

Research Article

Poisoning-Related Fatalities in Eastern Province-Saudi Arabia

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Abstract

Substance misuse is an increasingly pressing issue, and poison-related deaths account for a sizeable percentage of all deaths in the general population. This study investigated the pattern and manner of toxin-related fatalities in the Eastern Region, KSA, from 2009 to 2013. A total number of 1812 suspected cases of poison-related fatalities were reported to Dammam Poison Control Center (DPCC), and 353 (19.5%) cases were identified as positive for at least one drug or substance. Among them, 199 (56.4%) were related to accidental injury/death, 68 (19%) to suicide and 34 (9.6%) to homicide. In the current study, men constituted 92.6% of the total number of fatalities and 51.6% were non-Saudis. Ethanol-associated cases accounted for 173 deaths (49%), while heroin-related fatalities numbered 41 (11.6%). Amphetamine accounted for 48 deaths (13.5%). Finally, pesticides and carbon monoxide accounted for 28 and 47 deaths (7.9% and 23.6%) respectively. This study highlights the variation in the incidence and type of abused drugs and toxic substance-related deaths in Eastern Province –Saudi Arabia compared with other countries.

INTRODUCTION

Every year, a significant number of poisoning cases are reported worldwide. According to the WHO, approximately 370,000 deaths are caused by deliberate ingestion of chemicals each year. Pesticides, drugs, and alcohol are found most commonly in toxic substances-related cases. The collection and analysis of data from toxic substance-related cases may help reduce the occurrence of poisoning [1].

Drug abuse remains a significant problem in the society in many countries. Compared with their contemporaries, individuals abusing illicit drugs suffer a significantly higher risk of premature death and in studies where cohorts of drug abusers have been observed, a 6–38 higher mortality rate has been reported [2].

Mortality studies are recognized internationally as useful investigative tools for indicating trends in substance overdose. Taken in isolation the results may be of limited value, but taken in conjunction with information from other studies, for example the prescribing trends or problems related to drugs in accident and emergency departments, such studies give a clearer picture of drug-taking behavior and drug dependence [3].

Illicit drug-related deaths are usually seen among adolescents and adults, and constitute a large proportion of the problem. In most such cases, death is accidental. Strict legislation

concerning illicit drug dealing, as well as control over drug prescription, can prove effective in tackling this problem in the community. Drug abuse has been increasingly involved in violence and the number of deaths around the world. Although this abuse is not always the direct cause of death, it can influence the final outcome of a violent event. Fatalities involving alcohol are normally associated with traffic accidents [4].

THE AIM OF THE WORK

The aim of this study was to consider the various classes of toxic substances and investigate their associations with demographic data, forensic type of the case, and manner of death, and to clarify the pattern of drug abuse in suspected case fatalities, in the Eastern province of Saudi-Arabia during the period 2009 -2013.

MATERIALS AND METHODS**Data sources**

According to Saudi Arabian laws, all suspected unnatural deaths – including cases of suspected substance abuse, suspected drugs overdose, unknown cause of death, unknown identity, or sudden death cases - must be reported to the police by the physician issuing the death certificate.

In most of these cases, the police will request a forensic autopsy. During an autopsy in the institute of forensic medicine,

femoral blood, urine and vitreous samples are collected. These are then fluorinated, and submitted to the Forensic Chemistry department in Dammam Poison Control Center "DPCC" where all the samples are routinely and presumptively screened for pharmaceutical drugs, ethanol, illicit drugs and chemical substances, followed by confirmatory analysis by GC/MS & LC/MS.

Data collection procedure and identification of the cases

This is a cross-sectional descriptive study covering data collected in the period 2009 – 2013, involving two sections; the first one was a retrospective study of the first two years (2009-2010) and the second one was a prospective study of the last three years (2011-2013), during which all post-mortem reports and samples positive for drugs, chemicals and/or illicit substances were identified. The complete original file was used to scrutinize the circumstances surrounding death, and premorbid clinical and demographic information was also recorded in order to estimate the relative importance of different drugs and substances for the cause of death in poisoning cases.

