

Analysis of Individual and Environmental Factors for Road Traffic Accidents in Sirjan-Bandarabbas Road between 2010 and 2011, Iran

Ghorbanali Mohammadi*¹, Darius Mohammadi²

1) Industrial Engineering Department, College of Engineering, Qom University of Technology, Qom, Iran

2) Electrical and Computer Engineering Department, College of Engineering, Iowa State University, Ames, IA, USA

*Author for Correspondence: ghorbanalim@yahoo.co.uk

Received: 09 Feb. 2016, Revised: 26 Mar. 2016, Accepted: 01 April 2016

ABSTRACT

Sirjan -Bandarabbas road is one of the important commercial roads in Iran and for Sirjan's area situation and relevance between Sirjan and other states in Iran so high percentage of goods that forwarded from Bandarabbas to other states transit from Sirjan .Therefore this road is as one important transition road and traffic road too .This study analyzed road traffic accidents were occurred between 2010 and 2011 in Sirjan- Bandarabbas road. Individual and demographic factors include Time of accidents, Drivers age, time of the days, seat belt and safety laws, Guilty vehicle, Mode of accident and education Level. Time of day analyses suggested that the highest percentage of road traffic injuries occurred in the time group between 12-18 hours. Drivers with the age group of 36-50 had more involvement in death accidents. The findings of this study also revealed that most of the collisions was front to back and front to side. Female drivers were found to be generally safer drivers than their male counterparts; male drivers had a higher involvement rate in road traffic accidents. This study indicated that Observe safety laws, Guilty vehicle and Mode of accidents have a meaningful relationship with Type of accidents in road traffic accidents in Sirjan Bandarabbas road.

Key words: Sirjan -Bandarabbas Road, transition road, accidents, Individual and Demographic Factors, Road Safety

INTRODUCTION

Road traffic accidents are the main cause of death in many countries. This accident has already killed millions of people and has created a lot of economic and social prejudice .Worldwide, an estimated 1.2 million people are killed in road crashes each year and almost 50 million are injured [1]. Road traffic crashes injury increased from 110 to 401 per 100,000 populations between 1997 and [2]. Akbari, Naghavi, and Soori [3] reported that Iran has one of the highest incidences of fatality rates of road traffic crashes (RTC) across the globe (30.0 per 100,000 population in Iran compared with 22.6 per 100,000 worldwide and 13.9 per 100,000 in the eastern Mediterranean region), but there is a lack of a thorough investigation of RTC fatality and injury and their evaluation in Iran compared with the western countries.

Traffic accidents are one of the main external causes of morbidity and mortality in various parts of the world (World Health Organization (WHO) [4], including Sirjan- Bandarabbas one of important commercial roads in Iran.

Road traffic death statistics in Iran are lower than Saudi Arabia and Turkey and higher than Bahrain and Lebanon per 10,000 motor vehicles as can be seen in Table 1.

Table 1: Road fatalities per 10,000 motor vehicles in some countries

Countries	Year	Fatalities	Death Per 1,000 motor vehicles
Yeman	1996	1267	24
Pakistan	1996	4288	17
Oman	1996	512	17
Saudi Arabia	1994	4077	14
Turkey	1996	5428	11
Iran	1995	2963	6
Bahrain	1996	57	3
Lebanon	1994	328	2

Note: Derived from website <http://www.factbook.net>.

Iran has one of the highest fatality rates due to road traffic crashes (RTCs) in the world. The disability adjusted life years (DALYs) for RTC in Iran is more than 1, 300,000 years, which is more than that for any other diseases such as cardiovascular or cancer. In Iran, like many other countries annually a large number of people lose their lives in road accidents or encounter with consequences of accidents. In Iran Like many other countries the main cause of accidents is the human factor (error). Sirjan-Bandarabbas road is 320 kilometers and it is one of the most important transitions and international road in Iran.The large volume of goods from this road

ships to other parts of the country. Since many accidents are caused by traffic on the road.

In this study, the data collected by the police, to be effective in these accidents have been studied, of the total 315 accidents that have occurred during the years 2010 and 2011 on the road. Therefore, a great deal of work is needed to bring Sirjan-Bandarabbas's traffic fatality statistic to as low a rate as possible.

The objective of this study was to investigate RTC fatalities and injuries in Sirjan-Bandarabbas road from 2010 to 2011 in the Kerman areas not the total length of the road.

