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Epidemiologic Study of Motor Vehicle Accidents Resulting in Injury and Death in Mashhad, Iran (2006-2007)

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Abstract: This study aims to determine the general condition of driving accidents based on its distribution according to human factors, environmental conditions, the type and importance of vehicles effective in creating accidents and time and place factors. This is an analytic-descriptive research which has been done in a cross sectional way. After organizing with forensic medicine department, traffic department and teaching some people for collecting data, a collecting data form was provided. The validity of collecting data form was confirmed using earlier studies and consulting with authorities. Its reliability was confirmed by test-retest method among 10 persons with coefficient Cronbach Alfa 82%. Collected data was reviewed and after ensuring about its accuracy, it was encoded and entered into computer. To analyze the data, SPSS 11.5 software was used. The studied samples include all accidents resulting in injuries and deaths in Mashhad reported to Police Emergency department in 2006-2007 with reports prepared for them along with croquis. The number of studied samples is 5636 cases. Results suggest that 0.8% of accidents resulted in death and 0.4% resulted in both injury and death and the rest resulted in injuries. In 68 accidents with at least one death, drivers', passengers', pedestrians' and both driver's and passenger's deaths were 57.4, 11.8, 29.4 and 1.5%, respectively. The most occurrence times were in September in 12-18 hours and the most occurrence places were in the eastern and central parts of the city. The results also show that the main factor resulting in injury accidents is ignoring regulations, but most fatality accidents occurred due to driver's fatigue and sleepiness. Most cars, motorcycles and pedestrians' accidents relate to male drivers in age group of 20-29 which in 76.8% of cases the pedestrians had dark clothing on. Although, most injury accidents involve personal vehicles (77.6%), fatality cases relate more to heavy vehicles trafficking in the city. The results also show that 66.1% of accidents relate to drivers who took their driving licenses in less than 5 years ago. Since, the majority of accidents occur in young age group with little driving experience, giving particular attention to this class of people and applying special regulations and public education to introduce the proper driving culture for the youth and combating the main reasons of accidents such as exceeding speed limit and disobeying the driving regulations will have a great role in reducing driving accidents.

Key words: Motor vehicle accidents, injury, death, Mashhad

INTRODUCTION

The studies on health and medical matters show that the biggest part of peoples' lives in the world spoiled because of the accidents either natural or unnatural (Rautji *et al.*, 2004). The statistics in US show that each person needs emergency services, at least 2 times in his/her life (Anonymous, 2009).

According to world health organization definition, accident is an event that is not recorded and cause distinguishable injury (Last, 1990). Injuries and fatalities

occur in all forms of transportation, but numerically, road-traffic accidents account for the great majority worldwide (Sharma *et al.*, 2001). Accidents are one of the main problems related to public health and the threatening factors in health of most people in the society and they have increased in recent decades in developing countries (Ghaffar *et al.*, 2004).

Road traffic accidents are a major yet neglected public health problem in developing countries. An estimated 1.2 million people worldwide are killed as a result of road traffic injuries each year and as many as

50 million are injured, occupying 30 to 70% of orthopedic beds in developing countries hospitals. In 2002, road traffic crashes ranked as the 9th leading cause of burden of disease, accounting for 2.6% of all global disability adjusted life years lost. Trends in motorization indicate an increase in road traffic injuries; furthermore, by 2020, they could rank third in the order of burden of disease (Hussein Khan, 2007). In 2005, the most recent year for which data are available, 45,520 deaths in the United States were related to motor vehicles (Anonymous, 2009).

Driving accidents include the main part of events and 10 millions driving accidents occur annually in the world resulting in one million and two hundred thousands deaths and twenty to fifty millions injuries and disabilities and are the main reasons of death in the youth (WHO, 2004). Also, almost three fourth of these deaths occurred in developing countries. According to World Health Organization's (WHO) (2004) estimation, if no action is taken about it, the death resulting from driving accidents till 2020 in low-income and average-income countries will increase to 80% (Peden *et al.*, 2002).

