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Analysis of Injuries Resulting from Traffic Accidents in the Riyadh Area

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Abstract. An effective measure to reduce human losses resulting from traffic accidents should be based on detailed informatioin on the types of injuries and their locations in the victim's body. A systematic approach to collect such data is needed to produce accurate information upon which right decisions can be taken. In this study, a sample of 822 traffic accidents occurred in the Riyadh area during 1411H, was considered. Data collected from this sample included general characteristics of the accidents as well as the associated medical consequences of those accidents. General statistics on different types of accidents such as fatalities per accident, fatalities per passenger, injuries per accident and injuries per passenger were calculated. Medical consequences associated with the sample accidents were identified in terms of the disitribution of injuries on nine main body locations. This was done for both the injury and fatality cases of each accident type. The results indicated that the average rate of fatalities per accident is about 0.19 which is relatively higher than the reported figure. The results also indicated that head, chest and legs injuries are the most frequent types of injuries.

Introduction

General

The main function of a highway or street is to transport people and goods in a safe, comfortable and economic manner. Although highway safety has been well recognized long ago, it was not seriously considered and addressed in developed countries until the 1960's when massive efforts and safety programs were implemented [1]. This has resulted in a significant reduction in accident rates and in some cases in number of accidents, in spite of the increasing number of vehicles. While this is true for developed countries, the situation is reversed in most developing countries [2]. This situation in developing countries is deteriorating as indicated by several reports published by the World Health Organization (WHO) [1;3-5]. . This is unfortunately

true because of the limited resources allocated to investigate and to take effective measures to reduce the accident problems. For example, the WHO [3] reported a comparison between the yearly lost years of production before the age of retirement due to major death causes with the allocated budget for research on these causes as shown in Fig. 1. As indicated in the figure, traffic accidents are receiving the least amount of research funds per lost life. This clearly stresses the fact that efforts to reduce traffic accidents consequences are still way below the expectations.

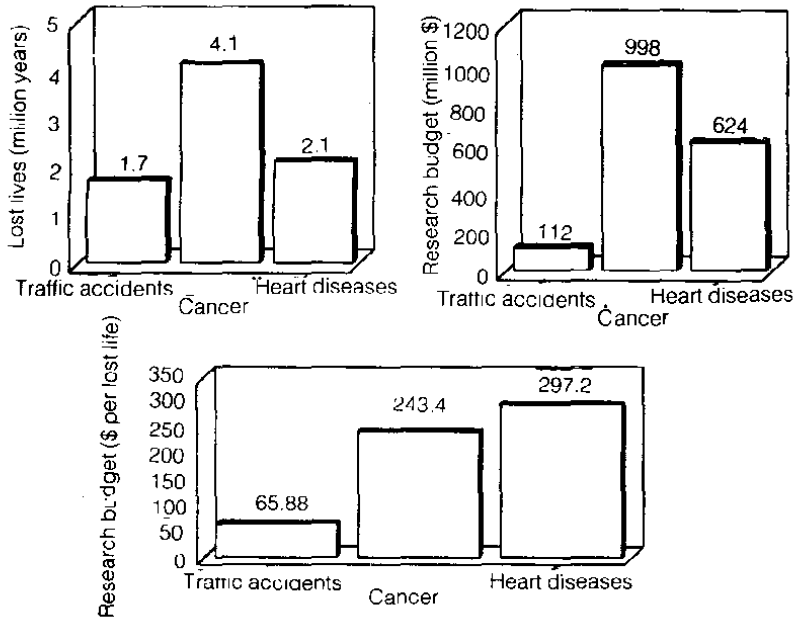

Fig. 1. Comparison between lost years and research budget for major death causes.

Medical and economic consequences of traffic accidents

The drastic impact of traffic accidents stems from the huge magnitude of their consequences in terms of social and economic losses. It is reported that the total yearly worldwide economic losses due to traffic accidents are more than 100 billion dollars, of which 64 billion dollars in USA. In the Gulf countries, these losses are about 1 billion dollars [6], while those losses sum to about 1.34 to 2.135 billion Saudi Riyals in the Kingdom of Saudi Arabia according to the studies reported in references [6;7].

