



## Epidemiological pattern of motorcycle injuries with focus on riding purpose: Experience from a middle-income country

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### Abstract

**Introduction:** Road traffic injuries (RTIs) are the eighth leading cause of death worldwide, which usually occurs among people aged between 15 and 29 years. In most low and middle-income countries (LMICs), half of fatal RTIs occur among motorcyclists, while, little is known about purpose of riding among motorcycle riders. The aim of this study was to map out epidemiological aspects of motorcycle traffic injuries with a focus on purpose of riding among victims admitted to referral centers, Tabriz, Iran.

**Methods:** A descriptive study was carried out on 200 motorcycle rider traumatic patients admitted to Shohada and Imam Reza Trauma Centers in Tabriz (the two referral hospitals for trauma in East Azerbaijan Province), Iran from April till November 2013. A questionnaire was filled out through face to face interview for all subjects. Statistical analysis was carried out using Stata statistical software package.

**Results:** All subjects were male with mean age of 29 years old. Among injured riders, 70 and 22% of them used a helmet and had a riding license, respectively. About 23% of motorcycle riders stated that their main purpose of motorcycle riding (PMR) was only for fun. Among motorcycle riders who used the motorcycle for fun purposes, the rate of helmet wearing was 43.5 vs. 78% among those riding for other purposes [ $P < 0.001$ ; odds ratio (OR) = 0.22, 95% confidence interval (CI) = 0.1-0.46]. Only 28% of the motorcyclists, who used motorcycle for fun had a riding license (OR = 1.56, 95% CI = 0.67-3.4). Crashes had happened more frequently in the summer and during the afternoon times.

**Conclusion:** Motorcyclists, who rode motorcycles for fun and amusement, were less likely to have riding licenses or to wear helmets compared to other motorcycle riders. Since motorcyclists are mainly young, the rate of risky behavior in this group is higher. Therefore, it is suggested that young motorcycle riders who ride for fun be prioritized for safety promotion intervention.

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### Introduction

Road traffic injuries (RTIs) are the eighth leading cause of death worldwide, which usually occurs among young people aged between 15 and 29 years. World Health Organization (WHO) has reported 1.27 million fatal RTIs and 20-50 million non-fatal injuries annually.<sup>1,2</sup> Moreover, RTIs are responsible for 85% of deaths and 90% of

disability-adjusted life years in low and middle-income countries (LMICs).<sup>3</sup> In most LMICs, much higher proportion of road users are pedestrians, bicyclists and motorcyclists compared with high-income countries and half of fatal RTIs in LMICs occur among motorcyclists.<sup>4</sup>

Due to the difference in cultural and social factors, death risk caused by motorcycle

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intervention in LMICs is higher compared with high-income countries. The risk factors that increase motorcycles death and injuries include age, gender, rider's experience, socio-economic state, alcohol consumption, avoiding helmet use and safety clothing, riding without license,<sup>5</sup> riding too fast, road unsuitability, and lack of appropriate sight, as well as other users of the road.<sup>6</sup> Moreover, other studies indicated that there is a significant association between gender, young age, occupation, educational level, and marital status, and the type of transportation as a risk factor of RTIs.<sup>7,8</sup> In addition, motorcycle users those are adolescents and young people who use motorcycles for amusement and leisure. Thus they have risky behavior are more at risk of probability of injuries.<sup>2,9</sup>

In Iran, fatal and non-fatal RTIs occur more often among men and motorcycle related injuries are more frequent in rural areas.<sup>10</sup> Moreover, head injuries are the most important causes of death, disabling and severe injury among motorcycle riders.<sup>7</sup> Wearing helmets decreases death risk up to 40% and reduces the risk of severe injury up to 70%.<sup>2,11</sup> Hence, the implement of successful motorcycle-injury prevention programs, particularly policy interventions such as helmet use laws, enforcement of licensure laws, and speed management may widely be effective and these implementation have a high benefit-cost ratio.<sup>12-14</sup>

Most studies carried out in Iran have investigated risk factors which increase the occurrence of crashes among motorcyclists,<sup>15-19</sup> and to our best knowledge little is known about the purpose of riding among motorcycle riders. While based on WHO's, any intervention for RTIs prevention need a basic epidemiologic pattern of RTIs.<sup>1,20</sup> This study aims to map out epidemiological aspects of motorcycle traffic injuries with a focus on the purpose of riding among victims who admitted in Shohada and Imam Reza Hospitals.

