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Analysis of the Factors Affecting Driving Errors in Emergency Technicians, A Case Study: Kermanshah University of Medical Sciences, 2014

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ABSTRACT

Human errors are the most important causes of traffic accidents; these errors are subject to cultural, social, economic, and geographical conditions and have a large variety in different societies. The skill of driving an ambulance in the personnel of emergency medical services (EMS) is an important part of the emergency care in injures. Therefore, the aim of this study was to determine the factors affecting driving errors in EMS personnel. The descriptive cross-sectional study was performed in 2014. Data were collected from urban and roadside EMS centers as well as its headquarters affiliated with Kermanshah University of Medical Sciences. The study population included 198 EMS personnel. The study samples were 167 individuals selected through the census method considering the inclusion criteria. Data were collected using two questionnaires, a researcher-made questionnaire and the Manchester Driving Behavior Questionnaire. The validity of the first questionnaire was confirmed by the experts' opinions while the second questionnaire was validated in previous studies. The researchers attended the centers in person for data collection. SPSS 15 was used for data analysis. The results showed that being arrested for traffic offences was only related with the marital status (P = 0.006). There was no association between a history of driver's license confiscation and demographic characteristics. Marital status and education were associated with injury accidents (P = 0.001). Finally, marital status (P = 0.006) and the type of the driver's license (P = 0.001) correlated with a history of fatal accidents. Driving and work experience, marital status and the type of the driver's license were associated with unintentional violation and level of education had a relationship with lapse errors and unintentional violation. Driving is one of the necessary skills of EMS technicians. Skill, experience, and knowledge of safe driving, in addition to preventing and reducing traffic accidents, save the lives of the injured persons and patients, as well. Therefore, it is necessary to improve the driving skill of the EMS personnel through continuous and targeted education programs.

Key words: Driving error, Emergency medical technician, Emergency medical Department.

INTRODUCTION

Traffic accidents are considered the main cause of death and injury[1]. Around 1.2 million people lose their lives due to road accidents annually worldwide; about 60% of these people are between 15 and 44 years of age and the number of injured people in traffic accidents is approximately 20 to 50 million[2]. The WHO introduces the injuries caused by traffic incidents as an important issue of public health and states that the vulnerable group of these injuries is often the poor class of the society[3].

Asian and Mediterranean countries with 16 percent of all vehicles in the world comprise more than 44 percent of the casualties in traffic accidents, but the share of European countries is merely 12% and the rest is the share of other countries[4, 5].

Between 2002 and 2011, more than 2,200,000 Iranian families, i.e. a population of 10 million, were involved with injured persons caused by traffic accidents[6]. Investigations of the WHO show that between 2000 and 2020, death due to traffic accidents in high-income countries will reduce by about 30%, while it will incraese in number in low or moderate incomes countries. Without taking appropriate actions until 2020, traffic accidents will be the third most common cause of death in the world[5,7].

During the first eight months of the years 2012 and 2013, 14,125 and 13,149 people were dead and 230,767 and 231,176 people were injured in traffic accidents, respectively[8]. In Iran, 92 people die in traffic incidents every day with a mean age of 36.8 years old. Also, there are 120 driving accidents for every 10,000 vehicles, while this figure is 12 accidents in France and Japan[9].

About 40% of urban accidents occur due to the drivers' preoccupation[10]. Inattention to driving regulations and lawlessness are other causes of traffic accidents in many societies, which is a function of cultural, social, economic and geographical conditions of those societis[11]. Human errors are the main cause of traffic accidents[5]. The term *human error* does not cover by no means all human causes of traffic accidents. In fact, there is a difference between error and violation[12]. Errors have been defined as the disability / inadequacy in correct judgment and doing a series of actions designed to achieve the desired result[13]. Violations are those behaviors that indicate the breaking of law and entail fine or penalty[14].

Driving errors are divided into mistakes and violations. Mistakes occur due to inattention and memory disruption; they are divided into slips such as an incorrect estimation of speed of the vehicle in front during overtaking and lapse errors such as driving at night with the lights off at a high speed. Violations are divided into two categories: unintentional violations, the behaviors that lead to the violation of laws without any specific intention such as failure to observe the speed limit unknowingly, and deliberate violations that are performed with the aim of breaking the law such as passing against double yellow solid lines[15].