MATERIALS AND METHODS

Sirjan-Bandarabbas road is 320 kilometers and 75 kilometers of that is relevant Kerman state (Sirjan Township). The information on RTAs was obtained from the records of police forces in Sirjan. The target groups in this study were dead and injured on RTAs. A total of 315 road accidents have been recorded in Sirjan- Bandarabbas road by the police. Data statistical analysis was performed using SPSS 19.0 software (SPSS Inc. Chicago, IL). In this study, the relationship between some variables such as weather, seat belts used, Guilty vehicle and Mode of Accident by Type of accidents χ^2 test and Cramer's V Correlation Coefficient were used; and for the relationship between Time of Accidents, Drivers age and Educational Level with Type of accidents Gamma Correlation Coefficient were used. Notice in this study Gender of drivers didn't study because in all cases of collecting data drivers were male.

RESULTS

Between 2010 and 2011, a total of 315 road accidents were recorded .The accidents resulted 249 damaged properties, 48 injuries and 18 deaths. This data show that number of accidents caused damage in mentioned years in this road(79% of all) has the most number of events ; But so mention road is a traffic transition road, usually accidents caused injury and accidents caused death(15.2%,5.7% respectively) include the high number of injured and killed.

Table 2 provides the frequency of accidents caused injure (with one to four injured) and tables 3 provides frequency of accidents caused injury and kill (with 1 to 13 injured and killed) both mortality and morbidity rates of traffic injuries are higher among males than females worldwide [2 and 5]. Table 4 shown the number of road traffic injuries and fatalities (male and female) between 2010 and 2011 in Sirjan-Bandarabbas road.

Analysis of Accidents and Time of Day

These accidents occurred at 24 hours were divided into 4 groups; the table 5 shows the number of each

type of accidents in each group. The highest percentage of accidents caused damage (30.5%) and accidents caused death (38.9%) were occurred in the time group 6-12 and the highest percentage of accidents caused injury (35.4%) were occurred in the time group between 12-18 hours. Value of Gamma Correlation Coefficient is 0.078; In this case the value of *Approx.Sig's* is 0.431 so there isn't a correlation and meaningful relationship between these two variables.

Table 2: Road traffic Injuries

Number of Ulcerous	Number of accidents	Percent
1	29	60.4
2	15	31.3
3	2	4.2
4	2	4.2

Table 3: Road traffic Dead

Number of Dead and Ulcerous	Number of accidents	Percent
	7	38.9
2	6	33.3
3	2	11.1
5	1	5.6
9	1	5.6
13	1	5.6

Table 4: Road traffic fatalities and injuries (male and female)

Type of Accidents	Number of injured		Number of killed	
	Female	Male	Female	Male
Accidents caused injure	23	50	–	–
Accidents caused death	13	14	5	20
Total	36	64	5	20

Analysis of Accidents by the weather

In present research three different types of weather conditions were considered: sunny, rainy and cloudy. As specified in table 5, just a case of an accident caused injury occurred in cloudy weather and the highest percentage of accidents caused damage, accidents caused injury and accidents caused death(92.0%,83.3% and 83.3% respectively) were occurred in sunny weather.

According to data collected, Cramer's V Correlation Coefficient between two variables is equal to 0.118, in this case *Approx.Sig's* value is higher than 5%(0.065) so therefore there is not a meaningful relationship between two variables.

Analysis of Accidents by Mode of accidents

Mode of Collision carried out in the road in the years 2010 and 2011 is the following categories: Front to Back, Front to Side, Front to the Front, Side to Side, Back to Side and Other. That table 5 shows the number of each type of accidents in each mode.

In this test, Cramer's V Correlation Coefficient between two variables is equal to 0.203 and Approx.Sig's value is 0.004 therefore there is a

meaningful relationship between two variables and value of Correlation is 0.203.

