

Original Article

Epidemiological Pattern and Mortality Rate Trend of Road Traffic Injuries in Kermanshah Province (2009-2014)

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Abstract

Introduction: The increasing rate of road traffic injuries have turned into a noticeable and critical danger threatening lives of people in different countries around the world. This study is done to determine epidemiological pattern and mortality rate trend of road traffic injuries.

Materials & Methods: In this cross-sectional study, the epidemiological pattern of mortality related to road traffic injury was determined in a 6-year-period data gathering by Kermanshah Forensic Medicine Center's census. The external cause of death was classified using ICD-10 codes. The population of Kermanshah was provided by the Governor General's Office. Data were then analyzed using Stata 11 software. To examine the mortality trend and its significance, the negative binomial regression was utilized.

Result: The average age of 3231 death cases of road traffic injuries was 39.83 ± 21.27 and 78.4% of the subjects were males. The most important cause of death was head concussion (71.6%). The highest number of external causes was related to cars/van crashes. The mean mortality rate of road traffic injuries in Kermanshah province in this 6-year period was 27.81 deaths per hundred thousand people. The rate of mortality due to road traffic in Kermanshah has decreased from 33.13 to 22.58 cases per hundred thousand people and mortality rate decreases by 6% on average in proportion to every unit of increase in year ($\beta = -0.06$; CI: -0.11, -0.002).

Conclusion: According to the results and despite the decrease in traffic injuries' mortality in recent years, this rate is still higher than that of other countries; therefore, this area of interest should be reviewed, changed, and even revolutionized.

Keywords: Rate, Epidemiological pattern, Mortality, Road Traffic Injuries, Trend

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Introduction

One of the main determinants of ongoing and progressive development is the society health promotion, because the progressive development hinges directly upon the healthy human beings. Nowadays, life is replete with dangers; one danger of prime importance endangering people's lives in many countries is the increase in intentional and unintentional road traffic crashes causing the death of over 1.3 million people around the world annually^[1]. Crashes and road traffic injuries make up to 12% of global disease load and cause the highest rate of mortality due to unintentional incidents all over the world^[2, 3]. In 2010, World Health Organization (WHO) reported that 1.24 million people die of road traffic injuries^[4]. The injuries due to road traffic crashes cause extensive damages to people and the world economy. According to the WHO report in 2013, the number of road deaths has declined in 87 countries, whereas the overall number of road traffic injuries and crashes has remained noticeably high. Over one-third of mortality caused by road traffic injuries, happen in countries with low and average income; the highest number goes to pedestrians and cyclists^[5]. About 60% of road traffic crashes' deaths occur in the age-range of 15-44 years old and more than 75% of victims are men^[6].

Studies in Iran show that the rate of mortality of road traffic injuries is 30 per 100,000 people while the global rate is 32.6 people. It is also worth noting that 15 people die out of every 100 injured ones, but this number is as less as 2 people in the

developed countries^[6, 7]. The WHO report (2008) revealed that 23,000 people in Iran died of road traffic crashes^[8]. The safety report of WHO in 2013 indicated a slight improvement in Iran's road safety, but there remains, still, a long way of much effort to the ideal condition^[5]. Road traffic crashes cause a lot of damage every year and the number is increasingly going up. As a result, it is incumbent on the officials to facilitate the conditions for experts to delve into these deaths, offering the required basis for policy-making in the areas of legislating, designing, and managing the interventionist policies. Kermanshah is located in the Western Iran with an area of 24,998 km² and it is divided into 14 districts. Total population of the province, based on census 2011, was estimated to be 1945227. So, this study is conducted to find the epidemiological pattern and mortality rate trend of road traffic injuries in Kermanshah, Iran.

Materials and Methods

In this cross-sectional study, we cover the data of mortality due to road traffic injuries in a 6-year period (2009 to 2014), gathered by Kermanshah Forensic Medicine Center. Data were collected applying a checklist including demographic variables and injuries information. The used checklist contained the following variables: age, gender, education level, occupation, death year and month, death place, part of lesion, the dead's conditions on the crash spot, and the main cause of death. Any death occurred within 30 days after the crash was considered as a mortality of a road

traffic injury ^[1, 8]. Therefore, this study did not cover the deaths occurring later than 30 days after the crash, the deaths not due to traffic issues, cases under examination to find the death cause, and mortality cases in bordering provinces. For road deaths, V01 to V98 codes were considered as the underlying cause of death. In addition, the classification of people according to external cause of death was carried out using ICD¹-10. The Kermanshah's Governor General's Office provided the province population of different years. The data was analyzed using Stata 11 software. To describe the various variables, the average, the number, and the percentage were utilized; the negative binomial regression was also used to check the mortality pattern and its significance. The population in different years served as the exposure of this model.

