



# Investigating the relationships between sensation-seeking and addiction with accident risk among professional drivers with structural equation modeling approach

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## Abstract

**Background:** A number of different risk factors for road traffic injuries have been identified following decades of research in the field of road traffic safety. Among the main risk factors, the personality characteristics of drivers have received much attention. Sensation-seeking personality is very common in drug addicts and is considered as a determining factor in increasing the risk of traffic accidents.

**Objectives:** This study aimed to investigate the relationships between sensation-seeking and addiction with accident risk among professional drivers with structural equation modeling approach.

**Methods:** This cross-sectional study was conducted on 303 professional drivers in Kashan city. Sensation-seeking trait was measured using the Zuckerman Sensation-Seeking Scale-V (SSS-V) (it consists of 40 forced-choice questions). Furthermore, a questionnaire was prepared to evaluate the number of accidents and socio-demographic factors. Structural equation modeling approaches using software Amos 24.0 were used to investigate the research hypothesis.

**Results:** According to the results, the average age of the participants was 43.15 years (SD=10.29), some of them were passenger vehicle drivers (20.1%) and the rest were cargo transport drivers (79.9%), most of whom were married (94%). Participants drove for an average of 11.3 years (SD=9.2) with an average speed of 85.9 km/h (SD=13.2). The sensation-seeking questionnaire had acceptable validity and reliability indicators (factor loading, Cronbach's alpha, composite reliability, average variance extracted were all higher than 0.7, 0.7, 0.5, 0.7). According to the results of the final model, there are significant and positive relationships between sensation-seeking and addiction and accident risk, as well as the fit indices of the model are good ( $\chi^2/df=2.79$ ; CFI=0.98; RMSEA=0.07).

**Conclusion:** There is a significant relationship between sensation seeking and addiction with the risk of accidents, therefore, a very important and primary issue in reducing road accidents and accidents is to know the prevalence and extent of occupational driving with drugs, in addition, it is necessary to further investigate the factors that lead to driving while taking drugs. Therefore, it is suggested that by examining the perceptions and attitudes of professional drivers, we will understand what causes this behavior in order to act as a deterrent for these behaviors by developing targeted educational strategies and also implementing relevant laws.

**Keywords:** Addiction, Professional drivers, Sensation-seeking, Risk of accidents.

## Introduction

Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years. Approximately 1.3 million people die each year as a result of road traffic

crashes. More than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists, and motorcyclists. One of the major economic, social and health challenges in many countries of the world,

including developing countries, is the use of illegal drugs (it refers to any domain of illegal drug use: heroin, amphetamines, barbiturates, hashish, cocaine, hallucinogens and opioids).<sup>[1]</sup> Substance use disorders are defined by a set of cognitive, behavioral and physiological symptoms that indicate the continuous drug use despite significant drug-related problems<sup>[2]</sup> and are considered as one of the most important risk factors for communicable diseases, non-communicable diseases, road traffic crashes and traffic accident-related mortality.<sup>[3]</sup>

United Nations Office on Drugs and Crime (UNODC), The United Nations Office on Drugs and Crime is a global leader in the fight against illicit drugs, international crime, and terrorism, in 2016, reported that more than 31 million people in the world had drug use disorders, with an estimated 450,000 deaths, of which 16,750 were directly due to overdose. Also, in that year, about 22 million people died due to premature death or disability due to substance abuse disorders.<sup>[4,5]</sup> According to the World Health Organization, Iran has the highest opium consumption rate in the world, and the consumption of opium in Iran is three times the world average.<sup>[6]</sup> According to statistics, about 2 million people in Iran use narcotics every day, which constitutes about 2.7% of the country's population.<sup>[7]</sup> There is a significant relationship between substance dependence and various mental disorders, but it is still a matter of discussion and research to what extent these disorders are the result of chronic drug abuse, even though they are a predisposing risk factor for drug use.

