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Trend and Seasonal Patterns of Injuries and Mortality Due to Motorcyclists Traffic Accidents; A Hospital-Based Study

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ABSTRACT

Objective: To investigate trend and seasonal pattern of occurrence and mortality of motorcycle accidents in patients referred to hospitals of Isfahan.
Methods: This cross-sectional study was carried out using traffic accidents data of Isfahan province, extracted from Ministry of Health (MOH) database from 2006 to 2010. During the study period, 83648 people injured due to motorcycle traffic accidents were referred to hospitals, all of them entered in the study. Logistic regression model was used to calculate the hospital mortality odds ratio, and Cochrane-Armitage test was used for assessment of linear trend.
Results: During the study period, the hospital admission for motorcycle accident was 83,648 and 89.3% (74743) of them were men. Mean age in accidents time was 26.41±14.3 years. The injuries and death sex ratio were 8.4 and 16.9, respectively. Lowest admission rate was during autumn and highest during summer. The injury mortality odds ratio was 1.01 (CI 95% 0.73-1.39) in the Spring, 1.34 (CI95% 1.01-1.79) in summer and 1.17 (CI95% 0.83-1.63). It was also calculated to be 2.51 (CI95% 1.36-4.64) in age group 40-49, 2.39 (CI95% 1.51-5.68) in 50-59 and 4.79 (CI95% 2.49-9.22) in 60-69 years. The mortality odds ratio was 3.53 (CI95% 2.77-4.5) in rural place, 1.33 (CI95% 1.15-1.54) in men, and 2.44 (CI95% 2.09-2.85) in the road out of town and village. In addition, trend of motorcycle accidents mortality was increasing (p<0.001).
Conclusion: Motorcycle accidents injuries are more common in men, summer, young age and rural roads. These high risk groups need more attention, care and higher training

Keywords: Seasonal trend; Mortality; Road Traffic Accidents; Motorcycle accident; Isfahan; Iran.

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Introduction

A road traffic injury (RTI) is an injury incurred as a result of a collision on a public road involving at least one moving vehicle [1]. RTIs are an issue in both public health and economics [2]. In addition to the grief due to RTIs, road traffic crashes result in considerable economic losses to victims, their families, and nations as a whole, the most countries spend 1–3% of their gross national product on RTIs [3, 4]. In Iran, almost 5 percent of gross national product is spent on RTIs [2]. RTIs are an emerging global epidemic, causing 13% of all injuries and 1.2 million deaths every year [5].

Iran showed one of the highest RTIs mortality rates in 2007 (31.8 per 100,000) [6] however, It is predicted the number of road traffic injuries will increase about 80 percent in developing countries by 2020 [7]. The Iranian automobile industry is already the greatest automobile industry in the region and the fastest growing industry in Iran. The time trend of car and motorcycle production showed after the year 1994 the car and motorcycle production started to grow up and got accelerated after 2002. The total product of this industry was over one million cars and 1.5 million motorcycles in 2009 [8]. The motorcycle is known as the most dangerous motor vehicle because for each mile that vehicle passes, motorcycle riders have a 34-fold higher risk of death in a crash than people driving other types of vehicles, and the chance of injuries is eight times more compared to other vehicles [9]. Motorcycle riders are an important target population [10], due to their younger age, shortage of protection and less visibility of the rider and vehicle to other road users [11]. The World Health Organization (WHO) report suggests that more studies should be done on the epidemiological pattern of RTI in developing countries [12]. There is any published study on motorcycle RTIs in Isfahan, we conducted this study to investigate incidence trend and seasonal pattern of motorcycle accidents and their hospital mortality in Isfahan province between 2006 and 2010. Modeling and predicting of motorcyclists RTIs have the potential to instruct allocation of resources and preparing a base for policy makers and for designing the interventions.

Materials and Methods

Study Population

This cross-sectional study was carried out in Isfahan, a province in central region of Iran. We extracted traffic accidents data of Isfahan province from the Ministry of Health (MOH), Information about accidents in every county entered in registration software and monthly send for accident prevention group of MOH. Standardized data collection form was used to ensure uniform handling of the data. Study subjects were all motorcyclists who have been injured or died in RTIs between 2006 and 2010. All eligible subjects included in the study. We included drivers/passengers of motorized 2-wheelers injured or died in RTIs, inpatient and outpatient victims during a 5-year period from 2006 to 2010. Exclusion criteria were: victims that their information was incomplete, patients referred from other provinces and pedestrians. International Classification of Diseases and Causes of Death (ICD 10), traffic accidents are classified under theV01–V99 codes. Duplicates case were removed in terms of three components of series of code names, age and date of accident. In order to respect the ethical issues in this study, the names and personal profile of motorcyclists remained confidential and an ID number was allocated for each of them. As this was a retrospective study, no informed written consent was required. We consider all motorcycle accidents injured that were referred to hospital by Emergency Medical Service- EMS (115) or Red Crescent or injured people referred to hospital to receive health care. In this study, motorcycle refers to a single-track, two wheeled motor vehicle usually with a third wheel for a small module attached to it. Due to the inaccessibility of high quality data about the damaged people who died immediately after the occurrence of accident or people that died after release from hospital, this study only considers the hospital mortality in motorcyclists.

