TRAFFIC ACCIDENTS UNDER THE INFLUENCE OF PSYCHOACTIVE SUBSTANCES – A STATISTICAL STUDY

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Abstract

Introduction: The use of psychoactive substances makes driving a car unsafe, as it puts the driver, passengers and other people who share the road at risk. Many of the accidents and deaths that occur on European roads are caused by people whose performance is impaired by alcohol, illicit drugs and medications, or a combination of these substances.

Material and methods: We performed full forensic autopsy, toxicological analysis of blood, urine and internal organ samples, with subsequent analysis of the results.

Results: For the period 2011-2017 of all cases investigated in the Department of Forensic medicine and deontology, Sofia, Bulgaria in 520 of them the cause of death was associated with traffic accidents. In 81 of the cases the chemical analysis showed the presence of alcohol and/or illicit drugs.

Discussion and conclusions: It is well known that alcohol and illicit drugs impair cognitive and physical abilities. Alcohol was the most commonly recorded psychoactive substance in traffic accidents, followed by marijuana, cocaine, amphetamines and opioids. All of these drugs affect the central nervous system, making driving and psychoactive substance use a life-threatening combination. Understanding the effects of alcohol and different illicit drugs, and the correlations between their use and the risk of traffic accidents are necessary to develop effective public health and law enforcement strategies for prevention and control.

Key words: *driving under influence, psychoactive substances, death, forensic medicine*

INTRODUCTION

The mobility that road transport provided, particularly the car, allows many Europeans today to enjoy a lifestyle characterized by flexibility and independence [1, 2]. However, the most recent statistics reveal that more than 28 000 people die on European roads each year, while a further 1.34 million are injured [1, 2, 3, 4, 5]. Many of the accidents and deaths that occur on European roads are caused by drivers whose performance is impaired by a psychoactive substance (alcohol, illicit drugs, psychoactive medicines or a combination of these substances). The results of experimental studies have indicated that several illicit drugs could have an influence on driving performance [3]. The chronic use of all illicit drugs is associated with some cognitive and/or psychomotor impairment, and can lead to decrease in driving performance even when the subject is no longer intoxicated. Epidemiological studies have confirmed many of the findings from experimental studies. The "Driving under the Influence of Drugs, Alcohol and Medicines" (DRUID) project has calculated that, on average, 3.48 % of drivers in the European Union drive with alcohol in their blood and 1.9 % with illicit drugs [6, 7]. Studies assessing the prevalence of drugs, medicines and/or alcohol in drivers who were involved in a traffic accident (fatal or otherwise) have found that alcohol is more prevalent than any other psychoactive substance, but drugs are also frequently found, and in a higher proportion than in the general driving population. Of the drugs analyzed, cannabis is the most prevalent after alcohol. Statistically, the use of amphetamines, cannabis, benzodiazepines, heroin and cocaine is associated with an increased risk of being involved in and/or responsible for an accident, and in many cases this risk increases when the drug is combined with another psychoactive substance, such as alcohol [9, 10].

MATERIALS AND METHODS

For the period 2011-2017 in the Department of Forensic medicine and deontology, Sofia, Bulgaria, 6672 autopsies of deceased with full forensic analysis were performed. In each case anamnestic and criminal data was gathered from relatives and authorities of the investigation. In addition, chemical analysis of biological materials (blood, urine, internal organ samples, and vitreous fluid) was performed, for the presence of alcohol, illicit drugs and other psychotropic substances. Furthermore, a subsequent complex analysis was made of the presence and type of psychoactive substances in the bodies of the deceased, their age and gender distribution.

RESULTS

For the period 2011-2017 of all cases investigated in the Department of Forensic medicine and deontology, Sofia, Bulgaria in 520 of them the cause of death was associated with traffic accidents. In 81 of the cases the chemical analysis showed the presence of alcohol and/or illicit drugs (Figure 1).

In 2011 in the Department of forensic medicine and deontology, Sofia 1078 autopsies of deceased were performed. In 80 of the cases death was a result of a traffic accident. The analysis of the data showed presence of psychoactive substances in 22,5% of the examined cases – alcohol and illicit drugs from the group of the opioids (methadone). In 82,4% of the cases the deceased were men, and 17,6% - women. The age distribution showed the following: 5,9% of the deceased were under 20 years old; 58,8% were in the age group 21-40 years; 23,5% - 41-60 years, and 11,8% were over 61 years old.