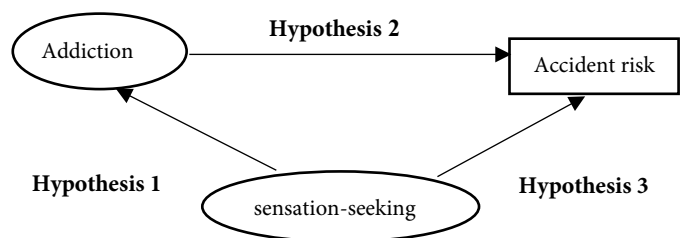
According to the previous studies, the personality trait of sensation-seeking is very common in drug addicts, and it has been considered as the determining factors and consequences of drug abuse.<sup>[8,9]</sup> In the study,<sup>[10]</sup> the relationship between drug abuse and its relationship with sensation-seeking and high-risk driving style was investigated and it was found that people who have consumed drugs have shown high-risk and sensation-seeking behaviors while driving. Sensation-seeking, which is defined as "a characteristic that has a desire for variety, complexity, excitement, gaining experience and taking risks to gain experience, is one of the most important personality traits in driving accidents".<sup>[11]</sup> Many researches have reached the conclusion that sensation-seeking people seek to reach their low level of arousal to an optimal level by participating in dangerous activities. Sensation seekers are constantly looking for new and fresh stimuli in their living environment and are ready to get it in any way, even after going through difficult steps, exposing their social prestige and even their physical health and life.<sup>[12]</sup> Zuckerman has introduced a tool to measure this scale. He

believes that sensation-seeking has the following four dimensions: Adventure, Experience Seeking, Boredom Susceptibility and disinhibition.

A number of different risk factors for road traffic injuries have been identified over decades of road traffic safety research. Some of the main risk factors include unauthorized speed, driving under the influence of alcohol, illegal drugs or drugs, not wearing a seat belt or helmet, and other demographic factors.<sup>[13]</sup> Jonah 1997 reviewed 40 studies to investigate the effect of stimulation seeking and risky driving behavior. He concluded that in almost all of these studies-except 4 - a positive relationship was reported between stimulation seeking and risky driving behaviors, and the strongest relationship was between sensation-seeking and adventure components with risky driving. This relationship has been observed in the drivers of Canada, America, England, Holland, Sweden and Finland among women and men.<sup>[14]</sup>

The importance of road traffic accidents is doubled when it can threaten the health and life of another person in addition to threatening the life of the person. Obviously, it is possible to reduce the rate of traffic accidents by taking the necessary measures by identifying the types of risk factors and determining the contribution of each one in the increase of the aforementioned accidents, as well as identifying the factors affecting them. Risky driving behaviors, which are mainly caused by drug use, are the second cause of death and the first cause of lost years of life due to premature death and disability in Iran.

Hypotheses and research model [Figure 1], 1- There is a positive and significant relationship between sensation-seeking and addiction. 2- There is a positive and significant relationship between addiction and the risk of car accidents. 3- There is a positive and significant relationship between sensation seeking and the risk of car accidents.



**Figure 1.** Research conceptual model

## Objectives

This study aimed to investigate the relationships between sensation-seeking and addiction with accident risk among professional drivers with structural equation modeling approach.

## Methods

This research is considered as a cross-sectional-correlational research. Considering that the aim of the present research is to test the theoretical model, the research is considered as structural equation research. The sample size should be several times as large as the number of variables in the study, it depends on the type of study and the number of variables in the structural equation analysis as recommended by the researcher.<sup>[15]</sup> There are a total of 55 observed variables in the present study. Therefore, at least 300 samples are needed. In this study, the subjects were increased to 320 people to reduce sampling error and prevent dropout. After filling the incomplete questionnaires, finally 303 questionnaires entered the final analysis.

### Population and sampling method

In the present study, the statistical population includes professional suburban drivers in Kashan city. Convenience sampling method was used in the present study. In this way, the required information was collected from different groups of heavy vehicle drivers, including trucks, trolleys, trucks, buses, by referring to drivers' gathering centers, such as Occupational Medicine clinic, Kashan truck drivers' cooperative, and Kavir Aran and Bidgol steel company. Throughout the duration of the study, the researchers tried to observe all the ethical considerations related to the subjects.

