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Identification of factors that cause the victim of road accidents: A case study of Erbil city

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Keywords:
Road traffic accidents, Factor Analysis, Bartlett's test, Communalities.

A R T I C L E I N F O

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Abstract: This study aims to show the factors that cause traffic accidents. In this study, some factors have been identified as the reasons for Road Traffic Incidents, it searched for a correlation between several sociodemographic factors and the number of accidents, including gender, age. On the other hand, Factor analysis is used to refer to the identification of dependent variables consisting of Speed, Poor roads, Alcoholic beverages, Trucks out of town, type of vehicle, Failure to comply with traffic laws, driving at night, driving in the fog, Use of mobile phones by drivers, Driver fatigue, Failure to obey a stop sign or red light, Temporary obstacle, Street racing, and Construction site. A questionnaire was used in this research to collect data. 231 Erbil City residents of both genders answered the survey at random. Using the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) of sphericity, we confirmed the sample's suitability for factor analysis. This research provides important conclusions for traffic accident control by identifying the most important factors that lead to loss of life and property. These factors have a direct impact on the social and economic conditions of the community.

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تحديد العوامل المسببة لوقوع ضحايا حوادث الطرق: دراسة حالة مدينة اربيل

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المستخلص

تهدف الدراسة إلى توضيح العوامل المسببة لحوادث المرور. في هذه الدراسة، تم تحديد بعض العوامل للنظر في أسباب حوادث المرور. على وجه التحديد، حاولت معرفة العلاقة بين العديد من متغيرات العوامل الاجتماعية والديموغرافية مثل الجنس والعمر مع الحوادث المعنية. من ناحية أخرى، تم استخدام تحليل العوامل للإشارة إلى تحديد المتغيرات التابعة المكونة من السرعة، والطرق السيئة، والمشروبات الكحولية، والشاحنات خارج المدينة، ونوع السيارة، وعدم الامتثال لقوانين المرور، والقيادة في الليل، والقيادة في الضباب، واستخدام الهواتف المحمولة من قبل السائقين، وإرهاق السائق، وعدم الامتثال لعلامة التوقف أو الضوء الأحمر، والعائق المؤقت، وسباق الشوارع، وموقع البناء. تم استخدام استبانة في هذا البحث لجمع البيانات، وقد أجاب على الاستبيان 231 من سكان مدينة أربيل من كلا الجنسين بشكل عشوائي. وباستخدام اختبار بارتليت للكروية واختبار كايزر ماير أولكين (KMO) للكروية، أكدنا ملاءمة العينة لتحليل العوامل. يقدم هذا البحث استنتاجات مهمة للسيطرة على حوادث المرور من خلال تحديد أهم العوامل التي تؤدي إلى فقدان الأرواح والممتلكات. هذه العوامل لها تأثير مباشر على الظروف الاجتماعية والاقتصادية للمجتمع.

الكلمات المفتاحية: حوادث المرور، الوفيات الناجمة عن الحوادث، تحليل العوامل، اختبار بارتليت، المجتمعات.

Introduction:

It is important to recognize that traffic accidents are some of the most common occurrences in our lives, leading to serious injuries and sometimes even death. Road accidents are an important global problem that has negative impacts on society and political concerns. This brings us back to our previous argument. Thus, among other negligent reasons, traffic accidents are the main cause of drivers losing their souls.

According to Al Joborae and Al Humairi (2014), Iraq has the highest number of road accidents in the Middle East and ranks fourth globally. The country has a high-income population with a large number of automobiles. Many factors contribute to the high crash risk, including road and vehicle design, speed, driver skill and behavior, and impairment. These accidents often lead to fatalities and serious injuries. The rapid increase in motorization is a major factor in the problem. Policymakers must recognize this issue as a public health emergency and implement appropriate legislative solutions. The statistics are especially alarming for the Middle East, where there are 17 to 22 road fatalities for every 100,000 people each year.

