



The Role of High-Risk Behaviors, Fatigue, and Drowsiness in the Occurrence of Road Accidents and Near Miss Accidents among Tehran Truck Drivers in 2019

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Abstract

Background: Road accidents, as the main causes of mortality and disability in the world, have been seriously endangering human health. Human factors are among the most significant causes of road accidents. This study aimed to investigate the association between high-risk behaviors among truck drivers with their fatigue and drowsiness in the occurrence of road accidents and near miss accidents.

Materials and Methods: This descriptive study was conducted recruiting 200 truck drivers in Tehran using two-stage cluster sampling method, in 2019. A standard driver safety questionnaire was used to collect data, with its reliability measured by the test-retest method. The Fisher's test, a chi-squared test, and the Pearson's correlation were used to analyze the data.

Results: The mean age of the drivers and the mean hour of driving were 47.5 ± 9.05 years and 10.66 ± 2.52 hours, respectively. In addition, the number of accidents had a significant association with the drivers' age, drowsiness, talking on the cell phone, texting, eating snacks, and driving hours. However, it had no significant relationship with drinking tea and smoking. Furthermore, the rate of road accidents had a significant correlation with the drivers' driving time and rest hours.

Conclusion: Behaviors and factors, such as talking on the cell phone, texting, eating snacks, long hours of driving per day, long hours of nonstop driving, low rest hours, and drowsiness were among the major causes of accidents among trucks drivers. In this regard, authorities are recommended to run educational courses to modify high-risk driving behaviors so as to reduce road accidents.

Keywords: Road Accidents, Behavior, Fatigue, Drowsiness, Road Traffic Accident.

Introduction

Road accidents and their damage are among current challenges to human societies, which endanger human health and impose high economic costs on countries. Accordingly, road accidents turned into the third major cause of death in 2020 [1-2]. According to a report by the

World Health Organization, if preventive measures are not adopted to reduce the number of accidents, the share of traffic accidents in mortality will exceed 67% [3]. Unfortunately, Iran is one of the countries where the average accident rate is higher than that in other countries, due to the lack of attention to safety principles and the factors affecting it. Accordingly, the rate of traffic accidents

in Iran, being the second leading cause of death after cardiovascular disease, is very high, with this country having a high ranking in traffic casualties in the world [4]. Furthermore, over 400,000 road accidents occur annually in Iran. This makes Iran rank first in the world in terms of road accident deaths, with truck accidents with other vehicles having the highest death rate of 60.5% on suburban roads in this country [5]. Unfortunately, Iran is one of the countries in which the rate of accidents has been always increasing due to the lack of attention to safety principles and the associates factors. In fact, the current statistics show that this condition is deteriorating. For instance, according to the statistics released by the Forensic Medicine Organization in Iran, almost 17,000 people were killed in traffic accidents in 2018 [6].

Developing countries have the highest rate of road accident victims. Thus, not only are road accidents among the leading causes of mortality as well as severe personal and financial damage, but they also impose great social, cultural, and economic burdens on human communities. According to research, the rate and severity of road incidents were several times higher in developing countries than in developed ones [5, 7].

Several studies have been conducted on the relationship between drowsiness and road accidents, according to which drowsiness in professional drivers can be caused by factors, such as long working hours, insufficient rest, irregular schedules, night shifts, long waking hours, physical activity, and mental obsession [8-10]. These factors have been reported to reduce the ability to drive, create a feeling of mental fatigue, slow the reaction time, lead to the lack of attention to important details, and cause poor performance [11-12]. Some studies consider the role of drowsiness and long driving hours essential in the occurrence of traffic accidents. Accordingly, fatigue caused by driving is defined as a feeling of drowsiness caused by factors, such as the driving time and tedious road conditions, with individuals' characteristics being directly associated with road accidents [13]. Research in the United States shows that fatigue is the cause of 30% of fatal crashes by heavy commercial vehicles and 52% of all crashes involving trucks alone, with 18% of drivers admitting their feeling of drowsiness [14]. In terms of road accidents, it has been reported that over half of truck accidents cause fatal injuries and/or chronic disabilities, with truck drivers blamed in most of the cases [15]. Some studies show that when drivers use their cell phones while driving, they increase the rate of traffic jams in the

middle of the day and in the morning, so the rate of road accidents increases [16-18]. Accordingly, physical and mental health as well as occupational risk factors can affect performance and safe behavior of heavy vehicle drivers [19].

