Research Paper: Ranking of Factors Influencing Injury and Death by Accident Using Analytical Approach: A Case Study of Ilam Province Roads

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ABSTRACT

Background: Every year many people are killed or injured in road accidents. The first step in planning to reduce accidents is to identify the causes of accidents. This study aimed to investigate and identify the causes and factors affecting the incidence and the severity of road accidents as a major issue in Ilam Province, Iran.

Materials and Methods: This research is a descriptive study with an analytical approach. Descriptive and inferential statistics indices were used for statistical analysis. A researcher-made questionnaire as fieldwork was used to investigate the factors affecting accidents. Friedman test was used in the analytical study of the data obtained from the questionnaires. The study population included all drivers of the public suburban fleet, including taxis, minibusses, and buses on the Ilam Province. Out of 190 drivers, a sample size of 127 was selected using a Cochran formula.

Results: From the drivers' point of view, the main causes of public fleet accidents on the roads of Ilam Province are the quality and technical issues of the roads. Interviewees believed that dangerous turns, low width, poor road quality, and inadequate traffic signs are the main causes of accidents. After that, human factors are in the second place, including high speed and overturning, left-sway, and unmanageable rush, emphasizing the two factors of high speed and overtaking. The technical and qualitative factors of the vessels are in third place. Finally, the environmental and natural factors are in fourth place.

Conclusion: Because the drivers consider the quality and technical issues of the roads as the main causes of traffic accidents in the transportation axes of Ilam Province, it is necessary to review and repair these transportation axes.

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1. Introduction

The increasing number of vehicles and users of transportation routes is a key issue with various and complex aspects [1]. A large sum of money is spent annually to reduce car accidents and their consequences in different countries. In Iran, with the increase of vehicles and drivers' disregard for traffic safety regulations, the number and severity of traffic accidents have increased [2].

Implementing strategies to reduce accidents and road casualties require the analysis of accidents, using prediction models and the impact of various parameters on their occurrence alongside efforts to improve traffic safety [3]. Comparing developed and developing countries, it is found that the industrialized countries, despite the high rate of ownership of motor vehicles, have learned to some extent over the past half-century how to deal with the increasing number of cars and users and so lawful driving is institutionalized in these countries [4]. But developing countries have not taken advantage of this opportunity for a variety of reasons and many of these countries are currently facing a serious and deteriorating problem of road accidents and casualties and available opportunities have become serious threats [5]. Also, despite the expansion of transportation systems in developing countries, little has been done to prevent or reduce the rate of road accidents and their severity. In these countries, despite the high rate of accidents, there are not enough resources to save the lives of the injured and help those who have suffered permanent disabilities as a result of these accidents [6].

Iran, as a large and populous country, but without a sufficient and modern railway network, has put heavy pressure on freight and passenger transport on the non-railway road network. Our suburban and urban road network has suffered from severe weakness in terms of quantity, quality, and maintenance, and this situation, combined with ignorance and lack of public education, worn-out fleet, severe traffic irregularities and non-compliance with traffic laws, poor emergency services, and lack of national determination to deal with this dangerous phenomenon, has created a situation that whoever steps on the roads and streets is prone to be killed or be injured [7].

In reviewing other studies on this subject, most of the factors involved in the occurrence of these accidents are divided into four general categories: road, environment, vehicle, and the human factor. Each of these factors includes various sub-sections, among which the human factor is the most influential element causing accident

[8]. Therefore, it makes sense for relevant organizations in society to focus all their efforts on human factors.

Road accidents are a new public health problem worldwide as they are one of the most important causes of death, physical disability, and hospitalization which will result in significant economic and social consequences. Traffic accidents are expected to be the second leading cause of death in high- and middle-income countries in the coming years [9]; therefore, reducing injuries and incidents related to traffic accidents should increase the general health of the community. The first step to reduce accidents is recognizing the causes of its occurrence.

