Int J High Risk Behav Addict. 2020 June; 9(2):e98001. doi: 10.5812/ijhrba.98001.

Published online 2020 May 4. **Research Article**

The Role of Impulsivity, Attentional bias and Decision-Making Styles in Risky Driving Behaviors

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Received 2019 September 11; **Revised** 2020 February 24; **Accepted** 2020 April 11.

Abstract

Background: Road accidents are a major cause of deaths, injuries, and financial losses globally, especially in developing countries. Iran is one of the countries with a high rate of road accidents causing considerable damage in different domains. Therefore, in order to tackle this problem, we need to examine its causes.

Objectives: The aim of the present study was to examine the association of risky driving behavior with impulsiveness, attentional bias, and decision-making styles.

Patients and Methods: This was a descriptive-correlational study. The sample included 117 male drivers, aged 20 - 34 years, attending car insurance agencies in Tehran. The participants were selected using the convenience sampling method. The data were gathered using the Manchester Driver Behavior Questionnaire (DBQ), the Barratt Impulsiveness Scale (BIS), the Decision-Making Style Scale (DMS), and the Dot Probe Task to assess attentional bias. All data analysis was conducted using Pearson correlation coefficient and multiple regression analysis, by using SPSS, version 22.

Results: According to the results of the Pearson correlation coefficient, risky driving behavior was significantly correlated with impulsiveness subscales ($P < 0.01$) and attentional bias ($P < 0.05$). In addition, significant relationships were observed between risky driving behaviors and three decision-making styles, including rational ($P < 0.05$), spontaneous ($P < 0.01$), and avoidant ($P < 0.01$).

Conclusions: Based on the study results, impulsivity, decision-making styles, and attentional bias as factors influencing drivers' cognitive skills related to driving, could explain the increase in the frequency of risky driving behavior.

Keywords: Health Risk Behaviors, Attentional Bias, Decision Making, Impulsive Behavior

1. Background

Road accidents and physical injury and post-traumatic stress disorder (PTSD) are among the significant threats to the wellbeing of people around the world. About 1.2 billion people annually die in road accidents. According to the World Health Organization (WHO), if immediate preventive measures are not taken, road accidents will become the fifth leading cause of death by 2030. In Iran, as a developing country, around 19000 people die, and 800000 people are injured in road accidents each year (1). Three types of factors are involved in road accidents: human, road, and the environment. Human error is regarded as the most important factor in road accidents that directly or indirectly influences driving performance (2). Among the human factors, the role of psychological factors has attracted considerable attention. For example, in recent decades, several studies have examined the role of cognitive factors in safe driving and have shown that examining these factors could help reduce road accidents and improve road safety (3). Some previous findings have revealed the role of such factors as impulsiveness, attentional bias, and decision-making styles in risky driving behaviors (4-6).

Barratt et al. designed a comprehensive, systematic theory for impulsiveness, encompassing biological, environmental, and cognitive factors. They distinguished between the three components of impulsivity: (1) motor impulsiveness (tendency to act without planning in advance), (2) attentional impulsiveness (inability to concentrate on an immediate task or cognitive instability), and (3) non-planning impulsiveness (lack of planning and forethought) (7). Previous studies have shown that drivers with a high level of impulsivity tend to react to stimuli more

quickly, and they are more likely to drive in a dangerous manner (2, 8, 9).

Attentional bias is another cognitive factor influencing driving safety (10). Attentional bias is the tendency to be focused on a stimulus despite one's efforts to ignore it. Research evidence indicates the important role of automatic processes, including attentional bias in reinforcement, maintenance, and recurrence of different types of normal and abnormal behaviors (11).

Decision-making is another cognitive factor that plays a vital role in driving (12, 13). Decision making styles are different ways of determining the effects of each decision and finding a solution based on the available information and related considerations (12). Harren's approach includes three different styles: rational (making decisions based on logic), dependent (making decisions based on others' beliefs and expectations), and intuitive (making decisions based on feelings and emotions). Philips, Pazienza, and Ferrin added the avoidant style (tendency to avoid or postpone decision-making) to Harren's model (14). Various studies have demonstrated associations between risky driving behaviors and psychological factors, such as impulsiveness, attentional bias, and decision-making styles (5, 15-17).

2. Objectives

Given the shortage of studies on this subject in Iran and the long history of exploring this issue in other countries, we decided to explore the role of cognitive factors in risky driving behaviors and to examine the association of impulsivity, attentional bias, and decision-making strategies with risky driving behaviors in Iranian drivers.

3. Patients and Methods

This was a descriptive-correlational study. The statistical population included all the male drivers in Tehran aged 20 - 34 years; among this population, 117 men attending car insurance companies in March 2018 in Tehran were selected as the study samples. The participants were selected using the convenience sampling method and based on the inclusion and exclusion criteria. The inclusion criteria were as follows: driving license obtained at least two years before the study and no history of brain damage, epilepsy, or psychiatric disorders. The exclusion criterion was a lack of consent to participate. After making the necessary arrangements, the drivers who met the inclusion criteria were included in the study. First, the Dot Probe Task was conducted, and then the questionnaires were given to the participants. Before collecting the data, the study objectives were explained to the participants, and they were reassured about confidential of their personal information. In addition, the participants were allowed to quit the study at any time. Data analysis was conducted using Pearson correlation coefficient and multiple regression analysis, and all the analyses were performed using SPSS, version 22.