The following year (2012) 895 autopsies were performed, and in 63 of them were due to a traffic accident. The chemical analysis of the biological materials revealed that in 15,9% of the cases there was presence of psychoactive substances – alcohol and illicit drugs (marijuana). In 70% of them the deceased were men and the other 30% were women. The age distribution is as follows: under 20 years – 10%, between 21 and 40 years 50%, for the interval between 41-60 years, and 61-80 years – 20% each.

In 2013 we observed 990 autopsies of deceased and in 81 of them death was associated with a traffic accident. Psychoactive substances (alcohol and marijuana) were detected in 13,6% of the examined cases. All the deceased were men with the subsequent age distribution: 21-40 years – 36,3%; 41-60 years – 54,5%, 61-80 years - 9,1%.

In 2014 we examined 949 cases of death. In 80 of them death was due to a traffic accident. The additional analysis done in these cases showed the presence of psychoactive substances (alcohol and illicit drugs /marijuana and Amphetamines/) in 12,5% of them. The gender distribution showed that the deceased men were 4 times more that woman (80% men to 20% women). The age distribution showed: 20% of the deceased were under the age of 20; 40% - between 21-40 years; 30% - between the ages of 41-60, and 10% over 61 years.

For 2015 the data is as follows: 904 autopsies were performed, in 85 of them death was a result of a traffic accident; the chemical analysis revealed that 13% of the cases were associated with the use of psychoactive substances (alcohol and illicit drugs/cocaine and amphetamines/). All of the deceased were men with the following age distribution: 9,1% under the age of 20; 54,5% were between 21 and 40 years; 27,3% were between 41-60 years and 9,1% over 61 years.

In 2016 we performed 867 autopsies and in 56 of them death was a result of a traffic accident. The chemical analysis revealed that 17,9% were positive for psychoactive substances –

alcohol and marijuana. All of the deceased were men. The age distribution is as follows: 10% under 20years, 30% between 21-40 years, and 60% between 41-60 years.

For the year 2017 in the Department of Forensic medicine and deontology 898 were performed and 75 of them were associated with a traffic accident. In 14,7% of the cases the toxicology analysis revealed the presence of psychoactive substances – alcohol, marijuana, cocaine and amphetamines. Again all of the deceased were men. The age distribution shows the following: 36,4% between 21-40, 27,3% between 41-60, and 27,3% over 61 years.

In alcohol positive cases the deceased were separated into three groups: with mild, moderate and heavy alcohol consumption as presented on Figure 2. In all three groups men prevail over women, as they are 67% of the cases with mild alcohol consumption, 100% with the moderate one, and 92% with the heavy alcohol consumption.

DISCUSSION

Driving while under the influence of psychoactive substances is especially dangerous [10, 11]. The effects of specific drugs on the human body differ depending on how they act in the brain. Drivers who have been drinking have a much higher risk of involvement in crashes compared to those with lack of alcohol in their blood, and this risk increases rapidly with higher blood alcohol concentration [2, 12]. Alcohol can affect drivers judgement and reasoning, it slows down their reactions, upsets the sense of balance and coordination, and causes impairment in vision (blurred and double vision, loss of peripheral vision) and hearing, loss of concentration and a feeling of drowsiness [13, 14].

After alcohol, marijuana is the drug most often found in the blood of deceased involved in traffic accidents [8, 14, 15]. Cannabis acutely reduces some cognitive and psychomotor skills that are necessary to drive, such as motor control, psychomotor speed, executive function, motor impulsivity, visual processing, short-term memory, working memory (reaction time and accuracy), perception and balance, and these effects are mostly dose dependent [15, 16, 17, 18, 19, 20, 21, 22]. Tests for detecting marijuana in drivers measure the level of delta-9- tetrahydrocannabinol (THC), marijuana's mind-altering ingredient, in the blood. But the role that marijuana plays in crashes is often unclear [21, 23]. THC can be detected in body fluids for days or even weeks after use, and it is often combined with alcohol. The risk associated with marijuana in combination with alcohol, cocaine, or other drugs appears to be greater than that for either drug by itself [6, 11].

