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Original Article

Time Distribution of Traffic Accidents in Shiraz, Iran, During 2017-2018

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Abstract

Introduction: Trauma is an important and inevitable part of the health of the community. The incidence rate of accidents in Fars province is high. Identifying the patterns of traffic accidents and reporting them to authorities to prevent and control more accidents can be helpful.

Methods: In this retrospective cohort study, information about traffic accidents in Shiraz from 21 March 2017 to 20 March 2018 was used; also, information about 35406 emergency calls was investigated. The variables studied included age, gender, holiday, time of traffic accidents, outcome, etc. Data were extracted as an Excel file and analyzed according to research hypotheses using SPSS software version 25. In order to test the hypothesis of the test, two independent sample t-tests or chi-square tests were used. A p value of 0.05 was considered as significant.

Results: The maximum number of accidents occurred in summer (10939) and in September (3797). From the days of the week, most accidents occurred on Thursday (15. 09%). The most accidents occurred at 16:00 to 20:00 p.m. At 00:00 to 04:00 a.m. and 04:00 to 08:00 a.m., the accidents leading to death were more than the accidents in which people survived.

Conclusion: The rate of accidents in Fars province is high due to its tourist attractions, historical sites and the weather condition. The findings of this study indicated that the number of traffic accidents varied in different times. Due to the high traffic accidents in the last months of the summer and at sunset, traffic police need to have more precise traffic control to prevent road accidents.

Keywords: Traffic Accident, Time, Statistical Distribution.

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Introduction

Trauma involves an important and inevitable part of the health of the community. Every year, it has a lot of health and medical expenses. There are many physical, mental and financial losses; therefore, it requires an effective emergency system (1).

According to the World Health Organization (WHO), road traffic accidents will be the third leading factor in the occurrence of diseases by 2020 (2).Also, more traffic accidents occur in the sex group of young men people and is considered as the second cause of early death (2-5).

Driving accidents include a variety of factors, including types of vehicles, pedestrians, road flaws and individual behaviors such as ignoring and violating traffic laws (6). Trauma and injuries caused by traffic accidents are increasing yearly (2). According to World Health Organization, traffic deaths from about 999 thousand people in 1990 reached 1.2 million in 2002, mostly in low-income and middle-income countries (7). Iran is considered as one of the countries with the highest road accidents and mortality (8). In total, 2.5 percent of the world's driving accidents occur in Iran, which is about 20 times that of other countries (7).Our country is in a critical situation in terms of mortality and injuries of driving, which in turn shows that this is an important issue that still requires an examination of various and effective factors (8). Fars province has the highest traffic accidents among the southern provinces (9). Many unsafe behaviors are related to individual characteristics such as gender, age, personality, etc. (2-6). In addition to individual characteristics, many environmental factors, such as town, road traffic accidents and accident time, have an impact on traffic accidents. In a study, Murat et al. from Turkey investigated the relevance of accidents with the time of the day, month, season, etc. from 2000 to 2009. They showed that traffic accidents rose with sunrise and decreased with the sunset. Moreover, traffic accidents decrease in winter and

increase in summer. The traffic flow is dependent on weather conditions and air temperature. Also, in the same study mentioned in this paper it was reported that most traffic accidents occurred in April and October after sunset. Also, they showed that traffic level was highest between 07:00 to 09:00 a.m. and 17:00 to 19:00 p.m. (10).

It can be concluded that the variables of day, hour, season, and month are different in each country, and each index depends on several factors and requires more research; also, each can vary according to the weather conditions and working policies of each country. Therefore, it can be helpful to identify seasonal and epidemiological patterns of hazardous and fatal traffic accidents and report them to authorities to prevent and control the accidents.

Methods

This is a retrospective cohort study. In this study, information about emergency missions in Shiraz from 21 March 2017 to 20 March 2018 was used and traffic accidents in Shiraz city were extracted from all patients above 15 years old who were transferred to the hospitals by EMS.

