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Research Paper: Patterns of Drunk and Drugged Driving in Fatally Injured Drivers in Tehran, Iran

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ABSTRACT

Background: Substance abuse in drivers is a global public health concern. We investigated patterns of alcohol and illicit drug consumption in drivers died in traffic accidents in Tehran Province, Iran.

Methods: In this cross-sectional study, presence of alcohol and illicit drugs in the body of dead drivers referred to Tehran Legal Medicine Organization during April 2016 to April 2018 were investigated. All participants underwent autopsy and their urine, visceral and vitreous samples were examined for alcohol and illicit drugs. Victims with Complete Toxicology Tests for both alcohol and non-alcoholic drugs and those autopsied during their first 24 hours of death were included. Victims' demographic characteristics, results of their toxicology tests and accident-related factors were investigated, too. To warrant confidentiality of information, identities of victims were concealed. The obtained data were analyzed by SPSS V. 16 and statistically significant level was set at less than 0.05.

Results: Of 618 study participants (mean age of 36.95 years), 601 (97.3%) were male. Of victims, 566 (91.3%) were city inhabitants and 471 (76.2%) were with educational attainment of lower than high school. The majority (93%) of crashes happened inside the city. Causes of death were head trauma in 519 (84%) cases, multiple traumas in 62 (10%) cases and bleeding in 37 (6%) cases. Multiple and single-vehicle accidents account for 498 (80.5%) and 98 (17.5%) crashes, respectively. A total of 73 (11.8%) cases were found positive for alcohol/drug consumption: 24 (4%) were alcohol positive, 52 (8.4%) were positive for non-alcoholic drugs (3 were positive for both). Main detected non-alcoholic drugs were morphine and tramadol. There was statistically significant association between drug/alcohol consumption of drivers and cause of death and crash mechanism (Both P<0.001). Multiple traumas and single vehicle crashes were more prevalent among drivers with drug/alcohol positive tests.

Conclusion: Rate of alcohol use in our drivers was lower than many countries which is attributed to religious and legal issues. Consistent with the reported pattern of drug abuse in Iranian general population, opioids and tramadol were the main drugs of abuse among studied drivers. Drug or alcohol use result in drivers' distraction and more fatal injuries.

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1. Introduction

Human errors while driving are of the main risk factors of traffic accidents [1]. Driving under the influence of alcohol or drugs raise the risk of fatal crashes by altering driver's mental status and reactions [2] that is an important public health concern [3, 4]. Drunk-driving have already been the topic of many studies and alcohol is now accepted as a great risk factor of fatal crashes [3]. However, the use of psychoactive drugs in drivers and their consequences are a new research area that suffers from insufficient evidence [3, 5]. Collecting results of studies on drugged-driving and comparing them with drunk-driving encounters various obstacles; psychoactive drugs constitute a wide spectrum with various indications and effects and studied populations and methods used for drug measurement among them are different in various studies [3, 5].

According to global reports, alcohol-related traffic deaths are 4.7 times more common than drug-related traffic deaths [3]. However, this pattern is not the same in all countries and regions. Patterns of the use of alcohol and drugs among drivers is a reflection of their use in general population of any region and this underscores the need for regional epidemiological studies [6]. The majority of information about substance use among drivers come from developed countries and there is lack of evidence from developing countries [3].

Mortalities and burden of traffic injuries in Iran are high [7, 8]. Errors and risky behaviors among Iranian drivers are considerable [7]. Some studies have focused on Iranian drivers' risky behaviors but they have not investigated substance use among them [7, 8]. Understanding extent and patterns of drug/alcohol use in drivers is essential for establishment and implementation of effective interventions [3, 6, 9]. Numerous studies have focused on drunk or drugged-driving in Iran but they are regional and methodologically different and no comprehensive study is available [10, 11]. In this study, we investigated frequency and patterns of drug/alcohol use in a sample of Iranian general drivers who died in traffic accidents.