Statistical Analysis

Study variables were gender, age in nine groups, occurrence season, accidents place (Urban, rural, out of urban – rural). The compiled data were analyzed in statistical package for social sciences (SPSS Inc., Chicago, Illinois, USA) version 20. In order to compare average age in two genders, we used the independent t test and for comparison the mean age at the time of the accident occurrence based on season, ANOVA test was employed. Moreover, to evaluate the relationship between seasons and other qualitative characteristics of traffic accidents, chi-square test was used. To calculate the death odds ratio in hospital due to traffic accidents, multivariate logistic regression was used and the category with lowest mortality, was considered as reference group. Furthermore, we used WinPepi Software (Programs for EPIdemiologists for-Windows, New York, Oxford University, 2001), and Cochrane-Armitage trend test for assessment of linear trend of traffic accident in the study duration. A two-sided p-value of less than 0.05 was considered statistically significant.

Results

During the study period (March 2006 to December 2010), total number of 83,648 motorcycle accident injuries were admitted to Isfahan province hospitals, of that 74743 (89.3%) were men. The male to female ratio in injuries was 8.4:1. Mean age in accidents time was 26.15 ± 13.9 years in men and 28.52 ± 16.4

in women. This difference was statically significant (p<0.001). The age range was from less than one year to 98 years with a peak incidence from 20 to 29 years. The age distribution of the patients is summarized in Table 1.

The total number of 411 (0.49%) patients died in hospital due to motorcycle accidents, among which there were 388 (94.41%) men and 23 (5.59%) women, and sex ratio (male/female) was 16.9:1. The mean age of this group (in-hospital death people) was 33.77±19.62 years in men, and 33.3419.35± years in women, this different was not statically significant (p=0.170). The mean age was significantly different between different seasons (p=0.001), (Table 2).

About the motorcycle accident evaluation and related admission in the hospital, the lowest hospital admission for traffic accidents was seen in Winter and highest during Summer. The maximum mortality rates were in Summer and minimum was in Winter (Table2). To assess the odds ratio of mortality from injuries in a motorcycle, the odds ratio was calculated according to the lowest mortality in Winter, this season was considered as the base, and used for multiple logistic regression analysis. The mortality was higher in rural areas compared to urban areas with an odds ratio of 3.53 (CI95% 2.77-4.5). The mortality odds ratio was 1.33 (CI95% 1.15-1.54) in men and 2.44 (CI95% 2.09-2.85) in the road out of town and village (Table 3).

Figure 1 demonstrates the seasonal pattern of

Table 1. Demographic, hospital admission and mortality of traffic accidents according to season in Isfahan province 2006-2010