## Methods

This study was part of a main project on the epidemiology of RTIs in East Azerbaijan

Province. A descriptive study was carried out on 200 motorcycle victims who admitted in Shohada and Imam Reza Hospitals (because these two hospitals are trauma referral in East Azerbaijan Province) of Tabriz University of Medical Sciences, Iran.

Tabriz is the center of East Azerbaijan province and covers an area of 2167.2 km<sup>2</sup> which is 4.76% of the whole provinces area. More than 400000 vehicles are used in Tabriz. In 2011, the number of public transportation vehicles was 13016 in this city.<sup>21</sup>

Data collection was carried out from April to November 2013. Motorcycle injuries among motorcycle riders were considered as cases in this study. Accordingly, victims those were not a motorcycle rider and unconscious were excluded from the study. A close end questionnaire was filled through the interview. Census was performed for data collection using face to face interview. The assessed variables consisted: Age (as a numeric value), which was categorized in five groups as: Under 20, 21-24, 25-29, 30-39 and over 40 years. Moreover, marital status and educational level were scaled in four levels including illiterate, primary school, high-school and university level. Furthermore, the purpose of motorcycle riding (PMR) was categorized in two groups: Riding motorcycle for fun and riding motorcycle for other purpose. Helmet usage also was measured in two scales (Yes, No). Daily riding distance, riding at night, weekly riding distance, climate status during a crash, road shape, daytime, bodily localization of injury, having motorcycle rider license were also used in data collection. According to traffic rules, the qualification for giving a motorcycle rider license covered: As being 18 years or more; having physical and mental health certified by medical authorities; participations in theoretical and practical traffic training courses; passing the theoretical and practical riding skills with a motorcycle.

The variables of age, marital status, educational level, purpose of using a motorcycle, using a helmet, having a riding license, weather conditions at the time of the crash were stated in the form of frequency,

percentage, and 95% confidence interval (CI), were used as descriptive statistics. For the variables of riding at night and daytime, median, first quarter and third quarter were used. For the variables of riding during the week and economic status, descriptive statistics were reported by means of mean, standard deviation and 95% CI.

The variables of the localization of injury, the date of the crash, and road conditions at the time of crash were reported as graphs. Bivariate analyses were carried out between the purpose of using a motorcycle (two categories) and using a helmet, the purpose of using a motorcycle and having a license (two categories), the PMR and the time of crash (two categories), the PMR and age groups (six categories), by means of chi-square test. Mantel-Haenszel test was applied to calculate odds ratio (OR) between age group (two categories) and having driving license (two categories). Statistical analyses

were carried out using Stata statistical software (version 11, Stata Corporation, College Station, TX, USA).

Informed written consent was taken from each interviewee. The study was approved by the Ethical Committee of Tabriz University of Medical Sciences.