2. Materials and Methods

In this cross-sectional study, we investigated the presence of alcohol or illicit drugs in the body of dead drivers during April 2016 to April 2018 in Tehran Province, Iran. All victims of traffic accidents are referred to Iranian Legal Medicine Organization for autopsy and further exploration. During autopsy, vitreous, urine and visceral (gastric, liver and biliary) samples are obtained for routine toxicology exploration. All samples are analyzed at Legal Medicine Organization Toxicology Laboratory. Head Space Gas Chromatography is used for the exploration of the presence of alcohol in vitreous samples. Thin Layer Chromatography (TLC) and Gas Chromatography-mass spectrometry (GC mass) are other methods used on visceral samples to explore the presence of routine illicit drugs.

Only cases with complete laboratory toxicology tests for both alcohol and illicit drugs were included in the study. To avoid false positive results due to alcohol production in cadavers, we only included recently dead cases (in the first day of their death). Victims with ambiguity in their condition during fatal accident (susceptibility of being driver or passenger) were not also included. Demographic data of victims and results of their laboratory tests were both investigated. Identity of all study participants were concealed and each one was assigned a code. Data were analyzed by SPSS V. 16. The Chi-squared Test was used for statistical analysis and statistically significant level was considered at less than 0.05.

3. Results

During this 2-year study, only 618 cases met the inclusion criteria of which, 601 (97.2%) were male. Mean±SD age of victims was 36.95±12.53 years and they ranged from 17 to 83. Figure 1 shows age classification of victims. Place of accident was inside the city in 575 (93%) cases and suburban roads in 43 (7%) cases. Among study population, 566 (91.3%) were city inhabitants and 54 (8.7%) lived in villages or suburb areas. Educational attainment of victims is presented in Table 1. Type of vehicles used by dead drivers are presented in Table 2. Causes of death were head trauma in 519 (84%) cases, multiple traumas in 62 (10%) and bleeding in 37 (6%) victims.

Alcohol was found in 24 (4%) cases. Blood alcohol concentration among them ranged from 62 to 310 mg/dL. Illicit drugs (other than alcohol) were found in 52 (8.4%) cases. Table 3 presents drugs of abuse and their frequencies in victims. It should be mentioned that 3 subjects were positive for both alcohol and other illicit drugs; therefore 73 (11.8%, 95%CI: 9.25% -14.34%) cases were positive for substances. A total of 296 (48%) cases died at crash scenes, 266 (43%) in hospital and 56 (9%) on the way to the hospital. Multiple and single-vehicle accidents accounted for 498 (80.5%) and 98 (17.5%) crashes, respectively. In 12 (2%) cases, mechanism of accident was not clear. Association between drug/alcohol use of

Table 1. Educational attainment of dead drivers

Education	No.	%
Illiterate	45	7.3
Lower than high school	426	68.9
High school graduates	117	18.9
College and higher	30	4.9
Total	618	100

drivers and their cause of death and also accident mechanisms are summarized in Tables 4 and 5.

4. Discussion

In this study on 618 consecutive fatally injured drivers in Tehran, Iran, more than 97% of the victims were male. Male predominance in traffic mortalities is a global picture [12] and may be attributed to greater risky driving behaviors among men [13]. Mean age of the victims was 36.95 years and 46% of them were in the age range of 20-40. This age distribution is in line with the findings of other Iranian reports of traffic-related mortalities [7, 14]. The majority of our study population had low educational attainment: 76.2% were illiterate or not completed high school. Numerous studies that have

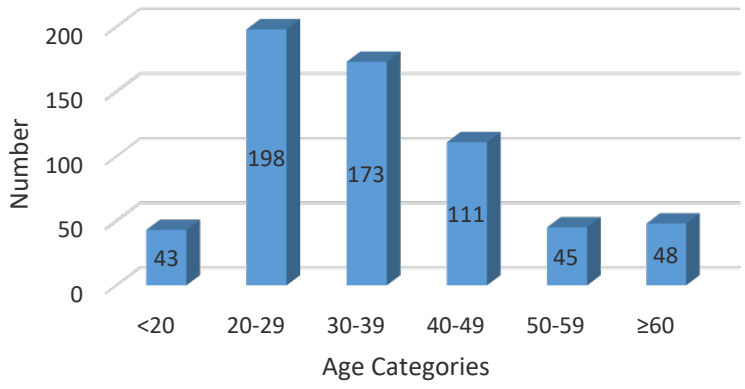

Figure 1. Age classification of study population

Table 2. Type of vehicles used by dead drivers

Vehicle Type	No.	%
Car	482	78
Motorcycle	48	7.8
Truck	34	5.5
Van	31	5
Bus	17	2.7
Bicycle	6	1
Total	618	100