Results

The age average of 3231 death cases of road traffic crashes was 39.83 ± 21.27 ; age ranges from 1 to 99 years old (39.47 ± 20.71 in men and 41.14 ± 23.14 in women). 78.4% of the subjects were men and the rest were women (with the sexual ratio of 3.6 men to women). Educationally, the highest number of people (41.1%) were at primary/middle educational level; the lowest (1%) had Associate degree or higher. Also, it was found that 23.4% of people were self-employed. Most lesions were on head and face (65.2%) and the least, on hand and arm (0.2%).

The main cause of death in most cases was head concussion/blow (71.6%), as observed in Table 1.

¹ International Classification of Diseases

Table 1: Frequency of death cases based on the demographic variables, Kermanshah-Iran, 2009-2014

Variables	N	%	Variables	N	%
Education			Crash Type		
Illiterate	947	29.5	Vehicle-vehicle clash	1515	47
Primary/middle	1318	41.1	Vehicle-pedestrian clash	857	26.6
Secondary	653	20.3	Vehicle-fixed objects clash	583	18.1
Associate's Bachelor's	192	6	Vehicle overturning	191	5.9
Master's & higher	19	1	Vehicle falling	14	0.4
Unspecified	74	2.3	Others	62	1.9
Total	3203	100	Total	3222	100
Occupation			Dead Condition on the Crash Spot		
Self-employed	750	23.4	Occupant	1184	36.7
Housewife	502	15.6	Driver	1127	35
Worker	283	8.8	Pedestrian	867	26.9
Farmer	280	8.7	Unspecified	45	1.4
Student	235	7.3	Total	3223	100
Driver	218	6.8	Death Place		
Employee	194	6	Scene	1655	51.6
Others	664	20.7	Hospital	1197	37.2
Unspecified	83	2.6	On way to hospital	326	10.1
Total	3209	100	Home	36	1.1
			Total	3214	100
Lesion Part			Main Cause of Death		
Head & face	2102	65.2	Head concussion (blow to head)	2310	71.6
Multiple traumas	714	22.1	Multiple fractures	340	10.5
Chest & abdomen	257	8	Bleeding	253	7.8
Neck	81	2.5	Multiple traumas	108	3.3
Pelvis	28	0.9	Others	105	3.2
Legs	22	0.7	Under examination	88	2.7
Body posterior	13	0.4	Burn	19	1
Hand & arm	6	0.2	Total	3223	100
Total	3223	100			

Table 2: Frequency of death cases based on seasons and months, Kermanshah-Iran, 2009-2014

Season	Months	considering months		considering seasons	
		number	percentage	number	percentage
Spring	April	242	7.5	743	23
	May	247	7.6		
	June	254	7.9		
Summer	July	364	11.3	1107	34.3
	August	395	12.2		
	September	348	10.8		
Fall	October	315	9.7	810	25
	November	259	8		
	December	236	7.3		
Winter	January	180	5.6	571	17.7
	February	156	4.8		
	March	235	7.3		
	Total	3231	100	3231	100

As it can be seen in Table 2, most deaths of road traffic injuries happened in summer (34.3%).

Table 3: Distribution of external causes of road deaths according to the crash place, Kermanshah-Iran, 2009-2014

Cause (ICD-10)*	urban	suburban	others**	unknown	Total
	No (%)	No (%)	No (%)	No (%)	No (%)
Pedestrian: V01-V04, V06-V09	566 (62.1)	251 (11.8)	21 (15.6)	12 (46.2)	850 (26.5)
Bicycles: V10-V19	2 (0.2)	2 (0.1)	0	0	4 (0.1)
Motorized two-wheeler: V20-V29	128 (14)	264 (12.4)	38 (28.1)	1 (3.8)	431 (13.4)
Car/van: V40-V59	169 (18.5)	1207 (56.5)	41 (30.4)	8 (30.8)	1425 (44.4)
Truck: V60-V69	21 (2.3)	275 (12.9)	17 (12.6)	3 (11.5)	316 (9.9)
Bus: V70-V79	6 (0.7)	72 (3.4)	4 (3)	1 (3.8)	83 (2.6)
Other road user: V80-V86	4 (0.4)	40 (1.9)	13 (9.6)	0	57 (1.8)
Unknown	16 (1.8)	24 (1.1)	1 (0.7)	1 (3.8)	42 (1.3)
Total	912 (100)	2135 (100)	135 (100)	26 (100)	3208 (100)

