

## Original Article

# Acute Adult and Adolescent Poisoning in Tehran, Iran; the Epidemiologic Trend between 2006 and 2011

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## Abstract

**Background:** The aim of this study was to determine the frequency of each poisoning and its related death in our center as a sample of Tehran in six consecutive years (2006 to 2011).

**Methods:** All poisoned children and adults referring to Loghman-Hakim hospital poison center and hospitalized in the study period were enrolled and evaluated.

**Results:** In 108,265 patients, the most common causes of poisoning were anti-epileptics and sedative-hypnotics (22.3%). The most common causes of death were pesticides (24.84%) and narcotics (24.75%). In drugs of abuse, opium was more prevalent in the early period of the study but was replaced by methadone later.

**Conclusion:** It seems that national policies for drug control and prevention of suicide have not been efficient enough. We expect to see Iran in the first 50 countries with regard to suicide and to maintain the first place in narcotic abuse if enough attention is not provided.

**Keywords:** Epidemiologic trend, frequency, Iran, mortality, poisoning, toxicity

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## Introduction

Acute accidental and deliberate poisoning by medications and chemicals is a common emergency in Iran.<sup>1</sup> This is partly due to the growth in suicide rates in our country. In 1991, Iran had the 91<sup>st</sup> rank of suicide in the world (111 suicides per year) which changed to 58<sup>th</sup> in 2003 (3967 cases per year).<sup>2</sup> Drug poisoning is the third cause of death in suicides after hanging and self-burning in our country.<sup>3</sup> Also, it has been claimed that in hospitalized patients, poisoning is the second cause of death after infections.<sup>4,5</sup> Meanwhile, no national control center or surveillance system exists to accurately record the epidemiologic information on poisoning.

Loghman Hakim Hospital Poison Center (LHHPC) is the largest poison center in Iran with more than 65 years of experience in managing poisoned patients. The annual reference to this center has been estimated to be 25,000 patients a year. The data in this hospital is therefore a good source of information for epidemiologic researches. Although not completely accurate as a multi-center study, evaluation of the epidemiologic trend of poisoning in this hospital can help determine the poisoning trend at least in Tehran. We aimed to determine the relative frequency of agents causing poisoning, hospitalization, and death according to the International Classification of Disease (ICD-10) in LHHPC as a sample of Tehran in six consecutive years from 2006 to 2011.

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However, since many of our poisoning cases are suicidal, we also meant to evaluate the epidemiology of suicidal attempts as an adjunct aim of the present study. Using this data, we can recognize the most common types of poisoning and the most fatal ones in a referral center in Iran for better policy making on management of toxicity.

## Patients and Methods

In this cross-sectional study, all poisoned patients who had referred to LHHPC and had been hospitalized in either the toxicology wards or medical ICUs from March 2006 to March 2011 were enrolled into the study. Those younger than 12 years of age and those who had died before admission to the emergency department of the hospital as well as those who had died in a few hours after admission were excluded. This was done to exclude the cases for whom we did not have enough time to confirm poisoning by confirmatory blood tests or thorough history taking. The patients' clinical charts were evaluated with respect to the etiological and demographical characteristics of the acutely poisoned patients using computerized discharge diagnosis codes (ICD-10 codes). The system consists of a 28-element diagnosis code, each categorizing a group of medications or poisons (Table 1). The number of patients poisoned by each group was determined and recorded. The diagnosis was made based on the history, clinical findings, and laboratory investigations in every single patient. Using a medication or poison was considered to be a possible cause of poisoning if the patient him/herself claimed to have consumed it, the patient's relatives gave such a history, or the circumstances described by police officers, suicide notes, or medical and psychiatric history including medication and substance abuse implied it.

