



Original Article

The relationship between illnesses and medical drug consumption with the occurrence of traffic accidents among truck and bus drivers in Tehran, Iran

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ABSTRACT

Purpose: To determine the relationship of illnesses and medical drug consumption with the occurrence of traffic accidents among truck and bus drivers.**Methods:** This is a cross-sectional study on truck and bus drivers in Tehran, Iran. The criteria for participating in this study were: married males over 30 years old, driving license in grade one, five years of job experience, mental health and non-addiction license. The criterion for not participating in this study was the lack of cooperation in responding to the questions. Six months was spent to collect the latest five years data of driving accidents from 2011 to 2016. A total of 323 truck and bus drivers in Tehran city and the suburbs, Iran were chosen. Among them, 112 were responsible for accidents (accident group) while 211 were not responsible for any accidents or involved in an accident in the last five years (non-accident group). A specially designed questionnaire was used to investigate the demographic information, medical drug consumption, medical backgrounds and history of accidents.**Results:** The results revealed that compared with healthy subjects, the occurrence of accidents among people with diabetes ($OR = 2.3, p = 0.001$) and vision weakness ($OR = 1.7, p = 0.020$) was significantly higher, while that among people with cardiac ($OR = 0.5, p = 0.002$) and hypertension ($OR = 0.9, p = 0.048$) problems was remarkably lower. Moreover, consumption of Gemfibrozil ($OR = 1.8, p = 0.010$) and Glibenclamide ($OR = 2.2, p = 0.002$) drugs resulted in significantly higher incidence of accidents than those without.**Conclusion:** Frequencies of illnesses like cardiovascular and hypertension were not higher in accident drivers than in non-accident drivers; but diabetes, vision weakness and consumption of Gemfibrozil and Glibenclamide lead to more traffic accidents.© 2019 Chinese Medical Association. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Traffic accidents are one of the important general health problems in both developed and developing countries. Around the world 1.2 million people die because of traffic accidents and about 20–50 million people are either injured or disabled. The pattern of traffic accidents is different in developing and developed countries, and every society has its own approaches and strategies to countering the accidents.^{1,2}

In Iran, the major cause of death is accidents. Based on the 2017 survey on formal cases in forensic medicine in this country, 16 201 people died from traffic accidents. Based on Central Information and Police Traffic Control of Law Enforcement Force of the Islamic Republic of Iran, 22000 people die due to road accidents every year. This number is almost four times greater than the world standard.³ However, the problem is not just the number of deaths that occur. As per statistics, in every traffic accident, for each death, three persons are disabled and 10 are injured. All the mentioned statistics are only part of the consequences of driving accidents. If these outcomes are combined with the indirect outcomes, which, based on the standards, are in the ratio of 1:4, then the statistics become quite alarming.⁴ Studies revealed that young people aged 15–30 years were affected most by driving accidents, and less experienced

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drivers were involved in more serious accidents, which lead to death.^{5–7}

Danger evaluation, investigation, and the analyses of traffic accidents show that we cannot explain all the accidents only by determining car incidental malfunctions. It has been proven worldwide that three important factors, i.e. human, road, and car play an important role in the occurrence of accidents. The human factor is more significant as it affects 70% of the accidents.^{3,7} Humans are complex creatures. Many studies have been done to recognize its characteristic behaviors in dangerous situations. In addition, age or physical illness forces the drivers to consume special drugs that may affect their consciousness while driving and cause problems.⁸ The consumption of some drugs can reduce drivers' reaction to acoustic and graphic stimuli; several illnesses create restrictions for them and lead to terrible accidents. Insomnia, tiredness, reduction in the level of alertness, and vertigo are the outcome of medical drug consumption and physical illnesses.⁹ A study was carried out in USA on the relation among chronic medical conditions, medications, and automobile crashes. The results showed that drivers with heart diseases were more probable to be involved in car crashes caused due to their fault; another study done in Norway had the same result. Benzodiazepine, nonsteroidal anti-inflammatory drugs, angiotensin converting enzyme inhibitor, and anticoagulants are associated with an increased risk of involvement in at-fault car crashes.^{10,11} In another study, arthritis and heart disease were associated with an increased risk of involvement in at-fault traffic crashes.¹² Table 1 lists the side effects of cardiovascular, diabetes and other drugs which may affect the crashes.