Analytical methods

Ethanol was analyzed using head-space gas chromatography. The limit of quantification was 0.1 mg/ml [5]. Pharmaceutical drugs were analyzed by gas-chromatography with a nitrogen specific detector after alkaline and neutral extraction. Illicit drugs were screened in urine and in blood by immunoassays. All positive screening results were confirmed and quantified with liquid chromatography-mass spectrometry after liquid/liquid extraction [6]. Opiates and Amphetamine were analyzed with GC-MS after liquid/liquid extraction before GC-MS detection [7]. Cannabis was confirmed by analyzing the presence of tetrahydrocannabinol (THC) using a method based on solid-phase extraction followed by gas chromatography-mass spectrometry [6]. Pesticides were analyzed with gas-chromatography-mass spectrometry (GC-MS) [8].

Case categorization and data analysis

A detailed analysis was undertaken to examine and correlate data elements with each other based on the following:

- Basic characters; this included the prevalence of deaths attributed to the drug and drugs of abuse in relation to gender, age, nationality, manner of death, circumstances of death, presence of injection marks and finally the type of case .

- Toxicological findings; which included results of drug(s) or substance(s) of abuse implicated in death.

- Circumstances & manner of death; accidentally discovered, suicide, homicide, road traffic accident, fire, sexual assault, hanging or undetermined cause of death.

- Pattern of drug abuse; mono-abuser, bi-abuser or triple-abuser pattern.

Statistical analysis

The latest SPSS statistical package, Version 21 was employed to evaluate the data statistically. The data was represented as

number, percentage, minimum, maximum, and mean \pm Standard Deviation of means (Mean \pm SD).

RESULTS

Over the five-year duration of the study, we received a total number of 1812 suspected cases for drug/chemical substance-related fatalities. The total number positively identified for at least one drug or substance was 353 (19.5%). Table 1 represents the age, gender and nationality of the victims by the manner of deaths. Death in more than 50% of cases, 56.4% (199/353), was of the accidental type. There was a predominance of males over females in all types of death. Non-Saudis represented a higher ratio than Saudis in suicidal deaths, 74% (50/68), and the most common non-Saudi nationality involved was Indian. On the other hand, Saudis represented the majority of accidental deaths, 58 % (115/199).

Among the studied cases, accidental death, suicide, and homicide were the more frequently observed types. The most common substance implicated in accidental, suicidal and homicidal deaths was ethanol 41% (82/199), 50% (34/68) and 44% (15/34) respectively, as shown in Table 2. Ethanol was positive in 49% of the cases (173/353). There was a significant increase of ethanol-related deaths during the year 2001, as shown in figure 1.

Numbers of samples tested positive for drugs of abuse related fatalities were 131 cases, 37% (131/353). As shown in table 3, Morphine was tested positive in 11.6% (41/353) and heroin was identified by detection of 6-MonoAcetyMorphine in 34 cases of 41 positive opiate cases. The nationality of most of morphine/heroin-associated deaths was Saudi (34/41). Amphetamine was positive in 13.5% (48/353). The nationality of most of amphetamine-associated deaths was Saudi 41/48. Tetra-hydrocannabinoids were detected in 10.4% (37/353) of cases. The nationality of most of the cannabis-associated deaths was also Saudi, 33/37. Cannabis was most commonly detected in the bi-abuser pattern as it represented 62 % (23/37) of the cases 15 cases with amphetamine and 8 cases with heroin, as shown in figure 2.

The revealed data from table 4 demonstrates the highest number of cases of detected alcohol was in road traffic accidents, 39 cases, while in suspected cases of toxicity, heroin represented the most detectable abused substance, 40 cases, in suspected overdose studied case.

Table 5 demonstrates a highly positive significant direct correlation coefficient relationship between alcohol concentration in variable biological samples of "blood, urine and vitreous humor".

