



The Impact of Safety Equipment on the Road Users of Traffic Accidents: A Hospital Based Study

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Abstract

Background: Traffic accidents are one of the main challenges of the community health. Since, three-fifths of road accident trauma are attributed to behavioral factors such as no use of protective equipment, including seat belts by car riders and crash helmets by motorcyclists. This study was undertaken to evaluate the severity of injuries due to motor vehicle accidents.

Methods: The present cross-sectional study was carried out in a period of one year from April 2015 to April 2016 on 600 car accident victims. Statistical analyses were carried out with SPSS 21.0 at a significance level of 95% ($P < 0.05$). Data were reported using frequencies, percentages, and means. Chi-squared test was used to determine correlation.

Results: Based on the results, the accidents were most prevalent between 5 p.m. to 12 midnight. Pedestrians and drivers were the highest risk for accidents on highways while motorcyclists exhibited the highest rate of accidents on side streets. There is no significant correlation between the type of injury, the location of accident, and the status of the victims in the emergency units and use of safety equipment. On the other hand, there was a strong correlation between the injury severity, type of injury, and the anatomic location of injury with use of safety equipment ($P < 0.05$).

Conclusions: Strong correlation was observed between the severity of injury, the type of injury, and the anatomic location of the trauma on one hand and no use of safety equipment on the other hand ($P < 0.05$).

Keywords: Injury, Safety, Accident Prevention, Protective Devices

1. Background

Trauma resulting from traffic accidents are one of the main challenges of the community health (1). Due to the importance of such problems, the United Nations has declared the 2010 - 2020 decade for adoption of measures for road safety (2). Based on previous studies, three-fifths of road accidents take place as a result of behavioral factors (3). Of all the criteria for the development of road safety, the behaviors of the road users are considered as the most important factor for road safety. In addition, use of protective equipment, such as seat belts, is the most important protective behavior during driving (4, 5).

It has been estimated that approximately 1.2 million deaths and 50 million nonfatal injuries per year are due to road traffic accidents (RTA) (6). Based on the estimates of the WHO, trauma resulting from traffic accidents will be the second most important etiologic factors for morbidity in developing countries (7) and the third most important reason for morbidity and mortality all over the world

by 2020. In addition, such accidents are the main etiologic agent for mortality of adolescents who are 15 - 19 years of age. Iran has one of the highest rates of mortality due to unintentional trauma compared to other countries and has a high rate of RTA; such accidents are the second most important cause of death after cardiovascular diseases and the most important cause of death in the < 40 age group (8).

Traffic accidents in Iran, with an incidence rate of 27 cases in 100000 of the population, are the second cause of mortality, the first cause of lost years due to premature death (8) and the most common cause of injuries (9-12). However, despite the high rate of mortality due to road accidents, only a limited number of studies have been undertaken on their main risk factors, including no use of seat belts, airbags, etc. Therefore, the present study was performed to determine the effect of safety equipment's on the severity of injuries in road users.

2. Methods

The present cross-sectional study was carried out in a period of one year, from April 2015 to April 2016, on 600 road user victims referring to Loghman Hakim, Imam Hussein, and Shohadaye Tajrish Hospitals in Tehran, Iran. The study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences and the researchers adhered to principles of ethics in performing biomedical studies and keeping patient data confidential throughout the study. Informed consent was obtained from the patients or their relatives for inclusion in the study. The sample size was calculated by considering the frequency of the use of seat belts in Iran, which was between 14% - 63% based on previous reports (13). The data of patients who were eligible to be included in the study (male and female victims of traffic accidents) and inadequate data; non-trauma accidents trauma patients were excluded. After initial clinical examinations and interviews with the victims and their relatives, time of the crash, location of accidents, age and sex of the victims, road users type, description of mechanism of injury, the most effective protective equipment in accidents including seat belts, airbags and infant seats in the car, walking on the predetermined routes and locations and wearing of light-colored clothes at night in case of pedestrians, helmet use for motorcyclist, seat belt in the drivers, and final outcome of the patients in the hospital were recorded on checklists. After evaluating the patients' statuses, *t* was also recorded on the checklist. Then, injury severity score (ISS), revised trauma score (RTS), and trauma injury severity score (TRISS) were calculated using the survival probability calculation software program. Data were reported using frequencies, percentages, and means. Chi-squared test was used to determine correlation.

Data were analyzed using the statistical package for the social sciences, version 21 (SPSS Inc., Chicago, IL), at a significance level of 95% ($P < 0.05$).