Regarding the medical consequences of traffic accidents, several studies reported the following international and national statistics:

- Worldwide, there are more than 300,000 deaths every year due to traffic accidents [8].
- The yearly number of injuries worldwide is about 10 to 15 million [8].
- In the Kingdom of Saudi Arabia, more than 275,000 persons were injured and more than 25,000 died due to traffic accidents during the period from 1402H to 1411H [8;9]. In 1411H, about 40,000 traffic accidents were recorded with about 35;000 injured and 3,800 dead [10].
- During the period from 1402H, an average annual increase of 1553 in traffic accidents was reported [11].

There are several efforts reported in different countries on some measures to reduce the severity of traffic accidents. One major measure is the use of seat belts. In Australia, for example, it was noted that fatalities and serious injuries have been reduced by more than 65% after enforcing the use of seat belts [12].

It was also reported that injuries and fatalities resulting from traffic accidents can be reduced by 25% to 50% when seat belts are used [8]. In addition, a study conducted in Sweden indicated that the probability of injuries of a passenger using a seat belt is significantly reduced [13].

The above estimates, about the effectiveness of the seat belts, as a major measure to reduce the consequences of traffic accidents, are typically produced using before and after analyses of traffic accidents. These analyses required the identification of injury distribution on different locations in the victims' bodies. Unfortunately, no efforts were reported in that direction in the Kingdom of Saudi Arabia. Without such information it would be very difficult to assess the real extent of accident problem and consequences, besides the difficulty to evaluate different measures to reduce accident consequences.

The main objective of this study is to determine the distribution of injuries on the different locations of the victim's body. As the Riyadh City represents about 60% of the total accidents in the Kingdom, therefore, it was decided to limit the study to the Riyadh area only.

Data Collection

The main source of data collected in this project was the accident FILES available in the Traffic Accident Branch of the Riyadh Traffic Directorate. Each accident is assigned a file. This file contains all data and informatioin associated with the accident including the accident reporting booklet, hospital report and any other correspondences related to the accident. The details of thc injuries (type and location on the body) are typically available from the hospital reports including, in most cases, in the accident files. Details of this data can be found in reference [14].

Thus, the data collected in this project can be divided into two main categories. The first deals with the general information of the accident while the second deals with the injuries. The main source for the first category was the accident reporting booklet (Police Report) while the main sourcc for the second category was the hospital reports. The sample of accident files was selected from the 1411H (1991G) accidents. A special form was designed to collect the above mentioned two categories of data. The data collected using this form was then coded and entered into a microcomputer using the "knowledge man" data-base-manager [15]. The data items are described below:

Accident file No. : A unique numerical value, for each accident
Accident time : 1 for day-time
2 for night-time
Accident location : 1 for within the city
2 for out of the city
Accident type : Refer to Table 1 for accident type description
Collision type : Refer to Table 2 for description of collision types codes
Accident position : 1 for within the carriageway
2 for outside the carriageway
Victim type : 1 for injury
2 for fatal
Injury types : Special codes indicating the types of injuries as reported on the hospital reports

Table 1. Accident types

Code	Accident type
1	Turnover
2	Crash with another vehicle
3	Crash with animal
4	Outside the carriageway
5	Pedestrian
6	Fixed object
7	Fire
8	Crash with bicycle

Table 2. Collision types

Code	Collision description
1	Head on collision
2	Right angle collision
3	Rear end collision
4	Side collision
5	Turn hit collision
6	With stopped cars
7	One car collision
8	Pedestrian collision
9	Bicycle collision
10	Animal collision
11	Fixed collision
12	Other types

