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Original Article

Road traffic deaths in Kashan region, Iran: An eight-year study (2006–2013)

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ABSTRACT

Purpose: The aim of this study was to analyze the trend of road traffic fatalities in Kashan Region, Iran, in a period of eight years.
Methods: Through a cross-sectional study, all road traffic deaths classified under the V01–V99 codes according to ICD-10 in Kashan region, central Iran, from March 2006 to March 2013 and population data were collected from the registration system of Kashan University of Medical Sciences. Years of lost life (YLL) and mortality rates were calculated regarding age, gender and year of the accident. Generalized linear model (GLM) with Poisson log-linear link was used to evaluate the effects of the mentioned variables on mortality rate.
Results: During the period of the study (8 years), 928 people (767 men) died due to road traffic injuries (RTIs). The total YLL was 20,818. The mortality rate due to RTIs has been declined constantly from 43.1 in March 2006 to 21.1 per 100,000 in March 2013. The highest mortality rate was found in the age group of over 60 years old and the lowest in the age group of 0–14 years old. Both mortality rate and YLL was greater in men than in women. Poisson regression showed that age, gender and year of the accidents had a significant effect on mortality rate ($p < 0.001$).
Conclusion: Although there has been a constant decline of mortality rate in Kashan area within the study period, the value remains higher than the mean level of Eastern Mediterranean region and the global average, which is a notable fact for policymakers and authorities.

Introduction

Road traffic injuries (RTIs), corresponding to 2.4% of all global deaths, is one of the leading causes of death and disability worldwide, but with a far greater effect on developing countries.[1] According to the World Health Organization (WHO) report 2015, the total number of road traffic deaths remains unacceptably high at 1.25 million per year.[2] This report also reveals that the Eastern Mediterranean region is responsible for 10% of the world's road traffic deaths and has the second highest road-traffic fatality rate among WHO regions. Although the high-income countries generally have lower fatality rates than low- and middle-income countries, high-income countries in the Eastern Mediterranean region have higher rates than those of their less-affluent neighbors in the region (22.4 vs. 19.7/100,000).

Iran among the countries of this region has the highest rate of 32.1 per 100,000.[3] This is far more than the rate of 8.7 per 100,000 population for high-income countries.[4] The mortality rate due to RTIs is a major concern in Iran, especially during the last decade along with the urbanization and industrialization processes.[5] A considerable amount of literature has been published on road traffic injuries in Iran in recent years. Soori et al[6] during a trend analysis of fatal RTIs in Iran showed that mortality rates from RTIs has been decreased from 38 per 100,000 populations in 2004 to 31 per 100,000 in 2009. A Similar study by Mirzaei et al[7] in subnational level also showed a decline in fatality rate due to RTIs from 77.6 per 100,000 in 2004 to 37.6 per 100,000 in 2010 in Yazd province in the center of Iran which is similar to Kashan region regarding socioeconomic and climatic features.

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Materials and methods

In this cross-sectional study, with ethics approval from university research ethics board, all the data come from the death registration system of deputy of health, Kashan University of Medical Sciences (KAUMS) from March 2006 to March 2013, which were used for data analysis. This university as a part of the Ministry of Health and Medical Education is responsible for providing health services for Kashan region (including Kashan and Aran-Bidgol Counties), which in the center of Iran with around 400,000 population. The deputy of health of KAUMS has an improved health networks' registration and certification and up to date information on the number of births, deaths, population and family planning activities within the covered area.

All of the deaths are registered in KAUMS data registry by age, sex, cause and place of residence and these data are cross-checked with those from other sources [e.g. National Organization for Civil Registration (NOCR), cemeteries, hospitals] and duplicates are removed (such as first name, surname, father's name), national code and date of accident. However, in order to increase the accuracy of the study, death data of KAUMS registry were compared to NOCR registration using capture-recapture method and KAUMS mortality data bank was used in this study for its consistency and accuracy. It has also previously shown that medical universities' death data are more reliable regarding the completeness and classification of the cause of the deaths compared to NOCR.[8]

In order to calculate mortality rates, the population of the Kashan region during the study period (2006–2013) was obtained from the registry of Kashan University of Medical Sciences. A fatality defined as a person who was died due to a traffic crash within 30 days. According to the International Classification of Diseases and Causes of Death (ICD 10), V01–V99 codes are dedicated for Road Traffic Accidents (RTAs) as underlying causes of death. Based on this classification in this study, all the deaths due to RTIs in Kashan region included pedestrians, drivers, car occupants, motorcyclists, and bicyclists. Also, the garbage codes were redistributed proportionally based on the accident causes. All the people killed in traffic accidents whose residents in other places were excluded from the study.