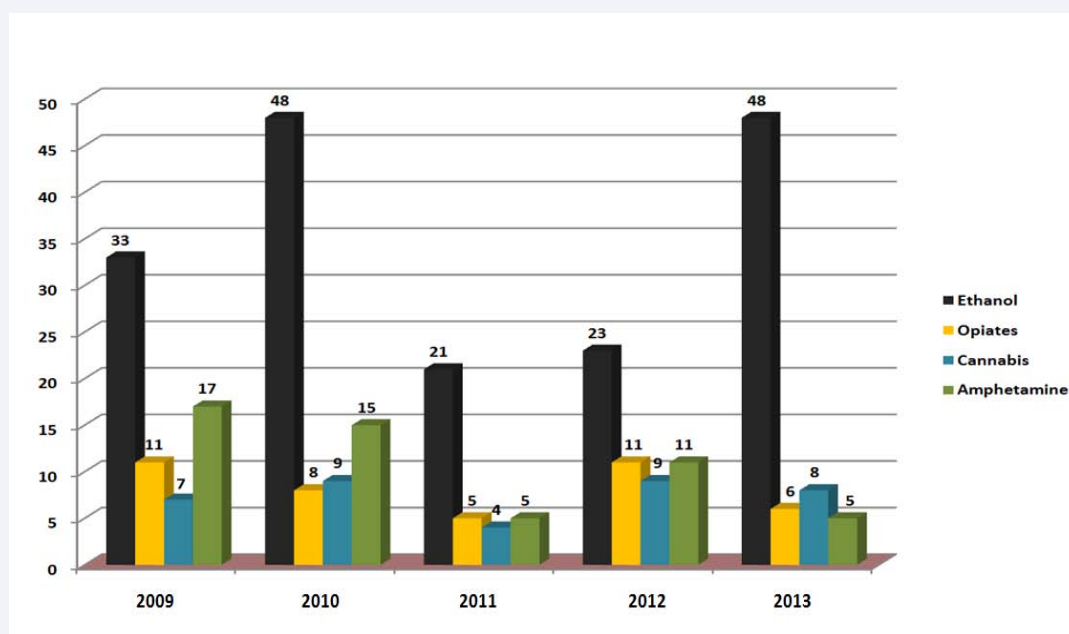
The recorded abused substances in this study included alcohol, morphine, heroin, amphetamine and cannabis. The mono abuser pattern was most commonly detected among non-Saudis while in the bi-abuser and triple abuser patterns the majority were Saudis, as shown in figure 3. The single most commonly abused drug was ethanol, as shown by figure 2. Also, the researchers reported injection marks in 75% (31/41) of heroin-positive cases.

Table 1: Age, sex and nationality of victims of poison related fatalities according to the manner of death.

Manner of death		Sex		Age		Nationality	
Type	N (%)	Male N (%)	Female N (%)	Male Mean±SD	Female Mean±SD	Saudi N (%)	Non Saudi N (%)
Accidental	199(56.4)	183 (92)	16 (8)	31±13	35±17	115 (58)	84 (42)
Suicidal	68(19)	60 (88)	8 (12)	35±9	34±6	18 (26)	50 (74)
Homicidal	34 (9.6)	34 (100)	0(0.0)	35±11	—	24 (71)	10 (29)
Undetermined	52(14.7)	50 (96)	2 (4)	42±10	37±18	15 (29)	37 (71)
Total	353 (100)	327(92.6)	26 (7.4)	35 ±10	35±13	172 (48.7)	181 (51.2)

Table 2: The Relationship between Implicated Toxins, Drugs and Substances of Abuse by Manner of Death.