* External cause of death

** Rural and dirt roads

Table 3 reveals that the highest number of external cause of death was related to cars/van crashes. 66.5% of deaths occurred on roads of suburban areas. The highest number of crash deaths in urban

areas is related to pedestrians: 566 people (62.1%); while in suburban areas, this figure is related to cars/van: 1207 deaths (56.5%).

Table 4: The 6-year average of road traffic deaths per hundred thousand people in terms of townships, Kermanshah-Iran, 2009-2014

Township	Mortality Rate	Township	Mortality Rate
Kermanshah	23.23	Gilan-e-Qarb	23.52
Eslamabad Qarb	44.86	Paveh	15.16
Sonqor	24.08	Ravansar	33.70
Harseen	35.59	Dalahou	54.02
Sarpol Zahab	32.64	Salas-e-babajani	15.11
Kangavar	39.76	Qasr-e-shirin	50.22
Sahneh	32.19	Total Province	27.81
Javanroud	21.82		

The average mortality rate of road traffic injuries in Kermanshah Province in this 6-year period was 27.81 deaths per hundred thousand people. The highest rate is connected to townships of Dalahou (54.02 cases per 100,000 people) and Qasreshirin

(50.22 cases per 100,000 people); the townships of Salas-e-babajani and Paveh had the lowest rates, 15.11 and 15.16 cases per 100,000 people, respectively (Table 4).

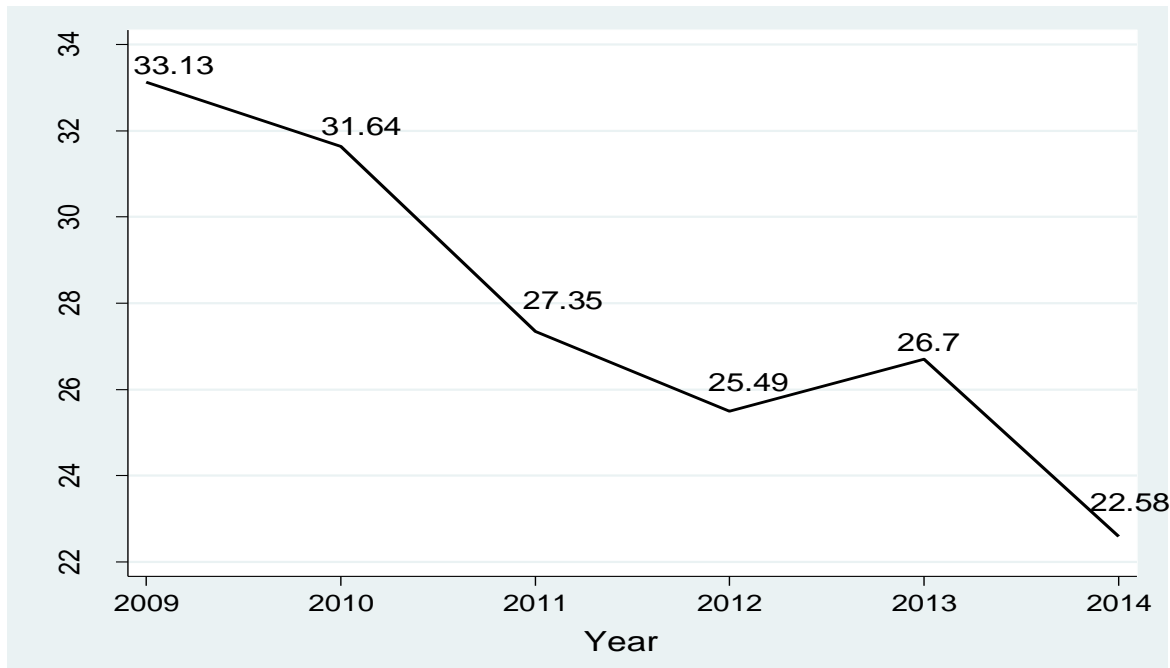


Figure 1: The 6-year trend of road traffic mortality rate in the province of Kermanshah, 2009-2014

Figure 1 shows that the rate of mortality due to road traffic injuries in Kermanshah has decreased from 33.13 to 22.58 cases per hundred thousand people in 2014; using the negative binomial regression, it shows that the mortality rate in this 6-year period is descending; in other words, mortality rate decreases by 6% on average in proportion to every unit of increase in year ($\beta = -0.06$; CI: -0.11, -0.002).