The classic Global Burden of Disease methodology was used to compute YLL with premature mortality.[9] The remaining life expectancy was used according to the Coale and Demeny West level 26 life table.[10] In addition, the calculation was performed using the formal WHO time discounting ($r = 0.03$) and age weighting ($\beta = 0.04$, $K = 1$).

Data were analyzed with SPSS software (version 16.0, SPSS Inc, Chicago, Illinois, USA). Descriptive statistics were used to describe demographic factors such as age and sex. Generalized Linear Model (GLM), Poisson log-linear link was used to consider the effects of age, sex and year of the accident on mortality rate. $p < 0.05$ was considered statistically significant.

Results

During an 8-year period of the study, from 2006 to 2013, 928 people of the Kashan region [767 men (82.7%) and male/female ratio of 4.7:1] died from RTIs. The total 8 year YLL was 20,818. The mean age (SD) of the victims was 40.74 (21.36) years. Also, the mean age (SD) was 40.44 (21.43) for male and 42.12 (24.36) for female victims. Approximately, one third of RTIs deaths (274 cases, 29.5%) were among those aged 15–29 years. The mortality rate due to RTIs has been decreased constantly from March 2006 (43.1 per 100,000) to March 2013 (21.1 per 1000,000) (Table 1). The YLL trend has also been declined continuously from 2006 to 2013 (Table 2 and Fig. 1). Although the crude number of deaths in the elder population was less than the deaths in younger population, there was a higher mortality rate per 100,000 in the elderly (Table 1 and Fig. 2). The YLL was reduced from 960/100,000 in 2006 to 470/100,000 in 2013. Furthermore, males had a higher rate of YLL compared with females (Fig. 1). The results of generalized linear model, using Poisson log-linear showed that age factor and male gender were associated with increasing mortality while the decline of the fatality over the years shows time (year of the accident) and mortality were inversely related (Table 3). The likelihood ratio test represented a good fitness of the model for mortality as well ($p < 0.001$).

Discussion

Generally, the results of this study showed a decline in the mortality rate and YLL trend during an 8-year period (2006–2013). Also, men had a greater mortality rate and YLL than women. Moreover, the mortality rate was higher in elder people (>60 years).

RTIs accounted for 23% of all deaths, and more than 90% of RTI deaths happened in low- and middle-income countries worldwide.[11] Although in 2010, middle-income countries had the highest road traffic death rate at 20.1 per 100,000, this rate for Iran was estimated as 34.1 per 100,000 in this year.[12] However, based on our results this value in the Kashan region in 2010 (27.1 per 100,000) was less than the estimated rate for Iran, but higher than the average rate for other middle-income countries in the same year (20.1 per 100,000) even though later this rate declined to 21.1 per 100,000 in 2013. This study came to these results which corroborate the findings of Lankarani et al[13], whose study showed a decline of 31.5% in RTI deaths per 100,000 (from 39.1 to 26.8) from 2006 to 2012 based on a national report in Iran. The findings of the present study are also in agreement with

Table 1
Mortality rates based on age and sex groups per 100,000 populations in different years.

Item	Year								Population in 2006[a]
	2006	2007	2008	2009	2010	2011	2012	2013	
Gender									
Male	70.4	61.8	52.8	47.7	46.3	41.4	41.1	36.2	184,732
Female	14.7	14.4	9.8	13.4	7.4	11.9	9.1	5.5	177,418
Age groups (years)									
0–14	12.6	11.5	17.7	11.4	7.7	12.6	14.8	7.3	79,412
15–29	39.5	37.9	32.9	29.6	17.3	25.8	20.1	20.3	121,388
30–59	50.4	33.8	30.6	35.6	34.1	29.4	26.1	21.9	124,893
>60	96.0	110.9	59.0	55.6	68.8	48.6	57.7	46.5	36,457
Total	43.1	38.5	31.6	30.8	27.1	26.9	25.3	21.1	362,150

[a] All population data were gathered form deputy of health, Kashan University of Medical Sciences (KAUMS). Since validity of these data has been cross-checked with the results of two national censuses held in 2006 and 2011, it is assumed that the data of KAUMS for all other years is accurate and valid. Data for 2006 is included just as an example.

Table 2
RTAs deaths and years of lost life in an 8 year period in Kashan Region, Iran.