		Variables	Spring	Summer	Autumn	Winter	*p* value
Injured	**Sex**	Male	18896(25.28)	28046(37.52)	13923(18.63)	13878(18.57)	p=0.002
		Female	2259(25.37)	3469(38.96)	1664(18.69)	1513(16.99)	
	Age	0-9	1497(28.38)	2298(43.56)	872(16.53)	608(11.53)	(p<0.001)
		10-19	5209(25.93)	7391(36.79)	3760(18.72)	3728(11.53)	
		20-29	8646(25.42)	12736(37.45)	6157(18.10)	6470(19.02)	
		30-39	2774(23.78)	4536(38.88)	2133(18.28)	2223(19.06)	
		40-49	1402(23.69)	2196(37.11)	1114(18.83)	1205(20.37)	
		50-59	798(24.58)	1127(34.72)	635(19.56)	686(21.13)	
		60-69	465(23.92)	716(36.83)	383(19.70)	380(19.55)	
		70-79	285(23.93)	423(35.52)	264(22.17)	219(18.39)	
		80	79(25.32)	92(29.49)	73(23.40)	68(21.79)	
	Accidents place	Urban	18562(25.22)	27331(37.14)	13636(18.53)	14060(19.11)	(p<0.001)
		Rural	1736(27.10)	2728(42.58)	1080(16.86)	863(13.47)	
		Out of urban - rural	857(23.47)	1456(39.87)	675(18.48)	664(18.18)	
Death	**Sex**	Male	81(20.88)	171(44.07)	74(19.07)	62(15.98)	p=0.205
		Female	9(39.13)	9(39.13)	3(13.04)	2(8.70)	
	Age group	0-9	2(14.29)	9(64.29)	2(14.29)	1(7.14)	p=0.628
		19-Oct	17(24.64)	26(37.68)	15(21.74)	11(15.94)	
		20-29	40(26.32)	62(40.79)	27(17.76)	23(15.13)	
		30-39	10(19.23)	23(44.23)	11(21.15)	8(15.38)	
		40-49	9(23.68)	17(44.74)	4(10.53)	8(21.05)	
		50-59	3(12.50)	11(45.83)	3(12.50)	7(29.17)	
		60-69	3(11.54)	12(46.15)	8(30.77)	3(11.54)	
		70-79	4(22.22)	11(61.11)	3(16.67)	0(0.0)	
		80≥	2(13.33)	9(60.0)	4(26.67)	0(0.0)	
	Accidents place	Urban	56(20.22)	122(44.04)	60(21.66)	39(14.08)	p=0.013
		Rural	25(28.09)	36(40.45)	16(17.98)	12(13.48)	
		Out of urban - rural	13(26.53)	22(44.90)	1(2.04)	13(26.53)	

Table 2. In hospital case fatality rate and Age average in death group and in total (Isfahan province 2006-2010)

Variables	Spring	Summer	Autumn	Winter	Total	*p* value
Overall patients	21155(25.3%)	31515(37.7%)	15587(18.6%)	15391(18.4%)	83648	
Number of deaths	90(21.9%)	180(43.8%)	77(18.7%)	64(15.6%)	411	
In hospital case fatality rate(in 10000 injured cause)	42.54	57.11	50.02	41.05	49.13	
Age average in total (mean±SD)	25.86±14.01	26.08±13.96	26.85±14.39	27.37±13.79	26.41±14.03	(p<0.001)
Age average in death group (mean±SD)	30.99±17.18	35.11±20.91	34.36±20.55	33.19±17.86	33.77±19.63	(p=0.430

Table 3. Mortality odds ratio of traffic acidents according to season, age, sex and place

Variable	OR (CI for 95% OR)	*p* value
Female	1	-
Male	2.18 (1.42-3.33)	<0.001
Age group		
0-9	1	-
10-19	1.29 (0.72-2.3)	0.383
20-29	1.7 (0.98-2.95)	0.057
30-39	1.71 (0.94-3.09)	0.075
40-49	2.51 (1.36-4.66)	0.003
50-59	2.93 (1.51-5.68)	0.001
60-69	4.79 (2.49-9.22)	<0.001
70-79	5.38 (2.66-10.87)	<0.001
80 <	23.57 (11.54-48.11)	<0.001
Spring	1.01 (0.73-1.39)	0.940
Summer	1.34 (1.01-1.79)	0.043
Autumn	1.17 (0.83-1.63)	0.353
Winter	1	-
Urban	1	-
Rural	3.53 (2.77-4.5)	<0.001
Out of urban – rural	3.18 (2.31-4.38)	<0.001

*Dependent variable: death from traffic acidents; **Independent variables: season of occurrence, age, sex and accidents place

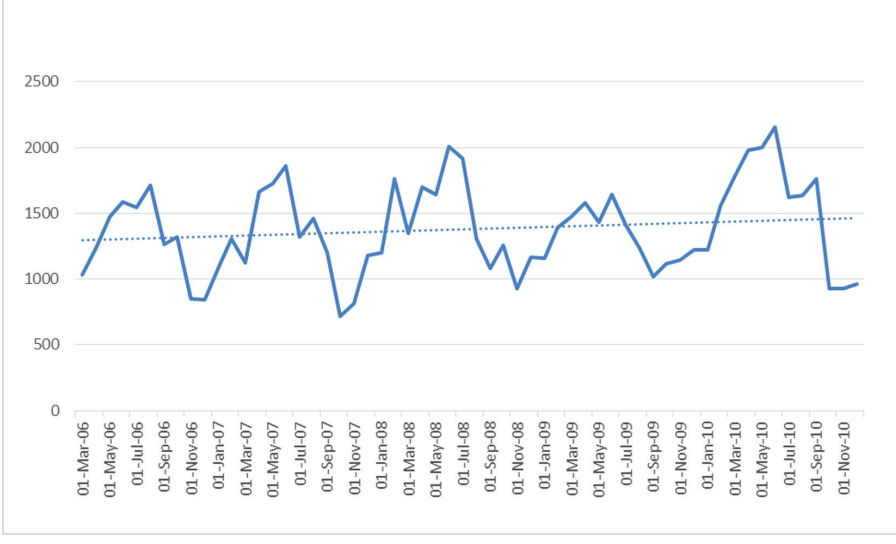

Fig. 1. The seasonal pattern of traffic accidents in motorcycle riders/passengers