Numerous studies in third world countries show that this is also one of their health problems and for example, in Pakistan the traffic accident rate in 2003 was 15 in 100,000 which is still increasing (Ghaffar *et al.*, 2004). According to Nantulya and Reich (2003), driving accidents pattern is different in developed and developing countries. In high-income countries, drivers and passengers of personal vehicles are usually at risk, but in low-income countries pedestrians, motorcycle riders, bicyclers and public transportation vehicles users such as bus and mini bus users are more subject to fatality and injury (Nantulya and Reich, 2002).

Driving accidents aim for not only the injured people but also affect other people's lives such as their families, relatives and even the whole society mentally and economically through their deaths, injuries and disabilities; especially in developing countries (Rautji *et al.*, 2004). The survivals of accidents and their families not only tolerate the mental effects of losing dear one(s) but also bear problems related to surviving people's disability such as paralysis and their therapy and care costs (Odero *et al.*, 1997). Evidences show that, first aids and referring the injured people properly would reduce effectively fatality and consequent events and disabilities which have received little attention in developing countries (Nantulya and Reich, 2002).

According to the studies carried out in Iran, driving accidents are the second fatality factor after cardiovascular diseases and the first factor of burden of diseases since cardiovascular diseases usually threaten the older people, while driving accidents occur more in

active population of the society; so years of lost life by driving accidents are more than that of cardiovascular diseases (Mohammad Fam and Sadri, 2000). According to Ministry of Health report, death resulted from driving accidents in Iran in 2004 was 27000 cases. Traffic accidents rate in Iran is 30 in 100,000 which is more than world and local statistics (Naghavi *et al.*, 2004). This rate in world and Eastern Mediterranean region is 23 and 14 in 100,000, respectively (Kapp, 2003). Years of lost life resulted from intentional and accidental events in world are 15% and in Eastern Mediterranean region are 13%. In Iran although, the fatality accidents rate resulted from these factors is less than world rate, the proportion of lost life to the accident factor to total lost life is 27% (Naghavi *et al.*, 2004). This difference is mainly resulted from high fatality accident rate resulted from traffic accidents.

This study aims to determine the whole situation of driving accidents in Mashhad city in Razavi Khorasan Province located in north-eastern of Iran. In this study human factors, environmental conditions, the type and importance of vehicles effective in creating accident and time and place factors have analyzed. Defining the current situation and factors influencing it can be the base of more accurate plans for effective interference. This study will be also a pattern for multi-centric broader studies in metropolises and its data can be used in national and local levels.

MATERIALS AND METHODS

This is an analytic-descriptive research which has been done in a cross sectional way. After organizing with forensic medicine department and traffic department, receiving their approvals and teaching some people for collecting data, a collecting data form, was designed according to the study's purposes. The studied samples include all accidents resulting in injury and death in Mashhad reported to Police Emergency department in 2006-2007 for which the expert officers prepared reports along with croquis. The number of studied samples in this research is 5636 accidents resulted in injuries and fatalities. The used collecting data form in this study is based on the current data in assistant office of traffic department of disciplinary forces of Islamic Republic of Iran and it was prepared and given to authorities and experts to determine its validity regarding different sources and referring to books, magazines and publications and its validity was finally confirmed scientifically using skilled professors' approvals and experts' advices. The collecting data form's reliability was confirmed using test-retest method among 10 people with

82% Cronbach Alfa coefficient. Collecting data forms were reviewed before encoding and after ensuring about the accuracy of encoded data, it was entered into computer.

In the present study accident is defined as the collision of a moving motor vehicle with any object, moving or stationary, resulting in injury or death. Thus those collision with no casualty are not included and a motor vehicle is defined as any mechanically or electrically powered device not operated on rails and includes cars, buses, trucks, vans and motorcycles.

For the purpose of study, a road traffic accident was defined as any vehicle accident occurring on a public road or highway and which takes place between two or more objects, one of which had to be any kind of a moving vehicle. Any injury on the road without involvement of a vehicle (a person slipping and falling on the road and sustaining injury) or injury involving a stationary vehicle (person getting injured while washing or loading a vehicle) were excluded from the study. Limitations of the study were missing information from police records and inspection of accidents sites. To analyze the data, SPSS 11.5 software was used.