Year	Crude death [*n* (%)]			YLL	YLL per 100,000
	Male	Female	Total		
2006	130 (16.9)	26 (16.1)	156 (16.8)	3481	960
2007	116 (15.1)	26 (16.1)	142 (15.3)	3138	850
2008	100 (13.0)	18 (11.2)	118 (12.7)	2880	770
2009	91 (11.9)	25 (15.5)	116 (12.5)	2700	720
2010	90 (11.7)	14 (8.7)	104 (11.2)	2055	540
2011	82 (10.7)	23 (14.3)	105 (11.3)	2391	610
2012	83 (10.8)	18 (11.2)	101 (10.9)	2273	570
2013	75 (9.9)	11 (6.9)	86 (9.3)	1900	470
Total	767	161	928	20,818	–

Abbreviations: *n*: Numbers, YLL: years of lost life.

Bahadorimonfared et al's[6] findings representing that the death rate due to RTIs in Iran statistically declined from 38 per 100,000 in 2004 to 31 per 100,000 populations in 2011. Also, Fallahzadeh et al showed a decline in the RTI mortality rate from 46.9 per 100,000 in 2006 to 38.8 per 100,000 in 2008 in Yazd province in Iran. Reduction of the death rates despite population growth and dramatic increase of motor vehicles is a promising point.[6] It could be partly due to reforming traffic regulations, driving policies like granting hardship driving licenses, increasing police enforcement, and increased fines of driving penalties.[14] Based on National Burden of Disease (NBD) study in Iran, 2003, RTIs had the highest burden in all ages and both genders that contribute to 15.1% of total YLL among unintentional injuries.[15] In terms of RTI-related YLL, an Iranian study showed that the rate of YLL in Iran for all ages and both sexes in 2005 had been 1290 per 100,000, while this rate were 960 per 100,000 in the Kashan region in 2006, less than the national rate in 2005 and this trend more or less continued its reduction since then.[16] However, in spite of the significant reduction of the RTI death rate, the burden of the road traffic accident fatalities remains high in our region. In our study, nearly one third (29.1%) of RTI-related deaths happened in the 15–29 years age group, which is in line with the WHO report.[17] These results are also consistent with the findings

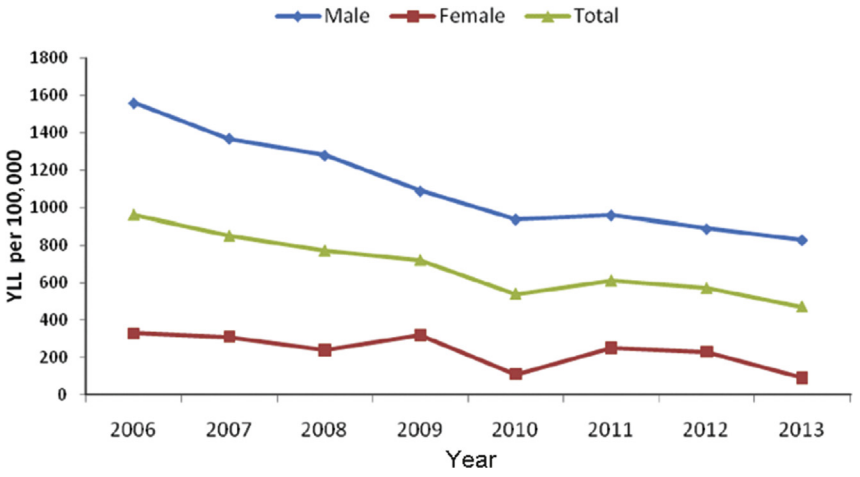

Fig. 1. Years of lost life (YLL) due to RTIs through the years.

