

Seasonal Pattern in Occurrence and In-hospital fatality rate from Traffic Accidents in Isfahan, Iran

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ABSTRACT

Background and aims: Although accident is the secondary cause of mortality in Iran, information on the occurrence and mortality are not wholly understood. The study aimed to explore seasonal occurrence and mortality pattern of traffic accidents in Isfahan population, Iran.

Methods: This study was a cross-sectional. The data on traffic accidents of Isfahan Province was extracted from the Ministry of Health (MOH) database from 2006 to 2011. The data included the number of traffic accidents attributed to motor vehicles, motorcycles and pedestrians.

Results: The hospital admission for traffic accidents was highest during the summer and lowest during the autumn. They increased 43.35%, 97.8% and 3.5% during the spring, summer and winter; respectively compared to the autumn. Odds Ratios for death from traffic accident were 1.87 (CI 95% 0.95-1.43) in spring, 1.5 (CI 95% 1.16-1.69) in summer and 1.42 (CI 95% 1.13-1.72) in autumn; for male was 1.37 (CI95% 1.13-1.52) and for age was 1.05 (CI95% 1.03-1.07) and in out of urban-rural 2.45 (CI95% 2.07-2.83), rural 3.1 (CI95% 2.61-3.61) and for motor vehicles 1.5 (CI95% 1.31-1.75) but for pedestrians was 1.74 (CI95% 1.47-2.06).

Conclusion: There is a seasonal variation in occurrence and mortality from traffic accidents. The highest occurrence of traffic accident was during summer, and the lowest rate in autumn. The highest and lowest in hospital mortality rate was observed in summer and winter, respectively. After adjusting the model, the risk of in-hospital mortality was significant for gender, age, season, type of accidents and accident place.

Keywords: Road Accident, Log Regression, Season, Isfahan, Iran

INTRODUCTION

Road traffic injury is a key community health problem to which insufficient

responsiveness has been paid.¹ According to the World Health Organization, traffic

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accidents and related mortality have become an emerging universal epidemic.² Worldwide, about 1.2 million persons are killed and up to 50 million people damaged yearly as a result of road traffic accidents.² Despite the growing trend of road traffic accidents in developing nations, the trend has been decreasing in developed countries.² It is estimated that the amount of road traffic mortality and injuries will increase as much as 80 percent from 2000 to 2020 in low and middle-income countries.³ The cost of these mortalities, disabilities and injuries could play a significant effect on health and community and economic growth.⁴ The growth pace of traffic accidents is high in Iran, and it may account for a major proportion of deaths.⁵ In fact, it was estimated that annually more than 30,000 deaths can be attributed to road traffic accidents in Iran.⁴

The implementation of regulations and interventions to control traffic accidents could reduce the charge of traffic accidents. Gasoline rationing, enhancement of traffic enforcement, creation of speed bumps, legislature, and the utilization of head covering for cyclists and motorcyclists are instances of such interventions.⁶ Nevertheless, there are certain characteristics which are out of human control with respect to traffic accidents such as weather conditions. Adversative weather in snowy and rainy seasons obviously could affect on the severity and incidence of road accidents.⁷ Furthermore, the number of trips differs according to different seasons. Therefore, the great number of journeys in certain times can meaningfully affect traffic accidents.⁸

Although accident is the secondary cause of mortality in Iran, information on the occurrence and mortality are not completely investigated.^{5,9} The aim of this paper was to explain the seasonal occurrence

and mortality pattern of traffic accidents in Isfahan population, Iran.

METHODS

This research was a cross-sectional study. The data on traffic accidents for Isfahan province was extracted from the Ministry of Health (MOH) database for 2006-2011. This source of data contains the number of traffic accidents attributed to motor vehicles, motorcycles and pedestrians.

In addition, according to the International Classification of Diseases and Causes of Death (ICD 10), traffic accidents are classified under the V01-V99 codes. In the present study, land road traffic accidents involving at least a motor vehicle with two wheels were included. Cases or events with lack of these conditions were excluded from the study.

All individuals who suffered from traffic accidents and referred for medical care at all hospitals in Isfahan, with no regard to their hospitalization status (inpatient or outpatient) during the study period were entered into the study. Due to inaccessibility of data on death, immediately after occurrence of accidents or during the arrival of paramedics, the data was included only in-hospital mortality records.