Therefore, doctors warn that driving after the consumption of some drugs can lead to fatal accidents. Statistics show that 62% of drivers drive while they are drowsy and one third of them cause accidents. Every year 1.2 million people were killed in crashes in the world.¹³ The purpose of this study is to determine the relationship of illnesses and medical drug consumption with the occurrence of accidents among truck and bus drivers in Tehran, Iran and to provide acceptable approaches to prevent these issues.

Methods

Inclusion and exclusion criteria

This is a cross-sectional study in 2017, which spent six months to collect data of accidents from 2011 to 2016. The sampling method was simple random. The subjects who went to the occupational medicine clinics in Tehran in 2016 to receive annual healthy job card and job health checkup were selected for participation in this study. The list of the truck and bus drivers in Tehran and the suburbs and their health records were taken from the occupational and environmental health center of Iran. Then, the demographic and other data related to the inclusion criteria were extracted.

The criteria for participating in this study were: married males over 30 years old; driving license in grade one; five years of job experience; mental health and non-addiction license for stimulants such as alcohol, opium, cannabis, and methamphetamine. The causes of accidents were taken from the police and those who caused the accidents due to medical drug consumption were included as subjects in the study. Based on these data, 500 subjects were selected. Then, the drivers were informed about the purpose of this study through telephonic calls and 396 of them agreed to participate in the study.

In the next stage, the participants were invited to a medical center on a specified date for interview, during which the multi-dimensional Minnesota Multiphasic Personality Inventory

(MMPI) questionnaire was adopted to confirm the mental health of drivers by clinic employees. MMPI questionnaire has 71 questions which assess the subjects from eight personality indices, respectively the HS scale or hypochondria, D or depression, HY or hysteria, Pd or social mental deviation, Pa or paranoia, Pt or mental weakness, Sc or schizophrenia, and Ma or hypomania. Then, the non-addiction certificate was requested from subjects.¹⁴ Professional drivers in Iran are evaluated annually and non-addiction license will be issued for the qualified ones.

In the third stage, the interviews were conducted and the subjects were asked to complete a designed questionnaire during the interview. Also, participants with accidents were asked to determine the tentative time before the accident that they consumed medical drugs.¹⁵ Those who had consumed drugs up to 2 h prior to the crash were allowed to enter the study. Participants without any accident experience were asked about their history of medical drug consumption and those who had regularly consumed drugs had been included in the study.¹⁶

The criterion for not participating in this study was the lack of cooperation in responding to the questions. In final, 323 participants fully responded to the questions and had the entry criteria of this study. A total of 112 subjects were guilty of causing accidents (accident group) while 211 persons were pronounced 'not guilty' by the police and were not involved in any accidents in the last five years (non-accident group).¹⁶

Measures

To better investigate the subjects, a specifically designed questionnaire was used, which consisted of four parts: (1) demographical and general questions, (2) questions on medical drug consumption including some of cardiovascular, diabetes and metabolic drugs, (3) medical backgrounds and diseases including cardiac, diabetes, pulmonary, hypertension, vision weakness and other diseases, and (4) history of driving accidents with bus or truck and their causes.^{15,17,18} It must be noted that all the questions were limited to the latest five years from 2011 to 2016. Question design of the first and fourth parts was clear, but those of the second and third parts required scientific review. Therefore, a list of illnesses and medical drugs was provided to researchers to check and review for the side effects of these drugs. Then, two expert doctors and pharmacologists were invited to discuss and select drugs to be included in the questionnaire and further give some suggestions on the prepare of the questionnaire.

