

Original Article

PATTERN OF INJURIES AND RISK FACTORS AMONG MOTORCYCLISTS IN ROAD TRAFFIC ACCIDENTS: A HOSPITAL-BASED STUDY IN SWABI, PAKISTAN

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Background: Worldwide, motorcycle-related road traffic accidents (RTA) are a major contributing cause of death, reporting 380,000 annual deaths, with developing countries bearing 93% of this. In our setup, knowing the serious injury problem and where exactly prevention and measures are most urgently needed is pertinent. This study determines the pattern of different types of injuries, associated risk factors, and demographic characteristics among motorcyclists involved in RTA presented to the District Headquarter's Hospital Swabi, KPK. **Methods:** It is a cross-sectional study conducted from 1st April to 1st October 2023 after IRB approval in District Headquarter's Hospital Swabi KP. A total of 182 samples was calculated, and non-probability consecutive sampling was used to draw the samples. Data was collected on a self-devised structured questionnaire and analysed using SPSS version 22. Chi-square was applied to assess the association between different variables. $p \leq 0.05$ was considered significant. **Results:** A total of 182 patients with a mean age of 27.52 ± 11.369 years, males 169 (92.9%), were included. In total, 92 (50.6%) did not possess basic knowledge of traffic rules, and 135 (74.2%) did not wear safety helmets. The most common cause of accidents was collision with other vehicles, 74 (40.7%), and injuries to lower limbs, 69 (37.9%). **Conclusion:** Motorcycle-related road traffic accidents are still common in the current area, primarily due to a lack of awareness of safety measures. It predominantly affects young males with lower limb and head injuries, mainly due to vehicle collisions.

Keywords: motorcyclists; injury pattern; road traffic accidents

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INTRODUCTION

Motorcycle-related road traffic accidents (RTAs) are a critical public concern globally, contributing to significant morbidity, mortality, and socioeconomic burdens, particularly in low-and middle-income countries (LMICs).¹ According to the World Health Organisation (WHO), approximately 1.19 million lives are lost annually to road traffic injuries, with motorcyclists accounting for 28% of these fatalities.² Motorcyclists are among the most vulnerable road users, facing a 34-fold higher risk of mortality per mile travelled compared to car occupants.³ Globally, motorcycle accidents account for over 380,000 annual deaths, with LMICs bearing 93% of this burden due to factors such as inadequate road safety infrastructure and enforcement of traffic regulations.⁴

In LMICs, motorcycle use has surged due to affordability and accessibility, particularly for economic activities and transportation in rural and urban areas. However, this rise has been paralleled by

escalating trauma rates, with young males aged 20-40 years constituting the majority of victims, reflecting their dominance in motorcycle-related occupations and risk-taking behaviours.⁴ Epidemiological studies highlight seasonal trends, with higher accident rates in summer months and geographic disparities, as rural roads often lack safety infrastructure, contributing to elevated mortality odds ratios.⁵ For instance, in Iran, summer motorcycle accidents accounted for 37.5% of hospital admissions, with the rural road mortality odds ratio reaching 3.52%.³ Similarly, autopsy-based studies in Malaysia revealed that 31% of fatally injured riders tested positive for alcohol or illicit drugs, underscoring behavioural risk factors.⁶

Injury patterns among motorcyclists are dominated by fractures and traumatic brain injuries, with lower limb fractures 44.6% and intracranial haemorrhages 74% frequently reported.⁴ The absence of helmets- a preventable risk factor-exacerbates head injury severity, as evidenced by studies in Malawi,

where 52% of victims lacked helmets.⁷ Despite these insights, region-specific data remain sparse in many LMICs, including Pakistan, where motorcycle use is widespread, but injury surveillance systems are underdeveloped.

This study examines the pattern of injuries and risk factors among motorcyclists presented to the District Headquarter's Hospital Swabi, KP Pakistan. We investigate local demographic, behavioural and infrastructural determinants based on findings from similar contexts, such as Iran's seasonal mortality trends, Malaysia's substance use associations, and Malawi's orthopaedic injury burden.