Section One: Research Methodology

First: research questions: This study focuses on the number of traffic accidents and attempts to address the following questions :

1. What are the variables that mainly determine the severity of traffic accidents in Erbil ?
2. What is the impact of these variables on the Road Events Server?

Second: Objectives of the Study: The overall objective of this study is to identify the factors that cause traffic accidents in Erbil.

Specific objectives include:

1. Classify and explain the major factors that contribute to the causes of traffic accidents.
2. Factor analysis is important as a statistical measure in determining the order of the effect of variables.

Third: The Aim of the Study: The importance of the study lies in the reasons why the phenomenon of traffic accidents in a situation that needs to be investigated

with the following:

1. The rate of traffic accidents and the number of victims has increased dramatically, as it constitutes the highest rate, especially in recent years.
2. Lack of research on the phenomenon of traffic accidents in Iraq, especially in Erbil province
3. Most studies generally only cover the number of accidents, without considering the causes of traffic accidents.

Section Two: Theoretical Framework

First: Background: Traffic accidents are common and can result in injuries, deaths, and property damage. Many factors contribute to the risk of car crashes, including vehicle and road design, driving speeds, road conditions, and driver behavior. Motor vehicle accidents can result in fatalities, disabilities, and financial costs to both individuals and society.

The GSP on Safety 2023 projections state that more than 1.9 million people lose their lives while traveling worldwide. In the meantime, the research claims that millions have suffered severe injuries and are dealing with long-term negative health effects. The leading cause of death for young people, particularly those between the ages of 15 and 29, is traffic accidents. Nonetheless, the study projected that by 2030, traffic accidents would rank

seventh among all causes of mortality, having been forecast to be the ninth factor across all age categories.

Second: Statement of the Problem/ Justification: A vehicle collision also referred to as a traffic accident, might involve a car colliding with another vehicle, a pedestrian, or just one vehicle operating alone on the road without the involvement of any other road users, like a tree or utility pole. Accidents involving vehicles may include injuries, fatalities, and property damage. Road traffic accidents seem to be a persistent global issue, resulting in fatalities, serious injuries, and destruction of property (Guide, 2004, 4).

The General Directory of Traffic Police reports that, in 2023, there were 4496 total road traffic accidents reported, with 1538 (34.2%) occurring at night and 2958 (65.8%) occurring during the day. Overspeed limits are thought to be a major contributing reason to the higher number of accidents each year, even if there are 2240 accidents in rural areas and 2256 accidents in urban areas. In 2023, the number of accidents is depicted in Figure 1.1 below.