### Sensation-seeking trait of the participants

The Zuckerman Sensation-Seeking Scale-V (SSS-V) consists of 40 forced-choice questions was designed by Zuckerman in 1971, which has 4 subscales: disinhibition, boredom susceptibility, adventure and experience seeking. In order to score Zuckerman's excitement seeking questionnaire, one must first extract the scores obtained from each question based on the test key.<sup>[16]</sup> This scale has been standardized by Majid Mahvi Shirazi in 2017 based on Iranian culture. The total variance of the questions is 8.577, the total variance of the test is 21.02, the standard deviation of the scale is 6.24, the validity of the total test (Cronbach's alpha) is 0.78, and the standard error of the total test is 2.92.<sup>[17]</sup>

### Personal and occupational characteristics and accident risk of the participants

Questions are asked about the duration of driving day and night, week and year, the average speed of driving and driving at night, having a history of accidents while driving, the result and its severity. Also, individual

characteristics include questions about age, education status, marital status, history of drug use, smoking and alcohol, and history of illness. (Do you have a history of drug use? Yes and No)

The structural equation modeling method was used in the present study to investigate the causal relationships between the research variables. The implementation of analysis in the structural equation model includes two general steps: confirmatory factor analysis to check the research measurement model, and then the structural equation model to test the hypothesis of the model:

Some assumptions of structural equation modeling are: checking the correlation between variables with the help of Pearson correlation test, the normality of the data used with the help of Kolmogorov Smirnov test, KMO and Bartlett test to check the adequacy of the sample size and the suitability of the data for modeling.

### Initial review of research data

The indices of skewness coefficient (for symmetry of mean) and kurtosis coefficient (for peakedness of a distribution) were used to check the normal distribution of data. According to the results obtained from the kurtosis and skewness, all dimensions of the research are in the numerical range ( $\pm 1$ ), which indicates the symmetry of mean, as well as the normal distribution of the data from a descriptive point of view. Also, the results of Pearson correlation analysis also indicated that there is a positive and significant relationship between research variables and accident risk.

Kaiser-Meyer-Olkin (KMO) value varies from 0 to 1. KMO value greater than 0.6 indicate the sampling is adequate. Since the value of KMO index is equal to 0.963 and its significance level is 0.0, it was concluded that the number of respondents (number of sample members) in this research is sufficient for model analysis. Also, the significance of the Bartlett test indicates the suitability of the data for modeling.<sup>[18,19]</sup>

### Investigating the validity of the measurement model

Confirmatory factor analysis with the help of AMOS software is used to check the validity of the measurement model. Based on the results, factor loadings are calculated by calculating the correlation value of the indicators of a structure; if this value is equal to or greater than 0.4, it confirms that the variance between the structure and its indicators is greater than the variance of the measurement error of that structure, and the validity of that measurement model is acceptable. As shown in Figure 2, which shows the confirmatory factor analysis of the

