






# Predicting Iranian road accidents: application of the theory of planned behavior

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## Abstract

**Objectives:** The aim of this research was to investigate the application of the theory of planned behavior (TPB) in predicting the influential factors in Iranian road accidents.

**Methods:** This cross-sectional, descriptive-analytical study involved a population of 240 Iranian drivers, with a mean age of 39.1 years and a mean driving experience of 16.5 years, selected through a convenient available sampling method. The study utilized questionnaires based on the theory of planned behavior construct and Manchester Driving Behavior. The collected data were analyzed using one-sample t-tests, Pearson correlation, and linear regression in SPSS version 26.

**Results:** The findings indicated that 62% of driving behavior variance could be predicted by the variables of attitude, behavioral intention, and drug abuse. Additionally, drug abuse and drunk driving were significant factors in determining the attitude and behavior of drivers.

**Conclusion:** The theory of planned behavior is a suitable conceptual framework for planning interventions to reduce traffic accidents. This study highlights the most important predictors of drivers' behaviors leading to accidents and identifies the relationships between them to reveal the main priorities. Based on the results, policymakers and stakeholders can plan effective and practical interventions to reduce casualties and promote compliance with accident prevention behaviors.

**Keywords:** Theory of planned behavior, TPB, Road accidents, Traffic accidents, Iran.

## Introduction

The health system considers traffic accidents and the resulting injuries as one of its primary concerns.<sup>[1]</sup> These accidents have been a leading cause of death worldwide for the past two decades, accounting for approximately 2.5% of all deaths.<sup>[2]</sup> Recent statistics show an increase in traffic-related injuries in Iran, with rates significantly higher than the global average.<sup>[3]</sup> Despite Iran's population being less than 1% of the world's population, the rate of driving-induced injuries is more than double the world average.<sup>[4]</sup>

<sup>5]</sup> Additionally, preventable factors contribute to around 60% of driving accidents.<sup>[2]</sup> Therefore, it is crucial for Iran to identify the factors that lead to road accidents accurately and design effective interventions to control preventable

factors.<sup>[6]</sup> Road injuries are impacted by a variety of factors, including the availability of roadside emergency and pre-hospital services, monitoring systems, the quality of automotive goods, and driver and passenger adherence to driving restrictions.<sup>[7,8]</sup> These factors can be categorized into behavioral, political, or environmental aspects, including personality factors, driving experience, subjective norms, and perceived behavioral control.<sup>[9-12]</sup>

However, it is crucial to accurately identify these factors and take effective measures to improve and manage them in order to effectively reduce road accidents. The first step in significantly reducing accidents is to accurately predict these factors.<sup>[13]</sup> Predictive models serve as a valuable tool in this regard, providing policymakers with informed

insights to make effective decisions that align with their objectives. Additionally, employing a comprehensive model can help determine the priorities and key factors contributing to road accidents, enabling targeted interventions to effectively reduce them.<sup>[14]</sup>

The theory of planned behavior (TPB) is a well-known theory in social psychology that focuses on attitude and behavior.

It is strongly supported by practical evidence.<sup>[15]</sup> By categorizing factors at individual, legislative, and social levels, the model of planned behavior predicts road accident-related factors and effectively promotes them through developed interventions.<sup>[15-17]</sup> This model considers individual attitudes toward conduct, subjective norms perceived by society, and environmental elements that influence behavior. The TPB is responsible for determining the behavioral intention and forecasting the compliance of the audience with desired behaviors based on this.<sup>[17,18]</sup> Numerous studies in recent years have highlighted the efficacy of this theory in predicting safe driving behaviors and reducing road casualties.

In 2019, a study conducted by J. Bordarie demonstrated the effectiveness of TPB in regulating the speed of drivers involved in traffic accidents.<sup>[16]</sup>

Additionally, Wishart et al. applied this theory in 2022 to predict the intentions of drivers to speed in roadwork zones versus school zones.<sup>[19]</sup> Consequently, TPB is employed to forecast the factors that influence road accidents, and the selection of this theory is attributed to the compatibility of its constructs with the factors that impact traffic accidents.

## Objectives

The objective of this study is to identify and predict the behavioral factors that contribute to road accidents in Iran using TPB.

## Methods

In 2022, a descriptive-analytical study was conducted to investigate inter-road accidents in Iran. The study focused on heavy and light truck drivers who were traveling between the routes of Kerman-Yazd and Isfahan-Yazd. The participants were required to meet the inclusion criteria of being a volunteer and a driver of either a light or heavy truck. Any participant who did not complete the questionnaire form appropriately had their response excluded from the study.