RESULTS

Results suggest that of 5636 accidents, 98.8% were injury accidents, 0.8% were accidents resulting in death and 0.4% were accidents with both injury and death, 68 accidents with at least one death, 57.4% resulted in driver’s death, 11.8% resulted in passenger’s death, 29.4% resulted in pedestrian’s death and 1 case resulted in both

driver’s and passenger’s deaths. In injury accidents, 49.3% of cases involved the driver, 23.4% related to both driver and passenger and the rest related to the pedestrian and passenger.

In examining months, the most occurrence time was September and the least was January. Also most accidents occurred in 12-18 hours (39.6%) and 18-24 hours (30.1%) (Table 1).

The 94.8% of accidents with recorded passage width occurred in main passages and 5.2% occurred in secondary passages. Also, the distance of accidents from the main axis in 51% of cases was less than 5 km, in 29.6% between 5-10 km and in 19.3% was more than 10 km. Out of total accidents, 4107 cases in the cars, 1230 cases in the bikes and 299 cases were due to other factors.

Results also suggest that maximum accidents resulted from ignoring regulations and undue hurry (Table 2).

Study shows that most accidents occurred in the eastern and central parts of Mashhad. Also, most cases related to the age group of 20-29 drivers (Table 3) in which 94% of cases involved men and only 6% of cases involved women and 85.4% of accidents involved personal and public vehicles and only 14.6% of cases related to heavy vehicles (Table 4). The results also indicate that most accidents relate to the drivers with little driving experience (Table 5). Examining the accidents based on licenses suggests that accidents included first degree licenses (8%), second degree licenses (88%) and temporary licenses (4%).

Table 1: Distribution of accidents resulted in injury and death according to hours (2006-2007)

Hours	Death-injury or death		Injury		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
0-6	3	7.0	182	4.5	185	4.5
6-12	20	46.5	1064	26.3	1084	26.5
12-18	12	27.9	1591	29.3	1603	39.6
18-24	8	18.6	1208	29.9	1216	30.1
Total	43	100.0	4045	100.0	4088	100.0

Table 2: Distribution of accidents resulted in injury and death according to human factors (2006-2007)

Human factors	Frequency	Percent
Fatigue and drowsiness	16	0.3
Defectiveness organ	2	0.0
Using drug	2	0.0
Using alcoholic drinks	6	0.1
Lack of paying attention to the rules	3031	58.4
Undue hurry	1010	19.5
Ignorance of the others rights	85	1.6
Unfamiliar with the road	5	0.1
Purposeful fault	54	1.0
Other manners	487	9.4
Lack of paying attention to the rules and undue hurry	413	8.0
Lack of paying attention to the rules and ignorance of the others rights	77	1.5
Unknown	448	
Total	5 636	100.0

Table 3: Distribution of accidents resulted in injury and death according to age (2006-2007)

Age	Death-injury or death		Injury		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Under 19	0	0.0	105	3.5	105	3.5
20-29	10	33.3	1156	38.8	1166	38.8
30-39	9	30.0	935	31.3	944	31.3
40-49	7	23.3	404	13.5	411	13.7
50-69	3	10.0	346	11.6	349	11.6
Over 70	1	3.3	32	1.1	33	1.1
Total	30	100.0	2978	100.0	3008	100.0

Table 4: Distribution of accidents resulted in injury and death according to guilty vehicle (2006-2007)

Guilty vehicle	Death-injury or death		Injury		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Personal vehicle	19	44.2	3169	78.0	3188	77.6
Renting vehicle	2	4.7	319	7.8	321	7.8
Minibus	4	9.3	70	1.7	74	1.8
Bus	2	4.7	53	1.3	55	1.3
Van	6	14.0	318	7.8	324	7.9
Truck	6	14.0	99	2.4	105	2.6
Trailer	4	9.3	31	0.8	35	0.9
Ambulance	0	0.0	5	0.1	5	0.1
Total	43	100.0	4064	100.0	4107	100.0

