

Road Traffic Accidents in Yazd Province, Iran: A Longitudinal Study (2012–2016)

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Abstract

Background and Objectives: The victims of road traffic accidents (RTAs) are mainly young. Hence, reduction of mortality from RTAs should be considered as one of the most important priorities for health-care systems. This study aimed at assessing the mortality rate of RTAs in Yazd Province during 2012–2016. **Subjects and Methods:** In this descriptive-analytic study, data were obtained from data collection forms of forensic medicine organizations in Yazd. The general equation estimation method was used to compare the number of accidents by distinguishing independent variables. To investigate the trend, a decomposition method was used to analyze a time series with a trend and a seasonal pattern in the Minitab software. **Results:** In this study, 1437 people who died due to RTAs during 2012–2016 were studied. The number of deaths in men was 1076 (75%), almost three times of women. The risk of death from RTAs in married couples, the main road, heavy car driving and driving out-of-town were 1.6, 3.6, 1.9, and 3.2, respectively. An indirect and significant linear relationship was found between the number of accidents and time during 2012–2016. **Conclusion:** According to the results of this study, the most cases of events are in the age group of 20–30 years. Therefore, prevention should be done for this age group. Furthermore, findings of this study show that decreasing in fatal RTA can be attributed to the exacerbation of traffic regulations and its implementation.

Keywords: Mortality, traffic accidents, trend

INTRODUCTION

Accidents and injuries constitute the major outbreaks of noncommunicable diseases in the current century.^[1] Accidental lesions are one of the five leading causes of death in different age groups in developed and developing countries.^[2] Annually around 1.2 million people die due to road traffic accidents (RTAs), and about 50 million people are injured.^[3] This is the ninth burden of disease in the world, which is, ranked third in 2030, according to the World Health Organization.^[3] Unlike other illnesses, the victims of the incident are mainly young. Almost 50% of victims are at the

age of 15–44 years.^[2] RTAs as a predictable and prevention event are one of the most important public health challenges that impose a lot of social burden on the community. RTAs as one of the most important causes of mortality with severe socioeconomic and cultural impacts on human threatened societies seriously.^[4] RTA is the result of an accident caused

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by any vehicle on the public transport routes.^[5] Death due to accidents is called death within 30 days after the incident. Risk factors associated with RTAs are divided into three categories: individual, vehicle, and environment. Among these three categories, the human factor plays a prominent role in accidents.^[6,7] The pattern of RTAs and their deaths varies greatly between developed and developing countries. In the past four decades, road traffic deaths have dropped in high-income countries, while this has increased in other countries, including Iran.^[8] RTAs death in Iran per capita and car number is much higher than the average in the world.^[9] RTAs were account for the 2nd cause of death and the 1st cause of lost life due to disability with the incidence of 30–40 people per 100,000 population annually in 2005 in Iran.^[10] RTAs were account for 2.19% of gross national product, and 11.2% of disability in Iran.^[11] The percentage of accidents in different provinces of Iran is different. A study that conducted by Vakili on the burden of road traffic injuries in Yazd Province of Iran estimated the burden of road traffic injuries in Yazd Province 12,478 years, 87.41% due to premature death and 12.59% due to disability.^[12] The terrible dimensions of driving accidents and its human and economic losses have prompted the United Nations to name this decade ahead as road safety action.^[13] Since RTAs follow different patterns according to time, and place and pattern of RTAs and deaths in the developed and developing countries are different and also it is different from one region to another region, we need to use special strategies. A time series study model for assessing the trend of RTA mortality is one of the strategies used to identify and reduce road accidents. In addition, the reduction of mortality from RTAs should be considered as one of the most important priorities for health-care systems. As a result, we studied the mortality rate of RTAs in Yazd Province during 2012–2016.

SUBJECTS AND METHODS

The present study is a descriptive-analytic study in which data were obtained, from data collection forms related to fatal RTAs in Yazd by forensic medicine organizations. In this study, we used monthly fatal RTAs data of Yazd province during 2012–2016. Based on these forms, we collected data on the frequency of RTAs based on age, sex (male/female), marital status, occupation, place of residence (city/village), type of vehicle used by the deceased and type of vehicle involved with pedestrian or deceased. In addition, the ultimate cause of death (bleeding, burns, and choking), lighting conditions (day, night, sunrise, and sunset), deceased status at death (driver, pedestrian, passenger), place of death (location of incident, during transfer to the hospital, hospital and home), how to crash collision with (another vehicle, or pedestrian, reversal), and Crash location (in-city and out-of-town). The inclusion criteria in this study are all the fatalities resulting from driving accidents in Yazd province during 2012–2016. The sample size is based on census and includes all deaths due to RTAs.