Manner of death	Drugs of abuse			Alcohols		Toxic Gases		Pesticides			Drugs	
	Opiates	Amphetamine	Cannabis	Ethanol	Methanol	Carbon Monoxide	Hydrogen Sulphide	Organophosphates	Carbamates	Rodenticide	Tramadol	Antipsychotics
Accidental: 199(56.4)	38(19)	24(12)	23(11.5)	82(41)	8(4)	47 (23.6)	13(6.5)	0 (0.0)	(0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Suicidal: 68 (19.3%)	2(2.9)	6(8.8)	2(2.9)	34(50)	—	—	—	22(32.4)	3(4.4)	3(3.4)	4(5.8)	2(2.9)
Homicidal: 34(9.6%)	1(2.9)	14(41)	9(26.5)	15(44)	—	—	—	—	—	—	—	—
Undetermined: 52 (14.7%)	0 (0.0)	9(17.3)	3(5.7)	42(80.7)	—	—	—	—	—	—	—	—

**Figure 1** Distribution of drugs of abuse and ethanol related deaths during the period of the study.

In the current study, twenty-eight postmortem samples tested positive for pesticides, twenty two for diazinon, three cases were positive for carbamate, two cases for aluminum phosphide and only one case for zinc phosphide. Four postmortem samples tested positive for tramadol and two were tested positive for antipsychotics (venlafaxine).

DISCUSSION

This study showed a marked preponderance of males over females; however, this ratio, 12:1, is far greater than the one reported in another previous study, which was 7.5:1[10]. This finding was in agreement with those of several studies indicating that males are likely to lead more social lives, and may

Table 3: Distribution of Abused Substances and Ethanol According to Demographic Data.

	Ethanol	Opiates	Amphetamine	Cannabis
Age				
(Mean±SD)	39±10	37±8	39±11	40±9
Sex				
Male (n.)	171	39	46	35
Female (n.)	2	2	2	2
Nationality				
Saudi (n.)	66	34	41	33
Non-Saudi (n.)	107	7	7	4
Total	173	41	48	37

Table 4: The Detected Toxins, Drugs, Substances of Abuse and Ethanol in Postmortem Samples According to Preliminary Forensic Case Diagnostic Type:

Type of Case	Drugs of abuse			Alcohols		Toxic Gases		Pesticides			Drugs	
	Opiates	Amphetamine	Cannabis	Ethanol	Methanol	Carbon Monoxide	Hydrogen Sulphide	Organophosphates	Carbamates	Rodenticide	Tramadol	Antipsychotics
Road Traffic Accidents: 40 (11.3%)	--	6	7	39	--	--	--	--	--	--	--	--
Hanging: 38 (10.8%)	--	4	6	29	--	--	--	--	--	--	--	--
Direct toxic overdose: 87 (24.6%)	40	14	6	20	8	--	--	22	3	3	4	2
Falling /drowning: 27 (7.6%)	--	6	1	30	--	--	--	--	--	--	--	--
Violence: 29 (8.2%)	1	12	8	14	--	--	--	--	--	--	--	--
Suffocation: 60 (16.9%)	--	--	--	--	--	47	13	--	--	--	--	--
Sudden death: 19 (5.4%)	--	7	1	13	--	--	--	--	--	--	--	--
Unknown: 33 (9.3%)	--	4	8	28	--	--	--	--	--	--	--	--
Total	41	53	37	173	8	47	13	22	3	3	4	2