Results and Analysis

Description of results items

The results of this project can be divided into two main groups. The first group includes the general statistics on the numbers of accidents and the involved passen-

ger, injured persons and fatalities. The second group includes the distribution of victim injuries on different locations on the body. The presentation of these two categories of results is based on the following classification of accidents:

1. All accidents
2. By accident time (day, night)
3. By accident location (in the city, outside the city limits)
4. By accident type (turnover, crash with other vehicle, animal,... etc.)
5. By collision type (rear, head on, ... etc.)
6. By accident position (within the carriageway or outside the carriageway)

The results included in the first group (general statistics) are listed below:

1. Number of accidents within each accident class (and subclasses)
2. Similar to number 1 but for passengers of the vehicles involved in the accidents
3. Similar to number 1 but for fatalities associated with the accidents
4. Similar to number 1 but for injuries associated with the accidents
5. A set of rates is also provided for each subclass. These rates are: fatalities per accident, fatalities per person (passenger), injuries per accident, and injuries per person (passenger)

Table 3 summarizes the main results of the first group.

In the second group of results, injury distribution on nine main locations on the victims' bodies was determined for each accident class. The nine locations are shown in Fig. 2.

For any accident class (*e.g.*, all accidents, by accident time, by accident locations, ... etc.), the total number of injuries associated with all accidents of that class was determined. The number of injuries in each of the 9 locations was then determined. The output is called the injury distribution. The injury distribution is determined for each subclass (*i.e.*, if the accident class under consideration is accident time, then the subclasses would be 1: day-time accidents and 2: night-time accidents). Furthermore, within each subclass the injury distribution is determined for the injury cases and for the fatal cases. The injury distribution can be presented in the following equation:

$$P_{ij} = \frac{N_{ij}}{N_j} \qquad i = 1,2,\ldots,9;\ j=1,2 \tag{1}$$

where

Table 3. Summary of general statistics obtained from the study sample

	No. of accidents	No. of occupants	No. of fatalities	No. of injuries	Fatalities per accident	Injuries per accident
All accidents	822	2340	154	1378	0.187	1.676
By time						
Day	528	1441	89	862	0.172	1.664
Night	304	899	65	516	0.214	1.697
By location						
Urban	657	1821	108	1068	0.164	1.626
Rural	165	519	46	310	0.279	1.879
By position						
Within carriageway	686	1994	118	1170	0.172	1.706
Outside carriageway	136	346	36	208	0.265	1.529
By accident type						
1	82	244	27	147	0.329	1.973
2	373	1331	51	861	0.137	2.308
3	8	12	2	9	0.250	1.125
4	3	5	1	2	0.333	0.667
5	239	491	45	211	0.188	0.883
6	76	170	22	107	0.289	1.408
7	0	0	0	0	-----	-----
8	41	87	6	41	0.146	1.000
By collision type						
1	108	376	19	256	0.176	2.370
2	61	244	6	180	0.098	2.951
3	103	344	10	209	0.097	2.029
4	27	93	3	63	0.111	2.333
5	39	182	8	102	0.205	2.615
6	13	41	2	20	0.154	1.538
7	119	307	36	184	0.303	1.546
8	241	495	46	212	0.191	0.880
9	57	142	12	78	0.211	1.368
10	10	16	2	11	0.200	1.100
11	40	89	10	55	0.250	1.375
Other	4	11	0	8	0	2.000