Statistical analysis

The general equation estimation method was used to compare the number of accidents by distinguishing independent variables because, first, the data were numeric. One of the advantages of this model, in comparison to simple methods such as variance analysis of repetitive measures, is the possibility of fitting them to the number of unequal data for different people in longitudinal studies. The data may have a seasonal trend and the correlation of the observations within each season will affect the estimation of their coefficients and their standard deviations. Therefore, statistical analysis cannot be done using regular regression. Therefore, generalized estimation equations were used to estimate regression coefficients while taking into account the correlation between observations. In order to investigate the trend, the autocorrelation function (ACF), and partial ACF (PACF) charts, and finally a decomposition method were used to analyze a time series with a trend and a seasonal pattern in the Minitab software (Minitab, Inc., Pennsylvania).

RESULTS

In this study, 1437 people who died due to RTAs during 2012–2016 were studied. In general, the number of deaths in men was almost three times more than in women. The mean and standard deviation of the age of the deceased was 37.6 ± 21.8 years, and the most cases were 20–23 years old. In addition, 30.6% of them lost their lives on Thursday and Friday due to RTAs. The risks of death from RTAs in married couples, the main road, heavy car driving, and driving out-of-town were 1.6, 3.6, 1.9, and 3.2, respectively, as shown in Table 1.

Different tests were used to investigate the trend in data. The PACF and ACF charts were used to measure the correlation of the data. PACF and ACF charts in which values decrease relatively faster were used in detecting the possible pattern of data, as shown in Figures 1 and 2. We used a decomposition method to analyze a time series with a trend and a seasonal pattern in the Minitab software. Figure 3 shows the trend in the number of fatal RTAs during 2012–2016. Indirect and

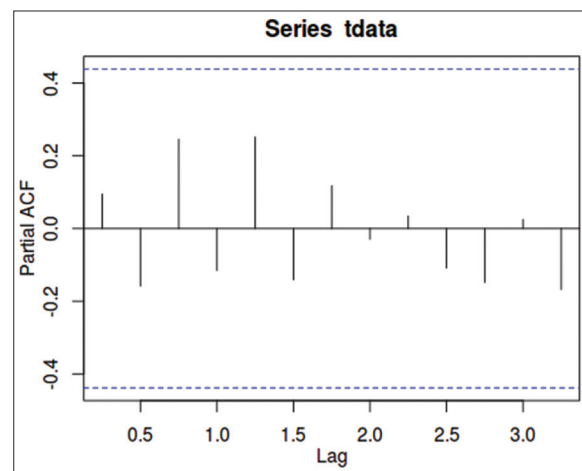


Figure 1: Partial autocorrelation function

Table 1: Frequency and risk ratio of variables on road traffic accidents in Yazd Province during 2012-2016

Variables	Frequency	Risk ratio	P
Sex			
Male	1076	-	-
Female	361	0.33	<0.001*
Deceased job			
Governmental	551	-	-
Nongovernmental	886	1.6	<0.001*
Marital status			
Single	495	-	-
Married	942	1.9	<0.001*
Place of residence			
City	1174	-	-
Village	263	0.22	<0.001*
Transfer of the deceased			
Ambulance	1426	-	-
Police	5	0.015	<0.001*
Passing vehicles	6	0.017	<0.001*
Lighting status			
Day	834	-	-
Night	416	0.5	<0.001*
At sunrise and sunset	187	0.2	<0.001*
Type of suburban road			
Highway	251	-	-
Main road	1096	3.6	<0.001*
Rural road	90	0.4	<0.001*
The ultimate cause of death			
Hit on head	1045	-	-
Bleeding	113	0.11	<0.001*
Fracture	200	0.19	<0.001*
Burn	24	0.07	<0.001*
Choking	55	0.07	<0.001*
Place of death			
Location of incident	731	-	-
During transfer to the hospital	90	0.13	<0.001*
Hospital	602	0.82	<0.001*
Home	14	0.05	<0.001*
Deceased status at death			
Driver	654	-	-
Pedestrian	255	0.39	<0.001*
Passenger	528	0.8	<0.001*
How to crash			
Collide with each other	702	-	-
Collide with pedestrians	255	0.36	<0.001*
Collide with object	50	0.08	<0.001*
Reversal	430	0.6	<0.001*
Type of vehicle used			
Riding	537	-	-
Light car	245	0.43	0.07
Heavy vehicle	243	0.45	0.1
Motorcycle	412	0.75	0.3
The type of car involved with the deceased			
Riding	195	-	-

Contd...