Discussion

The results of this study showed that the mortality rate has been descending in the past 5 years and is in alignment with the nationwide study conducted by Bahadori, according to which the mortality rate of road traffic injuries in Iran has decreased from 38.2 to 31.1 in the recent years^[9]. In the same vein, this number has diminished within the years 2004 and 2010^[10]. The 'Speed Down' strategy might be

the most fundamental reason for this matter in the recent years, because this is one of the most instrumental approaches in preventing road traffic crashes whose applicability has been proven. Recently, this strategy has been perfectly implemented in Iran, helping reducing this health-threatening factor. For instance, Switzerland, using this approach, has limited the speed from 130 km/h to 120 km/h and reduced road traffic crashes by 12%; similarly, Denmark has lowered the mortality rate of road traffic injuries by 24% by decreasing the speed from 60 km/h to 50 km/h^[11].

In spite of reduction in this type of mortality, the overall mortality rate in Kermanshah is 27.8 out of 100,000 people, whereas this number for other parts of the world was reported as the following: 32.6 per 100,000 population for the world, 16.1 for the Americas, 17.4 for Europe, 26.4 for the Eastern

Mediterranean countries, and 28.3 per 100,000 population for Africa ^[5, 7, 12]. These figures and numbers indicate that this area in Iran needs revision and some pivotal transformations; this involves Road Ministry officials and Traffic Police, but it seems that one thing in need of undivided attention is to establish and stabilize road manners so that people themselves will cut this threat down.

This study found that mortality in men is three times higher than in women; this is approved by most researchers in different parts of the world. A study done in India in 2004 revealed that the rate of crashes for men drivers is 4.9 time more than the women drivers' ones ^[13]. Another study of the same nature talked about a ratio of 9 (men) to 1 (women) ^[14]. For Odero systematic review of 83% of studies, this rate came out to be more than 3 ^[15]. In researches carried out in Europe, the U.S., and Japan, the achieved results were in line with the current study ^[16]. Even though all these studies indicated the men's using car more than women as the main reason for this result, it should be kept in mind that under equal circumstances, men are still more liable to crash than women. That's because of their different characteristics: men are more adventuresome and risk-taking so their driving, in turn is more aggressive and they break the laws more.

The average age related to mortality in Kermanshah Province was 39 which are in accordance with country statistics (65% of death cases were 40 years old or younger). This age was

30 for Shahroud ^[17]. The age of most crash victims in Sistan and Balouchestan Province was 15 to 24 years old ^[18]. This matter is important because it shows that crashes happen at the prime of life, when people are in the active phase. This group imposes hefty socioeconomic damages to country, so it is possible to highly cut this danger down by taking advantage of preventive strategies regarding to this most potential group.

In this study, most road traffic injuries happened in summer. The studies in other countries yielded different results. The peak month of road deaths was November for Delhi ^[19] and January for Nepal ^[20]. But the results of studies in Iran have converged. Monsef in Guilan declared that the majority of road traffic crashes and the following deaths occurred in the summer of 2011 (31.5%) and the fall of 2012 (29.4%) ^[21]. As in Shahroud, most city road traffic injuries took place in May and August, while the most of accidents happening outside cities were in July and August ^[17]. The reason for this can be the increase in summer travels which escalates the number of crashes by elevating the road traffic.

In the mentioned study, most injuries were inflicted on head and face while head concussion was reported to be the main cause of death; however, most injuries in Isfahan regarding both genders was (bone) fracture ^[22]. Yousefzadeh's study showed head and neck traumas as the main injury: 80% ^[23]. Other studies obtained similar results too ^[24-26]. According to WHO, every second, 15 people are hurt in head and neck; 2

people die every minute because of road traffic crashes inflicting blows on these parts of body ^[4]. In the research of Khorasani regarding Eastern Azerbaijan Province, two thirds of deaths happened before taking to the hospital ^[27] all of which show the seriousness of the crash; on the ground that the most important reason for serious crashes is the high speed; speed control gains the most attention and focus.