The following information was investigated: age, sex, height, job background, cigarette consumption history, previous job, driving hours in a day, medical drug consumption including some of cardiovascular, diabetes and metabolic and other drugs, diseases including cardiac, diabetes, pulmonary, hypertension, vision weakness and other diseases, and history of accidents with bus and truck (including number of accidents, the cause of accidents, the guilty of accidents, and the time of medical drug consumption before the accidents). Answers to questions took about 10 min. It took about 10 min to finish all the questions.

To confirm the information on the questionnaire, we checked the drivers' illness, medical drugs consumption, physical and mental condition through the recorded data in the national health care insurance database. In addition, the number of drivers' accidents from 2011 to 2016, the cause of accidents, and their guiltiness were asked from traffic police. Also, the cause of accidents was taken from the police and those who caused the accidents due to medical drug consumption were included as subjects in the study.

Table 1
Description and side effects of the drugs.

Drugs	Descriptions	Side effects
Insulin	<ul style="list-style-type: none"> To treat diabetes mellitus To decrease blood glucose 	<ul style="list-style-type: none"> Blurry vision; confusion; tachycardia; neurological deficits
Nitroglycerin	<ul style="list-style-type: none"> To treat high blood pressure during surgery To control congestive heart failure associated with heart attack 	<ul style="list-style-type: none"> Numbness; prickling; difficult or labored breathing; headache; tightness in the chest; rapid heart rate; feeling faint, dizzy; unusual tiredness or weakness; hypotension
Aspirin	<ul style="list-style-type: none"> To treat chest pain in certain patients To treat minor aches and pains To decrease the risk of stroke, heart attack, and death associated with stroke or heart attack 	<ul style="list-style-type: none"> Nausea; tachycardia; hypotension; dizziness; seizures; confusion
Gemfibrozil	<ul style="list-style-type: none"> To help reduce cholesterol and triglycerides in the blood. To treat very high cholesterol and triglyceride levels in people with pancreatitis. To lower the risk of stroke, heart attack, or other heart complications in people with high cholesterol and triglycerides 	<ul style="list-style-type: none"> Headache; nausea; diarrhea; dizziness; fatigue, vertigo; heartburn; blurred vision
Enalapril	<ul style="list-style-type: none"> To treat high blood pressure in adults and children who are at least 1 month old To treat congestive heart failure in adults To treat a disorder of the ventricles 	<ul style="list-style-type: none"> Blurred vision; confusion; dizziness; faintness; unusual tiredness or weakness; lightheadedness; chest pain
Propranolol	<ul style="list-style-type: none"> To treat tremors, angina (chest pain), hypertension, heart rhythm disorders, and other heart or circulatory conditions 	<ul style="list-style-type: none"> Difficulty with breathing; tightness in the chest; fatigue and/or lassitude; sleep disturbances; sleep disorder; dyspnea; depressive symptoms
Captopril	<ul style="list-style-type: none"> To treat hypertension, congestive heart failure, kidney problems caused by diabetes To improve survival after a heart attack. 	<ul style="list-style-type: none"> Chest pain; fast, pounding, or irregular; heartbeat or pulse; low blood pressure; troubled breathing or wheezing; unusual tiredness or weakness; vomiting and nausea; dizziness; Sleep disorder; disturbed vision, dry eye, itchy eye
Levothyroxine	<ul style="list-style-type: none"> To regulate the body's energy and metabolism To treat hypothyroidism To treat or prevent goiter 	<ul style="list-style-type: none"> Chest pain or discomfort; difficult or labored breathing; extreme fatigue; fainting; fast, slow, irregular, pounding, or racing heartbeat or pulse; nausea; tightness in the chest; tremors; blurred or double vision; dizziness; eye pain; severe headache; seizures
Glibenclamide	<ul style="list-style-type: none"> To treat type 2 diabetes 	<ul style="list-style-type: none"> Diarrhea; dizziness; headache; heartburn; nausea; trouble breathing; hypoglycemia; confusion; dizziness; feeling anxious; headache; blurred vision; fast heart rate; loss of consciousness; feeling unusually weak or tired
Atenolol	<ul style="list-style-type: none"> To treat angina (chest pain) and hypertension To lower the risk of death after a heart attack 	<ul style="list-style-type: none"> Cardiac failure; bradycardia; dizziness; fatigue; blurred vision; confusion; difficult or labored breathing; tightness in chest; unusual tiredness or weakness; anxiety; slow or irregular heartbeat; dizziness; feeling tired

Adopted from: www.drugs.com and <https://vsearch.nlm.nih.gov>.