* Refer to Table 1 for accident type descritpions

** Refer to Table 2 for collision type descriptions

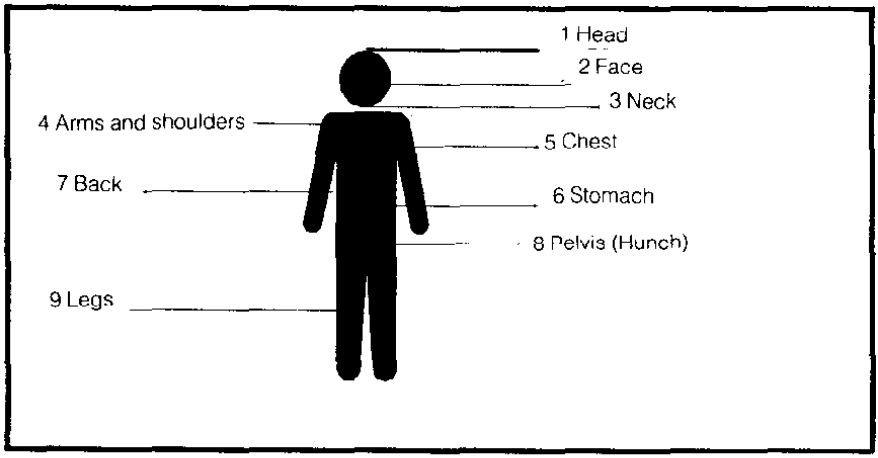

Fig. 2. Injury locations within victim's body.

P_{ij} = proportion of injuries (out of all injuries) with severity level "j" that occur in body location "i"

N_{ij} = number of injuries that occur in body location "i" for victims with severity level "j"

i = body location (i = 1-9). Refer to Fig. 2 for the identification of the 9 locations

j = severity level (j = 1,2),
j = 1 for injury
j = 2 for fatal

N_j = total number of injuries for victims with severity level j.

A summary of the results of injury distributions is presented in Table 4.

Analysis of results

Several remarks can be mentioned regarding the study results. In fact when refeence is made to the results presented in Table 3 and 4, one can feel the huge amount of comments and remarks that can be obtained. In this section, only selected remarks will be presented. These remarks, however, do not cover the wide range of variables and classes included in the study. The following indicators were selected:

- fatalities per accident
- injuries per accident
- the accident class/sub-class with highest percent of injuries in each of the fol-

lowing body locations: (1) head, (2) face, (3) neck, (4) arms and shoulder, (5) chest, (6) stomach, (7) back, (8) pelvis, and (9) legs.

Table 5 includes a summary of the main results that can be drawn from Tables 3 and 4. The table shows the overall average values associated with each of the above indicators along with the accident class with the highest value of the indicator.

Statistical analysis of the results

Two types of statistical analyses were selected to be performed on the severity rates results presented in Table 3: **(a)** development of Confidence Intervals for the severity rates (injuries per occupant and fatalities per occupant), and **(b)**contingency tables analysis.

Confidence intervals for the severity rates

Severity rates are defined as:

$$\text{Injury Rate} = \rho_1 = \frac{\text{No. of all injuries}}{\text{No. of all occupants}}$$

$$\text{Fatality Rate} = \rho_2 = \frac{\text{No. of all injuries}}{\text{No. of all occupants}}$$

For example, consider the case of all accidents in Table 3. The severity rates (proportions) are: (injury rate = 1378/2340 = 0.589) and (fatality rate 154/2340 = 0.066). The standard deviations associated with these rates (proportions) are 0.01 and 0.005, respectively. The corresponding Confidence Intervals are [0.569 - 0.609] and [0.056 - 0.076], respectively. Table 6 summarizes the Confidence Intervals for other accident classifications.

Contigency tables analysis

The general purpose of contigency tables analysis is to measure the degree of association between two classification factors. That is to what extent the characteristics of one factor and the characteristics of another factor occur together. In another way, a measure of association indicates to what extent a prior knowledge of a case's value of one variable better enables one to predict the case's value of the other variable. In this study, the two classification factors are: **(i)** accident severity (two levels: injury and fatal) and **(ii)** accident classification (*e.g.*, by time, by location, by position, by accident type, and by collision type). The results of this analysis are sum-