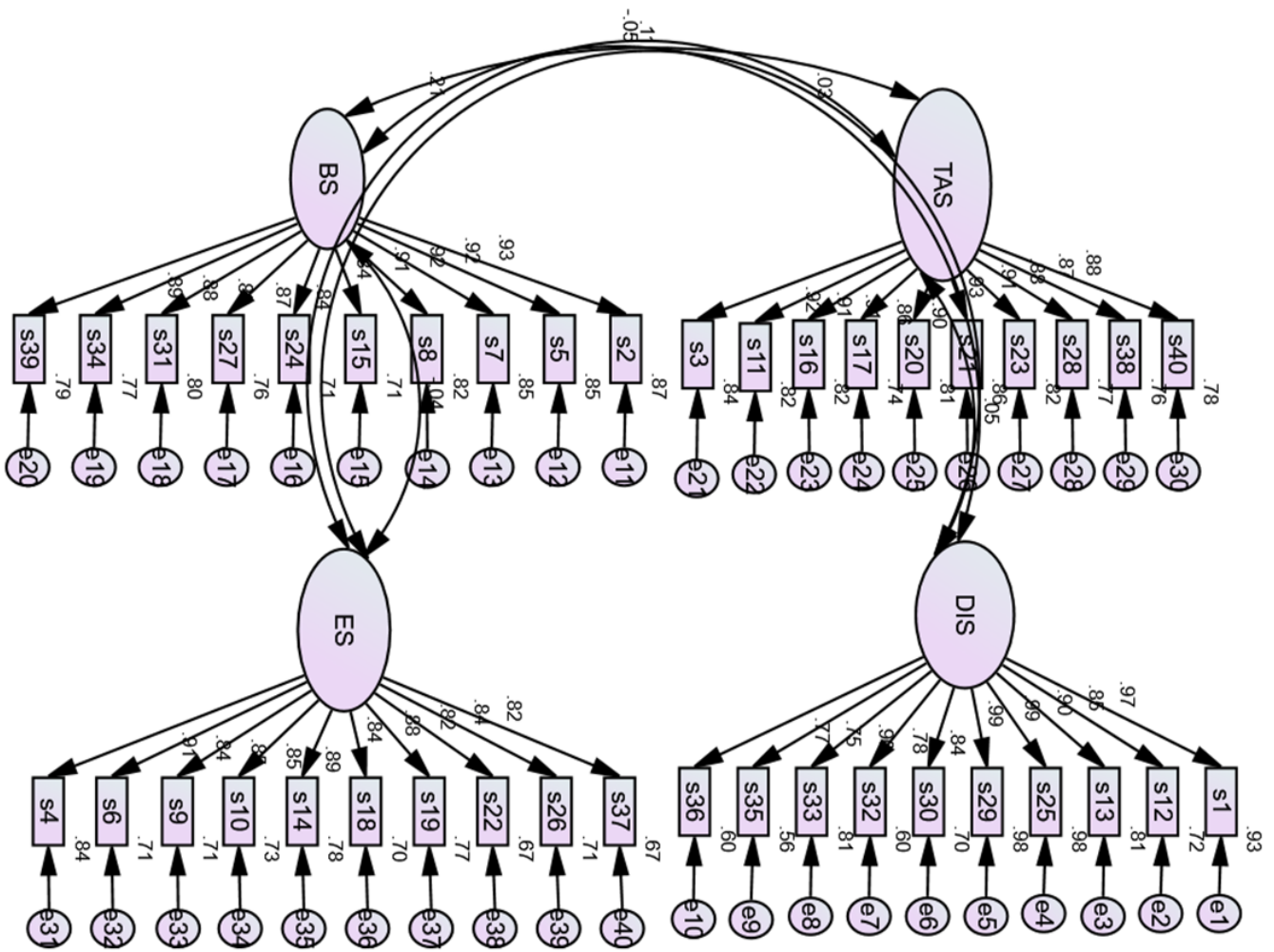
sensation-seeking questionnaire, all the factor loadings of the research constructs are greater than 0.7, this confirms that the variance between the construct and its indicators is greater than the variance of the measurement error of that construct, and it is acceptable for that measurement model.

The following research model fit indices were used to check the goodness of fit of the measurement model, the ratio of chi-square to the degree of freedom (2.792), which is lower than 5, indicating the optimal fit of the research model, the root mean square error of approximation (0.0770), which is lower than 0.08. The acceptable value of the goodness of fit criteria and its adjusted limit (0.95 &

0.95), normalized fit criteria (0.9610), comparative (0.9740), additional (0.9740) and relative fit criteria (0.9310) in the model fit levels should be more than 0.9,<sup>[18,20]</sup> which shows that in the measurement model of the excitement seeking questionnaire all indicators were in the acceptable range, indicating an acceptable fit level. The results are presented in Table 2. All

**Ethical consideration**

The study was conducted in accordance with the Declaration of Helsinki. Institutional Review Board approval (code: IR.KAUMS.NUHEPM.REC.1397.047) was obtained.



**Boredom susceptibility, Adventure  
Experience seeking, Disinhibition**

**Figure 2.** First-order confirmatory factor analysis of sensation-seeking questionnaire

**Investigating the reliability of the research questionnaire with the help of Cronbach's alpha (α), combined reliability (CR) and average variance extracted (AVE) indices**

Cronbach's alpha is considered as a classic criterion for measuring reliability and checking internal stability (internal consistency). The high value of explained variance between the construct and its indicators versus



the measurement error related to each indicator results in high internal consistency. A Cronbach's alpha value higher than 0.7 is an acceptable indicator of reliability. As, the Cronbach's alpha criterion is a traditional criterion for determining the reliability of constructs, a more modern criterion can be used than Cronbach's alpha called composite reliability. Its superiority over Cronbach's alpha lies in the fact that the reliability of the constructs is not calculated in absolute terms, but according to the correlation of their structures with each other. If the value of CR for any construct is above 0.7, it indicates adequate internal stability for measurement models, and a value less than 0.6 indicates the absence of reliability.<sup>[18,19]</sup>