Data analysis

In this study, the data were analyzed with the help of SPSS (version 19) software, with a significance of 0.05. Statistical-descriptive tests, *t*-test, Chi-squared, and odds ratio were used for data analysis. The *t*-test was used to investigate the difference between the variables of accident group and non-accident group. The Chi-squared was used to test the homogeneity about the nominal scale variables with more than two entries. Odds ratio was used to measure the association between variables.

Ethical review

Data collection was done after the drivers gave their consent. All the information given by the subjects were strictly confidential and were not shared with others. The information could only be shared with special people or organizations for the promotion of better. Ethical affirmation was achieved from the ethical committee.

Results

Demographic factors in relation with the accident of drivers are presented in Table 2, which reveals no significant difference between accident and non-accident group. The effects of illnesses and drugs on accidents of truck and bus drivers are respectively shown in Table 3. The results showed that the chance of accident occurrence in people suffering from cardiac ($OR = 0.5, p = 0.002$) and hypertension ($OR = 0.9, p = 0.048$) diseases was less compared to that in people without; while the chance of accident occurrence in subjects with diabetes ($OR = 2.3, p = 0.001$) and vision weakness ($OR = 1.7, p = 0.020$) was higher compared with those without the two diseases. Moreover, the accident occurrence in people with pulmonary disease was higher than that in people without, but the difference was not significant ($OR = 1.4, p = 0.200$). The illnesses such as blood lipids, migraine, stomach disorder and gout did not play any role in the occurrence of accidents. To the contrary, accidents were less in people with these illnesses. Disorders like skeletal and

Table 2
Demographic factors in relation with the onset of accidents between two groups.

Group	Demographic factors					
	Age (year)	Job experience (year)	Cigarette consumption daily	Driving distance in a week (km)	Body mass index	Weight (kg)
Accident	45.1	15.6	7	3164	26.4	79
Non-accident	44.8	15.5	5	3294	26.5	80
<i>p</i> value	0.21	0.34	0.05	0.35	0.80	0.50

All of the data are shown on average.

muscular problems, epilepsy and convulsions did not exist among the included drivers in the study.

The effect of medical drug consumption on accident occurrence is represented in Table 4. The results revealed that the occurrence of accidents among people who consumed Nitroglycerin, Aspirin, Enalapril and Captopril was less compared to that among subjects who did not, but the difference was not significant. While the occurrence of accidents among people who consumed Gemfibrozil ($OR = 1.8, p = 0.01$) and Glibenclamide ($OR = 2.2, p = 0.002$) was higher. The accidents occurred in people who consumed Insulin, Propranolol, Levothyroxine, and Atenolol were more in comparison with people who did not, but the difference was not significant. The results also revealed that the people who consumed Metformin, Nitroglycerin, Teofilin G, Salbutamol spray, and Meperazol had more chance of accidents. In this study, the effects of some drugs such as anti-histamine, Prazosin, and alcohol were not examined. Since, in the present study, none of the drivers used these drugs. Therefore, there was no relationship between these drugs and the accidents.

Discussion

It was observed that the drivers in both accident and non-accident groups showed no significant difference in risk factors of cigarette consumption, high body mass index, and long driving distances in a week, neither in terms of age nor job experience. Hence, we can conclude that the parameters in the two groups are equal and baseline differences can be omitted; and the chance of accident occurrence is influenced by medical drug consumption and illnesses alone.