Table 1: Contd...

Variables	Frequency	Risk ratio	P
Light car	342	0.89	0.7
Heavy vehicle	733	1.9	0.002*
Motorcycle	167	0.4	0.09
Crash location			
In town	258	-	-
Out-of-town	1179	3.2	<0.001*

*Significant at 95% confidence level

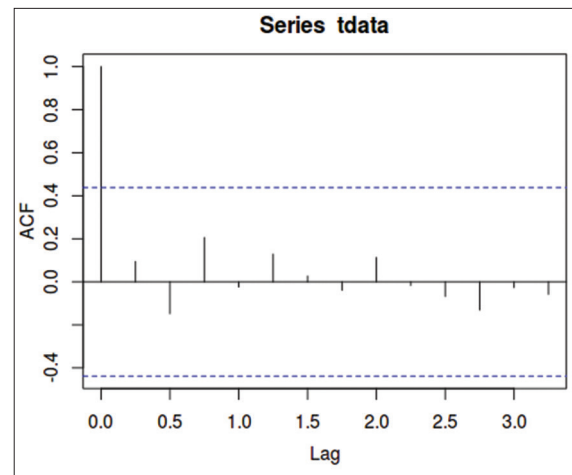


Figure 2: Autocorrelation function

significant linear relationship was found between the number of accidents and time.

Moreover, a multiplication model and trend plus seasonal model were used to consider a trend factor in the Minitab to measure the accuracy of the fitted model. Three criteria, including mean absolute deviation (MAD), mean squared deviation (MSD), and mean absolute percentage error (MAPE) were used to measure accuracy. MAPE, MAD, and MSD statistics were used to compare the fits of different forecasting and smoothing methods. These statistics are not very informative by themselves, but we can use them to compare the fits obtained using different methods. For all three measures, smaller values usually indicate a better fitting model. We also used generate forecasts for prediction. Since the data were monthly, we predicted the next 12 months. The implementation of this procedure produced three charts. Figure 4 shows the fitted model and the predicted values based on this model. Measure of accuracy was also given. Thus, since 2016–2017, the number of accidents showed a significant decrease.

DISCUSSION

The present study showed that there was a significant relationship between sex and the number of accidents during 2012–2016 so that most victims of RTAs were men. Death due to RTAs in women was 33% less than in men ($P < 0.001$). Given that men spend more hours outdoors than women, and the use of heavy vehicles, motorcycles were not common