According to the results of Table 1, Cronbach's alpha for all questions of the sensation-seeking questionnaire is 0.77. For the subscales, it was at an acceptable level above 0.7, and the combined reliability index for the sensation-seeking subscales was above 0.7. Average variance extracted; this index was proposed by Fornell, C., & Larcker, D. F. in 1981.<sup>[20]</sup> The validity of the convergence is checked based on the external model and by calculating the average variance of the sensation. The extracted average variance index shows the average variance shared between each construct with its indicators. In simpler terms, AVE shows the correlation value of a construct with its indicators, as the correlation increases, the fit increases. Fornell, C., & Larcker, D. F. believe that convergent validity exists when the average variance extracted is greater than 0.5,<sup>[3]</sup> which is why the sensation-seeking questionnaire has high convergent validity (Refer to Table 1 for more details).

$$AVE = \frac{\sum \lambda^2}{n} \quad CR = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \sum \delta}$$

**Table 1.** The results of correlation, mean and standard deviation and combined reliability indices and Cronbach's alpha of the sensation seeking questionnaire scales

No		1	2	3	4	5	Mean and standard deviation	Cronbach's alpha	Composite reliability	average variance extracted
1	Adventure	1					13.50±5.12	0.968	0.971	0.771
2	Experience seeking	0.385**	1				15.06±5.66	0.975	0.976	0.803
3	Boredom susceptibility	0.383**	0.274**	1			15.74±5.16	0.976	0.975	0.794
4	Disinhibition	0.467**	0.401**	0.413**	1		14.31±5.19	0.964	0.964	0.729
5	c-seeking	0.377**	0.304**	0.428**	0.451**	1	56.18±9.21	0.772		

## Results

In this study, questionnaires with missing data were discarded 17 (320 questionnaires were distributed among the participants), and the number of questionnaires was reduced to 303. According to the descriptive statistics of the participants, the average age of the participants was 43.15 years (SD=10.29) and the maximum and minimum age was 21 to 75 years, which included passenger vehicle drivers (20.1%) and commercial and cargo vehicle drivers (79.9%). Most of the participants were married (94%). Participants had an average of 11.3 years (SD=9.2) of work experience, and drove at an average speed of 85.9 km/h (SD=13.2). The average daily driving rate of professional drivers was 11.73 hours (SD=3.92) in one day and 5.15 days (SD=1.58) of driving in one week. Correlations were calculated to explore interrelationships between variables [Table 1]. There was a positive and significant correlation between sensation-seeking variables (ie Boredom susceptibility, Adventure, Experience seeking, Disinhibition) (P<0.01).

Figure 2 shows the structural model of the research, according to the SEM results, this model explains 65% of the variance of the accident risk.

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According to the estimation results, the investigated model was in the acceptable range, indicating an acceptable fit level) the results of fit indices are shown in table). According to the model 2-related results, there was a positive and significant relationship between sensation-seeking trait with accident risk (β=0.50) and addiction (β=0.75) in heavy vehicle drivers. Also, there was a positive relationship between addiction and accident involvement (β=0.37).