Drivers who have used cocaine or amphetamine can be aggressive and reckless when driving, because cocaine leads to a sense of over-confidence that can result in a riskier driving at greater speeds. Epidemiological studies show that cocaine may increase the risk of being involved in or responsible for an accident. Chronic use of cocaine can cause difficulties in processing cognitive tasks requiring attention, visuospatial perception, memory, cognitive flexibility, perceptual–motor speed, problem-solving, abstraction and executive functioning as well. When drugs are wearing off users may feel tired, affecting concentration levels which, in addition can be dangerous when the person is driving [4, 5, 24].

The research we conducted showed that for the period 2011 - 2017 in 15.2% of the cases investigated, the presence of psychoactive substances in blood and urine samples was found. Alcohol was the most frequently detected psychoactive substance in drivers killed in accidents - in 87.3% of the cases we found the presence of ethyl alcohol, and in 2.5% the alcohol was in combination with a narcotic (stimulant or opioid) substance. Most of the cases the blood alcohol concentration was mild (under 1,5 ‰) – in 39,6%, followed by moderate consumption (1,6-2,5‰) in 35,8% of the cases and the heavy alcohol consumption (over 2,6‰) – in 22,6%.

Narcotic drugs were found in 15.2% of the cases reported, distributed as follows: 6 of the cases were positive for marijuana as we found its active metabolite tetrahydrocannabinol (THC) in the examined samples of blood and urine; in 4 cocaine use was observed, in 3 - the use of amphetamines, and 1 showed the presence of the opioid analgesic methadone, a substance used in the treatment of heroin dependence. Therefore, from all cases with proved use of an illicit drug the most frequently used one in death cases associated with traffic accidents is marijuana, followed by cocaine, amphetamines and opioids (Figure 3).

The most affected age groups are in the age range of 21-30 and 31-40 years, followed by 41-50 and 51-60 year (Figure 4). Men significantly outnumbered women, with the latter accounting for only 10% of the cases investigated.

It is well known that alcohol and illicit drugs alter brain chemistry and impair cognitive and physical abilities. Experimental and epidemiological studies show that, while alcohol is still the number one substance endangering lives on European roads, the number of traffic accidents associated with illicit drug use is also of severe significance. Cannabis is the most prevalent illicit drug detected in drivers. It can reasonably be inferred that the use of alcohol and drugs in young age and the male gender are important factors that directly lead to a drastic increase in the risk of fatal outcome in cases of traffic accidents. As the age increases, fewer deaths cases are associated with the consumption of alcohol and other psychoactive substances. Understanding the effects of different psychoactive substances and the correlations between their use and the risk of traffic accidents are necessary to develop effective public health and law enforcement strategies for prevention and control. Efforts to understand these relationships can contribute to the process of identifying ways to prevent their occurrence or to reduce their magnitude, severity, and their recent apparent intensification.

Statement for Potential Conflicts of Interest – No potential conflict of interest was reported by the authors.

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Figure 1. Traffic accidents, psychoactive substances and their distribution for the period 2011-2017 by materials of the Department of Forensic medicine and deontology, Sofia, Bulgaria.