Cases of drug abuse for recreational purposes but becoming

**Table 1.** Poison groups overdosed by patients (International classification of disease ICD 10; N = 108265).

Code	Description	Male hospital admission (%)	Female hospital admission (%)	Total hospital admission (%)	Total mortality (%)	Case fatality ratio (in 100 patients)
T36	Poisoning by systemic antibiotics	384 (0.35)	639 (0.59)	1023 (0.94)	1(0.04)	0.09
T37	Poisoning by other systemic anti-infectives and antiparasitics	132 (0.12)	236 (0.22)	368 (0.34)	1(0.04)	0.27
T38	Poisoning by hormones and their synthetic substitutes and antagonists, not elsewhere classified	389 (0.36)	792 (0.73)	1181 (1.09)	5 (0.23)	0.42
T39	Poisoning by nonopioid analgesics, antipyretics and antirheumatics	9913 (9.14)	8425 (7.78)	18338 (16.94)	83 (3.93)	0.45
T40	Poisoning by narcotics and psychodysleptics [hallucinogens]	9923 (9.17)	3503 (3.23)	13426 (12.40)	522 (24.75)	3.88
T41	Poisoning by anaesthetics and therapeutic gases	20 (0.01)	11 (0.01)	31 (0.02)	2 (0.09)	6.45
T42	Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs	10459 (9.66)	13726 (12.68)	24185 (22.34)	177 (8.39)	0.73
T43	Poisoning by psychotropic drugs, not elsewhere classified	7864 (7.27)	7659 (7.07)	15523 (14.34)	251 (11.90)	1.61
T44	Poisoning by drugs primarily affecting the autonomic nervous system	1790 (1.66)	3934 (3.63)	5724 (5.29)	41 (1.94)	0.71
T45	Poisoning by primarily systemic and haematological agents, not elsewhere classified	842 (0.78)	1635 (1.51)	2477 (2.29)	9 (0.42)	0.36
T46	Poisoning by agents primarily affecting the cardiovascular system	639 (0.59)	819 (0.76)	1458 (1.35)	47 (2.22)	3.22
T47	Poisoning by agents primarily affecting the gastrointestinal system	592 (0.55)	687 (0.63)	1279 (1.18)	74 (3.50)	5.78
T48	Poisoning by agents primarily acting on smooth and skeletal muscles and the respiratory system	493 (0.46)	771 (0.71)	1264 (1.17)	3 (0.14)	0.23
T49	Poisoning by topical agents primarily affecting skin and mucous membrane and by ophthalmological, otorhinolaryngological and dental drugs	80 (0.08)	112 (0.10)	192 (0.18)	0 (0)	0
T50	Poisoning by diuretics and other and unspecified drugs, medicaments and biological substances	3026 (2.79)	2674 (2.47)	5700 (5.26)	67 (3.17)	1.17
T51	Toxic effect of alcohol	2180 (2.02)	329 (0.30)	2509 (2.32)	63 (2.98)	2.51
T52	Toxic effect of organic solvents	225 (0.21)	99 (0.09)	324 (0.30)	3 (0.14)	0.92
T53	Toxic effect of halogen derivatives of aliphatic and aromatic hydrocarbons	7 (0.01)	2 (0)	9 (0.01)	0 (0)	0
T54	Toxic effect of corrosive substances	320 (0.29)	359 (0.33)	679 (0.63)	15 (0.71)	2.20
T55	Toxic effect of soaps and detergents	3 (0)	3 (0)	6 (0)	0 (0)	0
T56	Toxic effect of metals	164 (0.10)	107 (0.15)	271 (0.25)	3 (0.14)	1.10
T57	Toxic effect of other inorganic substances	128 (0.12)	49 (0.04)	177 (0.16)	6 (0.28)	3.38
T58	Toxic effect of carbon monoxide	242 (0.22)	180 (0.17)	422 (0.39)	9 (0.42)	2.13
T59	Toxic effect of other gases, fumes and vapors	81 (0.07)	37 (0.04)	118 (0.11)	3 (0.14)	2.54
T60	Toxic effect of pesticides	2450 (2.27)	2657 (2.45)	5107 (4.72)	524 (24.84)	10.26
T61	Toxic effect of noxious substances eaten as seafood	7 (0.01)	3 (0)	10 (0.01)	2 (0.09)	20
T62	Toxic effect of other noxious substances eaten as food	158 (0.15)	70 (0.06)	228 (0.21)	3 (0.14)	1.31
T63	Toxic effect of contact with venomous animals	408 (0.38)	127 (0.11)	535 (0.49)	2 (0.09)	0.37
T64	Toxic effect of aflatoxin and other mycotoxin food contaminants	1 (0)	3 (0)	4 (0)	2 (0.09)	50
T65	Toxic effect of other and unspecified substances	3848 (3.55)	1849 (1.71)	5697 (5.26)	191 (9.05)	3.35
<b>Total</b>		<b>56,768 (52.43%)</b>	<b>51,497 (47.57%)</b>	<b>108265 (100)</b>	<b>2109 (100)</b>	—

\* Numbers in Parentheses are in percent, describing a portion of total admission.

symptomatic due to the drug side effects were considered as accidentally poisoned patients. The data was compiled in the statistical package for social sciences (SPSS) software version 17 and analyzed by application of Mann-Whitney U-test (non-normal distributions according to the Kolmogorov-Smirnov test) or Student's *t*-test (normal distributions) for continuous data. Based on the significance level of equality of variance, One-way ANOVA or Welch F test was used to compare means. A *p* value less than 0.05 was considered to be statistically significant. This study is in accordance with the Declaration of Helsinki and its last revision in Hong-Kong (1984).

## Results

During this 6-year period, a total of 108,265 patients had been hospitalized in LHHPC with the abovementioned inclusion criteria and were evaluated (Table 1). The most common cause of poisoning was poisoning with the medications categorized in T42 group consisting of anti-epileptics, sedative-hypnotics, and anti-parkinsonism drugs (24,185 patients; 22.3%) followed by T39 group (non-opioid analgesics, antipyretics, and anti-rheumatics in 18,338 patients; 16.9%) and T43 group (psychotropic drugs not elsewhere classified in 15,523 patients; 14.3%, Table 1). The least common poisoning was reported to be poisoning with the toxins in T64 category (aflatoxin and other mycotoxin food contaminants in only 4 patients in 6 years; 0.004%).