Another result of this study is that most deaths occur to suburban cars/van and to urban pedestrians. In Guilan, the highest number of suburban and urban injuries was related to motorcyclists ^[28]. Sadeghian pointed out that most injuries in urban locations is related to motorcycles while most suburban injuries are related to car's occupants ^[17]. The highest number in Tanzania is connected to the motorcyclists ^[29]. Based on the mentioned evidences, it is possible to highly reduce this sociological problem in cities by creating separate traffic areas for cars and motorcycles, observing traffic safety tips by drivers and pedestrians, building crossing facilities for pedestrians. This rate can also be cut down outside cities by improving roads' safety, fining and

punishing , streamlining the road signs, teaching the behavioral change techniques to follow the authorized speed limit, making the drivers to pay attention to the front, limiting the hours of uninterrupted driving, or preventing driving when drowsy.

Conclusion

The results indicated that despite the decrease in road traffic injuries in the recent years, still this figure is high in Iran compared to other countries. The road traffic in Iran needs to be revised, changed, and revolutionized considering the seriousness of road traffic crashes. The changes should focus on providing a system to keep crashes under control and prevent them, implementing the 'Safe Society' program perfectly, taking preventive actions, and setting appropriate programs to curtail the number and seriousness of crashes.

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References

1. Hashemi Nazari S, Kazemian M, Hosseini F. Trend of Five Years Traffic Accident Mortality in Khuzestan Province (2006-2010). *Legal Medicine Journal*. 2011;17(2):123-29 [Persian]. Available from :<http://en.journals.sid.ir/ViewPaper.aspx?ID=285222>.
2. Maracy MR, Tabar Isfahani M. The Burden of Road Traffic Injuries in Isfahan, Iran in 2010. *Journal of Kerman University of Medical Sciences*. 2013;20(5):505-19 [Persian]. Available from : <http://www.kmusjournal.ir/english/abstract.asp?articleID=4575>.
3. Sim T, Ng K. Childhood injuries: prevention is always better than cure. *Singapore Medical J*. 2005;46(3): 103-5.