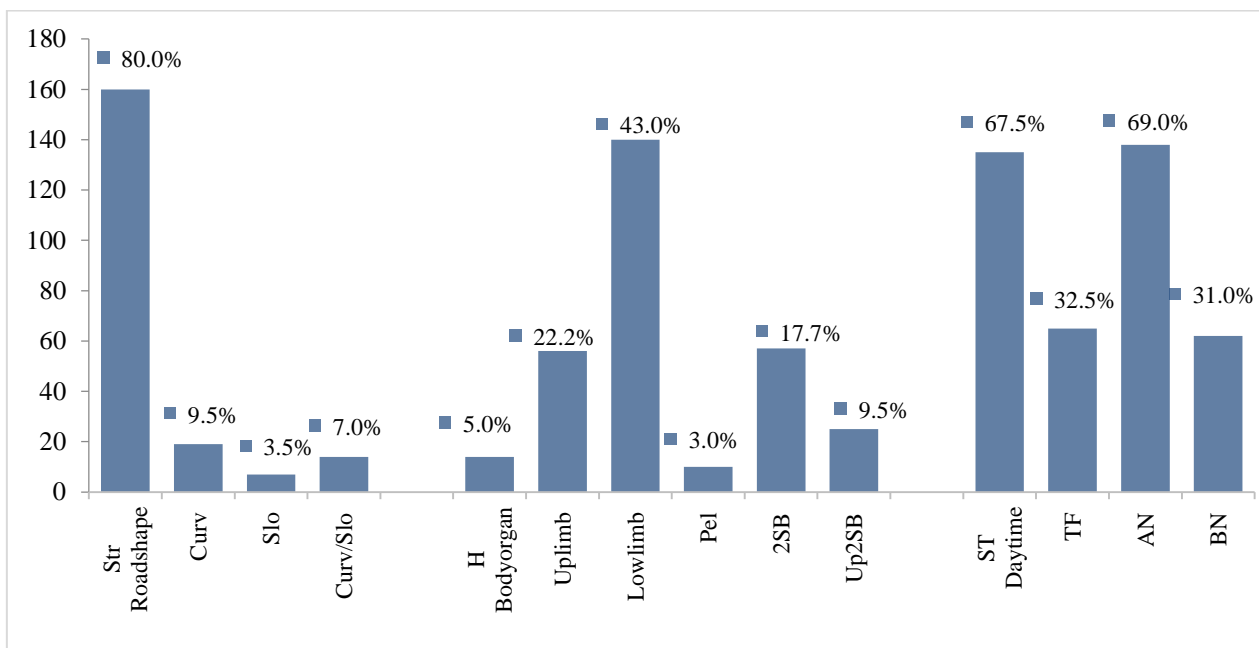
### Results

A total of 200 victims were admitted as a result of motorcycle traffic injuries; all were male, and the mean age of the victims was  $29.3 \pm 11.8$  years. As table 1 show, 22.5% of victims were at 21-24 age and majority of them were single. Only 7.5% of the victims were at university level, and almost one-quarter of motorcycle riders stated that their motorcycle riding was only for fun purposes. More than two-third of victims did not have a motorcycle license, and more than two-third of them used helmet during motorcycle riding. The mean riding time per week was 6 days.

**Table 1.** The distribution of variables in the motorcycle traffic injuries (n = 200)

Variable	n (%)	95% CI
Age groups (year)		
≤ 20	40 (20.0)	(14.4-25.5)
21-24	45 (22.5)	(16.6-28.3)
25-29	42 (21.0)	(15.3-26.6)
30-39	33 (16.5)	(11.3-21.6)
≥ 40	40 (20.0)	(14.4-25.4)
Education level		
Illiterate	16 (8.0)	(45.5-59.4)
Primary school	99 (49.5)	(42.5-56.4)
High school	70 (35.0)	(28.3-41.6)
University degree	15 (7.5)	(3.8-11.1)
Helmet usage		
Yes	140 (70.0)	(63.5-76.4)
No	60 (30.0)	(23.5-36.4)
Weekly driving amount (mean ± SD)	5.88 ± 2.06	(5.6-6.1)
Economic status index (mean ± SD)	22.00 ± 12.00	(20.8-24.4)
Marital status		
Single	105 (52.5)	(45.5-59.4)
Married	95 (47.5)	(40.5-54.4)
Having motorcycle riding license		
Yes	44 (22.0)	(16.2-27.8)
No	156 (78.0)	(72.2-83.7)
PMR		
Fun	46 (23.0)	(17.1-28.9)
Non-fun	154 (77.0)	(71.1-82.9)
Climate status during accident		
Mild	193 (96.5)	(93.9-99.0)
Windy	5 (2.5)	(0.32-4.70)
Rainy	2 (1.0)	(0.39-2.30)
Daily driving amount [Median (P25-P75)]	2 (1-3)	-
Driving at night [Median (P25-P75)]	0 (0-1)	-

PMR: Purpose of motor riding; CI: Confidence interval; SD: Standard deviation



**Figure 1.** Distribution of road shape, injured organ, and daytime in the motorcycle injuries

BN: Before noon; AN: Afternoon; TF: Thursday-Friday; ST: Saturday-Wednesday; Up2SB: Upper 2 site of body; 2SB: 2 site of body; Pel: Pelvic; Low limb: Lower limb; Up limb: Upper limb; Curv/Slo: Curved/Slope; Slo: Slope; Curv: Curved; Str: Straight