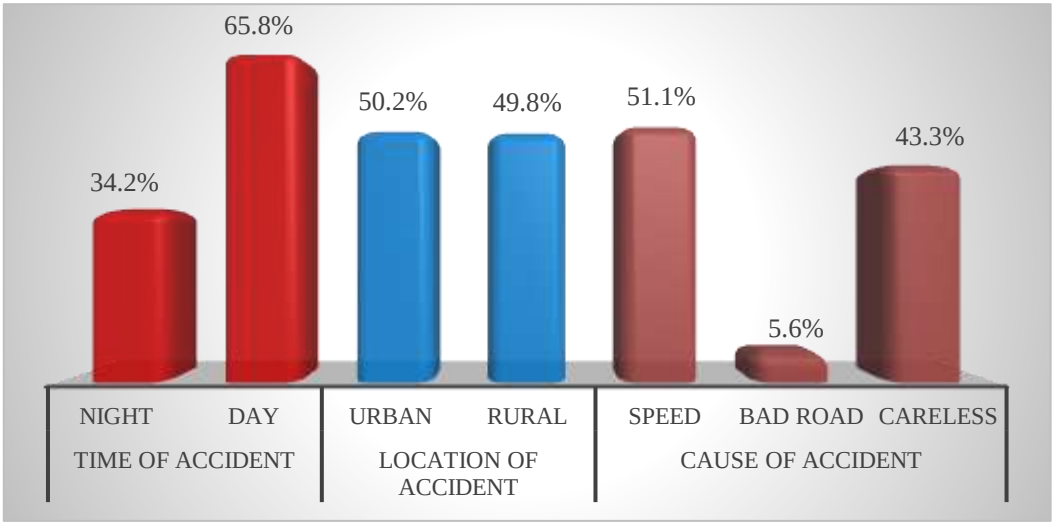

Figure (1): Number of accidents with reasons in the year 2023

Third: Factor Analysis: Factor analysis is one of the statistics methods, its goal is to search the complex phenomenon to find the most important extraction of factor, that affects it during the analysis of the relationship between variables of the investigated phenomenon (Watkins, 2018: 11)

Extraction of factors could be introduced as one of the branches of multivariate analysis that stands on a group of hypotheses, which is used for correlation and covariance to select hypothetical factors by relying on the

natural internal relationships among a group of variables in a certain time. Those variables also become a small number of main variables. Factor analysis is capable of reducing many variables and organizing them into hypothetical variables, which is opposite to common variance among variables that could be known as unconnected factors. By this, we are saved from the problem of multicollinearity (Al-Jubouri & Abdul, 2000).

Using the factor analysis method has expanded different aspects of life as a result of spreading variables vastly, like a phenomenon with internal relationships connecting it to itself. Explaining this by a mathematical example for analyzing the relationship of a large number of variables and illustration with a small number of factors, discovering some of the expected relationships which is a good beginning for implementing this command, that this is not important and oppositely it is right for reaching an important well-built based on statistical way. According to (Williams et al. 2010,10), there are two main types of factor analysis: confirmatory and exploratory.

Fourth: Concept Factor Analysis: In this research, we depend on factor analysis to find the most important affected factors in adding to the traffic accident phenomenon. Briefly, factor analysis is dependent on calculating the correlation coefficients between variables. where the correlation coefficients give a measure for the strength of this correlation between any variables, and an explanation of factor analysis may be useful in giving indicators of the type and nature of the relationship between any variables, however, at the same time it is unable to illustrate any variables affect with other variables. The purpose of using factor analysis is to determine the most important factors that affect the increase in traffic accidents based on the relationship among these variables and not based on dealing with any variable separately .

Factor analysis is supposed to correlate with variables resulting from shared factors affecting these variables and values of these correlations return to the reality of these variables correlation factors between any variables return the saturation nature of shared factors called (factors) and the degree of this saturation (Johnson and Wichern, 2013: 7).

As used in this research, the principal factor method is considered one of the most important factor analyses. It is applied using the principal component method but with a reduced correlation matrix (Widaman, 9). The basic idea

for analyzing this method is to find a new system for main variables and it is orthogonal with the navigable axis that creates a specific system.

It is called by main factor in engineering imagination for its growing up time. This idea referred to gaps of some variables in some axis (N) and during distribution multivariate normal as these variables are located on an oval surface based on its correlated factors .

the goal of factor analysis is to set variables (Zj) as linear relationships (or non-linear relationships) with some hypothetical linear variables (M) and the mathematical formula is:

$$Z_j = T_{j1}F_1 + T_{j2}F_2 \quad - - - - \quad T_{jn}\,F_m + \; T_{jn}\,K_jR_j$$

Where :

(Zj) is variables and (j=1, 2 …N) Represent common factors, and where (i= 1, 2,...M) is a phrase on operation relation of two of variables at least, as the number of common variables smaller at most or equal to the number of variables (M<= N) (Al-Jubouri and Abdul, 2000), (Hogarty et al., 2005). However, Tj represents the unique factor as the main factor for a single variable and only includes the quantity of variance or contrast. The factor (Kj Rj) represents the contribution rate of all common factors and special factors in each variable and is therefore referred to as factor loading, as it correlates the variables (Zj) with the common factors (Fi). Factor interpretation is important in factor analysis because these factors create separate linear axes and these axes create an orthogonal axis system. Counting measurement (M) at this field variables spread by coordinate points and these points refer to the saturation of factors. These factors do not spread randomly but in clusters. Suppose we rotate the axis by a right angle or acute angle. In that case, we will reach more explanation of factors. The most important method of rotation is orthogonal rotation. Its goal is to achieve a better saturation of factors by enlarging the value of reference of contrast by the amount of variance explanation (Garson, 2010;15).