In order to compare average age in two genders, the independent T-test and to compare the mean age at the time of the occurrence of accident and death according to the different season, ANOVA test were used. In addition, for evaluating of the relationship between seasons with the other qualitative characteristics of traffic accidents, chi-square test was used. To calculate the odds ratio of death in hospital from traffic accidents, multivariate logistic regression was applied and category with lowest mortality was considered as reference group. SPSS 15 software was used for data analysis. The significance level was less than 0.05.

RESULTS

Overall, 176489 injured people from traffic accident during the study period (from 20 March 2006 to 19 March 2011) were

admitted in Isfahan hospitals, of whom 137960 (78.2%) were men and 38529 (21.8%) women (Table 1).

Table 1: Demographic and accidents character of damaged people in Isfahan

Variables		In Hospital death	Alive	Total	P-value	In-hospital case fatality rate
sex	Male	1007	136953	137960	0.131	0.72%
	female	253	38276	38529		0.65%
Age group	0-20	319	58638	58957	0.001	0.54%
	21-40	475	82958	83433		0.56%
	41-60	251	24716	24967		01%
	61 and higher	215	8917	9137		02.35%
Occurrence season	Spring	311	46139	46450	0.001	0.66%
	summer	505	63597	64102		0.78%
	autumn	252	32149	32401		0.77%
	winter	192	33344	33536		0.57%
Accidents place	Urban	272	18951	19223	0.001	01.41%
	rural	770	142346	143116		0.53%
	Out of urban - rural	218	13932	14150		01.54%
Type of accident	motor vehicles	561	59807	60368	0.001	0.92%
	motorcyclists	411	83237	83648		0.49%
	pedestrians	288	32185	32473		0.88%

Amongst all injured people, 78.2% was men and 21.8% was women, resulting a sex ratio of 3.58. The mean age of injured people, men, and women was 28.45 ± 16.2 ; 28.05 ± 15.73 and 29.8 ± 17.72 year, respectively ($P < 0.001$). The mean age for in-hospital deceased patients was 36.53 ± 21.26 ; 36.78 ± 20.59 in men and 35.56 ± 23.78 in women ($P < 0.001$). In addition, the in-hospital case fatality rate was 0.72%. We observed the odds ratios for death from traffic accident was (1.88 CI 95% 0.98-1.42), (1.4 CI 95% 1.18-1.67) and (1.4 CI 95% 1.15-1.7) during spring, summer, and autumn; respectively.

The average age of the injured people in the time of accident occurrence was 28.45 ± 16.2 , (28.05 ± 15.73 in men, and 29.8 ± 17.72 in women), which yielded significant difference ($P < 0.001$). In-hospital case fatality rate was 0.72% (tables 1 and 2) and average of age for this group was (1260 death) 36.53 ± 21.26 ; (1007 patient) 36.78 ± 20.59 in men, and (253 patient) 35.56 ± 23.78 in women, again yielding a significant difference ($P < 0.001$). In terms of seasonal changes, the average age of occurrence time was shown statistically significant difference ($P = 0.001$), while this difference was not significant for deceased persons ($P = 0.815$) (Table 2).

Table 2: Survival, hospital admission, and death of traffic accidents according to season