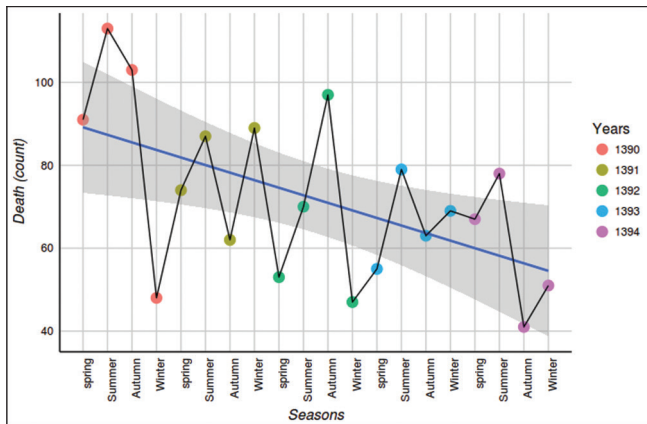


Figure 3: Trend of road traffic accident mortality during 1202–2016

among women, so this group was more likely to be exposed to RTAs. Such studies had reported similar results.^[2,4] Furthermore, in the present study, the highest mortality rate was in the age group of 20–30 years. Possible causes include the abundance of motorcyclists and the lack of proper use among adolescents and young people, lack of certificates when using vehicles, inappropriate road, and street conditions, and lack of camera installation for speed control. A study conducted by Fallahzadeh confirms our results.^[14] Such studies have assigned the highest mortality rates to the age group of 15–49 years.^[2] In this study, there was a significant relationship between marital status and number of accidents. Deaths from RTAs in married individuals were 1.9 times higher than in single ones. Montazeri’s study also reported similar results.^[15] In the present study, most of the deceased were residents of the city, so that the deaths from RTAs in the villagers were 22% less than urban residents ($P < 0.001$). One of the causes of injuries in urban areas relative to rural areas is the increase in the number of motor vehicles, density, and mass of traffic. Such studies reported similar results.^[2,4] In addition, in the present study, there was a significant relationship between the accident location and the type of suburban road with the number of crashes leading to death. The highest frequency is related to suburban and main road accidents. Furthermore, most deceased have died on weekends, which can be attributed to holidays, increased interurban travel, increased traffic mass, more vehicle traffic, and weekly fatigue. Such studies had reported similar results.^[4,10] In the present study, there was a significant relationship between the final cause of death and the number of deaths, so that the most common causes of death were, respectively, head trauma and fractures, which can be attributed to the absence of a belt, the absence of an airbag in used cars. Such studies had reported similar results.^[16,17] Also, the nonuse of a seat belt is a major hazard in the passenger car, and the most serious damage to unbelted passengers is damage to their head. However, Ganveer’s study found that the greatest cause of death from RTAs is fracture, which contradicts with our study.^[18] In the present study, there is a significant relationship between the lighting status and the number of deaths, so that death from RTAs was 50% at night and 20% at sunrise and sunset less than the day. Such

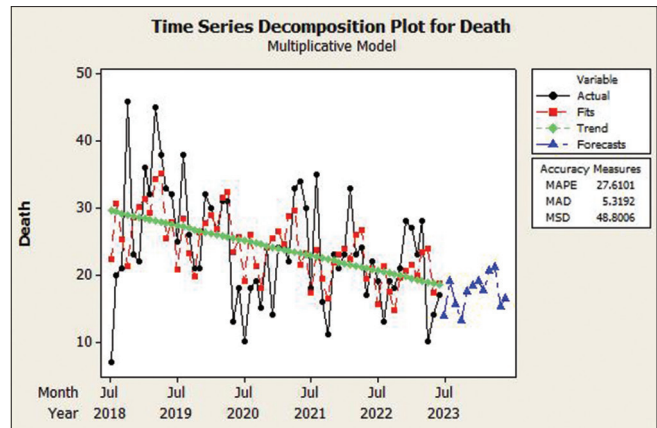


Figure 4: Time series decomposition plot for death

studies had also shown that the highest number of fatal RTAs occurred in the day, which is consistent with our study.^[10,19] In the present study, most deceased’s location of the death was in the scene of an accident, which has a significant relationship with the number of deaths. Considering the fact that most accidents resulted in an out-of-town, and since most of their transferring to the hospital was carried out by ambulance, the cause of more deaths at the scene of accident could be due to late arrivals of police and ambulance. The study carried out by Taravatmanesh had reported similar results.^[10] However, the study carried out by Sanaei-Zadeh contradicted our study and reported the highest number of deaths in the hospital.^[16] In this study, more deceased were drivers and then passenger and pedestrians. Speed, drinking, and mobile phone using among drivers can play a role on the risk of an accident and the consequences of it. However, such studies had attributed more deceased to pedestrians and passenger.^[20] In addition, in the present study, there was a significant relationship between how the accident occurred and the number of crashes that resulted to death. The most common type of accident during these years was related to vehicle collisions. Sleepiness and sleeping of drivers are one of the major causes of mortality from RTAs. However, results of such studies were contradicted with our results.^[21] Also, in the present study, such as a study carried out by Taravatmanesh, heavy vehicles were responsible for most casualties in the accident with the deceased.^[10] The risk of an accident caused by heavy vehicles will increase with factors such as driving at night, irregular working hours and prolonged daily work. However, such studies reported contradictory results and assigned motorcycles and riding as the most commonly cause of death.^[22] In the study of mortality due to RTAs in Yazd Province during 1202–2016, we showed that the mortality rate has decreased. A study on the mortality rate due to RTAs in Iran has also reported a decrease in incident events during 2006–2015.^[23] However, during 1998–2006, we had an increase in the death of RTAs.^[24]

CONCLUSION

According to the results of this study, the most cases of events are in the age group of 20–30 years. Therefore, prevention

should be done for this age group. This decrease in mortality can be attributed to the exacerbation of traffic regulations and their implementation and the construction of safer roads and cars. Also, educational programs using mass media have a significant role in reducing the incidence of deaths from accidents. Considering that Iran is one of the countries with a high mortality rate in the world in the discussion of RTAs. Comprehensive studies on epidemiology and factors affecting the outcome of RTAs can play an important role in controlling risk factors and reducing the burden of accidents.

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Conflicts of interest

There are no conflicts of interest.

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