Drivers are considered among vulnerable groups of the society, who are faced with a variety of stressors, including reduced physical activity due to fulltime sedentary work, unhealthy eating during long journeys, and sleep disorders caused by specific work schedules and shifts [20]. In addition, they spend a short time for recreation purposes because of their long working hours and fatigue. Besides, driving heavy vehicles is a stressful and risky job because making any mistakes during driving can endanger lives of many people. Thus, the behavior and health of this group of drivers are of great importance [21-22]. Accordingly, driving behaviors play a leading role in the occurrence of near miss accidents and road accidents. Thus, improving their behaviors can reduce near miss accidents and accidents. Given that traffic accidents are preventable and mostly occur following high-risk driving behaviors, improving drivers' behaviors is more cost-effective in reducing these accidents. Statistics on heavy vehicle crashes in the world indicate that although heavy vehicle drivers experience fewer crashes than private car drivers, a large percentage of heavy vehicle crashes leads to death. Therefore, the present study aims to investigate the relationship between fatigue, drowsiness, and high-risk behaviors in truck drivers while driving with the occurrence of road accidents and near miss accidents.

Materials and Methods

This descriptive study was carried out among truck drivers in Tehran. To select the study participants, the two-stage cluster sampling method was employed, with occupational medicine centers in Tehran having the drivers' information considered as clusters. To this end, random sampling was performed for each cluster. It is noteworthy that more participants were collected from the centers with a larger number of clients, with the participants not cooperating at some centers replaced with other participants from nearby centers. The sample size was calculated in two stages. Accordingly, 40 participants were selected randomly from each cluster, and the initial sample size ($n = 240$) was calculated through multiplying the total number of the selected clusters by the number of the samples in each cluster. According to the inclusion and exclusion criteria, 200 people

were evaluated eventually.

The inclusion criteria for entering the study were male drivers who aged at least 27, having more than two years of experience in driving trucks, having contact information in the profiles, and having completed laboratory test records. In contrast, the exclusion criteria included not having complete profile information (at least 20%), not completing questionnaires, and the lack of willingness to participate in the study. The participants were briefed on voluntary participation in the study by informing them that they could leave the research process at any time. Besides, they were ensured about confidentiality of their information.

To collect the participants' general information, their profiles at occupational medicine centers were reviewed. In addition, to collect information about the drivers' high-risk behaviors and observance of safety issues while driving, the Driver Safety Questionnaire, based on heavy vehicle driver sleep and the driver behavior measurement tool, was administered [23]. The reliability of the questionnaire was established using a panel of 4 experts in the field of occupational safety and health as well as by conducting a pilot study with 15 volunteers included, who completed the questionnaires in two weeks. In addition, the test-retest method was used for the reliability of the questionnaire, with a correlation coefficient used to obtain the reliability of this test, which was 82% for this questionnaire. This questionnaire evaluated the indicators of sleeping hours during the day, driving hours during the day, nonstop driving hours, rest hours during the day, smoking status, regular exercise, safety and health education, using a cell phone and texting while driving, drinking tea and eating snacks while driving, sleeping while driving, feeling annoyed at the vehicle noise while driving, and the number of accidents and near miss accidents.

To assess job stress, the drivers were asked to use an eye scale numbered zero to 10, where zero

meant no stress, numbers 2, 1, and 3 meant low stress, and numbers 4, 5, and 6 indicated moderate stress. In addition, numbers 7, 8, and 9 implied high stress, and number 10 indicated severe stress.

The results were analyzed using descriptive and inferential statistics. In the descriptive statistics, frequency distribution as well as central tendency indices, including the mean and standard deviation were utilized. In addition to examining the normality of data distribution, the Kolmogorov-Smirnov test was performed to test the normality of the data. Given the normal distribution of the data and constraints on the number of observations, the Fisher's exact test and the chi-squared test were performed to analyze the data. Besides, data were analyzed using SPSS Statistics 21.0.