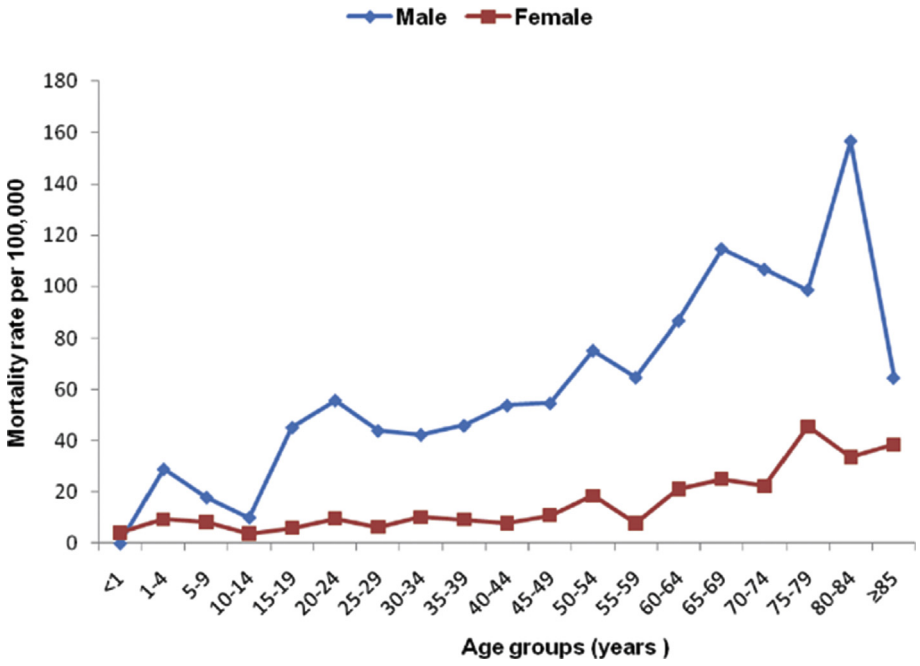

Fig. 2. Average road traffic fatality rate classified by age group in an 8 year period from 2006 to 2013 in Kashan region, Iran.

Table 3
Poisson regression model and parameters for considering the effect of age, sex and year on mortality rate during an 8 year study.

Variables	Coefficient	SE	Z value	*p* value	95% *CI*
Sex (male)	1.53	0.086	17.66	0.001	(1.36, 1.7)
Age	0.0899	0.0072	12.34	0.001	(0.075, 0.104)
Year	−0.097	0.0144	−6.72	0.001	(−0.125, −0.069)
Constant	185.13	29.02	6.38	0.001	(128.24, 242.02)
Accuracy of model	Log-likelihood = −562.14 LR (13) = 598.4 prob<0.001 pseudo R^2 = 0.347				

Abbreviations: SE: Standard error; *CI*: Confidence interval; LR: Likelihood ratio.

of a national study by Moharamzad et al[18], which showed that the second and third decades of life were the two most common age ranges of RTI victims (21.9% and 30.7% respectively). Higher mortality in this age group probably is due to substandard driver qualification and dangerous driving habits along with their higher exposure to road traffic. Nevertheless, despite the lower crude number of death in elder population (>60 years) in our study, the mortality rate was higher in this age group than the youth (Table 2) showing the vulnerability of this age group to RTIs' fatality. The findings of the current study are consistent with those of Mehmandar et al[19] who found the highest odds of RTI's fatality in people over 55 years old ($OR = 2.36$, $p < 0.001$). Cognitive and motor impairment as a result of age-related changes could have a negative effect on reaction time and movement in this class of society resulting in the increased risk of RTIs.[20] Moreover, most elderly trauma victims often have significant comorbidities that reduce their chances of survival following a trauma.[21–23] However, surprisingly, a slight increase in mortality rate in the 1–4 years old age group was seen, which should not be neglected (Fig. 2). The present findings seem to be consistent with Leidman et al's[24] findings showing a high number of RTIs fatality among young children in Iraq. This could probably be due to the fact that there is no child restraint law in Iran and it is common to observe children of this age group among the passengers of motorcycles. Moreover, it is suggested that the increased risk among this age group partly may be attributed to children playing in the streets and unsafe places.[25] The male predominance in this age group could be a result of cultural differences in Iran, that parents gave more freedom to boys than girls participate in outdoor activities.

According to the World Health Organization report, more than 75.0% of the road traffic deaths happened in males.[3] The finding of the current study shows that men accounted for nearly 83% of all the RTI fatalities and also had a greater YLL rate than the women, which is in line with the findings of other previous similar studies.[7,24,26] Higher mortality in men compared with women can be possibly justified because the men, as householders, are more likely to expose themselves to traffic accidents due to socioeconomic and cultural features.

Since there is not enough information about the exact number of vehicles in Kashan Region, as a limitation of the current study, it was not possible to determine the mortality rate based on the number of vehicles.

In conclusion, assessment of death trends caused by RTIs in Kashan region from March 2006 to March 2013 showed a decline in the crude number of deaths, fatality rate and YLL trend. However, despite this reduction, RTI mortality in our region is still higher than the global average, and even higher than the Eastern Mediterranean region.

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