



Mortality Rate and Years of Life Lost Due to Road Traffic Accidents in Fars Province, 2004-2019

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Abstract

Background: Traffic accidents are one of the most critical health problems and the ninth leading cause of death globally. We aimed to determine the Mortality rate and the number of Years of Life Lost (YLL) due to road traffic accidents.

Methods: In this retrospective cohort study, mortality rate and YLL due to road traffic accidents were examined in Fars province, central Iran during the years 2004-2019. Mortality statistics were collected through death registration of ministry of health and medical education for Fars Province. Age Standardized mortality Rate (ASR) was calculated and join point regression analysis carried out to examine the trend of YLL rate. Data were analyzed using Excel spreadsheet version 2016 and Join point Regression Program 4.9.0.0.

Results: During the 16-year study period, 25,858 deaths due to road traffic accidents occurred in the province. 79.2% (20483 cases) were in men, and 33.7% (8703 cases) were aged 15-29 years. Total YLL during the 16-year study period were 458,975 (14.6 per 1000 people) in men, 117,999 (3.8 per 1000 people) in women. According to the join point regression, the 16-year trend of YLL rate due to premature mortality was decreasing: AAPC was -4.9% (95% CI: -8.8 to -0.9; $P=0.018$) for male, and -3.5% (95% CI: -6.3 to -0.5; $P=0.011$) for female.

Conclusion: Considering that the number of deaths, mortality rate and YLL has decreased in Fars province during the 16 years under study. Therefore, because the mortality rate due to road traffic accidents in Iran is higher than the global average, the need for training programs for drivers, compliance with standards and retrofitting of vehicles, road safety, driving supervision and the use of seat belts are essential.

Keywords: Road traffic accidents; Join point regression; Years of Life Lost; Mortality Rate; Iran

Introduction

Traffic accidents are one of the most critical health problems and the ninth leading cause of

death globally. The burden of traffic accidents in Iranian society is very high, and the total number



of years of life lost (YLL) is higher than other causes of death(1). These events impose significant economic and social burdens and high mortality and disability on the people of the world, especially in developing countries (2). Traffic accidents are a significant cause of disability, morbidity, and premature death, especially in low- and middle-income countries(3). According to the WHO, 90% of road accident deaths occur in low- and middle-income countries (4). Traffic accidents are predicted to be the fourth leading cause of global disease burden in 2030 (5). Deaths due to traffic accidents affect not only the victims but also the family and the wider community, and the physical, psychological and economic consequences, reduce the quality of life (6). In Iran, traffic accidents are the second leading cause of death and YLL after cardiovascular disease. Also, the mortality rate due to traffic accidents is 31 per 100,000, which is much higher than the global average (7). Overall, 28% of the YLL in Iran are related to injuries (8).

In Brazil, more than a million of potential years of life were lost, in 2013, because of road traffic injuries, especially in the age group of 20 to 29 years (9). In China, the fatalities per 10,000 vehicles continued to decline, the health burden of RTIs it was higher in males than in females. The DALY rate and YLL rate among young and middle-aged pedestrians were higher (10). In Mexico, the overall burden of RTIs was 332,922 YLL and 82.4% of the deaths occurred in males. Males from 25 to 34 years of age and females from 15 to 24 years of age showed the highest age-adjusted YLL rates (11). In Kermanshah Province, trend of mortality and YLL due to road traffic accidents, decreased (12).

Fars Province is one of the parts of Iran with the highest rate of traffic accidents and the highest incidence of mortality due to traffic accidents (13). Calculating the YLL due to road traffic accidents in Fars Province and describing the current situation could be a good document for determining the essential information for decision-makers about policies and appropriate interventions. The impact of these interventions can also be evaluated and calculated periodically. There-

fore, we aimed to determine the mortality rate and the number of YLL due to road traffic accidents in this province.

Methods

This retrospective cohort study, extracted all deaths from road traffic accidents from the Electronic Population-Based Death Registration (EDRS) system based on age, sex, and years of death based on ICD-10. In this system, we used all the resources for diagnosing, registering and collecting information about death, such as hospitals, cemeteries, forensic medicine, and urban and rural health centers.

The codes used in this study were V01-V89. Twice-reported deaths were excluded from the study based on similarities in father's name, time of death, and national number. The age groups used in this study were 0-4, 5-14, 15-29, 30-44, 45-59, 60-69, 70-79, and over 80 years old.

The total estimated population of Fars Province has been measured using primary data of health centers and population and housing census from 1997 to 2017, including annual population growth. For standardization, the standard population of 2013 for low-and middle- income countries have been used (14).