Section Three: The Practical Side of Research

First: Data and Results: This chapter covers data collection methods, data organization for factor analysis, and key data analysis methods using SPSS.

1. **The questionnaires:** This study utilizes data to pinpoint the causes of traffic accidents and assess the impact of different causes on the frequency of traffic accidents. A questionnaire was developed for data collection, and participants who had been in a traffic accident were surveyed. The

questionnaire included 16 variables and was randomly distributed to participants in Erbil. Out of 300 distributed forms, 231 were accurately completed.

2. Results and discussion:

A. Descriptive statistics of the variables in the model

Table (1): Proportion and sex number of the sample

Gender	Frequency	Percentage
Male	178	77.8
Female	53	22.2
Total	231	100.0

The source: was prepared by the researcher based on the statistical program

This table explains that the percentage of male participants is higher, 178 out of 231 drivers. The rate of female participants is 53 out of 231 drivers.

Table (2): To what extent do drivers rely on the following factors to reduce traffic accidents?

Case	N	Mean	Std. Deviation
Y3	231	2.24	0.635
Y2	231	2.12	0.684
Y1	231	2.03	0.676
Y6	231	2.03	0.652
Y5	231	2.02	0.762
Y4	231	2.00	0.588
Y7	231	1.99	0.800
Y11	231	1.99	0.583
Y8	231	1.97	0.790
Y12	231	1.97	0.758
Y9	231	2.24	0.772
Y10	231	2.12	0.732
Y13	231	1.97	0.792
Y14	231	2.22	0.786
Y15	231	2.01	0.798
Y16	231	1.96	0.795

The source: was prepared by the researcher based on the statistical program

B. Model Results: The main purpose of using this analysis is to identify the most important causes (traffic accident effects), it is reduced to a small number called causes so that each cause of the causes is linked to all or part of the causes through this equation, we can interpret the variables according to their strong correlation with each other. The main idea of factor analysis is to reduce the number of interrelated factors to the original variable so that the factor explains the largest proportion of the difference in the original variables (Williams, Brown, et al., 2010: 10). The relationship between the original variables and the factors is expressed in the form of an equation as follows.

C. Bartlett's Test: The homogeneity of variances of the groups must be ensured for the correct application of variance analysis. This test is crucial for verifying factor analysis and determining the suitable model to represent the factor function between variables. It is clear from the table that we have obtained a KMO measurement value that is greater than (0.50) and this indicates an increase in the reliability of the factors that we obtain from the factor analysis. We also judge the adequacy of the sample size. We also find that the significance level value for the Barlett test of circularity is equal to (0.000) and is less than (0.05), confirming a statistically significant relationship, the factor analysis can be conducted.

Table (3): Factor analysis using the KMO and Bartlett's Test?

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.675
Bartlett's Test of Sphericity Approx. Chi-Square		543.016
	Df	120
	Sig.	0.000

The source: was prepared by the researcher based on the statistical program

Based on the table and using the Principal Components method, we analyzed the commonality coefficients of the variables. These coefficients are the squares of the correlation coefficients between the variables and the factors when considered as independent variables. This helped us calculate the explained variance values.