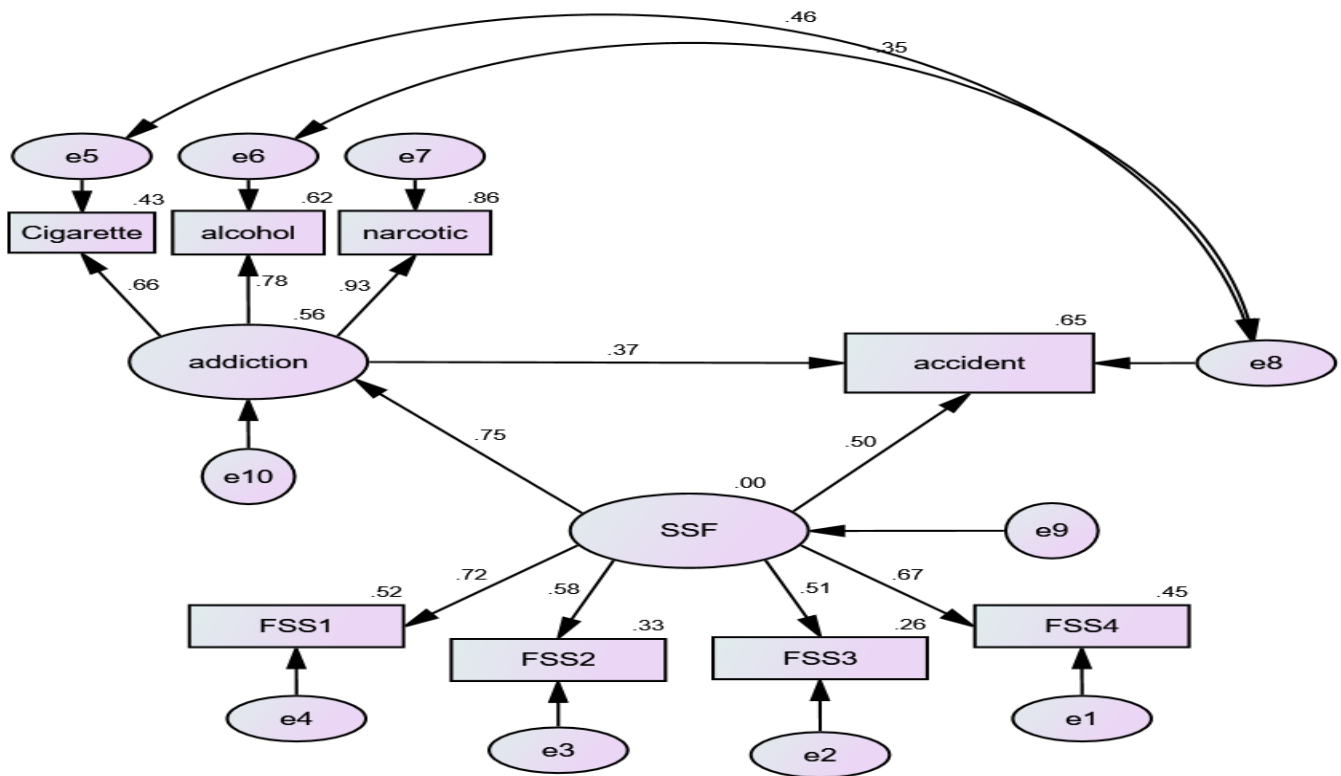


Figure 3. The final research model

Addiction	Smoking	Sensation-seeking	FSS1: Adventure
	Drugs abuse		FSS2: Experience seeking
	Alcohol abuse		FSS3: Boredom susceptibility
	FSS4: Disinhibition		

Table 2. Fit indices of the final model and the structural model of the research

Fit indicators	Recommended amount	Measurement model	Structural model
X <sup>2</sup>		2495.458	44.679
(X <sup>2</sup> /df)	1-3	3.400	2.792
(CFI)	≥0.90	.984	0.974
(NFI)	≥0.90	.957	0.961
(TLI)	≥ 0.90	0.914	0.955
(RMSEA)	< 0.08	0.08	0.077

### Discussion

The aim of the present study was to investigate important risk factors that can predict involvement of heavy vehicles in traffic accidents. Major findings show that sensation-seeking had a significant relationship with road traffic crashes ( $\beta=0.50$ ) and addiction ( $\beta=0.75$ ) probability. In addition, addiction had a significant relationship with road traffic crashes ( $\beta=0.37$ ). The findings of this study were based on a review study, which revealed that the

prevalence of opioids among injured drivers increased significantly, approximately 1 to 7%, between 1995 and 2016. The co- presence of opioids and alcohol in people involved in road traffic crashes was rare, according to the published information. However, the limited data available suggests that up to 30% of opioid-involved crash subjects also tested positive for alcohol, which agrees with the results of our study. These findings are alarming and highlight the deadly consequences of driving under the influence of alcohol.<sup>[21]</sup> This study was conducted to investigate the relationship between the consumption of addictive substances and sensation seeking in the risk of traffic accidents. Previous researches have shown that alcohol impairs driving performance based on the amount of the consumed dose. Therefore, these people have less self-control over their behavior.<sup>[22,23]</sup> Driving while impaired by these substances is considered a threat to road safety, because it increases the risk of accidents,<sup>[24,25]</sup> and the risk of fatal injuries.<sup>[26]</sup> These people do not understand well the risks of their unsafe behaviors due to their high consumption. A literature review on drunk driving shows

that 72% of participants who had consumed higher amounts of alcohol believed they would not be stopped by the police, and 25% of participants drove without a license after obtaining their driver's license due to drunk driving.