To determine the time distribution of the accidents, all data including call history, contact hours, mission ambulance, destination hospital, the time of arrival in the hospital, age and gender of casualties, mechanism of injury (car-to-car, car-to-motorcycle, etc.) were extracted from the emergency database in Excel files.

The variables studied included gender; holiday; time of traffic accidents; type of transfer to the hospital including emergency transfer; outcome; weekdays and the months of accident; seasons; and the type of accident (car, motor and pedestrian).

After completing the necessary information about patients, the data file was made according to the research hypotheses and data analysis was performed using SPSS software version 25. The frequency and percentage were used for qualitative variables such as months, time of accident and outcome; mean and standard deviation were used for quantitative variables such as age. In order to test the hypotheses of the study, two independent sample t-tests or chi-square tests were used; A p value of 0.05 was considered as significant

Results

In this study, 35406 injured patients were studied. The mean age of the patients was 31.18±16.73 years. In total, 74.7% of the patients were male. Of the accidents, 18.93%occurred on holidays. Most of the accidents occurred at 16 to 20 p.m. (24.63%) and in the second place they happened at 20 to 24p.m. (23.26%) and the lowest accident rate belonged to 4 to 8 a.m. (5.28%). Of all driving accidents, 79.14% occurred in the town and 19.67% was road accidents (Table 1).

Table 1: Descriptive statistics of the study population

Variables	Frequency (%)
Gender	
Male	26446 (74.7)
Female	8960 (25.3)
Holiday	
No	28705 (81.07)
Yes	6701 (18.93)
Time of accident	
0:00 to 4:00	2895 (8.18)
04:00 to 08:00	1870 (5.28)
08:00 to 12:00	6013 (16.98)
12:00 to 16:00	7675 (21.68)
16:00 to 20:00	8719 (24.63)
20:00 to 24	8234 (23.26)
Outcome	
Alive	31816 (99.26)
Death	238 (0.74)

The highest rate of pedestrian accidents (28.97%), motorcycle accidents (25.4%) and car accidents (22.17%) occurred at 16:00 to 20:00 p.m., and the lowest rate of pedestrian, motorcycle and car accidents occurred in the morning (04:00 to 08:00 Am), respectively (3.63%, 3.55%, 7.41%). Also, the rate of the road and in-town accidents was highest at 16:00 to 20:00 p.m. (27.16% and 24%, respectively) and the lowest at 04 to 08a.m. (4.97% and 5.36%, respectively). The highest number of accidents on non-holidays was at 16:00 to 20:00 p.m. and on holidays at 20:00 to24 p.m. The lowest number of accidents occurred both on non-holidays and on holidays between 04:00 to08:00 Am (Table 2).

Among the patients studied, 238 (74%) died and 31816 (99.26%) survived (Table 1). The mean age of the patients who died was 29.63 years and that of the survivors was 31.11. There was no significant relationship between the day (holiday or non-holiday) and the accident outcome (live or dead) (P=0.91) (Table 3). There was a significant relationship between the hour of accident and the outcome (P<0.001). During the time from 00:00 to 04:00 and 04:00 to 08:00 a.m., the accident rate resulting in death was more than those in which the people survived. The mortality rate was greatest at 12:00 to16:00 and 16:00 to 20:00 p.m., but the accidents in which the passengers survived occurred at 16:00 to 20:00 and 20:00 to 24 p.m. (Table 3).