To solve this serious problem, identifying the factors affecting accidents and determining the impact of each of these factors should be the main priorities of the responsible institutions and relevant organizations. The increase of pilgrimage and recreational trips to Ilam Province due to the closeness of this Province to Iraq and the international border of Mehran City caused a significant increase in traffic in the transportation axes of Ilam Province. So far no research has been done to rank the factors affecting accidents in this Province which can be used as an indicator for planning to reduce accidents. Therefore, we investigated the factors affecting accidents in Ilam Province, with a long common border with Iraq and the role of transit and tourism, as one of the important destinations of the travelers.

2. Methods

The research has a descriptive-analytical design to analyze statistical data obtained from descriptive and inferential statistics. The statistical population of this study included all drivers of the public intercity fleet of Ilam Province, including intercity taxis, buses, and minibusses, which were 190 people in total. Using Cochran's formula, the sample size was calculated as 127. The sampling method of the research is a cluster type which was selected from the statistical population of users of transportation axes. The inclusion criteria for this study were having frequent traffic in transportation axes and familiarity with transportation axes.

The study was done in the first quarter of 2018. To collect data, descriptive analysis was used from sources, documents, and information reports of the Traffic Police, which are recorded and stored in specific formats. At this stage, all documents of the accidents were studied to identify the factors affecting the accidents. In conducting library research, the main components and variables were identified and defined, and based on the categories

and design model, the library research and documentary research were completed.

In the next step, a researcher-made questionnaire was designed and compiled to collect analytical and inferential data. To ensure that the questionnaire has the appropriate stability, accuracy, and sensitivity, its validity and reliability were examined and evaluated. Equal weight is considered for each group and the questionnaire is adjusted based on the Likert scaling method, which has a 5-point scale, from very high, high, medium, low, and very low, given a score of 1 to 5.

Since the sub-factors and the main factors have different questions, the Friedman ranking method was used, which is a method for ranking with non-identical sub-factors. The validity of the questionnaire was confirmed by professors in the field of transportation and its reliability was obtained using the Cronbach alpha coefficient of 0.82. SPSS was used for data analysis.

3. Results

Out of 127 drivers of Ilam suburban public fleet, all of them were men, of whom 70 had a diploma, 26 had a post-diploma and 31 had a bachelor's degree or higher. Also, the highest age range of drivers was between 25 and 35 years (n=70, 55%). Besides, 82 people belonged to the intercity taxi fleet, 25 to the minibus fleet, and 20 to the intercity bus fleet in the transportation axes of Ilam Province.

To descriptively analyze the interviewees' responses, their views on four main areas were initially extracted. For this purpose, the average and median scores of the answers were used. As shown in Table 1, according to the respondents, the factors related to the road with an average score of 3.81 and a median of 1.4 were considered the main causes of accidents in Ilam Province, followed by other factors. Table 2 presents the status of all main factors based on the sub-factors.

Friedman test was used for the bilateral analysis of variance and also for comparing the mean ranking of different groups. Because the sub-factors of the main factors had different numbers, the ranking method was performed with the Friedman ranking method and based on the opinion of the statistical population without considering the grouping of four factors. According to the interviewees, the most influential factors are unauthorized overtaking and speeding, dangerous turning and yawing to left, and the least effective factors are sunny weather and high temperature, wind, and misalignment of car tires pressure (Table 3).

4. Discussion

Along with the expansion of communication networks and the development of road communications, one of the most fundamental issues in various transportation systems is the control and prevention of road accidents. Unfortunately, in recent years, Iran has been at the top of the list of road accidents and life and financial losses in the world. Obviously, with the foresight and improvement of transportation systems, this national problem can be prevented to a large extent and the lives of thousands of people can be saved. Unfortunately, Iran suffers a lot of life and financial losses due to road accidents, so that according to the latest statistics, accidents are the most important cause of disability in Iran. This is while every year 10% is added to the number of killed and injured in road accidents in Iran. Road safety is of great importance along with the development of transportation networks, i.e. before the expansion of communication networks, practical measures must be taken to reduce road accidents. To eliminate or reduce this matter, the main causes of the observed events or dangers (human-natural-managerial) must be found.