The available sampling approach was utilized due to the high volume of cars on the road each day and the absence

of a specific list of drivers. To ensure statistical validity, a sample size of at least 200 drivers was determined based on previous studies<sup>[20,21]</sup> and the recommended sample size for descriptive studies.<sup>[22]</sup>

Initially, the necessary preparations were carried out with the traffic department and police authorities on the highways of Yazd-Kerman and Yazd-Isfahan. Subsequently, four surveyors were stationed at the road police stations on these highways from 8:00 a.m. to 1:00 p.m. daily for a period of 30 days. The surveyors obtained both verbal and written consent from the drivers before administering the questionnaires. They then provided a brief explanation of the survey to the participants and requested that they complete the questionnaire. This process was repeated until 240 questionnaires were collected.

Data on the TPB constructs and driving behavior were gathered using two questionnaires. Ashoogh and Aghamolaei<sup>[20]</sup> have confirmed the validity and reliability of the TPB questionnaire in predicting safe driving behaviors. In their research, they employed the Cronbach's alpha method to assess the questionnaire's reliability, which was confirmed at 86% based on responses from 30 participants. The survey was divided into two sections. The first section gathered demographic information such as age, education, driving experience, drug use, number of fines, and accidents in the past three years. The second section focused on the constructs of TPB, which included attitude, subjective norms, perceived behavioral control, and behavioral intention. The attitude section consisted of 12 questions, the subjective norms section had eight questions, the perceived behavioral control section had six questions, and the behavioral intention section had eight questions. All sections were scored on a 5-point Likert scale. To evaluate driving behavior, the Iranian version of the Manchester Driving Behavior Questionnaire (MDBQ) was used, which consisted of items scored on a six-point Likert scale from 0 to 5. The questionnaire's validity and reliability have been confirmed in Iran,<sup>[23]</sup> with a Cronbach's alpha coefficient of 0.90.

The data was analyzed using SPSS (version 16.0, SPSS Inc, Chicago, IL, USA). To predict safe driving behaviors based on the TPB, one-sample t-tests, Pearson's correlation coefficient, and linear regression were employed. The continuous variables were expressed as the mean  $\pm$  SD, and the categorical variables were presented as a percentage and frequency. A "P-value" less than 0.05 was considered significant.

In addition, the ethics committee of Yazd University of Medical Sciences (approved Code:

IR.SSU.SPH.REC.1401.042) granted approval for the current study. Participants were duly informed about the study and provided written consent. The questionnaires ensured anonymity, and the data collected was treated with the utmost confidentiality. The study was conducted in accordance with the Declaration of Helsinki.

## Results

There was a total of 240 Iranian inter-road drivers who participated in the study, consisting of 202 (84.1%) men and 38 (15.9%) women. The average age of the participants was  $39.1 \pm 10.1$ , and their average years of driving experience were  $16.5 \pm 9.3$ . More than half of the participants were solely employed as drivers. On average, they had received  $6.1 \pm 10.0$  driving fines in the last three years, and the average number of accidents they had been involved in during the same period was  $0.34 \pm 0.9$ . Additionally, the average number of accidental injuries they sustained was  $0.09 \pm 0.5$ . Out of the participants, 72.3% had completed either a diploma or university

education. Furthermore, over 50% of them reported smoking cigarettes or using a water pipe [Table 1].

The driving behaviors were most accurately predicted by the construct of behavioral intention ( $\beta=0.524$ ). Furthermore, there was a notable correlation between the attitude structure ( $\beta=0.122$ ) and driving behavior, as indicated in Table 2.

Table 3 demonstrated a positive and significant correlation between the constructs of TPB and demographic variables, particularly between attitude and behavioral intention with driving behavior, as well as with drunk driving and drug abuse. These factors were found to be determinants of the behavior and intention of drivers. Furthermore, Table 4 demonstrated that attitude, behavioral intention, and drug addiction could explain 62% of the variation in driving behavior. In addition, Figure 1 showed that only 31.7% of drivers utilize seat belts, 55% drive at the speed limit, 7.5% do not use mobile phones while driving, and 30.8% are distracted while driving.