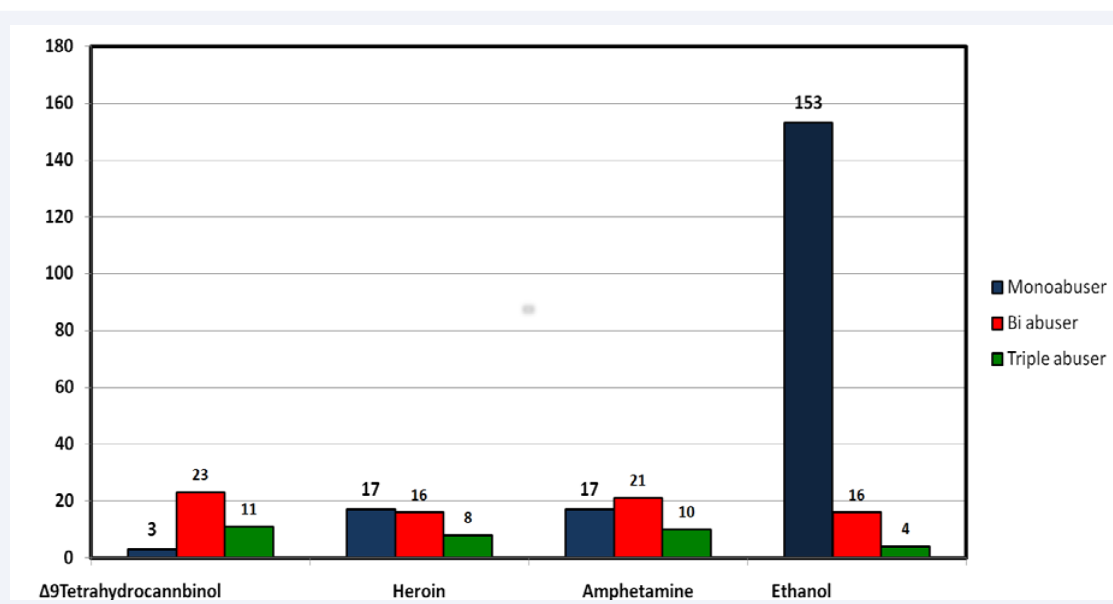


Figure 2 Pattern of abusing of the detected drugs of abuse and Ethanol.

therefore experience more conflicts with others[9,11,12]. The percentage non-Saudi victims in the current study were (51.2%). They were mostly multi-racial south-Asians, with a large number of expatriates of different ethnic and cultural backgrounds in the Eastern province. In addition to the attitude of Saudis who refuse to allow forensic examinations and autopsies of their relatives for cultural, social, and /or religious reasons.

During the study period, 86% of the total cases tested positive for drugs of abuse and ethanol. This was due to the problem of imported illicit drugs in Saudi Arabia. In Jordan, drug abuse related- or associated- death represented 23.9% (44/184) of death resulting from toxicological causes [13], which is nearly half the figure reported in Greece[14]. Ethanol was the main substance found in the postmortem materials (49%) and it represented the most common substance implicated in accidental deaths (41%) and suicidal deaths (50%) (by hanging), especially in non-Saudis. This could be attributed to the associated impaired consciousness level, poor motor co-ordination, lack of awareness and poor judgment. In many reported cases, ethanol was contaminated with methanol as that discovered by detection of methanol in eight studied cases, where its concentration varied from (40-309 ng/ml).

In the present study, the incidence of ethanol-related deaths showed an increase during 2013 compared to the previous four years as ethanol is locally manufactured and marketed at a cheap price, although it is prohibited. Although several results similar to those of the present study were found, differences also

existed between countries, which resulted from the different social sections, cultural aspects and historical influences of liquor in each country. In Sweden (2002–2003), alcohol accounted for 43% of the cases investigated [15]. In Jordan, alcohol accounted for 50% of the 60 cases investigated, followed by neuroleptic drugs (26.6%) [16].

Amphetamine was detected in 48 cases (13.5%). The last year of the study showed a marked reduction in the number of detected amphetamine cases in relation to the previous four years, which probably reflected the influence of the introduction of harsh punishments for drug dealing in the kingdom, coupled with a combined policy of strict legislation and tight religious control against drug trafficking. In the current study, most deaths related to amphetamine were attributed to direct accidental overdose (14/87) and violent behavior leading to a traumatic accident (12/87), which indicates a level of reckless behavior and poor awareness of danger that may not be well recognized by amphetamine users. The present study revealed that amphetamine was used most commonly in the bi-abuser pattern (21/48), especially with cannabis, which forms a dangerous drug combination that can easily cause accidental death as cannabis simply masks the other drug's effects, leading to amphetamine overdoses which can in turn lead to fatal hyperthermia, heart arrhythmia and stroke [17].