This study identified, in the first step, the quality and technical issues of the road as the main cause of road accidents in Ilam Province. According to the interviewees, dangerous turns of the road, narrow width, quality of the

Table 1. The average score of the main factors

Main Factors	The Average Score of Responses
Road factor	3.92
Human factor	3.69
Vehicle factor	3.31
Environmental factor	3.06

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Omidi N, et al. Ranking of Factors Influencing in Accident. HDQ. 2020; 5(4):207-214.

209

Table 2. Status of all variables based on the average score of the answers

Main Factors	Variables	The Average Score of Responses
Human factors	Yawing to left	4.06
	Unauthorized speed	4.29
	Disobedience of advance right	3.32
	Disobedience of longitudinal distance rules	3.12
	Unnecessary haste and acceleration	3.92
	Moving in reverse gear	2.54
	Unauthorized overtaking	4.30
	Improper driving style and culture	3.77
	Mindfulness and talking on cell phone	3.59
	Fatigue and lack of adequate rest	3.75
Vehicle factors	Vehicle type	3.31
	Worn-out vehicle	3.44
	Worn-out tires	3.63
	Vehicle's technical problems	3.34
	Not adjusting the vehicle's tire pressure	2.48
	Non-compliance with standards by the automaker	3.62
Road factors	Road quality	3.86
	Narrow road	4.07
	Dangerous turns	4.18
	Inadequate traffic signs	3.83
	Road type	3.69
Environmental factors	Wind	2.21
	Ice	3.71
	Dust	2.60
	Snow and rain	3.52
	Fog	3.43
	Sunny weather and high temperature	2.15
	The traffic of agricultural vehicles and livestock	3.61

asphalt, and lack of adequate traffic signs are the main causes of road accidents. The specific geographical and climatic location of the route has a negative impact on the design and construction of the road and its geometric space. It has caused roughness, steep slopes, dangerous turns, and insufficient visibility of signs. Besides, technical defects of the roads such as narrow road width, inadequate and non-standard traffic signs, geometric characteristics of the road, and the quality of asphalt cause traffic accidents, indicating the roads as a factor of accidents.

In Salmani et al.'s research, contrary to the results of this research, among the factors affecting accidents, human factors played the most important role with 54% part, and among human factors, high speed, rushing to reach the destination, neglecting the traffic rules, drowsiness, overtaking, and long distance between departure and destination, which causes tiredness, have played a greater role than other factors. Managerial and natural factors, with 34% and 12% of other factors, respectively, are effective in the occurrence of accidents, too [10]. In their research, Naemi et al. considered human factors as the main cause of traffic accidents in Sabzevar City, Iran [11].

Table 3. Ranking of all variables based on the Friedman method

Row	Factors	Scores
1	Unauthorized overtaking	20.78
2	Unauthorized speed	20.76
3	Dangerous turns	19.96
4	Yawing to left	18.85
5	The narrow width of the road	18.67
6	Unnecessary haste and acceleration	17.80
7	Road quality	17.39
8	Fatigue and lack of adequate rest	16.94
9	Improper driving style and culture	16.85
10	Inadequate traffic signs	16.84
11	Ice	15.87
12	Road type	15.76
13	Mindfulness and talking with the cell phone	15.46
14	Worn-out tires	15.16
15	The traffic of agricultural vehicles and livestock	15.14
16	Snow and rain	14.76
17	Non-compliance with standards by the automaker	14.65
18	Fog	14.08
19	Worn-out vehicle	13.54
20	Disobedience of advance right	13.47
21	Vehicle's technical problems	12.88
22	Vehicle type	12.48
23	Disobedience of longitudinal distance rules	12.05
24	Moving in reverse gear	8.86
25	Dust	8.33
26	Not adjusting the vehicle's tire pressure	6.96
27	Wind	5.90
28	Sunny weather and high temperature	5.82

In the second rank of the influential elements are human factors. According to the interviewees, they include unauthorized overtaking and speed, tiredness and drowsiness, levogyration, non-observance of the right of precedence, failure to observe the longitudinal distance, haste, and acceleration, move in rear gear, improper driving style, distractions, mental preoccupation, and talking on the cell phone have played a decisive role in the occurrence of road accidents. What has been emphasized in the area of human variables and repeatedly stated in the reports of experts and traffic police officers, was the effect of speeding and overtaking and deviating to the left in the occurrence of accidents. In this study, the two factors of speed and overtaking, regardless of any groupings, stand at the top of the list of influential factors of the mentioned road accidents.