Table 5: Distribution of accidents resulted in injury and death according to time of taking driving license (2006-2007)

Time of taking driving license (year)	Death-injury or death		Injury		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
0-5	14	51.9	1886	66.2	1900	66.1
5-10	11	40.7	774	37.2	785	27.3
10-15	2	7.4	146	5.1	148	5.1
Over 15	0	0.0	43	1.5	43	1.5
Total	27	100.0	2849	100.0	2849	100.0

The results related to the accident factor also show that main reasons include first ignoring the right of way (41.2%) and then not noticing the front side (20%) and the sudden change of way (10%).

In motorcycle riders' accidents, most cases relate to people with low education (under diploma). Like accidents related to car drivers, most of cases in motorcycle riders are also in age group of 20-29 and 89.5% of the studied motorcycle riders had no safety helmet.

Accidents occur more for male pedestrians and most injured people are in the age group of 10-30 years (35.6%) and adolescents (27%) are in second order and as expected, they happened more to the people with dark clothing (about 3.5 times). The cases that mostly resulted in injury and fatality accidents for pedestrians are passing the street (45.5%); of course passing through zebra crossing also includes 10% of the accidents. The accidents related to the crash of a vehicle with a motorcycle or bicycle and the crash of a vehicle with another vehicle were 50.5 and 25%, respectively.

DISCUSSION

With some efforts during the recent years, infectious diseases caused less injury and fatality in the society comparing to the past (Schappert, 1997).

Gradually, diseases pattern tends toward non communicable diseases and accidents. So, the cause of fatality that once was infectious diseases are changing now to other diseases and fatalities resulted from noninfectious diseases and this cause has the fifth order in main reasons of fatality and on the whole it comprises about 30% of total fatality cases. Therefore, authorities, policy makers and health officials pay more attention to non communicable diseases and accidents as the main reasons of death (Naghavi *et al.*, 2004).

What increases the importance of intra-city accidents is that only 50% of accidents in Iran occur in roads out of cities and highways. However, the accidents occurred in roads and highways cause more injuries, this point should not be ignored that intra-city accidents create lots of economic loss either (Naghavi *et al.*, 2004). Geographical distribution of accidents related to cars and motorcycles in the eastern and central parts of the city suggests that these regions are not economically in proper conditions comparing to other regions of the city. On the other hand, almost 70% of traffic accidents cases resulting in injury and death occurred in the second part of day (12 noon to 12 midnight), it's main reasons are heavy traffic and drivers' fatigue and drowsiness; especially in afternoon hours. A study performed by Mohammad Fam and Sadri (2000) showed that most accidents (72%) occurred during

6 to 18 hours. The important statistical point is the high rate of fatality in morning traffic accidents and the high percent of injury in afternoon traffic accidents which are note worthy and open to discussion and maybe their main reasons are drivers' high speed in the morning and heavy traffic in the afternoon which causes less speed and then creates injury accidents. Also, time distribution suggests that when Mashhad (due to Imam Reza's pilgrims) is over crowded, the accidents increase comparing to other times of year, but this does not seem very true that the existence of many vehicles causes traffic accidents because according to statistics the travel peak with personal vehicles is March, but as seen March has less traffic accidents comparing to other months. It seems that traffic accidents have a direct relation with temperature and traffic accidents increase with high temperature (more research on this issue is recommended).

Findings show that almost in 78% the main reason of accidents are disregarding regulations and hasty driving or both. Another research carried out by Marchini *et al.* (2000) also show that in 85% of cases, the main reason is disregarding regulations and hasty driving. Since intentional violation plays a minor role (1%) in injury and fatality accidents, more education (Viano *et al.*, 2007) and creating culture (Lippi and Guidi, 2005) can be a useful important step to control and decrease the accidents.