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Table (4): Factor analysis using the method principal components

Total Variance Explained						
Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.984	18.647	18.654	1.955	12.217	12.217
2	1.488	9.303	27.876	1.488	9.407	21.625
3	1.348	8.424	36.865	1.348	9.230	30.854
4	1.227	7.671	44.988	1.227	9.188	40.043
5	1.102	6.886	50.543	1.102	8.132	48.175
6	1.063	6.643	63.987	1.063	8.097	56.271
7	1.024	6.397	69.654	1.024	7.699	63.970
8	0.886	5.540	74.870			
9	0.849	5.307	79.432			
10	0.750	4.654	83.732			
11	0.657	4.107	90.521			
12	0.608	3.800	92.987			
13	0.568	3.342	94.309			
14	0.535	3.165	97.345			
15	0.507	2.543	100.00			
16	0.405	2.345				

The source: was prepared by the researcher based on the statistical program

The table above shows seven main (significant) factors affecting traffic accidents. These factor's value variance is greater than one, these seven factors explain 63.970% of the total variance, The factors summarized explain the variance but are important to identify effective variables to reduce traffic accidents.

D.Extraction: Factor extraction is the process of selecting a set of variables that explain the largest amount of total variance, which becomes the first factor. After extracting the first factor, the program then selects another set of variables that explain the largest amount of remaining variance, creating the second factor.

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Table (5): The factor summarized using the method Rotated Component Matrix

Rotated Component Matr								
	Component							
	1	2	3	4	5	6	7	Extraction
Y1	.150	-.185	-.437	.435	.187	.234	.111	.539
Y2	.766	-.188	-.148	.187	,098	.105	.221	.742
Y3	.516	-.145	.290	-.243	-.123	.236	.251	.583
Y4	.052	-.017	-.027	.064	.866	.082	-.073	.770
Y5	.185	-.028	.132	.100	-.081	.056	.769	.664
Y6	.148	.196	.232	.713	.065	-.156	.115	.643
Y7	.048	.107	.763	.190	.236	.209	.082	.743
Y8	-.078	.005	.089	.726	.-.049	.109	.065	.562
Y9	.204	-.074	.660	.198	.198	-.256	.143	.612
Y10	.578	.416	.187	.156	.065	.156	-.417	.631
Y11	.451	.104	.123	-.056	-.056	.098	-.069	.607
Y12	.632	.355	.145	.076	.075	.078	.-.069	.564
Y13	.065	.576	.014	.089	.078	.184	.0.23	.623
Y14	0.40	.784	.028	.078	-.040	.076	-.103	.669
Y15	0.50	0.87	0.16	.014	.052	.785	.037	.667
Y16	.160	.087	.011	.058	.013	.574	.050	.618

The source: was prepared by the researcher based on the statistical program

3. **Explanatory of the reasons:** To explain the factors that affect the occurrence of traffic accidents, we use the listed variables after rotation presented in the table (5)

❖ **The first reason:** This factor ranks first in importance explaining 12.217 % of the overall variance Variables that significantly affect the factor in order.

1. Y2 / Speed on the road affects traffic accidents by 0.766 and common value 0.766
2. Y3/ Poor roads affect traffic accidents by 0.632 and common value 0.564
3. Y10/ Alcoholic beverages affect traffic accidents by 0.578 and common value 0.631
4. Y12/ Trucks out of town affect traffic accidents by 0.516 and common value 0.583

❖ **The second reason:** This factor ranks second in importance explaining 9.407% of the overall variance Variables that significantly affect the factor in order.

1. Y14/ Failure to comply with traffic laws affects traffic accidents by 0.784 and common value by 0.669
2. Y13/ Driving at night affects traffic accidents by 0.576 and common value by 0.623

❖ **The Third reason:** This factor ranks third in importance explaining 9.230 % of the overall variance Variables that significantly affect the factor in order.

1. Y7/ Driving in the fog affects traffic accidents by 0.783 and common value by 0.743
2. Y9/ Use of mobile phones by drivers affects traffic accidents by 0.660 and common value by 0.612

❖ **The Fourth reason:** This factor ranks fourth in importance explaining 9.188 % of the overall variance Variables that significantly affect the factor in order.