Omidi N, et al. Ranking of Factors Influencing in Accident. HDQ. 2020; 5(4):207-214.

211

In the study of Pakgohar and Kazemi, which ranked human factors affecting accidents, the use of cell phone was the most common cause of traffic accidents [12]. The research of Zhang et al. considers the unauthorized overtaking of the human factor influencing accidents in China [13]. In the research of Christian et al., the main cause of accidents related to human factors was unauthorized speed [14].

The technical and quality factors of the car are in third place based on the findings. According to the interviewees, car-related elements such as car type, worn-out car, worn-out tires, car technical defects, car tire misalignment and non-compliance with standards by the carmaker have an impact on the occurrence of accidents. Some of these factors are directly related to the carelessness and negligence of the driver, such as a worn-out car, worn-out tires, car technical defects, car tire misalignment, which the driver is undoubtedly the cause of the accident. Kotzo et al. have considered the role of car technical factors in accidents to be important in South Africa [15]. In the research of Yang et al. in South Korea, because of the high quality of cars, technical defects of the car had the least impact on accidents [16]. Finally, the environmental and natural factors are in the final category of factors affecting accidents. Although these are climatic factors and are beyond the control of users, today with the emergence and supply of new road technologies, their negative impact can be minimized.

The results of this study showed that in the transportation roads of Ilam Province, from the drivers' point of view, technical issues and road safety are very important factors in the occurrence of accidents, due to the low quality of access routes, which indicates the need for serious investigation in this area. The main limitation of the present study is the lack of sufficient and comprehensive information and data for a long time. Some of the available information and documents are confidential and not necessarily accessible or, if accessed, their publication is not permitted. Also, because the interviewee tends to fill out the questionnaire quickly, the number of questions should be small but standard, and this is another limiting factor.

It is believed that by studying and conducting scientific studies and providing executive solutions, it is possible to effectively help reduce accidents and thus save the lives of thousands of people and prevent the waste of resources. For this purpose, the suggestions obtained from the analysis and review of research results are presented in the following order of importance and factors:

Because of the accidents, it is suggested that the following measures be taken in this study:

- Road widening or at least widening of high-risk passes and passages, especially from Razi to Meshkinshahr City intersection, is one of the most important factors in reducing accidents.

- Removal of ridges and passages (Razi area to Germi City after the intersection of Meshginshahr side road and after Alishan Sui village, etc.) is strongly recommended to solve the problems of drivers' vision during driving.

- Installation of traffic warning signs in accident-prone areas where their absence is strongly felt.

- Regular road markings for road safety in the study area, especially at the entry and exit points of cities and the main road on the first highway.

- Installation of smart boards to determine the speed limit (along the three-way route from Amir Kandi village to Barzand village) to provide the possibility of applying speed changes in different weather conditions because of the continuous weather changes in Ilam Province.

- Installation of CCTV cameras in accident-prone and high-traffic areas is very important, especially at the main routes, so that the police get direct control over local traffic events.

- To reduce human errors, the presence of traffic police in parts of the road before accident hotspots are necessary.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article.

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Authors' contributions

Mohammad Reza Omidi; Data Analysis and Writing the Manuscript Draft: Meisam Jafari Eskandari: Interviewing: Nabi Omidi; Data Collection and Analysis.

Conflict of interest

The authors declared no conflict of interest.

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Omidi N, et al. Ranking of Factors Influencing in Accident. HDQ. 2020; 5(4):207-214.

213

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