Table 5: Outsid variables distribution of people killed or injured in road traffic crash

Variable		Damage	Percent	Injury	Percent	Death	Percent	
Time of Accident	1-6	62	24.9	11	22.9	3	16.7	
	6-12	76	30.5	12	25.0	7	38.9	
	12-18	70	28.1	17	35.4	4	22.2	
	18-24	41	16.5	8	16.7	4	22.2	
Weather	sunny	229	92.0	40	83.3	15	83.3	
	Rainy	20	8.0	7	14.6	3	16.7	
	Cloudy	0	0.0	1	2.1	0	0.0	
Mode of Accident	Front to Back	52	20.9	3	6.3	1	5.6	
	Front to Side	12	4.8	4	8.3	1	5.6	
	Front to Front	5	2.0	6	12.5	2	11.1	
	Side to Side	20	8.0	4	8.3	0	0.0	
	Side to Back	12	4.8	0	0.0	0	0.0	
	Other	148	59.4	31	64.6	14	77.8	
	Guilty Vehicle	Car	62	24.9	22	45.8	7	38.9
		Trailer	149	59.8	13	27.1	8	44.4
Truck		21	8.4	4	8.3	0	0.0	
Van		13	5.2	5	10.4	0	0.0	
Bus		2	0.8	1	2.1	2	11.1	
Mini Bus		1	0.4	0	0.0	0	0.0	
Motorcycle		0	0.0	2	4.2	1	5.6	
other		1	0.4	1	2.1	0	0	

Since this road is a transition road, a large number of vehicles on the road are truck and trailers. As shown in table 4, in 68.3% of accidents caused damage, 35.4% of accident caused injury and 44% of accident caused the death guilty vehicle were truck and trailer; That It might add the amount of trauma. As shown in Table 4, in 24.9% of accidents caused damage, 45.8% of accidents caused injury and 38.9% of accidents caused death non- load bearing vehicles were causing an accident. Cramer's V Correlation Coefficient between two variables is equal to 0.266. In this case, Approx.Sig's value is zero therefore there is a meaningful relationship two variables and value of Correlation are 0.266.

Analysis by the driver's age

According to the age of drivers in accidents have been recorded by police, Drivers in four age groups are separated. As shown in Table 6, in the highest percentage of accidents caused damage (41.4%) and the highest percentage of accidents caused injury (45.8%) drivers were 25-35 and in the highest percentage of accidents caused death (44.4%) drivers were 36-50. In this test value of Gamma Correlation Coefficient is 0.084-, Approx.Sig's value is 0.439 .So

there isn't a meaningful relationship between these two variables.

Analysis of accidents by the seat belts used

Many studies have reported the effectiveness of car seat belts in preventing injury or death from traffic accidents [6, 7, 8, 9 and 10]. The majority of any type of accidents in this road between 2010 and 2011(76.3%, 54.2% and 72.2% respectively) used seat belts as shown in table 5.

Cramer's V Correlation Coefficient between two variables is equal to 0.465 and in this case Approx.Sig's value is zero therefore there is a meaningful relationship between two variables and value of Correlation is 0.465.

Driver's Education Levels

In the present study, drivers were categorized into six age groups, Sub Diploma, Diploma, High Diploma, Bachelor, Master degree and higher educational levels. As shown in table 6 for educational groups are divided in to six category types. Value of Gamma Correlation Coefficient is 0.036-, Approx.Sig's value is 0.750 and there isn't a meaningful relationship between these two variables.

Table 6: Individual variable distribution of people killed or injured in road traffic crash

Variable	damage	percent	injury	percent	death	percent
Driver's age						
<25	19	7.6	6	12.5	4	22.2
25-35	103	41.4	22	45.8	3	16.7
36-50	86	34.5	12	25.0	8	44.4
>50	41	16.5	8	16.7	3	16.7
Seat belt used						
Yes	190	76.3	26	54.2	13	72.2
No	2	0.8	13	27.1	3	16.7
Unknown	57	22.9	9	18.8	2	11.1
Educational Level						
illiterate	54	21.7	8	16.7	6	33.3
Sub Diploma	3	1.2	5	10.4	0	0.0
Diploma	72	28.9	14	29.2	5	27.8
High Diploma	46	18.5	12	25.0	0	0.0
Bachelor	0	0.0	2	4.2	1	5.6
Master degree and higher	7	2.8	0	0.0	0	0.0
Unknown	67	26.9	7	14.6	6	33.3

DISCUSSION

This study investigated road traffic accidents between 2010 and 2011 in Sirjan-Bandarabbas; the study also investigated the impact of the road accident fatalities and injuries by individual and environmental factors. In this period total of 315 accidents were recorded and 20 men, 5 females killed and 64 men, 36 females injured.