Statistical analysis

Over the study period, the crude and standardized mortality rate (ASR) of road traffic accidents were calculated according to sex and year of death. The Chi-square test was used to calculate the mortality trend over the study years. A *P* less than 0.05 was considered significant. Data were analyzed using SPSS 22 software (IBM Corp., Armonk, NY, USA) and Excel spreadsheet version 2016.

To calculate the YLL, The standard life table was used and the dataset was categorized into 5-year age groups based on each person's age at death. Based on the following relationship, the calculation was performed (15).

$$YLL = N C e^{(ra)} / (\beta+r)^2 [e^{-(\beta+r)(L+a)} [-(\beta+r)(L+a)-1] - e^{-(\beta+r)a} [-(\beta+r)a-1]]$$

Where,

N is the number of deaths at a certain age and gender.

L is the standard of living of the deceased at the same age and gender.

r is the Discounting Rate, which is equal to 0.03.

β is the contract rate in calculating the age value, equal to 0.04.

C is a modified constant value equal to 0.1658.

a is the age at which death occurred, and e is fixed and equal to 2.71.

The analysis of the number of YLL due to premature death from road traffic accidents was performed using the YLL template of 2015, the WHO in Excel spreadsheet software version 2016(16).

To examine the trend of YLL rate for different years, join point regression based on the log-linear model was used. Join point regression analysis describes changing trends over successive segments of time and the increase or decrease within each segment. The resulting line segment between join points is described by the annual percent change (APC) that is based on the slope of the line segment and the average annual percent change (AAPC). The analysis for the trend was carried out by Join point Regression Program 4.9.0.0.

The protocol of this study was reviewed and approved by the Ethics Committee of Shiraz University of Medical Sciences (code: IR.SUMS.REC.1399.772). All aspects of the study were conducted following the University Code of Ethics.

Results

During the 16-year study period (2004-2019), 25,858 deaths due to road traffic accidents occurred in the Fars province. Of these, 79.2% (20483 cases) were in men, and 33.7% (8703 cases) were aged 15-29 years.

As can be seen in Table 1, the crude and standardized mortality rate mortality rate in men and women decreased during study periods (P for trend <0.001).

Total YLL during the 16-year study period were 458,975 (14.6 per 1000 people) in men, 117,999 (3.8 per 1000 people) in women, and 576,974 (9.3 in 1000 people) in both sexes. (Male / Female sex ratio, 3.9).

The highest mortality rate (per 100,000 population) in both sexes was in the age group over 80 years, and the lowest mortality rate in both sexes was in the age group of 5-14 years (Fig. 1). The highest and lowest YLLs in both sexes were in 15-29 and more than 80 years groups, respectively.

According to the join point regression, the 16-year trend of YLL rate due to premature mortality was decreasing: AAPC was -4.9% (95% CI: -8.8 to -0.9; $P=0.018$) for male, and -3.5% (95% CI: -6.3 to -0.5; $P=0.011$) for female and -4.7% (95% CI: -7.5 to -1.8; $P<0.001$) for both genders (Fig. 2).

The model shows two join point in 2009 and 2012 and 3 segment (2004-2009,2009-2012,2012-2019) for males .The model shows one join point in 2007 and 2 segment (2004-2007,2007-2019) for females (Table 2). The model shows two join point in 2009 and 2012 for both genders when the APC was -2.9% (95% CI: -6.3 to 0.6; $P=0.087$) and -13.0% (95% CI: -25.7 to 1.9; $P=0.076$), respectively.

Table 1: Crude and standardized mortality rate (per 100,000 population) and YLL due to road traffic accidents by sex and year in the Fars Province during 2004-2019