In the present study, 41 cases (11.6%) tested positive for opiates (heroin was identified by detection of 6- mono-acetylmorphine in 34 of 41 cases). In a previous study done in the

Table 5: Correlation Co-efficient of various among various Blood, Urine and Vitreous Alcohol concentration:

Sample Type	No.	Ethanol Concentration {mean ±SD}	Correlation Coefficient (r)
Blood Alcohol Level "BAL"	178	174 ±144	r "BAL-UAL" = 0.000**
Urine Alcohol Level "UAL"	117	178 ±112	r "UAL-VAL" = 0.000**
Vitreous Alcohol Level "VAL"	28	177 ±115	r "VAL-BAL" = 0.006**

**p value highly significant >0.00

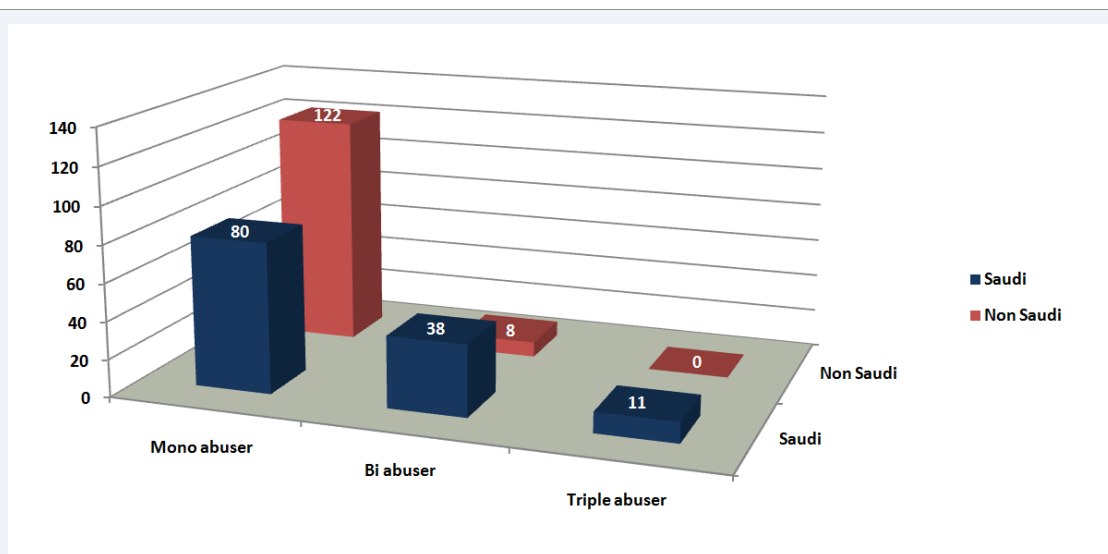


Figure 3 Pattern of abusing according to the nationality.

Eastern province, KSA, opiates were found to represent 47% of deaths [10]. The last national household survey on drug abuse conducted in 2001 showed the percentage of lifetime use of opiates was 1.3%, mainly from the use of codeine syrup [18]. All the cases that tested positive in this study were indigenous Saudi males, and that was consistent with a previous study in the Eastern region of Saudi Arabia [10] and another study in the region [13]. One can conclude that the main route of heroin and morphine abuse in Eastern province was intravenous, similar to other reported studies [19–20]. In the present study, opiates were abused alone in 40% of the cases, and in combination with another substance, mainly amphetamine, in 39% of the cases. Mixing opiates with amphetamine is a well-known bad practice because the stimulant effect will mask the opiate effects of heroin and make overdoses more likely, so heroin was the most commonly implicated substance in direct fatal overdose in Eastern province –Saudi Arabia.

The reported cannabis-related cases in this study numbered 37 (10.4%). Cannabis was most commonly detected in the bi-abuser pattern with amphetamine and to lesser extent with heroin. Deaths involved some opiate and amphetamine overdoses where such substances were detected in lethal amounts and considered as the main toxic substances.