Table 2: Mechanism of injury frequency and type of accidents based on time of accidents

Variable	Time of accident n (%)						P value
	0-4	4-8	8-12	12-16	16-20	20-24	
Mechanism of injury							
Car accident	1761 (11.74)	1111 (7.41)	2352 (15.68)	3260 (21.73)	3326 (22.17)	3190 (21.27)	<0.001
Motorcycle accident	677 (5.66)	425 (3.55)	2140 (17.89)	2705 (22.61)	3039 (25.4)	2979 (24.9)	
Pedestrian accident	309 (4.38)	256 (3.63)	1339 (19)	1449 (20.56)	2042 (28.97)	1654 (23.46)	
Type of accident							
Road accident	570 (8.12)	349 (4.97)	1045 (14.89)	1579 (22.5)	1906 (27.16)	1568 (22.35)	<0.001
In town accident	2325 (8.19)	1521 (5.36)	4968 (17.5)	6096 (21.47)	6813 (24)	6666 (23.48)	
Holiday							
Yes	834 (12.45)	297 (4.43)	867 (12.94)	1313 (19.59)	1682 (25.10)	1708 (25.49)	<0.001
No	2061 (7.18)	1573 (5.48)	5146 (17.93)	6362 (22.16)	7037 (24.51)	6526 (22.73)	

Table 3: Comparison of the examined variables between the dead and surviving groups

Variables	Alive 31816	Death 238	P value
Age (mean±SD*)	31.11±16.54	29.63±16.69	0.18
Gender number(%)			0.04
Male	22450 (70.56)	167 (70.17)	
Female	9366 (29.44)	71 (29.83)	
Holiday number(%)			0.91
No	25763 (80.97)	192 (80.67)	
Yes	6053 (19.03)	46 (19.33)	
Time of accident number(%)			<0.001
00:00 to 04:00	2575(8.09)	34 (14.29)	
04:00 to 8:00	1707 (5.37)	21 (8.82)	
08:00 to 12:00	5476 (17.21)	30 (12.61)	
12:00 to 16:00	6935 (21.8)	51 (21.43)	
16:00 to 20:00	7906 (24.85)	53 (22.27)	
20:00 to 24	7217 (22.68)	49 (20.59)	

*Standard Deviation

Most accidents occurred on Thursday (15.09%) and the least accidents occurred on Monday (13.85%) and Saturday (13.95%) (Figure 1).

The most accidents occurred at 16:00 to 20:00 p.m. and the lowest number of accidents occurred at 04:00 to 08:00 a.m. Therefore, at 00:00 to 04:00 and 04:00 to 08:00 a.m., the rate of accidents leading to more deaths is more than those in which the victims survived (Figure 2).

The highest accidents occurred on 23rd of August to 22nd of September and 23rd of July to 22nd of August, respectively, and they were the lowest on 22nd of November to 21st of December); 22nd of Dec to 20th of January; and 21st of March to 20th of April, respectively. Among the survivors, the highest driving accidents occurred on 23rd of July to 22nd of August and the lowest on 21st of March to 20th of April). Also, the highest number of accidents resulting in death occurred on 23rd of Augut to 22nd of Septemberand then on 23rd of July to 22nd of August (Figure 3).

The highest accidents occurred in summer and the lowest in winter (Figure 4).

Discussion

The results of this study show that death due to accidents in Fars province is 0.74%. Fars province, among the neighboring provinces, has a higher rate of accidents because of weather conditions, more historical places, and more tourist resorts. The highest rate of accidents occurred in the summer on 23rd of July to 22nd of August and also on 23rd of August to 22nd of September, which is consistent with Zhang's study in China and the study of Murat and his colleagues in Turkey (10-12). However, in a study conducted by Singh and Dhattarwal in the city of Rohtak in India, a higher accident rate was seen in winter (13). Also, in a study by Chong et al. in Japan, it was found that the average rate of accidents during