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Results

A total of 200 drivers were included in the present research. The participants were within the age range of 30-70 with a mean age of 47.5 ± 9.05 . Besides, their mean hour of driving was 10.66 ± 2.52 per day (Table 1).

The rate of injuries and deaths was 1218 cases (82.2%) in males and 264 cases (17.8%) in females. Also, 1166 (78.7%) of the registered accidents occurred between the ages of 16 and 45 years. Most of the recorded deaths in accidents were associated with the elderly (over 60 years), and injuries were associated with the age group of 16-30 years. Among the occupations, the most affected and dead groups were self-employed. The highest incidence of injuries and deaths in Yazd occurred in education levels of diploma and high school (Table 1).

Table 1. Demographic characteristics and occupation-related variables of the studied drivers

	Variable	Mean \pm Standard Deviation	Min.	Max.
Demographic	Age	47.5 ± 9.05	30	70
	Height	127.98 ± 6.59	157	189
	Weight	83.71 ± 11.7	58	132
	Body mass index	27.9 ± 2.99	21.85	40.74
Occupational	Driving hours in a day	10.66 ± 2.52	5	16
	Nonstop driving hours	5.82 ± 1.87	10	3
	Rest hours per day	8.7 ± 1.13	6	12
	Exercise hours per week	1.14 ± 0.92	0	5

Table 2. High-risk behaviors and interfering factors in the safe performance of the drivers in the present study

	Variable	Frequency	Percent
High-risk behaviors	Smoking	135	67.5
	Eating snacks, such as seeds, pistachios, etc.	156	78
	Drinking tea	186	93
	Talking on a cell phone	159	79.5
	Texting on a cell phone	85	42.5
Interfering factors	Drowsiness	45	22.5
	Feeling annoyed at the noise of the vehicle	50	25
	Hearing the noise of the vehicle when resting and sleeping	44	22

Out of 200 drivers, 45 (22.5%) fell asleep, 156 (78%) consumed snacks, 186 (93%) drank tea, 159 (79.5%) talked on their cell phones, and 85 (42.5%) kept texting while driving (Table 2).

The mean rates of near accidents and accidents were 4.26 (standard deviation = 2.29) and 1.1 (standard deviation = 1.2) for each driver during the past five years, respectively (Table 3).

Table 3. Traffic accidents among the studied drivers (n = 200) in the past five years

Variable	Total number	Mean ± Standard deviation	Max.-Min.	Frequency (%)*
Near accidents	852	4.26 ± 2.29	0-10	196 (0.98)
Accidents	221	1.2 ± 1.1	0-6	148 (0.74)
Accidents with pedestrians	7	0.18 ± 0.04	0-1	2 (0.01)
Accidents with cars	183	0.91 ± 0.85	0-5	88 (0.44)
Collision with an obstacle	23	0.4 ± 0.12	0-2	7 (3.5)
Vehicle rollover	6	0.17 ± 0.03	0-1	3 (1.5)

* Frequency of the drivers with a history of driving accidents

As Fig. 1 shows, 38 drivers (19%) had no stress, yet 6 drivers (3%) had severe job stress. According to Table 4, the results of the Fisher's exact test showed that the number of accidents was correlated with the drivers' age, talking on cell phones, texting, eating snacks, drowsiness, hours of driving per day, hours of nonstop driving, rest hours, hearing the noise of the vehicle during rest

and sleep, and feeling annoyed at the vehicle's noise while driving ($P \leq 0.05$). However, the number of accidents had no significant relationship with drinking tea ($P \geq 0.05$). In addition, the number of near miss accidents had a significant relationship with the drivers' age, drowsiness, driving hours per day, nonstop driving hours, and rest hours ($P \leq 0.05$).