Effect of disease

Based on the findings of this study, the chance of accident occurrence in people with cardiac and hypertension problems was

significantly less than those without. Klein et al.¹⁹ stated that cardiovascular disease can decrease the control of drivers on the vehicle and thereby cause an accident. The main pathophysiological mechanisms include disturbances of brain perfusion and general weakness. On the other hand, the people with cardiovascular diseases and hypertension problems have a tendency to take less risks and show less emotional behavior due to their fear of sudden strokes. Hence, they may avoid risky high speed driving and follow the rules better. Therefore, cardiovascular and hypertension diseases can have a double effect. As there are seldom studies on this, it is recommended a study conducted on the relationship between cardiovascular & hypertension diseases and driving behaviors. There are some studies whose results do not match that of this research. In Hours et al.'s study²⁰ in 2008, the results showed that the people with cardiac problems had fewer accidents while the subjects with high blood pressure had more accidents. In other studies, it was found that the people with high blood pressure had more accidents.^{21,22} The reason for these results in the mentioned studies was stated as tiredness and anxiety.²⁰ In addition to the factors of tiredness and anxiety, risk taking can also be an effective reason for the cause of accidents among subjects with cardiovascular diseases. Therefore, it is recommended that a study is performed on a larger scale to determine the contribution of each of these factors in the occurrence of accidents among subjects with cardiovascular diseases.

People with blood lipids, migraine, stomach disorders, and gout had less chance of accidents than the healthy people, but the difference was not significant. However, Jung et al.'s study²³ states that the people with migraine caused twice the number of accidents than the healthy ones do. Since the sampling was small, errors are present in this study. Hence, a bigger sample size is required. Since the drivers were under stress and did not have access to a good diet, they were prone to diabetes. As diabetic people have high or low glucose, which is enhanced by medical drug

Table 3
Illnesses and driving accidents.

Illness	With accident, <i>n</i> (%)	Without accident, <i>n</i> (%)	OR	95% CI	<i>p</i> value
Cardiac illness			0.5	0.25–1.11	0.002
Yes	10 (23.3)	33 (76.7)			
No	102 (36.4)	178 (63.6)			
Diabetes			2.3	1.4–3.8	0.001
Yes	42 (49.4)	43 (50.6)			
No	70 (29.4)	168 (70.6)			
Pulmonary illness			1.4	0.6–3.5	0.200
Yes	102 (34.0)	198 (66.0)			
No	10 (43.5)	13 (56.5)			
Hypertension			0.9	0.5–1.7	0.048
Yes	20 (34.5)	38 (65.5)			
No	92 (34.7)	173 (65.3)			
Vision weakness			1.7	1.06–2.9	0.020
Yes	37 (44.6)	46 (55.4)			
No	75 (31.5)	165 (68.8)			
Other illnesses			0.3	0.03–2.5	0.230
Yes	1 (14.3)	6 (85.7)			
No	111 (35.1)	205 (64.9)			

Table 4
Drug consumption and driving accidents.

Drug consumption	With accident n (%)	Without accident n (%)	OR	95% CI	p value
Insulin			5.7	0.5–56.2	0.120
Yes	3 (75.0)	1 (25.0)			
No	109 (34.2)	210 (65.8)			
Nitroglycerin			0.2	0.03–2.16	0.170
Yes	1 (12.5)	7 (87.5)			
No	111 (35.2)	204 (64.8)			
Aspirin			0.7	0.22–2.4	0.400
Yes	4 (28.6)	10 (71.4)			
No	108 (35.0)	201 (65.0)			
Gemfibrozil			1.8	0.2–10.9	0.010
Yes	4 (100.0)	0 (0)			
No	108 (33.9)	211 (66.1)			
Enalapril			0.7	0.1–3.9	0.500
Yes	2 (28.6)	5 (71.4)			
No	110 (34.8)	206 (65.2)			
Propranolol			1.2	0.2–7.6	0.500
Yes	2 (40.0)	53 (60.0)			
No	110 (34.6)	208 (65.4)			
Captopril			0.9	0.08–10.4	0.700
Yes	1 (33.3)	2 (66.7)			
No	111 (34.7)	209 (65.3)			
Levothyroxine			2.8	0.47–17.4	0.220
Yes	3 (60.0)	2 (40.0)			
No	109 (34.3)	209 (65.7)			
Glibenclamide			2.2	1.3–3.8	0.002
Yes	38 (49.4)	39 (50.6)			
No	74 (30.1)	172 (69.9)			
Atenolol			1.1	0.4–2.5	0.400
Yes	10 (37.0)	17 (63.0)			
No	102 (34.5)	194 (65.5)			
Other drugs			1.1	0.5–2.4	0.430
Yes	12 (37.5)	20 (62.5)			
No	100 (34.2)	191 (65.6)			