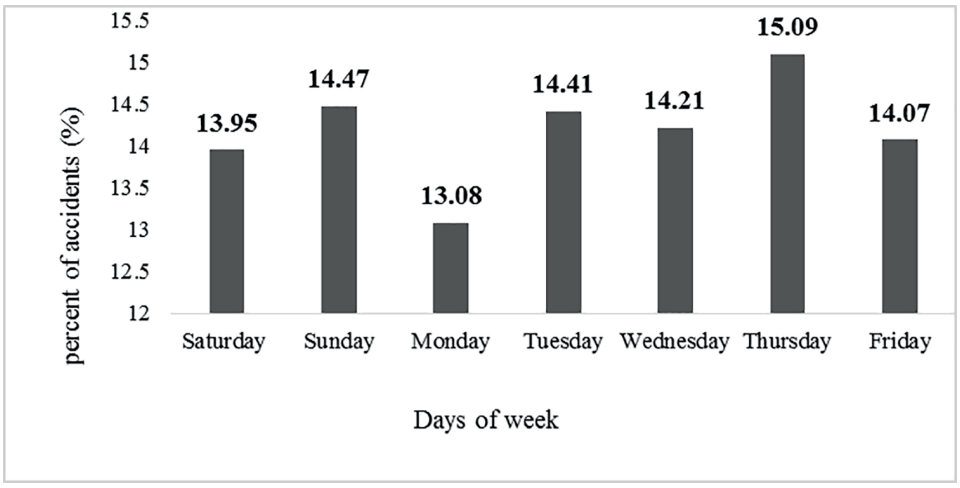

Figure 1: Frequency percentage of the occurrence of accidents on the days of the week

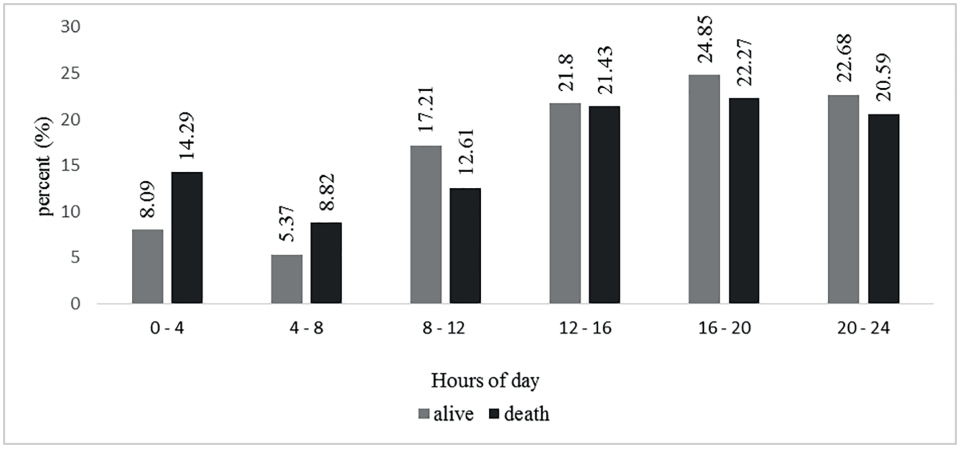

Figure 2: Comparison of the frequency percentage of the outcome of the accident (death and alive) based on the time of the accident