In this study, most of accidents related to drivers in the age group of 20-29. Some studies show that in heavy injury accidents, the drivers were young (Marchini *et al.*, 2007), but Khalagi *et al.* (2006) could find no relation between age and accidents' harshness in their researches. Fastening seatbelts can reduce the extent of injury; according to a report in 1995, two third of passengers killed in the accidents had not fastened their seatbelts (Peden, 2005). Proposed data suggests that almost 90% of fatalities and 85% of injuries resulted from traffic accidents in Mashhad occurred in the age group of 20-40 which on the whole 94% of them were males. An important matter is that sex fatality patterns in Mashhad are different from other regions of the country and from all countries in the world (Naghavi *et al.*, 2004). In most researches, the accident rate in males and females is the same. According to this data, the burden of this social problem has caused more years of lost life and life with disability than many main diseases in the society. Moreover, based on sex pattern in Iran, the mental problems and the problem of driving many families to lower social classes - for losing or having disabled family guardian(s) will be added to the earlier problems which unfortunately the statistics related to this issue can not be easily provided.

Data given in Table 4 shows that high traffic size in Mashhad is due to personal vehicles, but almost 50% of fatality accidents occurred as the result of crashing with

heavy vehicles; similar study show the same (Bener *et al.*, 2006). But it is not true in injury accidents and almost 85% of cases occurred as the result of crashing with light vehicles. So, it is necessary more attention be paid to this issue in programs; especially in entrances and exits of cities for heavy vehicles drivers entering the cities are tired of driving in roads and for they used to driving with high speed in roads, they would drive with high speed in cities; especially in entrance and exit of cities and do not care enough. Besides, the driver has a limited view for the chassis is up and he can not drive with control in the city. Results indicate that almost 90% of fatality accidents and 94% of injury accidents occurred by drivers with less than 10 years experience which both aspects of drivers' being inexperienced and young should be considered the main reasons of these accidents; so it is essential in driving tests more attention be given to drivers' skill and by creating legal barriers such as increasing driving penalties, limiting the driving place and time and offering public education for the youth encourage the drivers to obey traffic regulations and for compensation, the driving insurance fee which is now taken from the vehicle rather than the driver, be taken from the driver with improving the structure and the criteria such as driver's age, driving experience, earlier accidents rate should have roles in paying insurance fee. In brief we see that almost 55% of fatality accidents and 72% of injury accidents occurred for three faults of ignoring the right of way, ignoring the front side and the sudden change of way, respectively. So, by erecting more warning signs in passages and with public education and paying more attention to these main faults in driving, it can be expected that fatality accidents resulted from ignoring regulations be reduced. It is worthy to mention that in this report only the fatality and injury accidents will be discussed and if we add damage accidents to them, the economic loss resulted from ignoring regulations will be high.

Findings show that 89.5% of the studied motorcycle riders had no safety helmet. Another research shows that about 92% of dead motorcycle drivers had not used safety helmet (Khalagi *et al.*, 2006). Results suggest that similar to national accidents reports, in almost 50% of accidents one of parties has been motorcycle or bicycle and in about 15% the accidents occurred for the pedestrian (Rangraz and Farzandipour, 2002). Here, the role of public education and executing serious regulations; especially about bikes, will be obvious. It is clear that the burden of this social-cultural problem is maybe more than many incurable diseases including cancers in the society (Mao *et al.*, 1997).

According to the report of Ministry of Health (Naghavi *et al.*, 2004), the person who experienced the accident in 52% of cases is motorcycle riders, in 5.6% of cases is bicycler and in 17.5% of cases is pedestrian. This

statistics shows that how unsafe motorcycles and bicycles are for trafficking in Iran and how much economic and social damages are created by them in the society. So, it is necessary to pay more attention to this social problem and the culture of properly using bikes be taught to people and more preventing regulations be provided for them.

CONCLUSION

Since, most accidents occur in young age group with little driving experience, giving special attention to this class of people and applying particular regulations and public education on proper driving culture for the youth and combating the main reasons of accidents such as exceeding speed limit and ignoring driving regulations will play a main role in reducing driving accidents rate.

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