Year	No. death			Crude mortality rate			ASR (95%CI)			YLL					
	Male	Female	Both sex	Male	Female	Both sex	Male	Female	Both sex	Male	Female	Both sex	(per 1000)		
2004	1678	343	2021	90.2	19.3	55.6	88.4	22.6	56.3	39281	7772	47053	21.1	4.4	12.9
2005	1745	371	2116	94.3	20.9	58.3	91.3	24.4	58.5	40702	8269	48971	22.0	4.6	13.5
2006	1615	382	1997	87.3	21.2	54.7	83.5	23.6	53.8	37565	8839	46404	20.3	4.9	12.7
2007	1649	376	2025	88.3	20.6	54.8	83.5	22.2	53.2	38044	8677	46721	20.4	4.7	12.6
2008	1528	396	1924	81.0	21.4	51.5	76.8	23.0	50.1	35158	8806	43964	18.6	4.8	11.8
2009	1480	370	1850	77.7	19.7	48.9	74.7	20.3	47.6	33231	8449	41680	17.4	4.5	11.0
2010	1444	369	1813	75.1	19.4	47.4	71.8	20.8	46.3	32520	8020	40540	16.9	4.2	10.6
2011	1164	347	1511	60.0	18.0	39.1	56.5	18.7	37.6	26071	7825	33896	13.4	4.1	8.8
2012	1039	522	1561	52.8	26.8	39.9	51.2	27.1	39.1	20008	9313	29321	10.2	4.8	7.5
2013	1108	289	1397	55.5	14.7	35.3	52.8	14.9	34.0	24212	6393	30605	12.1	3.3	7.7
2014	971	304	1275	48.0	15.3	31.8	45.3	15.5	30.4	20916	6505	27421	10.3	3.3	6.8
2015	1030	287	1317	50.3	14.3	32.5	47.6	14.0	31.0	22090	6244	28334	10.8	3.1	7.0
2016	1034	242	1276	49.8	11.9	31.1	48.1	11.5	29.9	22969	5383	28352	11.1	2.7	6.9
2017	1129	250	1379	54.3	12.3	33.6	52.9	12.3	32.8	25061	5596	30657	12.0	2.8	7.5
2018	947	260	1207	45.3	12.8	29.3	43.2	12.2	27.9	20824	5920	26744	10.0	2.9	6.5
2019	922	267	1189	43.8	13.1	28.7	43.2	13.0	28.2	20323	5988	26311	9.7	2.9	6.3
Total	20483	5375	25858	65.1	17.5	41.5	61.8	18.0	40.1	458975	117999	576974	14.6	3.8	9.3

Table 2: Join point regression results stratified by sex, years of trend, annual percentage change (APC) and annual average percentage change (AAPC)

Male	Segment	Lower Endpoint	Upper Endpoint	APC	Lower CI	Upper CI	Test Statistic (t)	p.value
	1	2004	2009	-3.3	-7.9	1.5	-1.6	0.145
	2	2009	2012	-15.2	-31.7	5.4	-1.7	0.119
	3	2012	2019	-1.2	-4.1	1.7	-1.0	0.353
	Full Range	Lower Endpoint	Upper Endpoint	AAPC	Lower CI	Upper CI	Test Statistic (t)	p.value
Female	1	2004	2019	-4.9	-8.8	-0.9	-2.4	0.018
	2	2004	2007	3.9	-10.9	21.2	-4.9	0.593
	3	2007	2019	-5.2	-6.9	-3.5	-2.5	<0.001
	Full Range	Lower Endpoint	Upper Endpoint	AAPC	Lower CI	Upper CI	Test Statistic (t)	p.value
		2004	2019	-3.5	-6.3	-0.5	-4.9	0.011