Table 3. Frequency of non-alcoholic illicit drugs used by dead drivers

Drug	No.	%
Morphine	24	46
Tramadol	16	31
Amphetamines	9	17
Others	3	6
Total	52	100

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investigated socioeconomic status of traffic-related victims show relationship between fatality of accidents and low educational attainment [7].

Although crashes involving heavy vehicles are more fatal, most of the involved automobiles in our study were light vehicles. This may be due to characteristics of our study population that 91.3% of them were city inhabitants and commuted within the city in light vehicles. We need further studies on the relationship between types of involved vehicles and mortality of accidents.

Rate of substance (drug or alcohol) use in the drivers of this study was 11.8%. A recent study from the United States reports that 65.7% of drivers injured in traffic accidents used drug or alcohol [15]. Another study on 79932 drivers in the U.S. during 2008-2013 reported the rate of 54.8% for drunk or drugged driving [16]. Among 118 dead drivers in Scotland during 2012-2015, rate of alcohol/drug use was 57% [17]. A study in five Nordic countries in 2001-2002 found that 42% of drivers killed in accidents used alcohol or drugs [18]. Exploration of 223 dead drivers in Hong Kong during 2006-2015 indicates that 27% of them had alcohol or drugs in their bodies [19].

In a study of 614 dead drivers in Spain in 2014, 39% were positive for alcohol or drugs [20]. While the rate of substance use in our dead drivers is lower than other similar studies, it should be kept in mind that methodology of compared studies are diverse and most of them are from developed countries so comparing results of these studies is not correct [3, 5]. We need comprehensive studies to determine the real rate of substance use in Iranian drivers.

Rate of alcohol use among our drivers was 4%. According to Iranian police database, 12.3% of drivers involved in crashes during 2010 were positive for alcohol [21]. Another study in Hamadan, a Western city of Iran, reports the rate of 8.8% for alcohol use among drivers of crashed vehicles [10]. In the study of dead drivers from

Table 4. Association between drunk or drugged driving and causes of death

Drug/Alcohol Test		Causes of Death			P
		Head Trauma	Multiple Traumas	Bleeding	
Positive	No. (%)	48(65.7)	21(28.8)	4(5.5)	<0.001
Negative		471(86.4)	41(7.6)	33(6)	

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Table 5. Association between drunk or drugged driving and crash mechanisms

Drug/Alcohol Test		Crash Mechanisms			P
		Multiple-Vehicle	Single-Vehicle	Unidentified	
Positive	No. (%)	44(60.3)	26(35.6)	3(4.1)	<0.001
Negative		454(83.3)	82(15)	9(1.7)	

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various regions of the United States during 1999-2010, the rate of alcohol use was 39.7% [2]. Among a sample of Brazilian adult population, 34.7% reported driving under the influence of alcohol [22]. Rate of alcohol use among 1714 injured drivers in 2009 in Australia was 29% [23]. This rate was 5.5% in breath test of a series of general drivers in Thailand [24].

In an interview with professional bus or truck drivers in Pakistan, 6.3% reported alcohol consumption [25]. Most studies about alcohol use in drivers are from developed countries. It is obvious that rate of alcohol use in Muslim countries like Iran is lower than Western countries. However, this rate varies among numerous studies of Iranian drivers. Further studies with more representative samples are needed to determine the rate of alcohol use among Iranian drivers.