In the present study, carbon monoxide was the most frequently encountered poisonous gas in Saudi Arabia, which agrees with previous reports [21]. It was detected in the post mortem samples of 47 cases. The exclusion criteria victims of fire deaths where carbon monoxide levels were not lethal were excluded from this study) in the present study. Carbon monoxide is the second most common implicated substance in accidental deaths by asphyxiation, with concentrations ranging from 30–60 mg/dl. Similar to the Morocco report, accidental carbon monoxide-induced death because of exposure to a heating stove was the main cause of toxicity in the winter months of November to February in Morocco [21]. Also, the prevalence of camping trips in desert places and the use of heating stoves in closed tents had an influence on the figures. These data are supported by other studies in many countries which have stated that alcohol, illegal drugs and carbon monoxide are involved in most fatal poisoning cases [22]. In Cuyahoga, USA, the main cause of carbon monoxide-induced death was accidents due to fire or arson in the home [21].

Pesticides in the current study were the most significant source of intoxication in suicidal deaths. They were detected in postmortem samples of 28 cases of all in suicidal death manner. Highly hazardous pesticides are easily available because of their low price, widespread use, and lose control in sale and/or use [22]. The reason for the relatively low number of cases compared with studies in other countries and districts is lack of focus on evidence by investigators, as the symptoms of poisoning may have been obvious and identification was unnecessary. Another reason would be the lack of detection in laboratories. However, in some countries, pesticides were not the main source of poisoning, and instead, drugs, carbon monoxide and alcohol were involved in most fatal poisonings [23–25].

CONCLUSION AND RECOMMENDATION

In the analyses of 353 cases of drug-and poison-associated deaths over a five-year period, males carried a higher risk of death than females, and non-Saudis nationality represented more than half of the cases. Alcohol, amphetamines, opiates and cannabis were detected as the main abused drugs in Eastern Province - Saudi Arabia. Alcohol was mainly associated with accidental and suicidal deaths, while morphine and heroin were associated with direct toxic overdose. This study also confirmed the variation in the incidence and type of abused substances in Eastern Province-Saudi Arabia compared to different countries. The high incidence of ethanol-related deaths indicates the need for stronger legislation, with more real application of drug abuse prevention Saudi national program, especially regarding non-Saudis. In the present study there was noticed reduction of amphetamine-and opiate-related fatalities during the last year of the period of the study (2013). A national record of drug abuse-related fatalities may be helpful to estimate the extent of the drug abuse problem in KSA. Also, there is a need for a more detailed and systematic method of recording poison-related fatalities in order to inform drug/poison education and harm reduction strategies.

REFERENCES

1. Campelo EL, Caldas ED. Postmortem data related to drug and toxic substance use in the Federal District, Brazil, from 2006 to 2008. *Forensic Sci Int.* 2010; 200: 136-140.
2. Quaglio G, Talamini G, Lechi A, Venturini L, Lugoboni F, Mezzelani P. Gruppo Intersert di Collaborazione Scientifica (GICS). Study of 2708 heroin-related deaths in north-eastern Italy 1985-98 to establish the main causes of death. *Addiction.* 2001; 96: 1127-1137.
3. Jones AW, Kugelberg FC, Holmgren A, Ahlner J. Five-year update on the occurrence of alcohol and other drugs in blood samples from drivers killed in road-traffic crashes in Sweden. *Forensic Sci Int.* 2009; 186: 56-62.
4. Gossop M, Stewart D, Treacy S, Marsden J. A prospective study of mortality among drug misusers during a 4-year period after seeking treatment. *Addiction.* 2002; 97: 39-47.
5. Jones AW, Schuberth J. Computer-aided headspace gas chromatography applied to blood-alcohol analysis: importance of online process control. *J Forensic Sci.* 1989; 34: 1116-1127.
6. Kronstrand R, Grundin R, Jonsson J. Incidence of opiates, amphetamines, and cocaine in hair and blood in fatal cases of heroin overdose. *Forensic Sci Int.* 1998; 92: 29-38.
7. Kronstrand R, Grundin R, Jonsson J. Incidence of opiates, amphetamines, and cocaine in hair and blood in fatal cases of heroin overdose. *Forensic Sci Int.* 1998; 92: 29-38.
8. Druid H, Holmgren P. A compilation of fatal and control concentrations of drugs in postmortem femoral blood. *J Forensic Sci.* 1997; 42: 79-87.
9. Carmen del Río M, Gómez J, Sancho M, Alvarez FJ. Alcohol, illicit drugs and medicinal drugs in fatally injured drivers in Spain between 1991 and 2000. *Forensic Sci Int.* 2002; 127: 63-70.
10. Elfawal MA. Trends in fatal substance overdose in eastern Saudi Arabia. *J Clin Forensic Med.* 1999; 6: 30-34.
11. Worm K, Steentoft A, Toft J. Fatal poisonings during a 5-year period in Eastern Denmark. *Ugeskr Laeger.* 1999; 161: 6622-6625.
12. Lahti RA, Vuori E. Fatal drug poisonings: medico-legal reports and mortality statistics. *Forensic Sci Int.* 2003; 136: 35-46.