**Table 1.** Characteristics participants in the study (N=240)

Variables		Frequency (%)	P value	Variables	Mean (S.D)	Min	Max
Sex	Male	202(84.1)	<0.0001	Age	39.1(10.1)	19	71
	Female	38(15.9)					
Marital status	Single	51(21.3)	0.525	Frequency of driving experience*	16.5(9.3)	1	41
	Married	189(78.7)					
Residence	City	171(71.3)	0.150	Number of Driving fine*	6.1(10.4)	0	50
	Suburb	62(25.8)					
	rural	7(2.9)					
Education	Illiterate	10(4.2)	0.843	Number of accidents**	0.34(0.98)	0	8
	Elementary	18(7.5)					
	high school	32(13.3)					
	Diploma	109(45.4)					
	University	71(29.6)					
Smoking life time use	Yes	123(51.3)	0.002	Number of accidental injuries**	0.09(0.5)	0	7
	No	117(48.8)					
Drug abuse	Yes	22(9.2)	0.001	Monthly income***	16.3(3.5)	14	20
	No	218(90.8)					
Drunk driving	Yes	14(5.8)	<0.0001				
	No	226(94.2)					

\*(year), \*\*(Last 3 years), \*\*\* (million Rials)

**Table 2.** Regression analysis of the behavior predictors of the population in the framework of the TPB

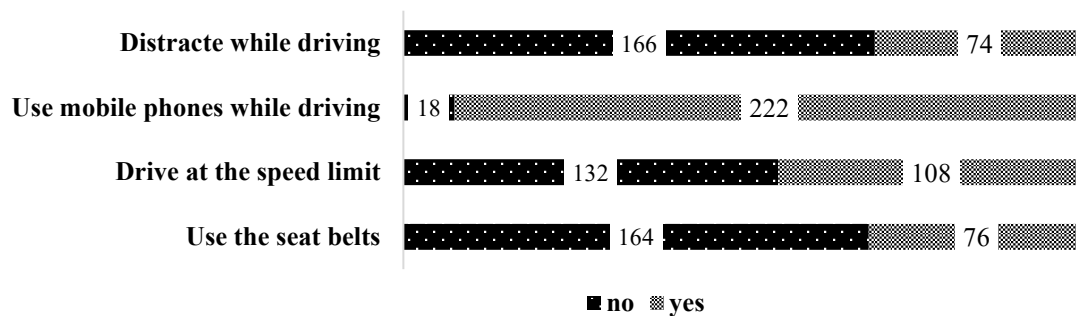
Variables	$\beta$	P-value	R <sup>2</sup>
Attitude	0.122	0.040	0.411
Abstract norms	-0.028	0.625	
Perceived behavioral control	0.08	0.247	
Behavioral intention	0.524	<0.0001	

**Table 3.** Correlation between TPB predictor constructs and demographic variables in the population

variables	Attitude		Behavioral intention	
	$\beta$	P value	$\beta$	P value
Sex	-0.022	0.756	-0.031	0.603
Job	-0.010	0.892	0.092	0.129
Smoking	-0.093	0.597	0.092	0.539
Drug abuse	0.456	<0.0001	0.637	0.02
Drunk driving	0.469	<0.0001	0.623	<0.0001
Number of punishments	0.090	0.206	0.085	0.161

**Table 4.** Behavioral predictors based on attitude, behavioral intention, and drug abuse

Variables	$\beta$	P value	R <sup>2</sup>
Attitude	0.201	<0.0001	0.623
Behavioral intention	0.668	<0.0001	
Drug abuse	0.122	0.003	

**Figure 1.** Additional findings revealed during the data collection of the study

## Discussion

The primary objective of this study was to identify the key factors influencing road behavior in Iran by utilizing the theory of planned behavior. The study's findings revealed that a significant proportion of drivers, more than half, engage in smoking either cigarettes or hookah. Specifically, around 58.9% of drivers were found to smoke cigarettes, while approximately 44.9% used hookah.<sup>[24]</sup> Additionally, drivers resort to drug usage in order to enhance alertness, combat fatigue and drowsiness, boost energy levels, heighten awareness, sharpen their senses, and improve tolerance while driving.<sup>[25]</sup> Furthermore, the effectiveness of an educational program in promoting negative attitudes towards drug abuse among drivers was demonstrated through the study's findings, indicating its success in combating drug abuse.<sup>[26]</sup>

The findings of the current investigation unveiled a noteworthy and affirmative correlation between behavioral intention and driving behavior, utilizing the constructs of the theory of planned behavior. The correlation outcomes indicated that drivers with a higher

perceived behavioral control are more inclined to engage in safe driving practices, while those with a higher behavioral intention have a greater likelihood of exhibiting safe driving behaviors. Similar associations have been observed in other studies.<sup>[27,28]</sup> Numerous studies examining the determinants of drivers' behavior within the TBP model have demonstrated that the model accounts for approximately 28% to 66% of the variability in drivers' behavioral intentions.<sup>[27-30]</sup> Additionally, it explains approximately 27% to 67% of the variability in driving behavior.