Table 4. Summary of injury distribution on different body locations

	Body location code								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
All accidents				**% of all injuries**					
Injuries	19.9	10.8	0.6	14.9	15.2	1.3	7.6	8.3	21.2
Fatalities	21.9	4.9	0.9	12.2	19.4	1.8	9.5	10.4	18.9
By time				**Day time**					
Injuries	21.0	12.3	0.6	14.8	14.4	1.2	7.1	7.5	21.0
Fatalities	22.2	4.6	0.8	11.1	19.5	1.9	9.6	10.3	19.9
				Night time					
Injuries	18.1	8.5	0.6	15.1	16.5	1.4	8.6	9.5	21.6
Fatalities	21.5	5.2	1.2	14.0	19.2	1.7	9.3	10.5	17.4
By location				**Urban**					
Injuries	19.4	11.7	0.6	14.7	14.9	1.5	7.0	8.1	22.1
Fatalities	20.1	5.2	1.0	13.0	18.2	1.8	9.9	10.9	19.8
				Rural					
Injuries	21.2	8.5	0.8	15.4	16.0	0.7	9.5	8.9	18.8
Fatalities	36.7	2.0	0	6.1	28.6	2.0	6.1	6.1	12.2
By location				**Within carriageway**					
Injuries	20.4	11.5	0.7	14.7	14.8	1.3	7.2	8.2	21.1
Fatalities	19.9	4.2	1.1	12.7	19.9	1.7	9.7	10.5	20.2
				Outside carriageway					
Injuries	17.3	7.7	0.2	15.8	17.1	1.5	9.8	8.6	22.2
Fatalities	31.9	8.3	0	9.7	16.7	2.8	8.3	9.7	12.5
By accident type				**1- Turnover**					
Injuries	18.4	5.2	0.5	17.9	18.9	1.0	11.7	8.4	18.1
Fatalities	34.0	2.0	0	12.0	16.0	2.0	10.0	8.0	16.0
				2-Crash with another vehicle					
Injuries	19.7	13.0	0.6	14.6	15.7	1.2	7.3	8.0	19.9
Fatalities	19.7	2.5	1.9	12.1	24.2	0.6	8.9	10.2	19.7
				3-Crash with animal					
Injuries	15.0	10.0	5.0	17.5	12.5	0	12.5	12.5	15.5
Fatalities	100.0	0	0	0	0	0	0	0	0
				4-Ooutside the carriageway					
Injuries	0	75.0	0	0	0	0	0	0	25.0
Fatalities	0	0	0	0	0	33.3	0	33.3	33.3
				5-Pedestrian					
Injuries	22.7	7.5	0.9	13.6	12.4	1.9	6.6	9.7	24.6
Fatalities	19.3	3.7	0.6	13.0	18.0	2.5	11.2	11.2	20.5

Table 4. (Continued)

	Body location code								
	1	2	3	4	5	6	7	8	9
	% of all injuries								
By collision type	**1-Head-on**								
Injuries	18.5	14.5	0.6	12.9	17.7	1.1	6.5	7.8	20.4
Fatalities	24.1	3.4	0	12.1	20.7	1.7	10.3	10.3	17.2
	2-Right angle								
Injuries	20.9	11.5	0.7	13.6	16.5	1.9	5.2	8.2	21.4
Fatalities	40	0	0	20.0	20.0	0	0	0	20.0
	3-Rear-end								
Injuries	21.1	9.8	0.7	15.3	16.0	1.2	10.2	7.9	17.9
Fatalities	7.7	0	5.1	17.9	20.5	0	10.3	12.8	25.6
	4-Side								
Injuries	23.5	14.2	0.7	17.6	9.5	1.4	7.4	5.4	20.3
Fatalities	25.0	0	0	8.3	16.7	0	8.3	16.7	25.0
	5-Turn hit								
Injuries	15.8	15.1	0.3	16.4	14.8	0.6	8.4	10.0	18.7
Fatalities	28.6	7.1	7.1	0	57.1	0	0	0	0
	6-With stopped car								
Injuries	15.4	20.0	0	20.0	10.8	3.1	1.5	4.6	24.6
Fatalities	50.0	0	0	0	25.0	0	0	0	25.0
	7-One car								
Injuries	18.5	6.5	0.4	17.4	17.6	1.1	10.5	9.2	18.7
Fatalities	25.3	8.0	0	10.3	17.2	2.3	9.2	10.3	17.2
	8-Pedestrian								
Injuries	22.7	7.5	0.9	13.5	12.4	1.9	6.6	9.7	24.7
Fatalities	19.4	3.6	0.6	12.7	18.8	2.4	10.9	10.9	20.6
	9-Bicycle								
Injuries	22.8	8.1	0.4	16.1	11.7	0.4	7.2	6.3	26.9
Fatalities	25.0	9.4	0	15.6	12.5	3.1	6.3	9.4	18.8
	10-Animal								
Injuries	12.0	16.0	4.0	18.0	14.0	0	10.0	10.0	16.0
Fatalities	100.0	0	0	0	0	0	0	0	0
	11-Fixed object								
Injuries	16.1	14.8	0	13.4	16.1	1.3	6.0	6.7	25.5
Fatalities	20.0	13.3	0	13.3	13.3	0	13.3	13.3	13.3