variables	Spring	Summer	Autumn	Winter	Total	P-value
Overall patients	46450 (%26.3)	64102 (%36.3)	32401 (%18.4)	33536 (%19)	176489 (%100)	
Number of deaths	311 (%24.7)	505 (%40)	252 (%20)	192 (%15.2)	1260 (%100)	
Patients surviving	46139 (%26.3)	63597 (%36.3)	32149 (%18.3)	33344 (%19)	175229 (%100)	
In-hospital case fatality rate	0.67%	0.79%	0.78%	0.58%	0.72%	
Age average in total (mean ± SD)	27.77±16.37	28.08±16.14	28.92±16.37	29.66±15.85	28.45±16.2	0.001
Age average in death (mean ± SD)	36.30±21.76	36.15±20.97	36.56±22.23	37.86±19.98	36.53±21.26	0.815
0-20	16346 (%27.7)	21846 (%37.1)	10650 (%18.1)	10115 (%17.2)	58957 (%100)	0.001
21-40	21534 (%25.8)	30288 (%36.3)	15238 (%18.3)	16373 (%19.6)	83433 (%100)	
41-60	6240 (%25)	8806 (%35.3)	4688 (%18.8)	5233 (%21)	24967 (%100)	
61 and higher	2330 (%25.5)	3162 (%34.6)	1825 (%20)	1815 (%19.9)	9132 (%100)	
Accidents place						
Urban	37775 (%26.4)	51411 (%35.9)	26530 (%18.5)	27400 (19.1)	143116 (%100)	0.001
Rural	3152 (%26.8)	4748 (%40.4)	2047 (%17.4)	1796 (%15.3)	11743 (%100)	
Out of urban - rural	5523 (%25.5)	7943 (%36.7)	3824 (%17.7)	4340 (%20.1)	21630 (%100)	
Sex						
Male	35946 (%26.1)	50372 (%36.5)	25591 (%18.5)	26051 (%18.9)	137960 (%100)	0.001
Female	10504 (%27.3)	13730 (%35.6)	6810 (%17.7)	7485 (%19.4)	38529 (%100)	
Type of Accident						
Motor vehicles	16223 (%26.9)	22024 (%36.5)	10378 (%17.2)	11743 (%19.5)	60368 (%100)	0.001
Motorcyclists	21155 (%25.3)	31515 (%37.7)	15391 (%18.4)	15587 (%18.6)	83648 (%100)	
Pedestrians	9072 (%27.9)	10563 (%32.5)	6632 (%20.4)	6206 (%19.1)	32473 (%100)	

More investigation of impatient showed that the lowest hospital admission for traffic accidents was seen during the autumn, while the highest was reported during the summer. In other words, the rate of traffic accidents had increased 43.35%, 97.8% and 03.5% during the spring, summer and winter, respectively compared to the autumn.

Between admission in hospital in the basis of season and gender (male and female), age group (0-20, 21-40, 41-60 and ≥61), type of accident (motor vehicles, motorcycles, and pedestrians) and traffic accident place (urban, rural and out of urban-rural) statistical significant relationship was observed (P<0.001) (Table 2).

To assess the odds ratio of mortality associated to traffic accidents, the lowest mortality was seen in the winter. To calculate the hazard ratio, this season considers as a basis and used of multivariate logistic regression model. We observed the odds ratios for death from traffic accidents during spring equal to 1.87 (CI 95% 0.95-1.43), 1.5 (CI 95% 1.16-1.69) for summer and in autumn equal to 1.42 (CI 95% 1.13-1.72), 1.37 (CI 95% 1.13-1.52) for men, 1.05 (CI 95% 1.03-1.07) for age, in out of urban-rural equal to 2.45 (CI95% 2.07-2.83), for rural 3.1 (CI 95% 2.61-3.61) and for motor vehicles 1.5 (CI 95% 1.31-1.75) and for pedestrians equal to 1.74 (CI 95% 1.47-2.06).(Table3)

Table 3: Odds ratios of death from traffic accidents according to season of occurrence, age, sex, type of accidents and accidents place

Variable	HR (Confidence interval 95%)	P-value
Winter	R	-
Spring	1.87 (0.95-1.43)	0.001
Summer	1.5 (1.16-1.69)	0.001
Autumn	1.42 (1.13-1.72)	0.001
Age	1.05 (1.03-1.07)	0.001
Men	1.37 (1.13-1.52)	0.001
Women	R	-
Motorcyclists	R	-
Motor vehicles	1.5 (1.31-1.75)	0.001
Pedestrians	1.74 (1.47-2.06)	0.001
Urban	R	-
Out of urban - rural	2.45 (2.07-2.83)	0.001
Rural	3.1 (2.61-3.61)	0.001

DISCUSSION

This study revealed that there is a seasonal variation in occurrence and mortality of traffic accidents in Isfahan, Iran. The highest occurrence of traffic accident was during summer and the lowest rate in autumn. The highest and lowest in hospital mortality rate was observed in summer and winter, respectively. After adjusting the model, the risk of in-hospital mortality was significant for gender, age, season, type of accidents and accident place.