In this study, 8.4% of victims were positive for illegal drugs. The detected non-alcoholic drugs in order of their prevalence were morphine, tramadol and amphetamines. Study of injured drivers in Hamadan, Iran reveals the rate of 17.9% for drug use [10]. In an interview with 920 professional drivers in Iran, 46.8% were opioid users [11]. Screening tests of culpable drivers from several states of Iran in 2008 reveals the rate of 60% for drug consumption: opioids in 37.3%, cannabis in 2% and both in 13.7% [6]. According to global reports in 2013, amphetamines (51%), cannabis (22%), cocaine (14%) and opioids (13%) have been the leading substances in drug-related traffic fatalities [3]. Two comprehensive studies on American dead drivers show that stimulants and cannabinol have been the main non-alcoholic used drugs [2, 26].

According to the reports from European Union in 2008, cannabis was the main illicit drug of abuse in injured or killed drivers [27]. Rate of drug abuse in drivers died from fatal accidents in Australia during 2010-2015 was 22% with cannabis as the most common detected drug [28]. In another study on 466 injured drivers in Australia, 54.35% were positive for cannabinoids, 15.6% positive for benzodiazepines, 11% positive for opiates, and 4.1% positive for amphetamines [29].

A new study on 11493 drivers in Denmark reports cannabis as the most frequent drug of abuse followed by cocaine, amphetamines and morphine [30]. According to a survey of 521 drivers in Spain, rate of drug use was 16.4% and drugs in order of their prevalence were cannabis, amphetamines, cocaine and opiates [31]. While rate of illegal drug consumption among drivers show diversity between and within countries, pattern of consumption is consistent in most countries as cannabis and stimulants are the main drugs of abuse. However, pattern of drug use among Iranian drivers is special and opioids stand at top of the list. This pattern is the same as drug abuse pattern in general population of Iran and is attributed to high accessibility to opioids in Iran.

Head trauma is the main cause of traffic-related mortalities in Iran [7, 14] and our study results confirm it, too. In our study 57% of deaths occurred before hospital admission. Comprehensive Iranian studies also report that the majority of traffic-related deaths happen before hospital admission [7, 14]. This may be due to shortcomings in emergency response or the severity of deadly crashes which need further investigations.

Mechanism of accident was associated with drug/alcohol use in our drivers: single-vehicle accidents, compared to multiple-vehicle accidents, were significantly more prevalent among drunk or drugged drivers. This pattern has also been found in other studies in Hong Kong [4], the United States [16] and Nordic countries [18]. Even alcohol/drug use of drivers has been found as a risk factor for single-vehicle crashes [26]. We also found statistically significant association between substance use and cause of death in our study population. Rate of multiple traumas (as the cause of death) in drugged or drunk drivers was about 4 times as this rate in drivers without substance use and indicates severity of traumas in victims with substance use.

This study had several limitations. We included a sample of dead drivers in Tehran by random sampling which may not be representative of all Iranian drivers. Lacking a registry system, many important personal and accident-related information was not available to be included in the study. We only included illicit drugs in our study while prescribed drugs may also be abused by drivers and cause traffic accidents. Owning to lack of victims' demographic information, we could not separate professional drivers from general drivers while their substance use patterns are usually different [11].

5. Conclusion

In this study, the rate of drug abuse among fatally-injured drivers of Tehran Province was twice as alcohol abuse among them. The main drug of abuse were opioids and tramadol which are the same as general profile of drug trafficking and consumption in Iran. To obtain a valid estimate of the extent of drug/alcohol use among Iranian drivers, further comprehensive studies are strongly suggested.

Ethical Considerations

Compliance with ethical guidelines

This project was approved by Ethics Committee of Legal Medicine Organization.

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Authors contributions

Conceptualization: Mohammadreza Ghadirzadeh, Mehdi Forouzesh, Seyed Davood Mirtorabi; Methodology: Mohammadreza Ghadirzadeh, Mehdi Forouzesh, Seyed Davood Mirtorabi, Fardin Fallah; Investigation: All authors; Writing (Original Draft): Fardin Fallah; Editing and Review: All authors; Supervision: Mohammadreza Ghadirzadeh, Mehdi Forouzesh, Seyed Davood Mirtorabi, Abdolrazagh Barzegar.

Conflict of interest

The authors declare no conflict of interest.

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