traffic accidents in motorcycle riders. The highest rate of injuries was recorded in summer and lowest in Autumn of each year (Figure 1). In addition, the increasing linear trend of motorcycle accidents from 2006 to 2010 was not statistically significant (p=0.08).

Discussion

Isfahan as the most populous city and the center of Isfahan province is a historical, industrial, touristy city, this cause more traffic vehicles in this city and outside of it and makes high volumes traffic that need more attention, care and higher training. Findings of this study revealed that motorcycle traffic accidents were higher in men than women, maximum of hospital admissions for motorcycle riders were significantly in summer season, the most of death and RTIs were in rural region then urban and suburban. Our study showed the average age at time of accident in male and female is about 26 and 28; it means the most user of motorcycle are young people or that the young motorcyclists involved in traffic accidents had short skills to control risky driving behaviors [13]. The study of Petre liviu *et al.* in a Romanian population, in 2014 presented that 30-39 years old man have highest accidents and fatal rate [14] also in the study of Guilan province (northern Iran), most of victims were 20-29 years old[15]. In another, at a Nigerian university hospital, Solagberou *et al.* at 2006 indicated that the mean age in accident was 28.7 and peak incidence was in 21-30 years [10] and study of Fatima Latif *et al.* in 2002 in Singapore, showed that the mean age in an accident was 26.4 years [16]. On the other hand, in the study of holy Karbala the highest number of injury patient

was in 15-19 years of age [17] The most of accidents were reported in men, because in Iran, women often can't ride motorcycle alone based on customs [18]. In another study in Singapore, predominant gender in accidents was male patient (95.8 %) [16]. Similar result was shown in other studies in deference parts of Iran [15, 19, 20]. The study of Jeffer *et al.* in 2004 in the United Kingdom reported the male to female ratio increased from 9:1 to 12:1 [21].

The minimum number of hospital admissions for motorcycle riders was in autumn and maximum of this was in summer season, probably because of more using of the motor vehicle and existence of heavy traffic in summer in Iran, caused due to holiday in this season in schools and universities and also, goodness of climate condition for a trip [22] . One study that conducted in the north of Iran(Mazandaran province), showed that the maximum mortality due to traffic accident was in June and September equal to two last month of summer [23] while about the seasonal pattern, study of Razzaghi *et al.* during 2013 in Taybad city (Iran) indicated more accident occur in winter because of snowy and slippery roads [7]. But it should be noted that Isfahan province is in the Subtropical and semi-arid region of Iran and during this research endured a drought period with an average precipitation less than the national average, therefore lack of snow and rain in this season caused that winter does not have the maximum motorcycle accidents injuries.

The most of death and RTIs were in rural region then urban and suburban regions may be in result of driving without license test and neglect to driving rules in rural regions or low safety roads [24-26]. Study of pourhossein in Mazandaran showed 57.3% of death due to traffic accident occurred on the rural road and 42.7% on the urban roads [23]. Lin *et al*. study 2003 being on rural roads at the time of motorcycle crashes to urban roads equal to 1.64 [27]. However, some studies have shown the most of the accidents occurred in intercity roads [28]. There is the increasing linear trend of motorcycle accidents from 2006-2010, although is not significant, It was expected that there is a downward trend with the policies, safety helmet rules, new penalties for offending motorists, petrol and gas rationing, pedestrian bridge, street widening and etc. Li Yang *et al*. study in China showed certain decrease motorcycle accident trend after 2002 but still remained a relatively high level [29].

In conclusion, the motorcyclist road traffic accidents are more common in men. Most of death and RTIs were in rural region. We also demonstrated a seasonal variation in occurrence and mortality of motorcyclists' traffic accidents. The maximum of RTIs was recorded in Summer and Spring, and the minimum rate was in Autumn and Winter. The in-hospital mortality was associated with male gender, age, season, type of accidents and accident place.

Conflict of Interest: None declared.

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