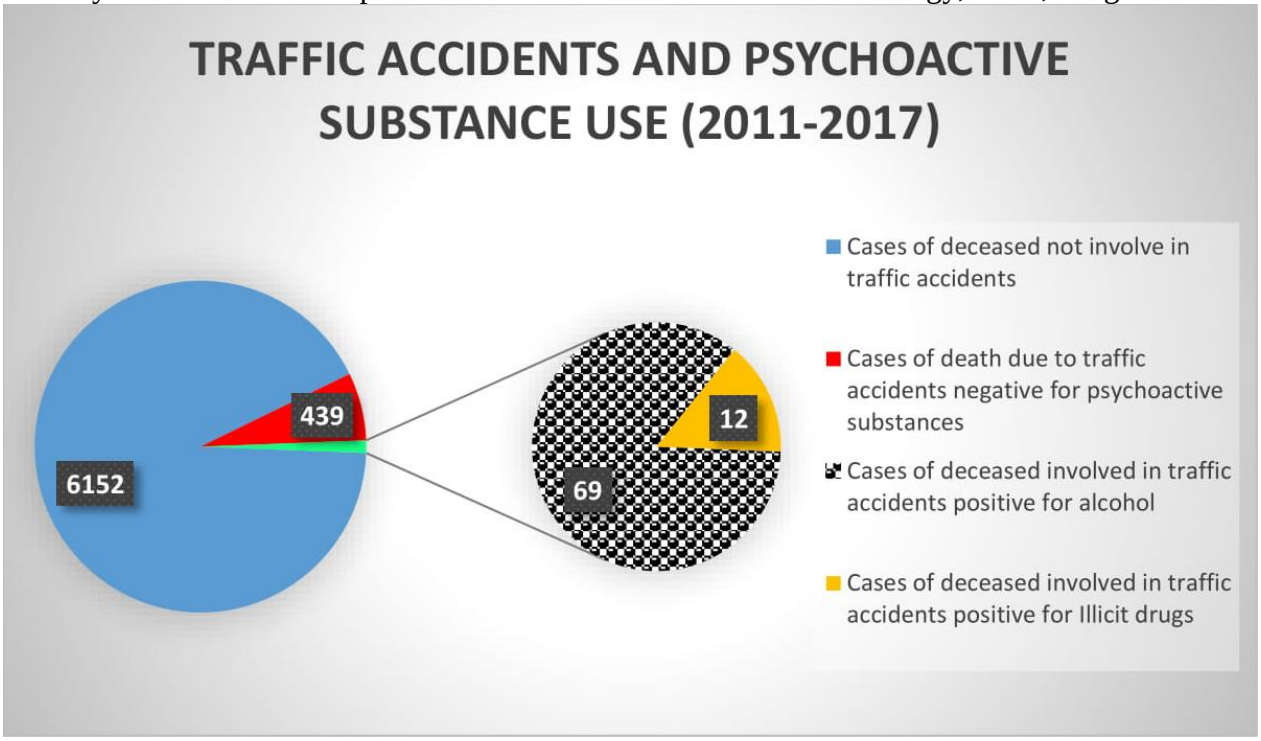

Figure 2. Type of alcohol consumption in cases deceased in traffic accidents. Gender differences.