3.1. Instruments

The Barratt Impulsiveness Scale (BIS): It has 30 items rated on a 4-point Likert-type scale. The items assess three factors, including attentional impulsiveness, motor, and non-planning impulsiveness (18). Various studies have shown the validity and reliability of this scale (19, 20). The Persian version of the BIS was validated by Ekhtiari et al. They found Cronbach's alphas of 0.845 and 0.831 for the total scale among people with substance abuse disorder and healthy people, respectively (21). In the present study, a Cronbach's alpha of 0.83 was obtained for the BIS.

The Manchester Driver Behavior Questionnaire (DBQ): This questionnaire assesses aberrant driving behaviors (errors and violations). It has 50 items that are rated on a 5-point Likert-type scale. Aberrant driving behavior is classified into four categories, including errors, lapses, intentional violations, and unintentional violations (22). Parker and Reason examined the reliability of the questionnaire among 80 drivers using an eight-week test-retest examination and found correlation coefficients of 0.81 and 0.75 for errors and violations, respectively (23). In the present study, the Persian version of the questionnaire was used that had been previously validated in Iran (24). We found a Cronbach's alpha of 0.94 for the questionnaire.

The Dot Probe Task: This is a computer-based task used to assess attention and vigilance to a specific stimulus (in the present study, we used neutral pictures related to risky driving). This Dot Probe Task was first developed by MacLeod using words (25). In Iran, Sarfaraz et al. reconstructed it using the emotional faces of Iranian people (26).

The General Decision-Making Style Questionnaire (GDMSQ): The GDMSQ developed by Scott and Bruce was used to assess five different decision-making styles, including rational, intuitive, dependent, avoidant, and spontaneous. It has 25 items that are rated on a 5-point Likert-type scale (27). Loo et al. reported alphas ranging from 0.62 to 0.87 (28). Hadizadeh Moghadam and Tehrani found a Cronbach's alpha of 0.78 for the total questionnaire and alphas ranging from 0.63 to 0.81 for its five subscales (29). In the present study, we found a Cronbach's alpha of 0.64 for the total questionnaire and alphas ranging from 0.43 to 0.80 for the five subscales

4. Results

A total of 117 male drivers aged 20 - 34 years (mean = 26.43, SD = 3.87) participated in the present study. The participants had education levels from primary school to a Master's degree, but most of them had a Bachelor's degree. Among the study variables, non-planning impulsiveness (mean = 23, SD = 4.99) and attentional bias (mean = -3.6, SD = 32.32) had the highest and lowest means, respectively (Table 1).

Table 1. Means and Standard Deviations of Attentional Bias, Decision-Making Styles, and Impulsiveness

Variable	Mean ± SD
Attentional impulsiveness	16.49 ± 4.16
Motor impulsiveness	20.87 ± 4.71
Non-planning impulsiveness	23 ± 4.99
Rational decision-making style	17.80 ± 3.58
Intuitive decision-making style	17.86 ± 3.30
Dependent decision-making style	14.04 ± 2.79
Spontaneous decision-making style	11.85 ± 3.98
Avoidant decision-making style	11.49 ± 3.55
Attentional bias	-3.6 ± 32.32

Pearson correlation coefficient was used to examine the relationship between risky driving behaviors and impulsiveness, attentional bias, and decision-making styles, the results of which are presented in Table 2. There were significant correlations between risky driving behaviors and impulsiveness subscales, including attentional impulsiveness ($r = 0.519$, $P < 0.01$), motor impulsiveness ($r = 0.484$, $P < 0.01$), and non-planning impulsiveness ($r = 0.386$, $P < 0.01$). In addition, a significant association was found between risky driving behaviors and attentional bias ($r = 0.207$, $P < 0.05$). Moreover, significant relationships were observed between risky driving behaviors and rational ($r = -0.251$, $P < 0.05$), spontaneous ($r = 0.438$, $P < 0.01$), and avoidant ($r = 0.389$, $P < 0.01$) decision-making styles, but no relationship was found between risky driving behaviors and dependent and intuitive styles.

Multiple regression analysis was used to examine the effect of decision-making styles, impulsiveness, and attentional bias on risky driving behaviors. Among the variables examined, attentional impulsiveness had a significant effect on risky driving behaviors. The results of the regression analysis are presented in Table 3.

5. Discussion

The main objective of the present study was to examine the relationship of risky driving behavior with impulsivity, attentional bias, and decision-making strategies in Iranian drivers. In line with the previous findings, our findings showed positive associations between risky driving behaviors and attentional, motor, and non-planning impulsiveness (5, 16, 17, 30). There were also positive associations between risky driving behaviors and spontaneous and avoidant decision-making styles and a negative association between risky driving behaviors and the rational decision-making style (31-34). Finally, the results indicated a positive relationship between attentional bias and risky driving behaviors; this is also consistent with previous findings (15). Among all the impulsivity subscales, only attentional impulsivity significantly predicted risky driving behaviors (Beta = 0.30); this finding is in line with the results of previous studies on the effects of impulsivity on risky driving behaviors (35).