* Refer to table 1 for accident type descriptions

** Refer to table 2 for coillision type descriptions

Table 5. Summary of main results

Indicator	Overall average	Accident class with highest rate	Heighest value
Fatalities per accident	0.19	turnover	0.33
Injuries per accident	1.70	right angle accidents head-on collisions	2.95 2.37
% of all accidents in the head	22 for fatalities 20 for injuries	rural accidents	37
% of all accidents in the head	5 for fatalities 11 for injuries	hitting fixed objects	17
% of all accidents in the neck	0.92 for fatalities 0.64 for injuries	turn-hit accidents	7.14
% of all accidents in the arms and shoulders	12.2 for fatalities 14.9 for injuries	hitting bicycles	25
% of all accidents in the stomach	1.8 for fatalities 1.3 for injuries	hitting bicycles	3.1
% of all accidents in the back	9.5 for fatalities 7.6 for injuries	turnover	12
% of all accidents in the pelvis	10.4 for fatalities 8.3 for injuries	back hit	13
% of all accidents in the legs	18.9 for fatalities 21.2 for injuries	hitting bicycles	39

marized in Table 7 where the χ^2 value and the corresponding p-value are shown for each analysis case. The results indicate that there is a significant degree of association between accident severity and all accident classification categories, except for the "by time" classification category.

This means, whether the accident occurs at night or during the day, the likelihood of being killed is almost even, and thus the difference between the two fatality proportions (*e.g.*, 89/951 = 0.093 and 65/581 = 0.11) was due to chance. Table 8 summarizes the data used in the contingency table analysis for the accident time case (the data shown in this table was extracted from Table 3). On the other hand, this likelihood is statistically significant in the case of other classification categories. For instance, considering accident location classification category, the results indicate that the chance of being killed in a rural accident is higher than that in an urban accident. Thus, the difference between fatality rates in rural and urban accidents (46/356

Table 6. The 95% confidence intervals for severity rates of different accident classifications