As a result, multiple studies have shown the predictive value of planned behavior. According to research, the predictability of attitude, abstract norms, and perceived behavioral control in the theory of planned behavior may vary depending on their application. The study found that perceived behavioral control ( $\beta=0.414$ ) and attitude ( $\beta=0.317$ ) were the most accurate predictors of intention, which aligns with the findings of Aghamelai et al.<sup>[20]</sup> It has been suggested that attitude and subjective norms play a significant role in predicting safe behaviors.<sup>[31]</sup> However, in

the current study, no association was found between subjective norms and driving behavior. On the other hand, subjective norms and perceived behavioral control can influence the behavioral intentions of drivers.<sup>[32]</sup>

Previous research has found that behavioral intention can predict attitude and perceived behavioral control. Nevertheless, based on the present findings, perceived behavioral control emerges as a predictor of driving behavior intention. This implies that drivers are more likely to engage in certain behaviors if they feel they have control over them. It is worth noting that sometimes performing a behavior may require a skill that an individual lacks. For instance, attempting to overtake a heavy vehicle in the fast lane without sufficient skills can lead to severe damage. Other internal factors that can affect behavior include a lack of information, fear, and ability. Additionally, external factors such as environmental and situational circumstances, including the timing of the event, will also influence perceived behavioral control.<sup>[5-7,12,14]</sup> The amount of perceived behavioral control, according to Ajzen, is affected by both self-efficacy and the controllability of one's behaviors. This perceived behavioral control can directly and indirectly influence behavior through intention. Numerous studies on health behavior have reported the predictive power of the theory of planned behavior.<sup>[33]</sup>

The findings of the current study demonstrate a significant correlation between drug abuse and the constructs of the Theory of Planned Behavior. Ainy et al. conducted a study on drug abuse among public transport drivers in Iran and found a significant difference in drug addiction among individuals aged 32–39 years.<sup>[34]</sup> A review conducted in Asia, the USA, and Europe revealed that addicted drivers were responsible for 25% of accidents.<sup>[35]</sup>

The impact of an educational program aimed at reducing substance abuse among suburban bus drivers, using the theory of planned behavior, was examined.

According to the findings, combining the idea of planned behavior with training in skills and techniques to resist drug misuse had a significant impact on promoting psychological resilience and substance rejection among drivers.<sup>[26]</sup> In this research, the coefficient of determination (R<sup>2</sup>) exceeded 0.6 during the regression analysis. This indicates that more than 60% of the variations in the frequency of traffic accidents can be attributed to factors such as drug abuse, drivers' attitudes, and their willingness to comply with traffic regulations. Individuals who lack personal control and self-confidence are unable to make independent decisions, making them more susceptible to social influence and drug use. However, by enhancing

individuals' ability to resist social pressures, their vulnerability to such influences can be reduced, thereby decreasing the likelihood of falling into the trap of addiction.

In the present study, the conceptual framework of Ajzen's theory of planned behavior was employed to address traffic accidents. The variables of attitude, subjective norms, perceived behavioral control, and drivers' behavioral intention were examined, and the results revealed that attitude and perceived behavioral control were strong predictors of behavioral intention. This implies that a positive attitude towards driving behaviors and a higher perceived control over performing these behaviors are associated with a greater intention to engage in such behaviors among drivers.<sup>[33]</sup>

The present study has identified two significant limitations: the time constraints faced by drivers and the need for accurate responses to the questionnaire. Additionally, it is suggested that the sample size be increased to over 200 in order to enhance the generalizability of the study. It is worth noting that drivers from all regions of Iran, including the transit axes of Yazd to Kerman and Isfahan, were included in the study. The study has successfully identified key factors that contribute to road accidents and their relationships. These findings can be utilized to develop and implement targeted interventions based on models in future research. Such interventions have the potential to promote preventive behaviors and reduce the number of casualties resulting from road accidents. Furthermore, future research could explore these factors on different roads across Iran and among diverse groups of drivers to gain a more comprehensive understanding of predictive factors.

## Conclusions

The findings of this research provide crucial insights for planners to gain a deeper understanding of the factors that contribute to traffic accidents. Moreover, by designing an educational curriculum rooted in the theory of planned behavior and emphasizing the importance of cultivating positive attitudes and perceived behavioral control, it will contribute to reducing drug misuse among drivers.

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### Competing interests

The authors declare that they have no competing interests.

### Abbreviations

Theory of planned behavior: TPB;  
Manchester Driving Behavior Questionnaire: MDBQ.

### Authors' contributions

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.SSU.SPH.REC.1401.042) was obtained. All participants signed an informed consent form.

### 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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