1. Y6/ Driver fatigue affects traffic accidents by 0.726 and common value by 0.562
2. Y8/ Failure to obey a stop sign or red light affects traffic accidents by 0.713 and common value by 0.643

❖ **The fifth reason:** This factor ranks fifth in importance explaining 8.132 % of the overall variance Variables that significantly affect the factor in order.

1. Y4/ Problem with the vehicle affects traffic accidents by 0.866 and common value by 0.770

❖ **The sixth reason:** This factor ranks sixth in importance explaining 8.097 % of the overall variance Variables that significantly affect the factor in order.

1. Y15/ Temporary obstacle, animal, or infrastructure problem affects traffic accidents by 0.785 and common value by 0.667
2. Y16/ Street racing affects traffic accidents by 0.574 and common value by 0.618

❖ **The seventh reason:** This factor ranks seventh in importance explaining 7.699 % of the overall variance Variables that significantly affect the factor in order.

1. Y5/ Construction site affects traffic accidents by 0.769 and common value by 0.664.

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Section Four: Conclusion

According to the research that we have carried out, we reached these results:

During using factor analysis, it appeared that seven factors have the effect, from this aspect, we can determine the most important affected variables as follows:

1. **The first reason:** Determining the factors that have a significant effect, the variables that have a significant effect are (speeding affects traffic accidents, alcoholic drinks, bad roads, and Trucks out of town). This factor ranks first in importance explaining 12.217 % of the overall variance.
2. **The second reason:** Determining the factors that have a significant effect, the variables that have a significant effect are (Failure to comply with traffic laws and driving at night). This factor ranks second in importance explaining 9.407 % of the overall variance.
3. **The Third reason:** In determining the variables that have a significant effect, (driving at night and Failure to comply with traffic laws are the variables that have significant effects. This factor, which is responsible for 9.407% of the total variance, is ranked second in importance.
4. **The Fourth reason:** The variables that have a major impact include (driver fatigue and failure to obey a stop sign or red light), according to the analysis of the factors that have an impact. This factor, responsible for 9.18% of the total variance, is ranked fourth in importance.
5. **The fifth reason:** Determining the factors that have a significant effect, the variables that have a significant effect are (Problem with the vehicle). This factor ranks fifth in importance explaining 8.132 % of the overall variance.
6. **The sixth reason:** Determining the factors that have a significant effect, the variables that have a significant effect are (Temporary obstacles, animal, or infrastructure problems, and Street racing). This factor ranks sixth in importance explaining 8.0.97 % of the overall variance.
7. **The seventh reason:** Determining the factors that have a significant effect, the variables that have a significant effect are (Construction site). This factor ranks seventh in importance explaining 7.699 % of the overall variance.

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Appendices:

Questionnaire form

Salahddin University

College of Administration and Economics

M/ Questionnaire

The following form consists of several parts questions about a scientific study titled (Identification of factors that cause the victim of road accidents: a case study of Erbil city**(**Your answers to the entire questions are correctly very important for research

First: Personal information:

1. Age of driver's _____
2. Sex of driver's: Male (1) _____, Female (2) _____

Second: Questionnaire axes

N	Paragraphs	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
1	Is a driver's license important for a driver?					
2	Is speeding a cause of traffic accidents?					
3	Is poor roads a cause of traffic accidents?					
4	Does a Problem with the vehicle affect traffic accidents?					
5	Dose construction sites affect traffic accidents?					
6	Does driver fatigue affect traffic accidents?					
7	Does driving in the fog affect traffic accidents?					
8	Dose Failure to obey a stop sign or red light affect traffic accidents?					

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N	Paragraphs	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
9	Dose Use of mobile phones by drivers affects traffic accidents?					
10	Dose drinking alcohol a cause of traffic accidents?					
11	Is driving experience important for drivers?					
12	Do out-of-town trucks affect traffic accidents?					
13	Dose Driving at night affects traffic accidents?					
14	Does failure to comply with traffic laws affects traffic?					
15	Dose Temporary obstacle, animal, or infrastructure problem affects traffic accidents?					
16	Does street racing affect traffic accidents?					