consumption along with their side effects, the subjects have a weaker vision and suffer from lower consciousness. Hence, the chance of accident occurrence among them is more and the relation between this disease and accidents is significant. The results of Lagarde and coworkers²⁴ and Jung et al.²³ show that people with diabetes and epilepsy caused more accidents.

The problem of vision weakness leads to more accident occurrence as well. Vision weakness is one of the effective obvious disorders in the traffic accident. People are evaluated for visual impairment before they receive a driver certificate and they may have a good vision. However, results of studies show that the consumption of some drugs can temporarily cause the weakness and other disorders of vision.^{4,25,26}

People with pulmonary diseases also faced more accident occurrence but the difference was not significant. Tiredness and physical weakness in people with pulmonary disease results in low consciousness due to lack of oxygen. Drugs can directly create a traffic accident through their side effects such as impaired thinking, dizziness, fatigue, sleepiness, nervousness, confusion, headache, and blurred vision.²⁴ In general, the consumption of some drugs impair the attention and concentration of drivers on driving and increase the reaction time that can enhance the risk and severity of traffic accident.¹⁵

Effect of drug consumption

The results of the current study showed that the drivers who injected insulin had more chance of accident occurrence but the difference was not significant. Perhaps the people suffering from diabetes have a low level of consciousness due to low glucose. The findings of the Kennedy et al.'s study²⁷ in 2002 showed that the number of accidents among drivers with insulin complications was

more than the drivers without this issue. The results showed that the drivers who consumed Nitroglycerin, Aspirin, Enalapril, and Captopril had less chance of accident occurrence. The ones who consumed Gemfibrozil had more accidents since this drug had a higher number of side effects like vertigo, headache, vision weakness, and heartbeat disorder, which can easily lead to an accident. When a driver, who had diabetes, consumed the above-mentioned drugs as well, the chances of causing an accident increased as these drugs, when consumed together, can lead to glucose reduction, which in turn results in low levels of consciousness. The results also revealed that the drivers who consumed Propranolol, Levothyroxine, Atenolol, and other drugs like Metformin, Nitroglycerin, Teofilin G, Salbutamol spray, and Meperazol are exposed to a higher risk of accident occurrence, but the difference was not significant. Also, a larger sample size is needed. Based on these findings, the drivers who consumed Glibenclamide had more chance of accident occurrence and the difference was significant. Glibenclamide is an antidiabetic drug. This type of drug decreases the blood glucose level and produces hypoglycemia. The side effects of hypoglycemia include shakiness, dizziness, confusion, drowsiness, weakness, jerky movement, seizure, and blurred vision that these can be effective in the crashes.²⁵ Other results show that the consumption of somnolent drugs (a drug that sleeps), anti-histamine, Prazosin, and alcohol play an important role in driving accidents,^{27,28} in this study, none of the drivers consumed them. The limitation of this study was self-report.

Conclusion

The result of this study revealed that frequencies of cardiac and vascular, and hypertension diseases were not higher in drivers with traffic accidents than in those without traffic accidents while

diabetes and weakened vision lead to an increase in traffic accidents in comparison with healthy people. It should be noted that two factors including the more physical weakness and lower consciousness from one side and less risk taking from other side can be led to more chances of accidents. A bigger sample size is possibly required to compare each factor separately. Among the medical drugs consumed, Gemfibrozil and Glibenclamide led to more chance of accident occurrence because of their side effects on the central nervous system.

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Ethical statement

Ethical affirmation has been achieved from the ethical committee

Conflicts of interest

The authors report no conflicts of interest.

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