3. Results

Of all the 600 subjects included in the study, with a mean age of 33.8 years, 455 (74%) subjects were female. The minimum and maximum ages of the subjects were two and 84 years, respectively. Side streets were the most frequent locations of accidents, followed by main streets and highways, with 470 (78.3%), 111 (18.5%), and 19 (3.2%) cases, respectively. In all the locations, the highest rate of accidents was related to motorcycles; however, on highways, second to motorcycles, the pedestrians and on minor streets car accidents exhibited the most frequent accidents (Figure 1). For the evaluation of the status of the victims, discharge from the hospital, hospitalization, discharge leave

Table 1. The Final Outcome of the Victims

	Frequency (%)
Discharge	380 (63.3)
Hospitalization	138 (23)
Leaved against medical advice	73 (12.2)
Admission into ICU	7 (1.2)
Death	2 (0.3)

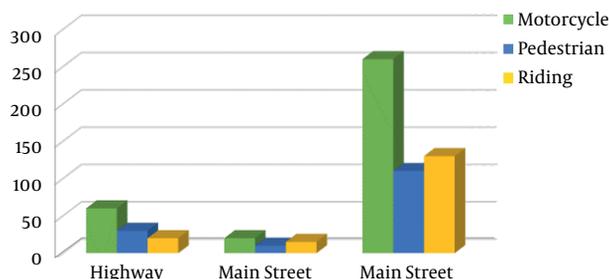


Figure 1. Comparison of the location of accidents and the type of vehicles involved

against medical advice, admission into the intensive care unit (ICU), and death were considered as variables (Table 1).

Based on the results, motorcyclists had sustained trauma in the head and face region in the majority of cases (112 cases). In car accidents the most frequently injured regions were the head, face, and upper extremities (60 cases). In relation to pedestrians, the lower extremities and pelvis had sustained the most injuries (72 cases). In this context, trauma to the head and face region of victims who had not fastened their seat belts were minor in the majority of cases; however, the absence of an airbag had resulted in more severe injuries. In pedestrians, trauma to the head and face region were mild in the majority of cases; however, the motorcyclists had sustained serious injuries to the head and face region in cases in which they had not used a crash helmet. In relation to the upper extremity, in the absence of seat belts, there were four cases of mild trauma and two cases of severe trauma, and in pedestrians crossing the roads or streets, there were five cases of life-threatening injuries and one case of serious injury. In the case of lower extremities, the majority of injuries were very severe in the absence of seat belts. However, pedestrians crossing dark streets had sustained very severe injuries and those not wearing light-colored clothes had sustained minor or moderate injuries. In relation to trauma to the neck and the thoracic cavity, the majority of car accident victims were those who had not fastened their seat belts; however, the trauma were minor in the majority of

Table 2. Chi-Squared Test Revealed Correlation Between the Use of Safety Equipment and the Location of Trauma

	Value	df	Asymptotic Significance (2-Sided)
Pearson Chi-square	112.728 ^a	40	0.000
Likelihood ratio	66.129	40	0.006
Fisher's exact test	0.000		0.000
N of valid cases	600		

^a 46 cells (83.6%) have expected count less than 5. The minimum expected count is 0.01.

cases. Pedestrians crossing the streets and motorcyclists had sustained pelvic trauma when they were crossing the streets; these types of trauma were very severe in many cases. Trauma to the abdomen and the spinal column had only occurred in car riders and motorcyclists, which resulted in very severe injuries in car riders who had not fastened their seat belts. Motorcyclists not wearing crash helmets sustained minor trauma. Fisher's Exact test revealed correlation between no use of safety equipment and the location of trauma with a probability value of 94% ($P < 0.05$) (Table 2).

Based on the results of the present study, the most severe injuries on highways were related to pedestrians crossing the roads, followed by motorcyclists not wearing crash helmets, and car riders not fastening their seat belts. However, on main streets, the motorcyclists not wearing crash helmets had sustained the most severe injuries; on side streets the motorcyclists not wearing crash helmets had sustained the most severe injuries, followed by car riders not fastening their seat belts, and pedestrians crossing the streets (Table 3).