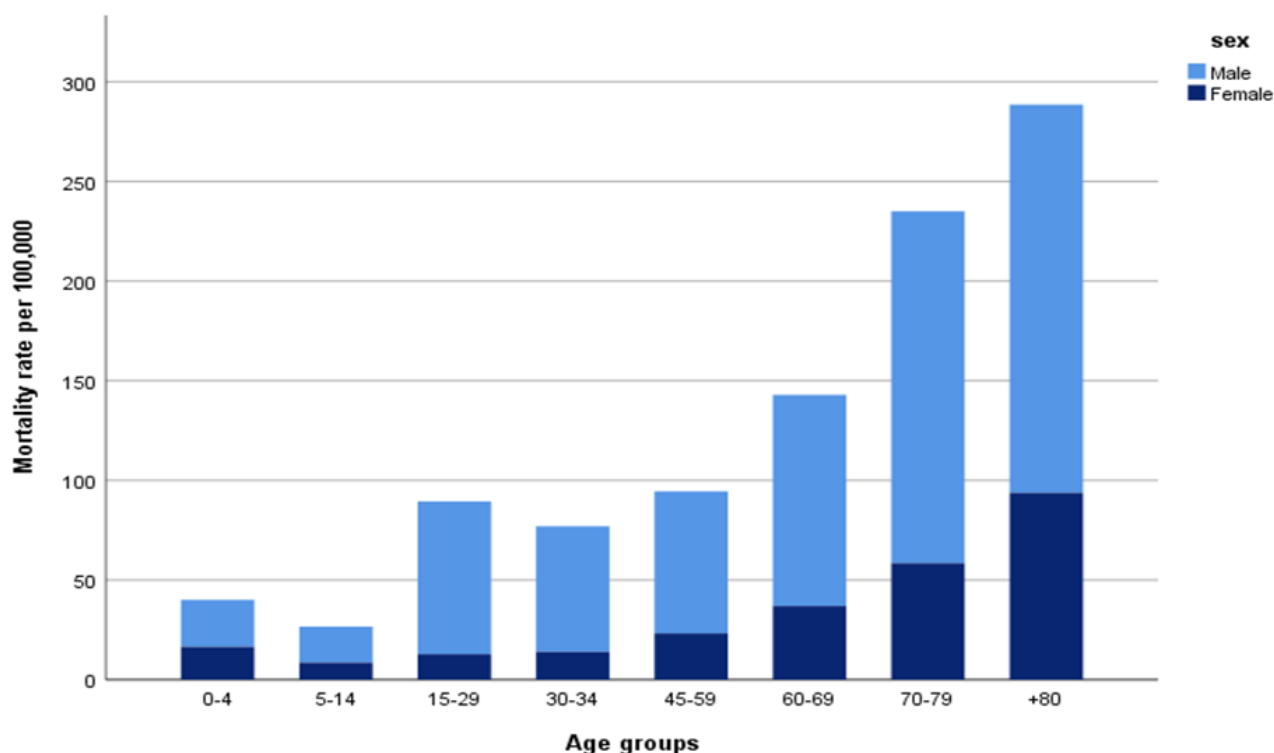


Fig. 1: Crude mortality rate (per 100,000 population) due to road traffic accidents by gender and age groups

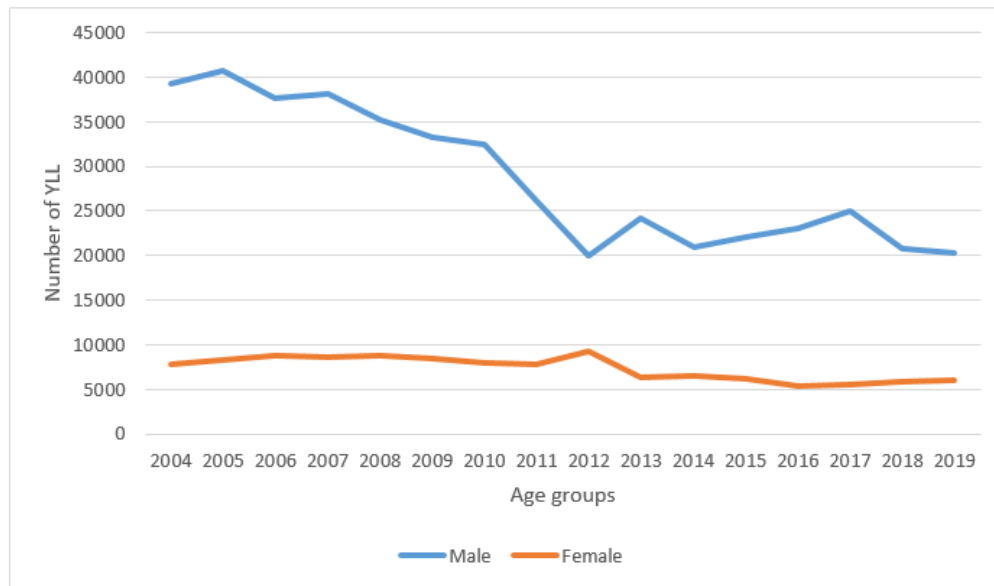


Fig. 2: The trend of years of life lost due to road traffic accidents during 2004-2019

Discussion

During the 16 years of the study, 25,858 deaths due to road traffic accidents occurred in the Fars Province. The share of men in deaths due to road traffic accidents was more than twice that of women (79.2% vs. 33.7%). Also, most YLL were in the age group of 15-29 years. The age-standardized mortality rate was 61.8 in men and 18.0 in women (per 100,000 population). Also, the total YLL in this period was 14.6 in men and 3.8 in women (per 1,000 population). This indicates that the burden of road traffic accidents is higher in men than women. In Africa and low- and middle-income countries in Europe, men have the highest mortality rate due to road accidents (17). In India, deaths due to road traffic accidents are higher in men than women (25.7 deaths in men versus 8.5 deaths in women per 100,000), and 77% of deaths due to road injuries occur in men. The age-standardized mortality rate was three times higher in men than in women (18). In this study, the crude mortality rate in men and women during the years under study was 65.1 and 17.5 per 100,000 population, respectively. In Iran, 80.1% of people who died due to road traffic accidents were men (19). In the Eastern Mediterranean region, 75% of people who died

in road traffic accidents were men (19). In Kashan, the mortality rate and YLL were higher in men than women (20). In our study, the age-standardized ratio of road accident mortality in men to women was 3.78, which was 3.84 in the Mediterranean region, and 3.1 globally. In this region, Pakistan with 12 and then Kuwait with 4.5 had the highest mortality rate among men to women (21).