Accident classification	Sub-class	Proportion (standard deviation)		95% Confidence intervals	
		Injuries	Fatalities	Injuries	Fatalities
All accidents		0.589 (0.010)	0.066 (0.005)	0.569 - 0.609	0.056 - 0.076
By time	Day	0.598 (0.013)	0.062 (0.006)	0.573 - 0.624	0.049 - 0.074
	Night	0.574 (0.016)	0.072 (0.009)	0.542 - 0.606	0.055 - 0.089
By location	Urban	0.586 (0.012)	0.059 (0.060)	0.564 - 0.609	0.048 - 0.070
	Rural	0.597 (0.022)	0.089 (0.013)	0.555 - 0.639	0.064 - 0.113
By position	Within	0.587 (0.011)	0.059 (0.005)	0.565 - 0.608	0.049 - 0.070
	Outside	0.601 (0.026)	0.104 (0.016)	0.550 - 0.653	0.072 - 0.136
By accident type	1	0.602 (0.013)	0.111 (0.020)	0.541 - 0.664	0.071 - 0.150
	2	0.647 (0.013)	0.038 (0.005)	0.621 - 0.673	0.028 - 0.047
	3	Sample size is too small for reliable estimates			
	4	Sample size is too small for reliable estimates			
	5	0.430 (0.022)	0.092 (0.013)	0.368 - 0.474	0.066 - 0.117
	6	0.629 (0.037)	0.129 (0.026)	0.557 - 0.702	0.079 - 0.180
	7	Sample size is too small for reliable estimates			
	8	0.471 (0.054)	0.069 (0.027)	0.366 - 0.576	0.016 - 0.122
By collision type	1	0.680 (0.024)	0.051 (0.040)	0.634 - 0.728	0.028 - 0.073
	2	0.738 (0.028)	0.025 (0.010)	0.683 - 0.793	0.005 - 0.044
	3	0.608 (0.026)	0.029 (0.009)	0.556 - 0.659	0.011 - 0.047
	4	0.677 (0.049)	0.032 (0.018)	0.582 - 0.772	0.000 - 0.068
	5	0.560 (0.037)	0.044 (0.015)	0.488 - 0.633	0.014 - 0.074
	6	0.488 (0.078)	0.049 (0.034)	0.334 - 0.641	0.000 - 0.115
	7	0.599 (0.028)	0.117 (0.018)	0.545 - 0.654	0.081 - 0.153
	8	0.428 (0.022)	0.093 (0.013)	0.384 - 0.472	0.067 - 0.119
	9	0.549 (0.052)	0.085 (0.023)	0.467 - 0.631	0.039 - 0.130
	10	Sample size is too small for reliable estimates			
	11	0.618 (0.052)	0.112 (0.034)	0.517 - 0.719	0.047 - 0.178
	12	Sample size is too small for reliable estimates			

* Refer to Table 1 for accident type descriptions
** Refer to Table 2 for collision type descriptions

= 0.13 and 108/1176 = 0.09, respectively) is statistically significant. Table 9 summarizes the data used in the contingency table analysis for the accident location case (the data shown in this table was extracted from Table 3).

Table 7. Summary of the contingency tables analysis on the degree of association between accident severity and different accident classifications

Accident classification	Chi-Square [χ^2]	P-value
By time	1.334	0.248
By location	4.222	0.040
By position	7.096	0.007
By accident type	49.669	≈0
By collision type	53.089	≈0

Table 8. Contingency table for severity level by accident time

Severity level	Accident time		Total
	Day time	Night time	
Injury	862	516	1378
Fatal	89	65	154
Total	951	581	1532

Table 9. Contingency table for severity level by accident location

Severity level	Accident location		Total
	Urban	Rural	
Injury	1068	310	1378
Fatal	108	46	154
Total	1176	356	1532

Conclusions

(1) Based on the sample accidents considered in this study, it was found that the average rate of fatalities per accident was about 0.19 which is relatively high.

(2) There is a significant degree of association between accident severity and all accident classification categories except the "by time" category.

(3) In general, it was found that the most frequent types of injury were, head, chest and legs injuries.

(4) Head and chest injuries were more frequent in fatality cases than in injury cases, while leg injuries were higher in injury cases.

(5) Head, chest and legs accidents constituted, on the average, about 60% of total injuries in fatality cases and about 55% in injury cases.

References

[1] World Health Organization. "National Road Accident Control Program Development." *Annual Report*, Dhaka, Bangladesh, (1983).

[2] Gaber, M.A.; Boutros, W.Y. and Sharaf, E.A. "The Egyptian Experiment of the Road Safety System." *The Second African Road Safety Congress*, Addis Ababa, (1989), 124-131.

[3] World Health Organization, Geneva. "Accidents in Children and Young People." Vol. 39, No. 3 (1986).

[4] World Health Organization. "Accident and Injury Prevention at the Primary Health Care Level." *Annual Report*, Thailand, 1987.

