Rickshaws and three-wheelers account for 5% of RTA fatalities.

Out of the 292 injured who were involved in a motorcycle accident, 69 persons (23.6%) were also involved in a previous motorcycle accident. Out of which 9.2% have been previously hospitalized.

Majority of the people (90.1%) were not wearing helmet at the time of accident. Only 9.9% people were wearing a helmet. In 85.6% of the cases in which pillion rider was present, he/she was not wearing a helmet at the time of accident. Only 0.7% of the pillion riders were wearing a helmet.

The biochemical consequences of road trauma cannot be overlooked. For example, head injuries and polytrauma often lead to elevated oxidative stress markers and systemic inflammation. It has been observed that post-traumatic inflammatory response is associated with raised interleukin-6, CRP, and serum cortisol, which can help gauge the severity of trauma and guide therapeutic decisions. These parameters also reflect the body's acute phase response, highlighting the importance of early biochemical assessment post-RTA[14].

Furthermore, electrolyte imbalances, acid-base disturbances, and hypoxia markers must be monitored, especially in patients with prolonged immobilization or internal bleeding.

Based on the statistics of our study, the most common causes of the accidents were, ignoring safety measures (21.9%) and over speeding (20.5%). And a large percentage (20.5%) blamed it on the other driver and feigned ignorance regarding the cause of accident. Other reasons for accidents were poor

infrastructure of the roads (13.7%), 9.6% were due to the driver's own error (such as lack of attention, poor vision, old age etc.

Effective solutions require a multifaceted approach, involving both short-term and long-term strategies. Enhancing public awareness through education and media campaigns can encourage responsible driving practices. Improving road infrastructure, including maintenance and signage, can reduce accident risks. Implementing intelligent transportation systems (ITS) and strengthening emergency medical services can minimize the impact of RTAs. Ultimately, a concerted effort from all stakeholders is necessary to mitigate the devastating consequences of road traffic accidents in Pakistan.

CONCLUSION

Major causes of accidents in motorcyclists were not following safety measures, over speeding, not wearing helmets and poor enforcement of traffic laws. Observance of safety precautions, strict adherence to traffic rules and regulations are mandatory to avoid any possible accident. A national effort is required for the prevention of accidents to conserve human life and the financial resources of the country.

Recommendations: Effective enforcement of traffic laws such as consistently enforcing speed limits, right-of-way rules, and other traffic regulations to reduce accidents is essential to promote safer driving behaviors and reduce accidents. Measures should include:

- Mandatory Helmet Use: Strictly enforcing helmet laws for both riders and pillion passengers, with penalties for non-compliance.
- Licensing Regulations: Ensuring that all motorcycle riders possess valid driving licenses.
- Passenger Limits: Limiting the number of passengers on motorcycles to avoid overloading.
- Monitor high risk areas: Identify accident prone zones and increase police presence to prevent reckless driving.
- Traffic signs and signals: Install clear and visible traffic signs at critical locations, including accident-prone areas, schools, and marketplaces.
- Proper traffic lights: Ensure functional traffic lights at all major intersections and high-risk areas.
- Improving road infrastructure: Poorly maintained roads and inadequate traffic management systems contribute significantly to accidents.

Alongside infrastructure and policy reforms, integration of routine biochemical screening in emergency trauma protocols is recommended. Rapid biochemical profiling in the Emergency Department such as arterial blood gases, serum electrolytes, lactate, and cardiac enzymes can improve survival outcomes in RTA victims. Collaborative work with Biochemistry departments can also help in the development of trauma biomarker panels to standardize severity assessment and monitoring.

Education and awareness among medical teams about biochemical responses in trauma is equally critical to reduce the burden of RTAs on tertiary care systems.

The government should prioritize repairing and maintaining existing roads to eliminate potholes and other hazards. Proper lighting is needed particularly in rural and under-served areas. Constructing dedicated motorcycle lanes to separate two-wheelers from larger vehicles, minimizing the risk of collisions.

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