However, all traffic accidents should not be viewed from the human perspective; it should also be noted that factors such as the car and the road are implicated, as well. Haddon's Matrix shows the interaction between three factors: human, vehicle, and environment through three stages of an accident, i.e before, during, and after the accident. Based on the Haddon's insight, the system approach identifies the main sources of error compensation or weak designs which result in the death or injury of the individuals in accidents. In this matrix, the factors before the accident and accident prevention have a special role that can reduce the risks resulting from driving and accidents with focus on the human factor (driver) as one component from the three factors of human, vehicle, and environment[6].

One of the most important skills of the EMS personnel is driving in the emergency situations and safe driving is an important part of emergency care of the injured persons. Attention and concentration while driving according to the standards and removing any visible weakness in the driving skills are important points which can prevent traffic accidents; therefore, an ambulance driver must be a professional driver[16].

The Manchester Driving Behavior Questionnaire is a standard tool for investigating the driving errors which is completed based on the self-report of the drivers. Areyzi and Haghayegh (2010) used this questionnaire to investigate a variety of driving anomalies related to drivers in Isfahan and suggested that it should be used in the researches related to driving behaviors[15]. Binner *et al* (2011) reported that laps errors, violations, and mistakes of their study samples were more in the United Arab Emirates versus Australia and European countries using this questionnaire[17]. Ozkan *et al* (2006) reported a relationship between driving behaviors and traffic accidents in six countries: Finland, England, Greece, Iran, Norway,

and Turkey. They stated an estimation can be meade on traffic accidents in every country based on the pattern of driving behaviors[18]. This questionnaire has been used not only for professional drivers[19] but also for amateur drivers[20] and is a valid tool to predict driving behaviors[21]; however, this questionnaire cannot predict the incidence of the accidents[22]. Given the importance of investigation of the driving correct behavior in order to minimize the life and economic damages caused by accidents and emphasizing this point that studies similar to this have not been conducted in Iran for medical emergency personnel, the aim of this study was to determine the factors affecting the incidence of driving errors in medical emergency personnel of Kermanshah University of Medical Sciences in 2014.

MATERIAL AND METHODS

The descriptive cross-sectional study was performed in 2014. The research resources were the urban and roadside EMS centers as well as the headquarters affiliated with Kermanshah University of Medical Sciences. The research population was 198 EMS personnel working in medical emergency centers. The census sampling method used. The sample size was calculated 167 individuals based on the inclusion criteria .

Inclusion criteria

1. Having a driver's license;
2. At least one year experience of driving an ambulance.

Data were collected using two questionnaires. The first questionnaire was a researcher-made one used for collecting the demographic data of the participants. The data included age, work experience, driving history , marital status, level of education, and the type of the driver's license. The content validity of the questionnaire was confirmed by ten faculty members in the medical emergency of Kermanshah University of Medical Sciences. The second questionnaire was the Manchester Driving Behavior Questionnaire. The reliability and validity of the questionnaire has been confirmed in previous studies(22-24). This questionnaire contains 50 questions on a Likert scale ranging of 0 to 5 (0: never, 1: rarely, 2: occasionally, 3: often, 4: repeatedly, and 5: always).

The driving behavior was examined using this questionnaire in two aspects of the behavior type and the risk it poses to other drivers. Abnormal behaviors included four categories: 1) slip errors, 2) laps errors, 3) deliberate violations and 4) unintentional violations. Questions to assess the risk included three categories: 1) low risk (behaviors without risk to other drivers on the road only causing a feeling of discomfort for others (2) medium risk (behaviors likely to put other drivers at risk) and 3) high risk (behaviors that are absolutely dangerous for other drivers). Researcher attended the EMS centers and collceted the data by distributing the questionnaires among the study samples. Then, the data were analyzed with the SPSS 15 software using descriptive and analytic indicators of Chi-square, the Pearson's independent T test, and multivariate tests for demographic characteristics, driving culture, and the risk. The study was authorized by the Research and Technology Deputy of Kermanshah University of Medical Sciences and necessary correspondence was made with the head of Medical Emergency Center of the university for cooperation in the project implementation.