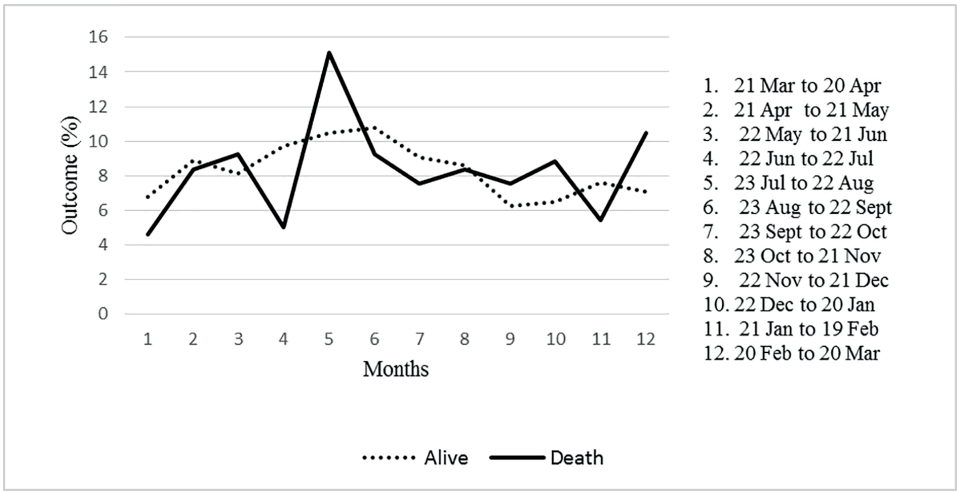

Figure 3: Investigation of the outcome (death or alive) in terms of the month

rainfall was higher than other times (14). The highest death rate occurred on 23rd of July to 22nd of August, due to the closure of universities and schools along with the better climatic and geographical conditions compared to other southern provinces, and the influx of passengers in this area .On the other hand, on 23rd of August to 22nd of September, due to the enrollment and reopening of the university and schools, travel increases; as a result, the frequency of traffic accidents grows significantly. Accidents rate among the males is approximately 3 times that of females (74.4% vs. 25.3%); other previous studies have shown that

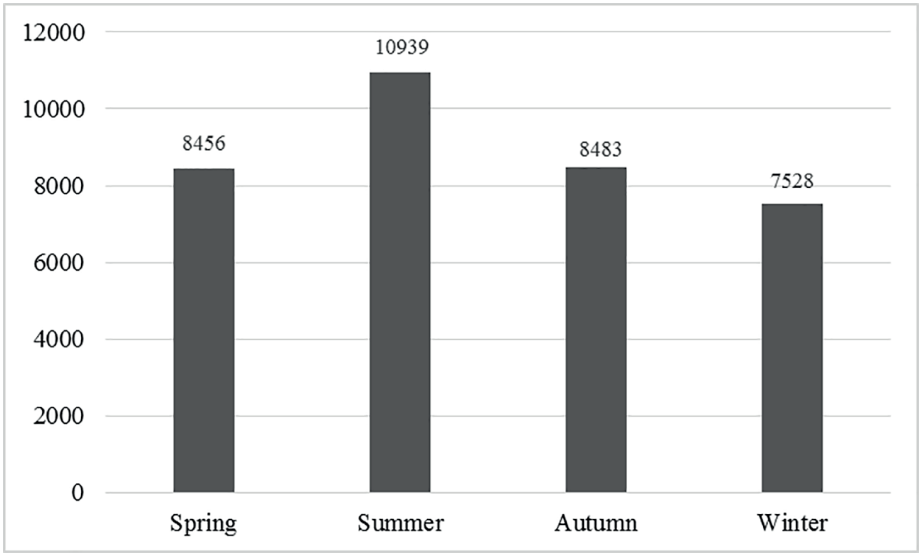

Figure 4: The frequency of traffic accidents in terms of season

men, in comparison with women, spend more hours outside home. Men are more likely to be drivers, and they also earn money by driving more than women. In this study, we showed that the highest number of accidents and traffic accidents was among the youth (death patients with a mean age of 29.63 years and living subjects with a mean age of 31.11 years) (7).

Emotional and high-risk behaviors and lack of observing the driving laws and regulations in this group of people can be more than the causes of accidents. Due to the fact that the number of accidents and mortality is higher in young people and men and these people are the active part of society, controlling them and applying rules and regulations can have a positive economic outlook (7). As to time, the highest number of accidents occurred at 16:00 to 20:00 and 20:00 to 24 p.m. (24.63% to 23.26%), when most of offices are closed, and these hours are the times many people come back home and rest. Thus, factors such as work-related fatigue, lack of adequate rest and high traffic can affect the occurrence of accidents. It is the time of snset, which can disturb the view, and the people's recreation in Shiraz is more likely to be in these hours. However, in a study by Murat and his colleagues in Turkey, it was shown that the largest traffic was reported to be at 07:00 to 09:00 a.m. and 17:00 to 19:00 p.m. In a study by Doherty et al. on the accident and risk factors in Ontario, Canada, it was found that the number of accidents at night was more than day (15). We also showed that the highest number of accidents on vacation occurred between 20:00 and 24 p.m. and on non-holidays at 16:00 to 20:00 pm., but in the study of Lefering and his colleagues in Germany, the highest accidents occurred during the week at 17:00 to 18:00 p.m. and on the weekends at 02:00 to 03:00 a.m. (16).