[5] World Health Organization. "Asian Seminar on Road Safety." *Annual Report*, Bangkok, 1987.

[6] Al-Saif Abduljalil. "Road Traffic Accidents in Holy Makkah and the Eastern Regions." *Proceedings of the International Symposium on Road Traffic Accidents, Riyadh, Saudi Arabia*, 1992, 31-33.

[7] Al-Angari Sultan. "Human Factors and Psychological Effects in Safe Driving." *Proceedings of the International Symposium on Road Traffic Accidents*, Riyadh, Saudi Arabia, (1992), 70-73.

[8] Al-Salloum Nasser. "Safety on the Roads - The Engineering Aspects and Traffic Awareness." *Proceedings of the International Symposium on Road Traffic Accidents*, Riyadh, Saudi Arabia, (1992), 15-21.

[9] Al-Turki Ahmad. "Social and Economical Dimensions of Road Accidents." *Proceedings of the International Symposium on Road Traffic Accidents*, Riyadh, Saudi Arabia, (1992), 22-27.

[10] General Traffic Directorate. *Yearly Traffic Accidents Statistics Report*, Riyadh: Ministry of Interior, 1991.

[11] Al-Turki Mansour. "A Highlight of Road Traffic Accidents." *Proceedings of the International Symposium on Road Traffic Accidents*, Riyadh, Saudi Arabia, (1992), 66,67.

[12] Mufti Mohammed. "Seat Belt Legislation." *Proceedings of the International Symposium on Road Traffic Accidents*, Riyadh, Saudi Arabia, (1992), 54-66.

[13] Hutchinson, T.P. *Road Accident Statistics*. Rumsby Scientific Publishing, Australia, (1987).

[14] Sharaf, E.A. and Al-Hamad, F. "Analysis of Traffic Accidents Injuries." *Presented at the National Symposium on Traffic Safety*, Riyadh, Saudi Arabia, (1994).

[15] Management Data Base System. *Knowledgeman Integrated System Software: User Manual*. Ver. 3.0, MDBS: W. Lafayette, Indiana, 1991.

تحليل الإصابات الناتجة من حوادث المرور في منطقة الرياض

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ملخص البحث. يبنى المقياس الفعّال للتقليل من الخسائر البشرية الناتجة عن حوادث المرور على معلومات مفصّلة عن أنواع الإصابات ومواقعها على جسم المصاب. ولهذا فإن هناك حاجة إلى أسلوب نظامي لجمع البيانات للحصول على معلومات دقيقة يمكن الاعتماد عليها في صنع قرارات صحيحة. في هذه الدراسة، تمّ فحص ٨٢٢ حادثًا مروريًا وقعت في منطقة الرياض خلال عام ١٤١١هـ (١٩٩١م). من تلك العيّنة، تمّ جمع بيانات عن الخصائص العامة للحوادث إضافة إلى الآثار الطبية المترتبة عليها. تمّ حساب إحصاءات عامة لأنواع الحوادث المختلفة مثل الوفيات لكل حادث، الوفيات لكل راكب، المصابين لكل حادث والمصابين لكل راكب. كما حُدّدت الآثار الطبية المرتبطة بحوادث العيّنة وذلك بالنسبة لتوزيع الإصابات على تسعة مواقع على الجسم، لكلٍ من حالات الإصابة وحالات الوفاة. أشارت النتائج إلى أن متوسط معدّل الوفيات يقارب ١٩,٠ وهو أكبر نسبيًا من المعدّل المسجل. كما أوضحت النتائج أن إصابات الرأس والصدر والأرجل هي الأكثر تكرارًا بين أنواع الإصابات. هذا وقد تمّ إجراء تحليل إحصائي تفصيلي لمعدّلات الحوادث اتضح منه أن هناك ارتباطًا إحصائيًا معنويًا بين التصنيفات المختلفة للحوادث وبين تلك المعدّلات فيما عدا وقت الحادث (ليلاً أو نهارًا).