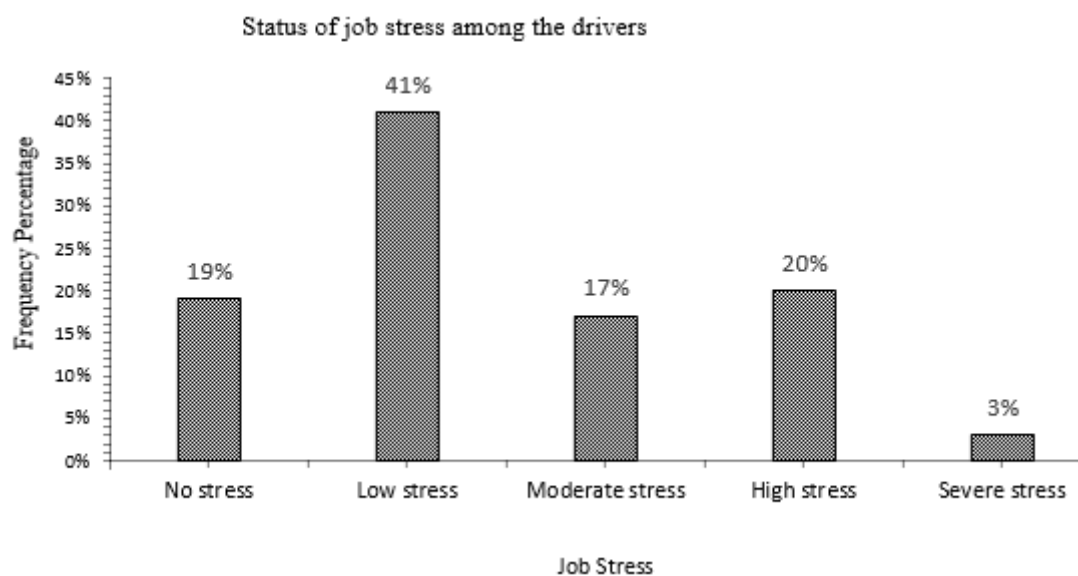


Fig. 1. Frequency distribution of job satisfaction and stress among the drivers (n = 200)

Table 4. Fisher’s exact test results for determining the relationship of the research variables with the number of accidents and near miss accidents in the study participants (n = 200)

Variables	Number of accidents		Number of near miss accidents	
	Fisher’s test	P-value	Fisher’s test	P-value
Age	7.853	≤0.001	5.511	≤0.001
Talking on the cell phone	65.162	≤0.001	0.45	0.503
Texting	10.233	0.002	3.457	0.064
Drinking tea	0.79	0.375	0.576	0.449
Eating snacks	35.716	≤0.001	0.148	0.7
Hearing the noise of the vehicle during rest and sleep	41.366	≤0.001	0.004	0.951
Feeling annoyed at the noise of the vehicle	129.195	≤0.001	0.08	0.777
Drowsiness	2.43	0.021	2.2	0.039
Safety and health education	0.262	0.005	1.557	0.025

Given the normality of the data, the Pearson’s correlation test was administered to investigate the relationship of road accidents and near miss accidents with the drivers’ age, driving hours, nonstop driving hours, rest hours, exercise hours, and the number of cigarettes smoked per day. The results of Table 5 show a significant relationship between the number of road accidents and the

variables of driving hours ($P \leq 0.001$, $r = 0.38$), nonstop driving hours ($P \leq 0.001$, $r = 0.322$), and rest hours ($P \leq 0.001$, $r = -0.38$). Besides, a significant correlation was observed between the number of near miss accidents and the variables of driving hours ($P \leq 0.001$, $r = 0.423$), nonstop driving hours ($P \leq 0.001$, $r = 0.427$), and rest hours ($P \leq 0.001$, $r = -0.40$).

Table 5. The correlation of the number of accidents and near miss accidents with driving hours, nonstop driving hours, rest hours, exercise hours, and the number of cigarettes smoked per day in the study group (n = 200)

Variables	Number of accidents		Number of near miss accidents	
	R	P-value	R	P-value
Driving hours	0.381	≤0.001	0.423	≤0.001
Nonstop driving hours	0.322	≤0.001	0.427	≤0.001
Rest hours	-0.38	≤0.001	-0.4	≤0.001
Number of cigarettes	-0.069	0.642	-0.033	0.329
Exercise hours	-0.154	0.008	-0.191	0.007

*The level of significance was set at $P < 0.05$.