RESULTS

The study subjects were 167 EMS personnel with a mean age and work experience of 27.44 (±3.41) and 6.34 (±2.85) years, respectively. In addition, 55.1% of the participants were single and 44.9% were married. Most of the participants (52.7%) were technicians. Most cases (57.5%) worked in urban centers and Certificate B1 comprised the majority of the certificates (49.1%). The complete demographic characteristics of the participants are provided in Table 1.

The accident and fine history, the type of the accident, and the behaviors resulting in accidents are shown in Table 2. About 51.5% of the participants had a fine history and 7.8% had a history of injury accidents. The use of the seat belt (86.8%) was a risk factor that was observed more than other items.

The results of Table 3 show the

Table 1: Demographic characteristics of samples (n=167)

Variable	Category	frequency	Variable	Category	frequency
Age group	<20	8			
	20-25	78	Education	LPN	16
	26-30	39		Technician	88
	30-35	23		Bachelor	63
	≥36	19			
Work experience	≤1	58			
	2-5	43		Certificate 1	10
	6-10	42	Driving certificate type	Certificate 2	44
	11-15	15		B1	82
	16-20	7		B2	31
	>20	2			
Driving experience	<1	10			
	1-5	124	number of samples from emergency center	Urban	96
	6-10	20		Roadway	50
	11-15	6		center	21
	16-20	4			
	>20	3			
Marital status	Single	92			
	Marriage	75			

Table 2: Frequency of samples history in driving penalty, type of crash and road safety risk factors (n=167)

	N(Yes)	Percent
Penalty history	86	51.5
Driver capture history	6	3.6
Certificate capture history	8	4.8
Injury accident history	13	7.8
Death accident history	6	3.6
Mobile	66	39.5
Seat belt	145	86.8
Eating	60	35.5
Speed	135	80.8
Driving difference	121	72.5

N= numbers of sampels that have "Yes" respons to variable

relationship between the demographic characteristics, fine record, type of fine, and type of accident. The work experience and driving were analyzed using the Independent Samples Test while marital status, education, and type of certificate were analyzed using the Chi-square. All demographic characteristics had a relationship with the fine record (P = 0.001) and being arrested for a traffic offensce was associated only with marital status (P = 0.006). There was no relationship between the history of certificate confiscation and demographic characteristics. Also, marital status and education were associated with a history of injury accident (P = 0.001). Finally, marital status (P = 0.006) and certificate type (P = 0.001) were associated with a history of fatal accident.

Table 3: Relationship between demographic characteristics with penalty, type of penalty and crash history (n=167)

	penalty history	driver capture history	certificate capture history	injury accident history	death accident history
work experience driving experience	.001	.661	.686	.967	.114
	.001	.911	.749	.641	.686
marital status	.001	.006	.080	.001	.006
Education certificate type	.001	.651	.375	.001	.061
	.001	.653	.857	.884	.001

Table 4 shows the relationship between the risk of accident factors and their risk level. According to the data analysis by the Chi-square test, there was no relationship between the driving difference and the moderate risk level.

The correlation between demographic characteristics and the type of error behaviors was analyzed using the Pearson test as shown in Table 5. Among different types of error behaviors, only unintentional violation was associated with work and driving history.

Table 4: Correlations between road safety risk factors and level of risk (n=167)

	high risk	med risk	low risk
Seat belt	.001	.001	.001
Mobile	.001	.001	.001
Eating	.003	.002	.003
Speed	.001	.001	.001
Driving difference	.001	.184	.001

Table 5: Correlations between demographic characteristics and errors behavior (n=167)

	slip error	laps error	unintentional violation	deliberate violation
work history	.101	.110	.363(**)	.066
	.196	.157	.001	.400
driving history	.002	.090	.271(**)	-.031
	.982	.248	.001	.690

** Correlation is significant at the 0.01 level (2-tailed).

Table 6: Multivariate tests between demographic charactristics and errors behavior (n=167)

Source	Dependent Variable	Sig.
marital status	slip error	.678
	laps error	.354
	unintentional violation	.000
	deliberate violation	.979
Education	slip error	.280
	laps error	.004
	unintentional violation	.002
	deliberate violation	.128
certificate type	slip error	.399
	laps error	.500
	unintentional violation	.000
	deliberate violation	.798

The relationship between demographic characteristics and the error behaviors was investigated using the multivariate tests. Marital status was associated only with unintentional violation. The level of education was associated with lapse error and unintentional violation; finally, the certificate type had a relationship only with unintentional violation (Table 6)

DISCUSSION

Driving violations are the most important cause of traffic accidents in the societies that differ in amount and type depending on the cultural, social, economic, and geographical context. Traffic accidents are the third main cause of death in the contemporary world and are the first cause of death in the age group 15 to 45 years old[5]. Although executive environmental-control factors and road structure abnormalities as well as the number of vehicles and traffic units are involved in the incidence of driving violations, human causes comprise the highest percentage of the causes of violations[25].