13. Hadidi MS, Ibrahim MI, Abdallat IM, Hadidi KA. Current trends in drug abuse associated fatalities - Jordan, 2000-2004. *Forensic Sci Int.* 2009; 186: 44-47.
14. Vougiouklakis T, Boumba VA, Mitselou A. Fatal poisoning in the region of Epirus, Greece, during the period 1998-2004. *J Clin Forensic Med.* 2006; 13: 321-325.
15. Jönsson AK, Holmgren P, Druid H, Ahlner J. Cause of death and drug use pattern in deceased drug addicts in Sweden, 2002-2003. *Forensic Sci Int.* 2007; 169: 101-107.
16. Abu-al Ragheb SY, Hadidi KA. Fatal poisoning with alcohol and drugs in the Greater Amman County. *Forensic Sci Int.* 1999; 99: 209-215.
17. Lahti RA, Korpi H, Vuori E. Blood-positive illicit-drug findings: implications for cause-of-death certification, classification and coding. *Forensic Sci Int.* 2009; 187: 14-18.
18. Galduróz JC, Noto AR, Nappo SA, Carlini EA. Household survey on drug abuse in Brazil: study involving the 107 major cities of the country--2001. *Addict Behav.* 2005; 30: 545-556.
19. Gerostamoulos J, Staikos V, Drummer OH. Heroin-related deaths in Victoria: a review of cases for 1997 and 1998. *Drug Alcohol Depend.* 2001; 61: 123-127.
20. Druid H, Holmgren P. Fatal injections of heroin. Interpretation of toxicological findings in multiple specimens. *Int J Legal Med.* 1999; 112: 62-66.
21. Ait El Cadi M, Khabbal Y, Idrissi L. Carbon monoxide poisoning in Morocco during 1999-2007. *J Forensic Leg Med.* 2009; 16: 385-387.
22. Below E, Lignitz E. Cases of fatal poisoning in post-mortem examinations at the Institute of Forensic Medicine in Greifswald--analysis of five decades of post-mortems. *Forensic Sci Int.* 2003; 133: 125-131.
23. Campelo EL, Caldas ED. Postmortem data related to drug and toxic substance use in the Federal District, Brazil, from 2006 to 2008. *Forensic Sci Int.* 2010; 200: 136-140.
24. Below E, Lignitz E. Cases of fatal poisoning in post-mortem examinations at the Institute of Forensic Medicine in Greifswald--analysis of five decades of post-mortems. *Forensic Sci Int.* 2003; 133: 125-131.
25. Zhou L, Liu L, Chang L, Li L. Poisoning deaths in Central China (Hubei): A 10-year retrospective study of forensic autopsy cases. *J Forensic Sci.* 2011; 56 Suppl 1: S234-237.

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