Discussion

Road accidents are among the major crises in Iran, which are mainly caused by drivers’ unsafe and high-risk behaviors. In this regard, identifying the types of high-risk behaviors and their causative factors can reduce the incidence of road accidents and near miss accidents by running relevant educational courses on high-risk behaviors for drivers. Against this backdrop, the present study was conducted to investigate the relationship of road accidents and near miss accidents with high-risk behaviors, fatigue, and drowsiness in truck drivers.

According to our findings, age plays an essential role in reducing the rate and severity of road accidents and near miss accidents. This finding, as supported by other researchers, including Mehmandar et al [24] and Alavi et al [25], indicates that age is an important causative factor for road accidents among Iranian drivers.

Based on the findings, high-risk behaviors, such as talking on a cell phone and texting while driving, increase the risk of road accidents significantly.

These two behaviors have been identified as the most dangerous secondary activities increasing the rate of driving accidents [26-29]. According to the literature, talking on a cell phone while driving not only limits a driver’s power and field of vision, but it also causes mental and behavioral distraction, for a part of the driver’s attention is shifted to the conversation [30- 31]. As Caird et al noted, texting had a negative effect on almost all aspects of driving performance [32].

Drowsiness increases the risk of road accidents, so it is one of the effective factors in the occurrence of severe road accidents killing and injuring many victims every year. This finding was supported by the studies by Li Y et al [33], Bener et al [34], Moradi et al [35], and Philip et al [36], indicating the importance of drowsiness in traffic accidents.

Driving hours, nonstop driving, and resting during the day showed a significant relationship with the rate of road accidents. Accordingly, an increase in the duration of driving increased the rate of accidents, yet an increase in rest hours decreased

the number of driving accidents. These findings were confirmed by many studies, including Darwent et al [37], Vinagre-Ríos et al [38], and Godzik [39]. To explain these findings, one can say that drivers' fatigue lowers their ability to judge and make correct decisions, which can have dangerous consequences.

Although drinking tea had no effect on the rate of road accidents, consumption of snacks, such as seeds and pistachios, increased the risk of road accidents. Choudhary and Velaga reported that eating and drinking did not negatively affect driving performance in their study [40].

The results of the present study showed that noise annoyance had a significant impact on the risk of road accidents, which could affect the drivers' ability to concentrate well, thereby reducing their reaction speed. Thus, the driver would become more mentally stressed, with this increasing the risk of accidents. This finding was in line with the findings of Bąkowski et al [41] and Popusoi [42].

In addition, we found that safety and health education could play an essential role in road accidents and near miss accidents. In other words, the rate of road accidents and near miss accidents decreased in drivers who attended safety and health courses, having been consistent with the results of Ghandi et al [43], Ennajih et al [44], and Goniewicz et al [45]. Accordingly, effective education facilitates developments in various fields and plays a significant role in reducing road accidents. Thus, planning, running, and evaluating effective training courses for drivers can reduce accidents by improving the level of drivers' skills, knowledge, and insight into safety issues in practice and boosting their morale and self-confidence.

Although the drivers' smoking did not have a significant effect on the rate of road accidents in the present study, Useche et al [46] and Saadat et al [47] reported contrary results. This could have been due to the presence of different participating groups (with various demographic information, such as age, personality types, and driving experiences), vehicle types, data collection tools, and environmental factors.

In addition, the drivers' regular exercise was significantly correlated with a decreased rate of accidents. This finding was supported by Taylor et al [48] and Hoque et al [49], who explained that regular exercise could improve drivers' attributes of alertness, attention, and concentration.

In this study, some drivers did not cooperate or respond to the questions truthfully because they feared they might jeopardize their position. The number of the participants in terms of their gender, places of residence, and types of vehicles were

among other limitations. Given the sampling method employed in the present study, the findings of other drivers, such as drivers of light vehicles, private cars, and buses should be generalized with caution.

Given the findings of the present study, future interventions of drivers' high-risk behaviors, gender, educational level, driving experience, type of vehicles, and place of residence are required to be made.

Conclusion

According to the findings of the present study, behaviors causing accidents during driving included talking on the cell phone, texting, eating snacks, drowsiness, long driving hours per day, long hours of nonstop driving, low hours of rest, as well as feelings of fatigue and drowsiness. In fact, running educational courses on raising the level of awareness and skills among drivers can be effective in improving their high-risk habits, thereby reducing the rate of road accidents.

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