Individual and peripheral factors such as Time of accidents, drivers age, Climate, Observe the safety laws, Guilty vehicle, Mode of Accident and Education Level were analyzed. This study indicated that there isn't a meaningful relationship between some of this factors and Type of accidents. This factors include: Time of accidents, driver's age, Climate and Education Level. And Observed safety laws, Guilty vehicle and Mode of accidents have a meaningful relationship with Type of accidents.

The seat belt is one of the most common forms of protective equipment designed to reduce the number of vehicle occupants being killed or injured in a crash. Seat belt use by drivers and front seat passengers has been a legal requirement in Iran. Despite the mandatory seat belt usage laws, and the proven benefits of seat belt usage [11 and 12], a significant number of vehicle occupants still do not use them. Our results support these findings, providing evidence that restriction prevents both fatal and non-fatal injuries, although risk reduction is larger in association with fatalities.

This study has also shown that in Sirjan-Bandarabbas road, like the rest of the country, there is little compulsory fastening of seatbelts especially in multi passenger commercial vehicles, as well as non-compliance with annual MV condition examinations, and there is an absence of dedicated lanes for various types of vehicles. Additionally,

fatigue among drivers who drive cross country coaches, trucks and trailers without halting and resting may be predisposing them to RTCs and related fatalities.

This study has also affirmed that males have a higher percentage of deaths than females. The analysis of the data indicated that the female drivers have a much better road safety record than male drivers, especially with regard to their involvement in severe traffic accidents.

This study has revealed that most accidents occurred in sunny weather (83.3%) followed by rainy (14.6%), and cloudy (2.1%) weathers.

The findings of this study also revealed that most of the road traffic injured occurred between 12-18 hours (35.4%), and most of the deadly RTAs were between 6-12 hours (38.9%). Most RTAs in Sirjan-Bandarabbas have happened between 12-24 hours.

In our study, the age group of 25-35 years and the age group 36-50 and age group more than 50 were the most common and those less than 25 years were the least common age group involved in accidents. This corresponds with other studies [13 and 14]. The young and middle-aged groups largely consist of students and working people in various jobs, who usually travel by own vehicles. This results in the involvement of young adults more commonly in RTAs. The elderly are the weakest road users. In fact, they have the highest risk of death after an accident both when driving vehicles, as shown also by [15].

Statistical analyses from every country indicate that over 90% of RTAs occur due to human fault, while only very small percentages are due to vehicle and road factors. A report from Turkey showed that RTAs due to human fault accounted for 95%, with drivers occupying 80%, pedestrians 14%, and passengers 1%. RTAs due to vehicles and roads

accounted for 3% and 2%, respectively [16]. Statistical data from China in 1997 revealed that RTAs due to human fault accounted for 92.9% (i.e., drivers 83.6%, non-motor-vehicle drivers 4.4%, pedestrians and Passengers 4.9%). Vehicles and roads were responsible for 4.5% and 0.1% of RTAs, respectively [17]. In addition, human fault induced 94% and 95% of RTAs in the United States and the United Kingdom, respectively [18]. Traffic accidents in Iran's roads cause thousands of deaths and injuries every year, and cost the country's economy billions of dollars. UNICEF[17], together with Iran's Ministry of Health, State Welfare Organization, police forces and the Municipality of Tehran, has begun an awareness-raising campaign to shed more light on these facts and to contribute to reducing the mortality and injury rates caused by road accidents. According to UNICEF, the rate of road accidents in Iran is 20 times more than the world's average, and every 19 minutes one person dies on Iran's roads, and every 2 minutes people will hear that one of their family members has survived a crash but with serious injury and perhaps lifelong disability [19].

CONCLUSION

Although we were unable to address personal risk factors for fatal accidents such as risk-taking behaviors because of lack of information, we identified groups of subjects and environmental conditions that were associated with higher road accident fatality.

This study investigated individual and environmental factors of fatalities in Sirjan-Bandarabbas road Iran between 2010 and 2011. These factors such as Time of accidents, drivers age, Climate, Observe the safety laws, Guilty vehicle, Mode of Accident and Education Level was analyzed. This study has found a definite trend of significantly higher accident rates for male compared with females.