4. World Health Organization. Injuries and Violences: the Facts. Geneva, Switzerland: World Health Organization; 2010. Available from : http://apps.who.int/iris/bitstream/10665/44288/1/9789241599375_eng.pdf.
5. World Health Organization. Global Status report on Road Safety 2013. Available from : http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/. Accessed Feb 1,2016.
6. Yazdani J, Ahmadi E, Ghadami M. Classification map of registered deaths due to truck accidents in Mazandaran Province (2007-2010). *Journal of Mazandaran University Medical Sciences*. 2012;22(97):50-8 [Persian]. Available from: <http://jmums.mazums.ac.ir/article-1-1759-fa.html>.
7. Koptis E, Cropper M. Traffic fatalities and economic growth. *Accident Annual Prevention*. 2005;37 (1):169-78. Available from : <http://www.sciencedirect.com/science/article/pii/S0001457504000685>.
8. Izadi N, Najafi F, Khosravi A, et al. Estimation of mortality and calculated years of lost life from road traffic injuries. *Journal of Mazandaran University Medical Sciences*. 2014;24(112):51-8 [Persian]. Available from : http://jmums.mazums.ac.ir/files/site1/user_files_0d0bf0/nedaizadi-A-10-1932-3-c5ac010.pdf.
9. Bahadorimonfared A, Soori H, Mehrabi Y, et al. Trends of fatal road traffic injuries in Iran (2004–2011). *PloS one*. 2013;8(5):e65198. Available from : <http://dx.doi.org/10.1371/journal.pone.0065198>.
10. Zhang L, Li Z, Li X, et al. Study on the trend and disease burden of injury deaths in Chinese population, 2004–2010. *PloS one*. 2014;9(1):e85319. Available from : <http://dx.doi.org/10.1371/journal.pone.0085319>.
11. World Health Organisation. Racioppi F, Eriksson L, Tingvall C, et al. Preventing road traffic injury: a public health perspective for Europe. 2004. Available from : http://www.euro.who.int/__data/assets/pdf_file/0003/87564/E82659.pdf.
12. Lagarde E. Road traffic injury is an escalating burden in Africa and deserves proportionate research efforts. *PLoS Med*. 2007;4(6):170. Available from : <http://dx.doi.org/10.1371/journal.pmed.0040170>.
13. Jha N, Srinivasa D, Roy G, et al. Epidemiological study of road traffic accident cases: A study from South India. *Indian J Community Med*. 2004;29(1):20-4. Available from : <http://medind.nic.in/iaj/t04/i1/iajt04i1p20o.pdf>.
14. Ghosh P. Epidemiological study of the victims of vehicular accidents in Delhi. *Journal of the Indian Medical Association*. 1992;90(12):309-12. Available from : <http://www.ncbi.nlm.nih.gov/pubmed/13040> 14.
15. Odero W, Garner P, Zwi A. Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine & International Health*. 1997;2(5):445-60. Available from : <http://www.ncbi.nlm.nih.gov/pubmed/9217700>.
16. Orsi C, Bertuccio P, Morandi A, et al. Trends in motor vehicle crash mortality in Europe, 1980–2007. *Safety science*. 2012;50(4):1009-18. Available from : <http://www.sciencedirect.com/science/article/pii/S0925753511003213>.
17. Sadeghian F, Khosravi A, Emamian M, et al. Pattern of traffic accidents and injuries related factors in Shahrood. *Payesh*. 2008;7(3):225-33 [Persian]. Available from : <http://en.journals.sid.ir/ViewPaper.aspx?ID=112098>.
18. Taravatmanesh S, Hashemi-Nazari S, Ghadirzadeh M, et al. Epidemiology of fatal traffic injuries in the Sistan and Baluchistan Province in 2011. *Journal of Safety Promotion and Injury Prevention*. 2015;3(3):161-68 [Persian]. Available from : <http://journals.sbm.ac.ir/en-spip/article/view/10937>.
19. Kumar A, Lalwani S, Agrawal D, et al. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. *The Indian Journal of Neurotrauma*. 2008;5(2): 63-7. Available from : <http://medind.nic.in/icf/t08/i2/icft08i2p63.pdf>.

20. Jha N, Agrawal CS, editors. Epidemiological study of road traffic accident cases. A study from Eastern Nepal. Regional Health Forum WHO South-East Asia Region; 2004 . Available from:
http://apps.searo.who.int/pds_docs/B0031.pdf
21. Monsef V, Asadi P, Maleki ziabari S. Mortality due to road traffic injuries in Guilan Province in 2011-2012. *Journal of Safety Promotion and Injury Prevention*. 2015;3(2):97-102 [Persian].
22. Maracy M, Tabar Isfahani M .The Burden of Road Traffic Injuries in Isfahan, Iran in 2010. *Journal of Kerman University of Medical Sciences*. 2013;20(5):505-19[Persian].
23. Yousefzadeh S, Dafchahi MA, Maleksari HM, et al. Epidemiology of Injuries and their Causes among Traumatic Patients Admitted into Poursina Hospital, Rasht. *J Kermanshah Univ Med Sci*. 2007;11(3).
24. Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. *Journal of forensic and legal medicine*. 2008;15(2):75-7.
25. Odero W, Khayesi M, Heda P. Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Injury control and safety promotion*. 2003;10(1-2):53-61.
26. Yates PJ ,Williams WH, Harris A, et al. An epidemiological study of head injuries in a UK population attending an emergency department. *Journal of Neurology, Neurosurgery & Psychiatry*. 2006;77(5):699-701.
27. Khorasani-Zavareh D, Haglund BJ, Mohammadi R, et al. Traffic injury deaths in West Azarbaijan Province of Iran: a cross-sectional interview-based study on victims' characteristics and pre-hospital care. *International Journal of Injury Control and Safety Promotion*. 2009;16(3):119-26.
28. Monsef V, Asadi P, Maleki Ziabari SM. The Epidemiologic of the Traffic Accidents Helped by EMS, Guilan 2011-2013. 2014;20(2):55-60 [Persian].
29. Chalya PL, Mabula JB, Dass RM, et al. Injury characteristics and outcome of road traffic crash victims at Bugando Medical Centre in Northwestern Tanzania. *Journal of trauma management & outcomes*. 2012;6(1):1.