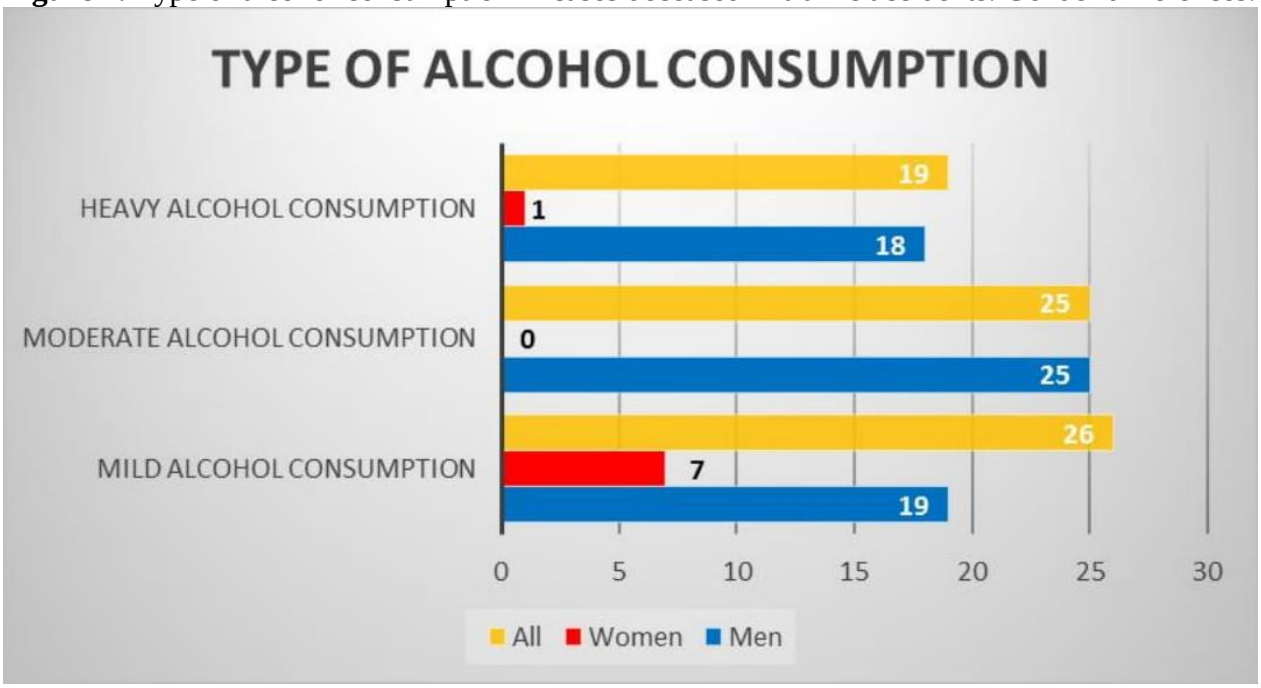

Figure 3. Distribution of the cases positive for illicit drugs (by materials of the Department of Forensic medicine and deontology, Sofia, for the period 2011-2017)

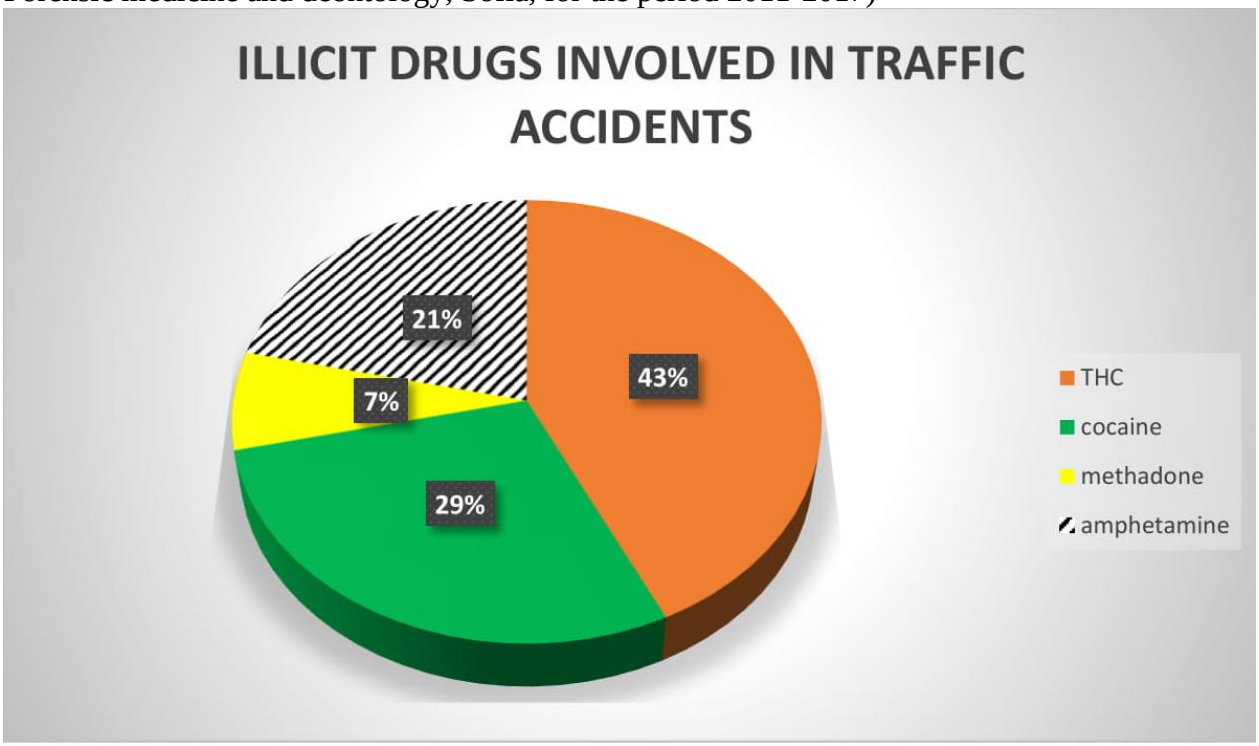

Figure 4. Age distribution of the cases positive for psychoactive substances for the period 2011-2017, by materials of the Department of Forensic medicine and deontology, Sofia, Bulgaria