From biological and neuropsychological perspectives, people with an underactive BIS are less likely to recognize unpleasant stimuli and perceive them as threatening. People with an overactive BAS, due to being highly motivated to gain rewards, have difficulty in learning inhibitors, while people with an overactive BIS are highly sensitive to punishment (36). Sensitivity to reward may present itself in the form of traffic or rule violations that are observed in impulsive individuals, and sensitivity to punishment may present itself in the form of adjustment to the environment (37). In addition, damage to the orbitofrontal cortex (OFC) that is located in the ventromedial frontal cortex (VMF) leads to a type of motor impulsivity in which the person is not able to control their behavior and repeats a risky behavior despite learning the subsequent rewards or punishments. This is not true for a damage to the VMF that is limited to this region and does not spread out to the adjacent areas; people with this type of damage suffer from another type of impulsivity, called attentional impulsivity (38). As was pointed out in the Results section, and attentional impulsivity can predict risky driving behaviors. This finding can be explained from the cognitive perspective, according to which impulsivity refers to the lack of ability to inhibit impulses (36).

Various studies have reported that decision-making as a major cognitive function is related to behavioral inhibition (39) and that impairment in inhibitory control as an executive function, inability to refrain from instant rewards and impulsivity as an emotional state are powerful predictors of risky decision-making (40).

Regarding the relationship between decision-making styles and risky behaviors, it can be argued that risky behavior is characterized by dysfunction in attentional processing, meaning that people with risky behaviors only pay attention to affect-eliciting experiences such as winning or losing; therefore, they are not able to learn from their

Table 2. Correlation Coefficients between Risky Driving Behaviors and Impulsiveness Subscales, Decision-Making Styles, and Attentional Bias

Variable	1	2	3	4	5	6	7	8	9	10
1. Risky driving behavior	1									
2. Attentional bias	0.207*	1								
3. Motor impulsiveness	0.484**	0.140	1							
4. Attentional impulsiveness	0.519**	0.152	0.565**	1						
5. Non-planning impulsiveness	0.386**	0.092	0.556**	0.480**	1					
6. Rational decision-making style	-0.251**	-0.120	-0.348**	-0.407**	-0.421**	1				
7. Intuitive decision-making style	-0.021	-0.041	0.137	-0.062	-0.205*	0.311**	1			
8. Spontaneous decision-making style	0.438**	0.106	0.503**	0.358**	0.391**	-0.301**	0.075	1		
9. Dependent decision-making style	0.098	0.028	0.029	0.160	0.139	-0.152	0.112	0.055	1	
10. Avoidant decision-making style	0.389**	0.285	0.300**	0.338**	0.328**	-0.245**	0.094	0.457**	0.323**	1

Table 3. Regression Analysis with Risky Driving Behavior as the Dependent Variable and Attentional Bias, Impulsiveness, and Decision-Making Styles as the Independent Variables[a]

Variable	SE	Beta	T	Sig.
Motor impulsiveness	0.84	0.11	1.00	0.3
Attentional impulsiveness	0.87	0.30	2.43	0.01
Non-planning impulsiveness	0.76	-0.04	-0.35	0.7
Rational decision-making style	1.06	-0.08	-0.67	0.5
Intuitive decision-making style	0.98	-0.07	-0.69	0.4
Dependent decision-making style	1.22	-0.03	-0.32	0.7
Spontaneous decision-making style	0.92	0.16	1.22	0.2
Avoidant decision-making style	1.02	0.12	1.07	0.2
Attentional bias	0.13	0.03	0.35	0.7

[a] Adj. $R^2 = 0.26$; $R^2 = 0.34$; $R = 0.58$.

mistakes (41). On the other hand, it has been observed that decision-making problems in people with ventromedial damage is related to a kind of blindness to the consequences of actions in the future (i.e., paying more attention to instant gratification or less attention to harm) (42).

Finally, people with risky driving behaviors had increased response times in the Stroop test when presented with emotionally negative words. The reason behind this is that negative words require more attention compared to neutral words. Therefore, people with a higher response time in the Strop test tend to have more driving errors. This finding is explained by the fact that attentional bias results from the effects of emotions on cognition and that emotional state impacts driving conditions (15). In addition, the study results showed that negative emotional states influence the driver's traffic-dependent behavior and cognition. While negative emotions increase drivers' perception of driving risks, at the same time, they increase their desire to engage in risky driving behaviors, such as speeding (43).

Overall, the study results indicated impulsivity, decision-making styles, and attentional bias as factors influencing drivers' cognitive skills related to driving that can explain the increase in the frequency of risky driving behaviors.

Acknowledgments

The authors wish to thank Iran and Pasargad insurance companies for allowing us to conduct the sampling procedure in their branches in Tehran.

Footnotes

Conflict of Interests: The authors have no conflicts of interest to declare.

Funding/Support: This study was supported by Vice-Chancellor for Research and Technology, University of Social Welfare and Rehabilitation Sciences.

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