The study results showed that an increase in age increased inadvertent violations and the medium risk of driving and there was a relationship between work and driving experience and this type of violation. This finding was also reported by Lucida *et al* (2010); this is somehow an interpretation of this fact that an increase in age and experience gives a false confidence in driving skills that can lead to dangerous behaviors in the driving pattern[26]. Some studies have reported an increase in the

consumption of alcohol and drugs affecting the nerves in older drivers as a factor of dangerous driving behaviors[27]. However, several studies have also pointed to incidence of dangerous behaviors in the driving pattern at young ages and the factors such as less controlled stress and irritability have been regarded as the factors causing dangerous driving behaviors[28, 29]. Therefore, it seems essential to highlight the importance of safe driving in educational projects and improve the driving skills of the EMS personnel regardless of age.

Ambulance drivers must be able to drive more distinctly than others and have more professional behaviors. There are several reports about the difference between dangerous driving and response to stress in different professional and non-professional drivers so that the educational needs of professional drivers in terms of driving behaviors, such as non-choosing the driving time, speed observation, and destination, are different from non-professional drivers(29). In this study, there was a significant relationship between the increase of more or less danger amount and the distinct driving, i.e. when the driver drives with ambulance or usual car; it can result from the nature of driving an ambulance and its resuting stress. Studies have shown that individuals with higher education overtake more and are more likely to ignore the spped limit[30]. In this study, the level of education was associated with the fine history, history of injury accidents, and unintentional violations. Moreover, laps errors were only associated with the level of education.

The EMS personnel are more law-abiding with regards to the accident risk factors identified by the World Health Organization[31]. About 86.8% of the drivers used seat belts. The frequency of the use of mobile phone and eating and drinking while driving was 39.5 and 35.5%, respectively. A study by Banner *et al* in the United Arab Emirates showed that 63.1% of public vehicle drivers used the seat belt[17]. In Iran, the use of seat belt became compulsory in 2005; as a result, there are growing reports of the use of the seat beltin recent studies[32].

One limitation of this study was the use of the self-reported data of the EMS staff when completing the Manchester questionnaire that could lead to the social desirability bias. Nevertheless, several studies have reported that this questionnaire has weak effects on the responses of the study samples in terms of social desirability bias[10, 16].

Another limitation of this study was related to the type and model of the vehicles. Although the vehicle discussed in this study was the ambulance, we could not make any comprisons due to the variety and different models of this vehicle. Some studies have shown that the drivers of more powerful vehicles and top car brands committ more driving offences, particularly unauthorized speed[33].

In investigating the structure of the questionnaire in this study based on the classification of errors and the risk probability of that error (high, medium and low), most of the violations were related to intentional violations and laps errors. This trend was associated with inadvertent violations and laps errors in a study on the drivers of Isfahan, Iran[11]. The finding showed that the risk taking pattern of the EMS drivers was not similar to other drivers in other cities and even other countries. This finding was also reported in a study by Ozkan *et al*[13]. The notion that the Manchester questionnaire is a valid tool for investigating the driving behavior in the EMS personnel can be correct, but attention should be paid to to local and regional problems of each city regarding the indigenous cultural context of that region in addition to national traffic problems when examining factors such as intentional violations of driving. Teaching positive driving behaviors is perhaps the best way to improve driving behaviors[9].

CONCLUSIONS

Driving is one of the essential skills for the EMS staff, particularly medical emergency technicians. Skill, experience, and knowledge of safe driving prevent and reduce traffic accidents and save the lives of the injured persons and the patients, as well. An increase in age and work experience increases the probability of driving errors and the skill should never be considered less important with regards to the work experience and age. It is also possible that young technicians with an associate degree do not have the necessary

experience in this regard and may make some unintentional driving offences. Therefore, it is necessary to design safe driving training workshops and educational programs for EMS personnel to improve their driving skills.

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