4. Discussion

Based on the results of the present study and comparisons made with previous studies, there were significantly more male road accident victims than females, which is explained by confrontations and more dangerous behaviors of males in contrast to more cautious behaviors of females during driving and in crossing the streets (13). It appears that considering a lack of safety equipment for pedestrians and also motorcyclists, they sustain more serious trauma in accidents compared to car riders, necessitating more attention by authorities to educating people, provision of safe places for pedestrians to cross the streets, and safe roads for motorcyclists. In addition, comparison of the results of the present study with those of similar previous studies might lead to the conclusion that in similar studies, such as those by Hatamabadi et al. (11) and Mohammadfam et al. the majority of trauma had been inflicted on

the skull, leading to death. However, in the present study, due to less severe accidents and the small number of victims dying (only 2 cases), the most severe trauma were related to lower extremities, followed by the head and face. Therefore, it might be concluded that the results of the present study are not different from those of previous studies and this study has evaluated a different aspect of accidents, in which the trauma were not very severe, due to the fact that in the present study accidents in cities were evaluated, where cars and motorcycles were moving at lower speeds compared to roads out of the cities.

It might be claimed that the results of the present study and those of a study by Hatamabadi et al. (11) showed that the severity of trauma was significantly related to the type of use, i.e. on highways, the mean ISS for pedestrians was high, and on the main and side streets it was high for motorcyclists. In addition, Zargar et al. (8) reported that in terms of the trauma severity, there were no significant differences between the car riders on front seats and back-seats, which is consistent with the results of the present study, indicating the necessity of attention to car riders irrespective of their seats in the car.

4.1. Conclusion

Based on the results of the present study, the highest frequency of trauma severity was related to mild trauma and the majority of the victims had been treated in an outpatient setting without hospitalization, indicating that many accidents in cities (where the vehicles do not move at a very high speed) can be prevented and avoided by increased scrutiny and observation of laws and regulations. In addition, despite the absence of any significant correlation between the type of trauma and location of accident on one hand and no use of safety equipment on the other hand, strong correlation was observed between the severity of injury, the type of injury and the anatomic location of the trauma on one hand and no use of safety equipment on the other hand ($P < 0.05$). Therefore, we recommend the use of safety equipment and further education of the pedestrian for wearing light-colored clothes and walking on the predetermined routes and locations.

4.2. Limitation and Strength of the Study

In this study, the data were gathered from the emergency department traffic accidents victims instead of the accident scene. In order to avoid both selection bias and loss of deceased subjects, we attempted to collect data from all of victims and passengers that were involved in crashes. However, another limitation of this study is that we used data collected from a regional location near the hospital, which is difficult to generalize the data on an international scale. These three hospitals were located in the

Table 3. Comparison of Location and Protective Equipment, and the Severity of Trauma

Location of Accident	No Use of Safety Equipment	ISS					
		Minor	Moderate	Serious	Severe	Critical	Survivable
Highway	No use of seat belts by riders on the front seats	5	3	5	0		1
	Not crossing the street on the zebra line	0	0	1	0		1
	Crossing across the highway	2	14	10	0		2
	No use of seat belts by riders on the back seats	3	1	2	0		0
	Absence of airbags in the car	0	1	0	0		0
	No function of the airbag during the accident	0	1	0	0		1
	No use of child safety seat	1	0	0	0		0
	No use of a crash helmet	29	17	8	2		1
Main street	No use of seat belts by riders on the front seats	3	0	0			
	Crossing across the street	2	0	0			
	No use of a crash helmet	4	7	3			
Minor street	No use of seat belts by riders on the front seats	42	28	9	0	0	0
	Not crossing the street on the zebra line	3	1	2	0	0	0
	Crossing across the street	36	23	12	0	0	6
	No use of seat belts by riders on the back seats	6	2	5	1	0	1
	Absence of airbags in the car	3	3	1	1	0	0
	No function of the airbag during the accident	3	1	2	0	0	0
	No use of child safety seat	1	1	0	0	0	0
	No use of a crash helmet	113	89	35	4	2	7
	Low-quality crash helmet	2	4	3	0	0	0
	No use of light-colored clothes at night	4	4	1	1	0	0
	Inadequate illumination of the street at night	2	3	3	0	0	0

north, south, and east of the capital city of Iran and could be compensated of this limitation. Therefore, we suggest that more studies should be done on different roads and in different geographic settings to make the conclusions more generalizable.

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Footnotes

Authors' Contribution: Hamidreza Hatamabadi: Study concept and design, acquisition of data; Roghaieh Ghandari: Analysis and interpretation of data and statistical analysis; Mohammad Manouchehrifar: Drafting of the

manuscript; critical revision of the manuscript for important intellectual content; administrative, technical, and material support and study supervision.

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