The burden of transportation injuries is significantly higher in men than women. This gender ratio is in line with global trends. The fact that men are much more likely than women to die in road accidents may be related to the fact that women drive less than men. Around the world, deaths from road accidents are lower among women due to cultural and economic differences, as well as less risky behaviors in women than in men (22). In this study, the crude mortality rate was 65.1 for men and 17.5 for women (per 100,000 population). In northern Iran, the mortality rate in the whole population was 59.1 (per 100,000 population) (23). In other cities of Iran, the mortality rate of road traffic accidents was different from the present study, so the mortality rate in Kermanshah was reported 51.3%, in Isfahan 21.1% and in Yazd 46.4% (24-26). Also, the

death rate in Europe was 9.3% and in Africa was 26.6% (27, 28).

In the present study, the YLL decreased in both men and women between 2004 and 2019, so that the YLL in 2004 in men and women was 21.1 per thousand and 4.4 per thousand, respectively, and in 2019 in men and women, respectively, it reached 9.7 and 2.9 per thousand. The results of the studies conducted in the Eastern Mediterranean region are consistent with the present study. In the Eastern Mediterranean region, between 1990 and 2015, the YLL rate per 100,000 due to road accidents or transportation decreased by 15% (21). The the Eastern Mediterranean region, the death rate due to road accidents in 1995, 2005 and 2015 were higher than the global average for Iran, but have been declining over the years (29). However, in the Eastern Mediterranean region, age-adjusted YLLs per 100,000 people are significantly higher than the global statistics (21).

In this study, the highest YLL in both sexes was in the age groups of 15-29 and then 30-44 years, respectively, and the lowest in the 80-year-olds and above. In a study conducted in the Eastern Mediterranean region, the highest YLL was in the age group of 20-24 years (21). Most of all, considering that the age group of 15-44 years old is considered an active labor force for any society. Thus, the death of people who are an economically active and income-generating group causes extensive and irreparable economic damage to the economy of society and the family. So that in low- and middle-income countries, it can lead families into poverty. In Iran, more than 50% of deaths due to road traffic accidents occur in people aged 15 to 44, who are economically active population (30). Therefore, the negative impact of these deaths on life expectancy at birth and consequently on the economy and society, especially in the country's health sector of the country will be inevitable (31, 32).

According to the WHO in 2019, road traffic accidents (RTCs) are the eighth leading cause of death in low-income countries and the tenth leading cause of death in lower-middle income and upper middle-income countries (33). In addition to road accidents and transportation being a pub-

lic health burden, these accidents are associated with a huge economic burden. Road traffic injuries account for approximately one-third of the total damage burden in EMRO countries, which account for a significant amount of countries' gross domestic product (GDP). In Afghanistan 1.2%, Bahrain 0.6%, Djibouti 1.9%, Egypt 0.9%, Iran 1.96%, Iraq 1.3%, Jordan 1.7%, Kuwait 1.2%, Lebanon 0.96%, Libya 1.6%, Morocco 1.23%, Oman 1.72%, Pakistan 1.2%, Qatar 0.99%, Saudi Arabia 1.74%, Somalia 2.16%, Sudan 1.92%, Syria 0.91% Tunisia 1.33%, UAE 0.85% and Yemen 1.92% (34). It is estimated that it costs the EMRO countries a total of US \$ 7.5 billion a year, which is equivalent to 1-1.5% of the GDP of most countries in the region (35). Therefore, there is a need for intervention to reduce accidents in the region, especially in Iran.

Strengths and weaknesses

A limitation of the present study was that YLL was not evaluated throughout the whole of Iran due to the unavailability of the necessary data. This study was of high quality and with a strong study design, large sample size, and extensive time-period of data analyzed.

Conclusion

Considering that the number of deaths, mortality rate and YLL has decreased in Fars province during the 16 years under study, the mortality rate due to road traffic accidents in our region is still higher than the global average and even higher than in the Eastern Mediterranean region. Therefore, the need for training programs for drivers, compliance with standards and retrofitting of vehicles, road safety, driving supervision, and the use of seat belts are essential.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission,

redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interests.

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