In this study, 78% of injuries occurred in men and 21.8% in women, the ratio of traffic accident occurrence in male was 3.58 times higher than women. Other studies in Iran have also confirmed this consequence⁵⁻⁷. Similar results in different parts of the world was observed too, for example, this ratio was 1.6, 4.6 and 6 in Sweden, Singapore and Pakistan, respectively. Moreover, 79.92% of death occurred in men, and only 20.08% in women.⁸⁻¹⁰

The mean age of injured people from traffic accidents was 28.05 ± 15.73 year refers to the fact that the highest rate of traffic accidents occurring in younger people, which is consistent with results of other Iranian studies.^{5,11}

The difference between the occurrence of the traffic accidents and in hospital deaths in relation to season has been reported in different parts of the world.¹²⁻¹⁶ In this study the highest rate of traffic accidents occurred in summer (36.6%) that is in accordance with a study conducted in Korea by Peak HJ, showing that 31.3% of accidents concentrated in summer.¹⁶ However, some studies have shown that the highest rate of traffic accidents occurring in the winter, with a significant relationship between traffic accidents and temperature. For instance, in the study conducted by Won-Kyung Lee and et al in Seoul, evidence of the effect of cold temperature on road traffic injuries with considerations for climate conditions had been observed. Thus, the association among temperature and road traffic injuries established a clear J-shaped curve in the winter. Moreover, road traffic injuries raised by 2.07% per each one centigrade decline in temperature below the freezing temperature. The expected effects of cold temperature can differ with the severity of injury, and type of accident.¹⁷

Traffic accidents in winter could be influenced by road circumstances such as

snowy, ice-cold, or rainy roads. Near-freezing temperatures can as well lead to unsafe road conditions and increase the hazard of traffic accidents. The highest numbers of traffic accidents have been anticipated in the winter in Hokkaido, Japan and in the winter time in Canada. It has been reported a negative correlation in Finland, and Montreal in Canada.¹⁸⁻²⁰

Conversely, the maximum rate of traffic accidents occurring in the summer (36.32%) and spring (26.31%) in Isfahan. Dissimilar patterns in traffic accidents in Isfahan, are caused by variation in climate circumstances in recent years, lengthy period of drought, which has led to have a winter time with low rainfall and snow storms, which in turn has declined the occurrence of snow fall and storms.²¹ An additional factor which might affect on the level of accidents is the amount of trips made, which also diverges according to season.²² In the beginning of spring in Iran, there is the most important Persian celebration, i.e. Norouz feast; in addition, in the summer, education system, almost in all levels, are closed, making the main trips more appealing at these periods of year. Consequently, it was anticipated that there would be the highest level of holiday journeys in the summer time. Therefore, in Iran, with consideration of this fact (highest number of journeys in the summer holidays) and having a long period of drought across the country, it makes the sense that the maximum number of injury and mortality from traffic accidents would occur in the summer, instead of winter.

Demographic factors had an influence on road accidents by their effects on real driving-related manners.²³ In this study, odds ratios of death from traffic accidents for each year of age was 1.05, 1.33 (men compared to women), 2.44 for out of urban-rural and for rural was 3.1 compared to urban accidents, for pedestrian was 1.79 and for motor vehicles

was 1.5 times higher than motorcyclist. Similar result observed in the study of Francesca Valent in Italy with aim of distinguishing risk factors for fatal road traffic accidents in Udine, so that, the risk of contribution in fatal rather than non-fatal accidents was lower between females than males: OR=0.65 and compared to subjects <30 years of age, subjects aged ≥ 65 had a meaningfully increased risk of fatal injury as pedestrians: OR=10.87, car drivers: OR=1.85, moped riders: OR=3.53, and bicycle riders: OR=7.72. Risk of death among pedestrians, car drivers, moped, and bicycle riders was also significantly increased on roads outside the urban center.²⁴

Limitations: We acknowledge that there are certain limitations with our study, such as uncertainty regarding the quality of data, and inaccessibility to correct information about pre and post-hospital deaths from traffic accidents. Also, limitations included poor access to relevant information to the Traffic Police and city morgue about the incidence and mortality from traffic accidents. These limitations forced us to consider only in hospital death from traffic accidents.

CONCLUSION

The results indicated that there are seasonal variations in occurrence and mortality due to traffic accidents. The maximum of occurrence traffic accidents were seen during summer and spring times, while the lowest rate was in the autumn. The in-hospital mortality rate was the highest in summer and the lowest in winter. After adjusting the model, the odds of in-hospital mortality were significant for gender, age, season, type of accidents and accident place.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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