**Table 2.** The relation between the purpose of motor riding and helmet usage, having driving certificate, and accident time

Variable	Purpose of driving motor		P*	95% CI
	Fun [n (%)]	Non-fun [n (%)]		
Helmet usage				
Yes	20 (43.5)	120 (77.9)	< 0.001	0.22 (0.1-0.46)
No	26 (56.5)	34 (22.1)		
Having motorcycle rider license				
Yes	13 (28.0)	31 (20.0)	0.240	1.56 (0.67-3.4)
No	33 (71.0)	123 (79.0)		
Accident time				
After noon	34 (73.9)	104 (67.0)	0.410	0.73 (0.32-1.6)
Before noon	12 (26.1)	50 (32.0)		
Age groups (year)				
≤ 20	18 (39.1)	22 (14.2)	< 0.001	3.85 (1.60-8.6)
21-24	17 (37.0)	28 (18.2)		
25-29	6 (13.0)	36 (23.4)		
30-39	2 (4.3)	31 (20.1)		
≥ 40	3 (6.5)	37 (24.0)		
Marital status				
Single	37 (80.4)	68 (44.0)	< 0.001	5.1 (2.25-13.01)
Married	9 (19.6)	86 (55.0)		

CI: Confidence interval, \* P value based on Pearson's chi-square

As figure 1 present, motorcycle traffic injuries were most common in the afternoon and on straight paths (status of the path at the time of the crash). The lower limbs were the most common bodily localization injured among victims.

As table 2 shows, one-third of the crashes happened afternoon for who used motorcycles for fun. The helmet use a

proportion of who rode motorcycles for fun was 43.5% of its use in other motorcyclists. The individuals younger than 20 years of age used motorcycles for fun more than other people. Using motorcycles for purposes non-fun (motorcycle used for job, transportation of cargo and extra) was more frequent among the individuals above the age of 40. More than two-third of victims those used

motorcycles for fun were single. There was not any significant relationship between weather conditions, time of crashes, having motorcycle rider license and type of motorcycle application.

As table 3 shows, there is a significant difference between age group and having a motorcycle license. Applying Mantel-Haenszel test to calculate the OR showed that the age group of people under 25 is preventive at the level of 67% for having a license compared to the age group above 25.

**Table 3.** Relation between the age group and having motorcycle rider license

Variable	Age group		P*	OR
	≤ 25 years	> 25 years		
Motorcycle rider license				
Yes	12 (27.3)	32 (72.7)	0.004	0.33
No	83 (53.2)	73 (46.8)		

OR: Odds ratio; \*P value based on Mantel-Haenszel test

## Discussion

This study showed that 23% of the injured motorcyclists rode motorcycles for fun, and the majority of them were young under 20 years old. Without considering the type of motorcycle use, two-third of the motorcyclists used helmets and just 22% of them had motorcycle rider license. None of the riders used motorcycle clothing. There was not any significant relationship among weather condition, crashes time, and type of a motorcycles use.

One-third of the motorcyclists used motorcycles for fun. This group of motorcyclists often used helmets less frequently than other group, and they did not have a riding license. Change of behavior while riding for fun can be the cause of crash related injury in this group.

Finding of a study in Kerman, Iran, indicated that young people, riding for fun, use motorcycles as a means of getting excited through having speed contests among themselves and they use motorcycles as a way to attract other people's attention.<sup>16</sup> A qualitative study performed in Tehran, Iran, shows that most of the motorcyclists who use motorcycles for fun and amusement are

among the young group who also do not have a riding license. In that study, this type of motorcyclists had bought their motorcycles for the purpose fun and amusing activities to show off, a behavior that endangers the lives of the motorcyclists and those of other people. Such riders usually had become proud and arrogant under the influence of their peers.<sup>22</sup>

The findings of the study in Kerman show that young people perform different showy activities with their motorcycles in order to demonstrate their power and skill in using a motorcycle.<sup>16</sup> The findings of the study show that most adolescents are under the influence of their friends in such a way that if their friends use helmets, they will also do the same.<sup>23</sup>