Furthermore, drunken drivers who crash or violate traffic laws are responsible for frequent accidental accidents. They found that drivers who drove under the influence of alcohol more than once had more sensation-seeking traits than drivers who drove under the influence of alcohol only once.<sup>[27]</sup> It can be concluded that this is the result of the sensation-seeking personality of these people. According to the results of the studies, people with high-risk personalities as sensation seekers reported high speed and more dramatic movements while driving.<sup>[28]</sup> Also, similar results were reported in the studies of Schaubel et al. in 2006, which observed many dangerous traffic violations, including high speed and showmanship while driving in drivers suffering from boredom.<sup>[29]</sup> According to the results of Jonah's study, people with more excitement than drivers with less excitement have reported more dangerous behaviors, including driving at speed, not wearing a seat belt while driving, and driving after drinking alcohol.<sup>[14]</sup> Samar Sal showed in his study that there is a significant and direct relationship between the personality traits of excitement and high speed in driving.<sup>[30]</sup> According to the results of Verma's study, people with high and low levels of boredom are prone to conflict in road accidents.<sup>[31]</sup> Boredom due to long journeys, monotonous driving, sleepiness and lack of sleep especially at night plays an important role in bus drivers turning to drugs and psychedelics. Hajlo and Jafari<sup>[32]</sup> concluded in a study that excitement seeking and perceived negative stress are more in drug addicts than healthy people. In their study, Yaqouti Zargar and Ahmadi<sup>[33]</sup> showed that there is a positive and significant relationship between the total score of sensation seeking and its subscales with the tendency to use drugs. In their study, Ashish et al. suggest that with appropriate engineering interventions in the design of highways, the risks of boringness can be minimized by providing gentle curves in the design of the road to break the monotony of driving and warn drivers. Drivers working for long journeys should be forced to take adequate breaks during each long journey. Also, computer technology such as "electronic stability program" (as proposed by Wan) can be incorporated into vehicles to periodically adjust the steering control as well as the vehicle's driving speed to avoid crash hazards.<sup>[34]</sup>

There are some major limitations in this study. One limitation is that the samples used are unlikely to be

representative of the population of drivers as a selection bias. This would certainly affect the parameter estimates in the multiple regression analyses, and in general the effect would be to diminish any observed relationships. Also, with regard to the self-report of data, there is an additional possible concern about the accuracy of the memory of participants when asked to recall accidents over a three-year period lead to recall bias. However, West has argued, interpretation of self-report data only becomes problematic when there is a reason to suggest that any bias or error could plausibly account for the reported findings.

## Conclusions

The findings of the present study reveal that addiction and sensation-seeking was an important predictor of driving accidents ( $R^2=65\%$ ). An important step in reducing road accidents and serious injuries is to obtain appropriate statistics regarding the prevalence and extent of drug driving, but it is also necessary to gain insight into the background factors like sensation seeking that may lead to drug driving. It is suggested that people's perceptions and attitudes about drugged driving (for both legal and illegal drugs) be investigated to help us understand what drives this behavior, and to inform the development of targeted educational strategies. Also, law enforcement is often used as a deterrent to unsafe driving behaviors.

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## Competing interests

The authors declare that they have no competing interests.

## Abbreviations

Sensation-Seeking Scale-V: SSS-V;

United Nations Office on Drugs and Crime: UNODC.

## Authors' contributions

FK: concept, design, definition of intellectual content, manuscript editing and manuscript review. FK & PKH: literature search, data acquisition, data analysis, manuscript preparation, manuscript editing and manuscript review. HA & MHN: data analysis, statistical analysis, manuscript preparation, manuscript editing and manuscript review. MHN, FK, HA and KA: manuscript editing and manuscript review. All authors read and approved the final manuscript.

All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

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### Role of the funding source

None.

### Availability of data and materials

The data used in this study are available from the corresponding author on request.

### Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. Institutional Review Board approval (code: IR.KAUMS.NUHEPM.REC.1397.047) was obtained.

### Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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