Three factors such as Observe safety laws, Guilty vehicle and Mode of accidents have a meaningful relationship with Type of accidents. So to prevent road traffic accident safety laws (for example use of a seat belt or helmet) has to be enforced by road traffic police. Most accidents in this road happened by Guilty vehicle drivers, because in this road heavy vehicle for example Truck, Trailer,... exist, therefore this subject can increase RTAs.

The study finding also indicated that male aged 25-35 were involved in more road accidents, whereas lower age groups had a lower percentage of accidents. Older age groups (more than 50) had a second highest percentage of accidents.

Analyses of the data reported in this study revealed a definite trend of significantly higher accident rates for male drivers compared with female drivers.

ETHICAL ISSUES

Ethical issues such as plagiarism have been observed by the authors.

COMPETING INTERESTS

Authors declare that there is not any competing interest.

AUTHORS' CONTRIBUTIONS

All authors contributed equally.

FUNDING/SUPPORTING

This study had no financial support and supported by the authors.

REFERERENC

- [1] Soroush AR, GhahriSaremi SH, Rambod M, and *et al.* Pattern of injury in Shiraz .Chinese Journal of Traumatology 2008; 11(1): 8-12.
- [2] Mohammadi G. Pattern of deaths and injuries in road crashes on three main entrances road in Kerman, Iran. International Journal of Injury Control and Safety Promotion 2009; 16:17-33.
- [3] Akbari ME, Naghavi M, Soori H. Epidemiology of deaths from injuries in the Islamic Republic of Iran. East Mediterranean Health Journal 2006; 12, 382-90.
- [4] World Health Organization, World Report on Road Traffic Injury Prevention, WHO, Geneva, 2004. Available at: <http://www.who.int/world-health-day/2004/info/materials/world-report/en/>.
- [5] Peden M, Scurifield R, Sleet D, Mohan D, Hyde RA, Jarawan, E *et al.* World report on road injury prevention .Geneva: World Health Organization, 2004.
- [6] Newman R J. A prospective evaluation of the protective effect of car seat belts .The Journal of Trauma, 1986; 26(6),561-64.
- [7] Latimer EA, Lave LB. Initial effects of The New York State auto safety belt law. American Journal of Public Health 1987; 77(2):183- 86.
- [8] Cooper WE, Salzberg P. Safety restraint usage in fatal motor vehicle crashes. Accident Analysis and Prevention, 1993; 25(1): 67-75.
- [9] Evans L. Safety-belt effectiveness: the influence of crash severity and selective recruitment Accident Analysis and Prevention 1996;28(4): 423-33.
- [10] Petridou E, Skalidou A, Ioannou N, Trichopoulos D. The Ellenic Road Traffic Police. Fatalities from non- use of seat belts and helmets in Greece: a

nationwide appraisal. *Accident Analysis and prevention* 1998; 30(1): 87-91.

[11] Letho M & James D. Safety knowledge of users and non-users of the lap belt on two-point Motorized belt systems. *Accident Analysis and Prevention* 1997; 29(6): 739-44.

[12] Li L, Kim K, & Nitz L. Predictors of safety belt use among crash-involved drivers and front Seat passengers:adjusting for over reporting. *Accident Analysis and Prevention* 1999; 31(6):631-38.

[13] Afukaar FK, Antwi P, & Ofosu-Amaah, S. Pattern of road traffic injuries in Ghana: Implications for control. *International Journal of Injury Control and Safety Promotion* 2003; 10(1-2): 69–76.

[14] Biswas G, Verma SK, Sharma JJ, & Aggarwal NK. Pattern of road traffic accidents in North-East Delhi. *Journal for Medical Toxicology* 2003; 20: 27–32.

[15] Massie DL, Campbell KL, Williams AF. Traffic accident involvement rates by driver age and gender. *Accident Analysis and Prevention* 1995; 27(1): 73–87.

[16] Tansel A. Traffic accidents in three provinces in Turkey. METU Economic Research Center Working Paper. ERC, Ankara; March 1990: 1992—5.

[17] Traffic Administrative Bureau of Public Security (TABPS). Collection of Statistical Data of Road Traffic Accidents in People’s Republic of China, TABPS, Beijing 1999; 47: 66–67.

[18] Wang ZG, Zhu PF. Review of the 14th World Congress of IAATM, Chin. *J. Traumatology* 1995; 11:388–90

[19] UNICE. Islamic Republic of Iran. Retrieved from http://www.unicef.org/iran/media_4783.html, 2004.