In order to have better coverage of helmet use, experience from high-income countries indicate that as a preventive measure it is effective to give a helmet to the customer at the time of motorcycle buying. Moreover, police enforcement, an educational campaign can also increase helmet use coverage. It is important to note that finding from study in Iran conducted in West Azerbaijan Province indicated that in order to increase the helmets use, various factors need to be considered, "some by educational campaigns, others possibly by manufacturers, e.g. addressing weather conditions, comfort and weight".<sup>7</sup> More focus should took place on weather condition and helmet engineering in order to be more user friendly for motorcyclists. Motorcycle driver license issue also needs to be more restricted for a young group, a strategy that currently is underway by police organization.

According to the findings of this study, most numbers of motorcycle injuries had happened in young motorcyclists. The findings of this study were consistent with the findings achieved in Italy,<sup>11</sup> New Zealand,<sup>24</sup> and Kerman.<sup>9</sup> This indicates the necessity of paying more attention to the safety of young people. Safety promotion in this group covers training them for the appropriate use of motorcycles and preparing safe places for riding motorcycles.

The findings of a study in the United States show that the risk of having a crash is higher among age less than 25 compare to other age group.<sup>25</sup>

For the youth in Europe, using a motorcycle for the first time is the first experience of independence, grown individual and social responsibilities.<sup>26</sup> The nature of the danger for young group and old people is different because the youth prefer more unsafe attitudes and risky behavior than the elderly. In Iran, perhaps due to shortage of facilities for recreation, young people consider motorcycle riding in the streets as a means of having fun and getting excitement. Since low age and using motorcycle for fun, are two causes of bringing young group about higher risk, it seems that more intervention programs are needed to be done with young people. Manufacturing motorcycles with lower speeds and sizes and expanding their use among youth can be an effective measure as it has been already done in European countries and implementation of licensing systems required small engine sizes for motorcycles risen by novice riders.

Around two-thirds of the victims in our study did not have riding licenses, and only one-third of them used helmets. Since about two-third of the population in this study were young, a reason for not having riding licenses can be their ages, which are mostly too young to be qualified for riding licenses. Another reason might be a lack of sufficient knowledge and training about riding motorcycles and its risk without a license. It is important to note that riding without a license increases the risk of having crashes in such a way that the risk of crash for riders without a license is two times higher more than that for the riders with a license.<sup>27</sup>

Helmets use is lower in motorcyclists who ride motorcycles for the purpose of having fun than other riders. Since in this study, most of the riders who used motorcycles for fun are adolescents and young, infrequent use of helmets can be due to lack of sufficient knowledge about the rules of riding, which might be due to

insufficient training about the benefits of using a helmet and compulsory rule of using helmet while riding.

Other reason for avoiding the use of helmets can be their heaviness, warmth, disturbing proper hearing, creating vapor in warm seasons, blocking proper eyesight.<sup>7</sup> This is in line with other study conducted in the neighborhood of study area, that all above factors affect low coverage of helmet use<sup>7</sup> and even in Tehran, the capital city of Iran. It may suggested that using helmets needs to be emphasized and needs to be legal obligations for riding bicycles when they are a child, in which it can become a culture in the adulthood. On the other hand, designing helmets based on different climates in Iran must be taken into account.

Our study showed that most riders injuries those were for non-fun, had occurred in the afternoon, which is in line with study conducted in Tehran that summer was the season in which the highest number of crash related injuries took place and mainly between 3 and 21 o'clock in the afternoon, compared to other times.<sup>28</sup> Higher rate of motorcycle crashes in summer and in the afternoon is probably because motorcycles are usually used more in summer due to their higher accessibility and ease of transport compared to cars, and in the afternoon we usually have the peak of traffic in city area, thus the probability of crashes increases.

### **Conclusion**

Most of the motorcyclists, who rode motorcycles for fun and amusement, usually did not have rider licenses and used helmets less than other motorcycle riders. Crashes happened more frequently in summer and during the afternoon. Since motorcyclists are mainly young people, the rate of risky behavior among them is higher. Therefore, it is suggested that young motorcycle riders who ride for fun, be the priority group for safety promotion interventions.

### **Conflict of Interests**

Authors have no conflict of interest.

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