MATERIAL AND METHODS

It is a cross-sectional study conducted from 1st April 2023 to 1st October 2023 after IRB approval in District Headquarter's Hospital Swabi, KP, Pakistan. Using WHO software for sample size estimation with a confidence interval of 95%, an absolute precision of 0.07 and an anticipated population proportion of 63.5%, a total sample size of 182 was calculated, and non-probability consecutive sampling was used to draw the sample.⁸ The sample included all those patients who had met with motorcycle accidents and presented to either the emergency department or the OPD, or were admitted to the wards. All patients who were unconscious at the time of data collection or denied consent to the study were excluded from our study. Data was collected on a self-devised structured questionnaire and analysed using SPSS version 22. Descriptive analysis of continuous variables (age) was done in the form of mean \pm standard deviation. For categorical variables (gender, residence, and socioeconomic status), frequencies and percentages were calculated. Chi-square was applied to assess the association between different variables. $p \leq 0.05$ was considered significant.

RESULTS

A total of 182 patients with a mean age of 27.52 ± 11.369 years, among whom males were 169 (92.9%) and females were 13(7.1%), were included in the study Table-1. Half of the participants did not possess basic knowledge of traffic rules, and 135(74.2%) did not wear safety helmets Table-2. The most common causes of accidents were collisions with other vehicles, i.e., 74(40.7%), and injuries to lower limbs, 69(37.1%). Table-3.

Association of patterns of injuries with various conditions of patients resulted in non-significant statistics; $p < 0.05$. However, fractures were most common among those who did not wear helmets

67(49.7%) and were brought to the hospital with a conscious mind 67(51.9%). Similarly, fractures were caused mainly through vehicle-to-vehicle collisions, mostly involving lower limbs 40(58.0%) Table-4.

Table-1: Frequencies of socio-demographic parameters

Parameters		Frequency	Percentage
Gender	Male	169	92.9
	Female	13	7.1
Residence	Rural	95	52.2
	Urban	87	47.8
Education	Illiterate	29	15.9
	Below matric	66	36.3
	Below bachelors	72	39.6
	Above bachelors	15	8.2
Occupation	Student	45	24.7
	Labourer	19	10.4
	Teacher	15	8.2
	Others	103	56.6

Table-2: Basic description of participants about the accident

Ordinal variables		Frequencies	Percentage
Driving license	Yes	75	41.2
	No	106	58.8
Knowledge about traffic Rules	Yes	90	49.4%
	No	92	50.6%
Wearing helmet	Yes	47	25.8%
	No	135	74.2%
Time of accident	8 am to 8 pm	143	78.6%
	8 pm to 8 am	39	21.4%
Status at time of hospital arrival	Conscious	129	70.9
	Unconscious	53	29.1
Drug usage	Prescribed	10	5.5
	Addiction	16	8.8
	No usage	156	85.7
Eyesight	Normal	137	75.3
	With glasses	37	20.6
	Reduced visual acuity without glasses	8	4.4
Total		182	100

Table-3: Descriptives of different characteristics of injury and causes of incident

Ordinal variables		Frequencies	Percentage
Cause of accident	Bad roads	43	23.6
	Other vehicles	74	40.7
	Mechanical failure	19	10.4
	Over speeding	46	25.3
Site of injury	Head	61	33.9
	Trunk	14	7.7
	Upper limbs	30	16.5
	Lower limbs	69	37.9
	Others	8	4.4
Type of injury	Fracture	92	50.6
	Blunt injury	44	24.2
	Perforating injury	14	7.7
	Lacerations	32	17.6
Total		182	100

Table-4: Association of patterns of injury with different conditions of patients

Different conditions of patients		Type Of Injury [n (%)]				Total	p
		Fracture	Blunt Injury	Perforating Injury	Lacerations		
Was the patient wearing a helmet	Yes	25 (53.2)	11 (23.4)	1 (2.1)	10 (21.3)	47 (25.8)	0.370
	No	67 (49.6)	33 (24.4)	13 (9.6)	22 (16.3)	135 (74.2)	
Condition in which brought to hospital	Conscious	67 (51.9)	30 (23.2)	9 (7.0)	23 (18.8)	129 (70.9)	0.889
	Unconscious	25 (47.2)	14 (26.4)	5 (9.4)	9 (17.0)	53 (29.1)	
History of drug usage	Prescribed drugs	4 (40.0)	3 (30.0)	1 (10)	2 (20.0)	10 (5.5)	0.646
	Drug abused	11 (68.8)	2 (12.5)	2 (12.5)	1 (6.3)	16 (8.8)	
	None	77 (49.7)	39 (25.2)	11 (7.1)	28 (18.1)	155 (85.2)	
Cause of accident of patient	Bad road condition	24 (55.8)	11 (25.6)	2 (4.7)	6 (14.0)	43 (23.6)	0.874
	Another vehicle	38 (51.4)	14 (18.9)	8 (10.8)	14 (18.9)	74 (40.7)	
	Mechanical failure	8 (42.1)	6 (31.6)	1 (5.3)	4 (21.1)	19 (10.4)	
	Over speeding	22 (48.9)	13 (28.9)	3 (6.7)	7 (15.6)	45 (24.7)	
Site of body injured	Head	26 (42.6)	16 (26.2)	6 (9.8)	13 (21.3)	61 (33.5)	0.894
	Trunk	8 (57.1)	3 (21.4)	0 (0)	3 (21.4)	14 (7.7)	
	Upper limbs	15 (50.0)	6 (20)	3 (10.0)	6 (20)	30 (16.5)	
	Lower limbs	40 (58.0)	17 (24.6)	4 (5.0)	8 (11.6)	69 (37.9)	
	Others	2 (28.6)	2 (28.6)	1 (14.3)	2 (28.6)	7 (3.8)	
Total						182 (100)	