In this study, we investigated the magnitude of road accident and in town accident in a different time period, showing that at 16:00 to 20:00 p.m. , both road and in-town accidents had the highest rates; of 8719 casualties during the mentioned hours, 1906 were related to road accidents and 6813 to urban traffic accidents (3.57 times more in the town than out of town), and the lowest accident rate was seen at 04:00 to 08:00 a.m. in the morning. Out of 1870 casualties within these hours, 349 were road accident casualties (21.86%), and urban accident casualties included 1521 cases (78.14%) (Urban casualties are 4.35 times more than road accident casualties).

The death rate compared to survivors had the highest rate at 00:00 to 04:00 a.m., which can be due to drowsiness, lack of proper lighting on roads and streets, inadequate rest, and so on. Also, the classification of accident rate in terms of the mechanism of the accident showed that the highest rate of pedestrian accident, motorcycle and car was all at 16:00 to 20:00 p.m. and the lowest at 04:00 to 08:00 a.m. The highest number of accidents occurred during the day, according to Murat et al. (10). Considering the fact that Thursday is the official holiday in Iran (but not in Turkey), and due to the climatic conditions of Fars province and the enjoyment of high historical and recreational areas, traffic and travel increase on Thursdays. The lowest accident rate was observed on Mondays and Saturdays, respectively, meaning that people are less likely to use their own personal vehicles, and that they use more public and urban vehicles, which in turn reduces traffic accidents and

the resultant mortality.

As to the results of the transfer to the hospital, it was shown that all people who were transferred to hospital by air survived, indicating that the system and the air personnel have been very careful and up to date. About 185 urban casualties led to the victim's death because many people had appeared on the scene of the accidents until the emergency arrived and ordinary untrained people had intervened. The Gathering of people on the scene reduces the oxygen supply to the injured person and prevents the timely arrival of the police and the emergency facilities at the accident site and this means ultimately further injury and death of the patients. Also, 50 road accident victims died in road accidents due to the lack of a system and the distance between the city or village and medical centers, so that the casualty damages got severe or even the victim passed away till the arrival of emergency or on the way to a well-equipped medical center.

One of the strengths of this study is the fact that information about one year starting from the 21st of March 2017 to 20th of March 2018 was investigated and emergency data were used which is accurate and reliable. In this study, some data were not available due to the coincidence of the accidents and the busy work time at so that the emergency technicians could not complete the information accurately. Also, in this study, the death on accident site and the arrival of the emergency were studied.

Suggestion

The findings of this study indicated the effective role of gender, age and time distribution in traffic accidents in Shiraz, Fars. It is suggested that pedestrians should wear bright color clothes at night because of insufficient light and sunset and should wear dark clothes to be easily seen by drivers while crossing crowded places on daylight; especially on rainy and snowy days, the pedestrians should use the pedestrian bridges and crossroads. It is suggested that, the drivers should focus more on driving and use protective equipment such as wheel chains and public transport equipment at the time of snow and rain. In order to manage traffic accidents, we need to consider these important facts and follow thorough and comprehensive plans. This study shows that people still do not have enough information about traffic accidents and this results from inadequate social media programs to inform people about traffic and traffic related issues. Programs aiming at teaching the time awareness and other effective factors to improve the people's outlook are recommended. For further studies, it is suggested that the climatic conditions of the area should be explored and reviewed, using the information of police department about the exact cause of death.

Conflict of Interest: None declared.

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