DISCUSSION

The finding of this hospital-based study in Swabi, Pakistan, underscores critical epidemiological patterns and modifiable risk factors associated with motorcycle-related RTAs, contributing to the global discourse on road traffic injury prevention in LMICs. The predominance of young males (92.9%) in our cohort aligns with global trends, where motorcycle use is disproportionately concentrated among males aged 20-40 years, engaged in high-risk occupations or informal transportation roles.⁹ This demographic's vulnerability is exacerbated by systemic factors such as inadequate traffic law enforcement, poor road infrastructure, and low compliance with safety measures, which collectively amplify injury severity and mortality in LMICs.^{10,11}

Only 25.8% of victims wore helmets, consistent with studies from Malawi (52% non-compliance) and Iran (74% non-compliance).^{3,7} This aligns with WHO estimates that helmet use reduces head injury risk by 69%. However, structural barriers, such as affordability, cultural resistance, and inconsistent enforcement, persist in LMICs. Despite the lack of statistical significance between helmet use and injury patterns in our study ($p=0.370$), autopsy-based analysis emphasises that helmet non-use correlates strongly with fatal head injuries, particularly in high-speed collisions.¹² The predominance of lower limb injuries (37.9%) and features (50.6%) mirrors the finding from Malawi, where lower limb fractures constituted 44.6% of motorcycle trauma cases, likely due to motorcycle design and poor road conditions.⁷ These injuries highlight the need for integrated protective strategies, such as reinforced footwear and road infrastructure upgrades, to address region-specific injury mechanisms.¹³

Most accidents occurred during daylight hours (78.6%), contrasting with studies from Iran and

India that identified seasonal peaks (e.g., summer months or monsoon seasons) linked to increased traffic density or hazardous weather.¹⁴ This discrepancy may reflect Swabi's unique climatic stability or underreporting of nighttime accidents due to limited traffic usage. Notably, 58.3% of riders lacked a valid license, and 50% did not know traffic rules, underscoring systemic gaps in driver education and licensure protocols, a critical area for policy intervention. Substance use (8.8% addiction, 5.5% prescribed drugs) was lower than in Malaysian autopsy studies (31% positive for substances), suggesting cultural or methodological differences in reporting high-risk behaviour.⁶

The high incidence of vehicle-to-vehicle collisions (40.7%) and speeding (24.7%) underscores the roles of mixed-road and lax enforcement in LMICs. Longitudinal studies on training load and fatigue markers in athletes suggest that accumulated stress and inadequate recovery increase injury risk, a framework applicable to motorcyclists facing repetitive exposure to hazardous roads.¹⁵ For instance, rapid increases in acute training load correlate with immunosuppression and injury susceptibility, paralleling the risks faced by motorcyclists in high-traffic environments.

This study advocates multisectoral interventions, including stringent enforcement of helmet laws, infrastructure updates targeting rural road hazards, and community education programs to address low traffic rule literacy.¹⁰ Limitations include survivor bias (excluding pre-hospital fatalities) and the cross-sectional design, which precludes causal inferences. Future research should employ longitudinal designs to track injury outcomes and integrate biomechanical analysis of lower limb injuries alongside qualitative assessments of

behavioural risk factors such as substance use and fatigue.

CONCLUSION

This hospital-based study in Swabi highlights a critical burden of motorcycle-related injuries, characterised by high rates of lower limb fractures, helmet non-compliance and vehicle-to-vehicle collisions, underscoring systemic gaps in road safety enforcement and infrastructure. To mitigate this preventable morbidity, policymakers must prioritise context-specific strategies, including mandatory helmet laws and rural road rehabilitation, to align with global road safety targets.

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