During this period, 2,109 patients were deceased (Table 1). The most common cause of death in our poisoned patients was toxins and medications in groups T60 (pesticides in 524 patients; 24.84%) and T40 (narcotics in 522 patients; 24.75%) which put together were the cause of death in almost 50% of the deceased patients (Table 1). The medications/poisons in the categories T43, T65, and T42 also entailed rather high mortality risks.

In general, 51,497 patients were female (47.57%) and 56,768 (52.43%) were male. Among those who had died, 627 were female (only 29.7%) and 1,482 were male. In the most frequent poisonings, such as poisoning with medications in T42 category, males were the majority. Even the most fatal toxicity (T60) was more prevalent in males but without statistically significant difference ( $P = 0.35$ ). Also, poisoning with T51, T52, T62, T63, and T65 were significantly more prevalent in men ( $P = 0.001$ ). In some poisonings, no sex preference existed and the patients were equal among the males and females (T43 and T55).

In a comparison between the years of the beginning and termination of the study (2006 and 2011, Table 2), a point was found; a decrease was seen in the use of diuretics and medicaments and biological substance (T50; from 5.85% to 2.71% of the total poisoning cases) as well as an increase in the poisoning by venomous animals (T63; from 0.30% to 0.69% of the total poisonings).

Among the drugs of abuse, opium was the most common in the early period of the study (2006–2009; almost 50% of all overdoses) while its frequency of abuse decreased to almost 30% after 2009 (Table 3). In contrast, the prevalence of methadone toxicity increased significantly (2.26% in 2006 versus 24.72% in 2011,  $P = 0.001$ ). Abuse of all drugs was more common in males except for the abuse of T40.2 group of drugs (other opioids including codeine and morphine) which was more common among females (59% versus 41%). The frequency of cannabis abuse remained the same during the whole period of the study (almost 1–2% of all overdoses). Table 3 summarizes the frequency of overdose with

drugs of abuse during the entire period of the study.

## Discussion

According to the results of the present study, hospital admission due to poisoning is more common in males. Toxicity-related deaths are also more common in males except for poisoning by the medications of the T47 group which killed the females more frequently. The most common cause of toxicity-related deaths was pesticides which is according to the findings of some previous studies in Iran as well as other countries.<sup>6–10</sup> Trend of opioid overdose changed from opium to methadone.

In 1991, 481 hospital admissions at LHHPC (17% of all poisonings) were due to opioid overdose which increased to 1438 cases in 2005–2006.<sup>11–14</sup> This rate has recently (2011) reached 2371 patients, accounting for almost 14.51% of the poisoned patients referring to LHHPC. The rate of opioid abuse has decreased and the trend of its abuse has changed from opium in early 2006 to methadone in late 2011. The frequency of heroin abuse (4.39% versus 1.23%,  $P = 0.01$ ) and other opioids (codeine and morphine; 22.36% versus 10.66%,  $P = 0.001$ ) has also decreased significantly. This is probably due to the addicted people's will to give up addiction and go on methadone maintenance therapy (MMT) programs or simply their desire to receive legal methadone from MMT clinics.

The rate of mortality due to narcotic toxicity was higher in males which is compatible with the previous reports.<sup>3,15,16</sup> However, even ignoring the fatalities due to the usual causes of poisoning more frequent in men such as narcotics and toxic alcohols, other intoxications were more fatal in males, as well.

The main cause of death was T60 toxins (pesticides) which is now slightly more prevalent than the T40 drugs (narcotics and hallucinogens) in contrast to the last results of the national study of Iranian Legal Medicine Organization in 2002 in which the most common cause of death was found to be related to narcotics (71%) including 3.1% of female cases.<sup>17</sup> Our previous results in 2003 also confirmed their results.<sup>7</sup> However, T40 drugs are still a major cause of death in our population.

The most frequent cause of death was pesticides in our series. As mentioned above about the drugs, easy access to poisons such as pesticides, including aluminum phosphide, is also the main possible cause of the increasing frequency of these poisonings in Tehran. In Iran, the first cause of death in poisoning was once pesticides (in 1991) which switched to antidepressants (1997–1998) followed by ALP and narcotics in early 2000s.<sup>6,18</sup> The point is that although pesticide poisoning itself is responsible for only 4.7% of hospital admissions, it is the most common cause of death in poisoned patients (almost 25% of deaths).

Poisoning with other medications including psychotropics (T43) and antiepileptics and sedative-hypnotics (T42) have the 3<sup>rd</sup> and 4<sup>th</sup> ranks of deaths due to poisoning in our country.

Toxic alcohols, once the second cause of poisoning-induced mortality,<sup>19</sup> are now responsible for about 2.3% of the toxicities and only 2.98% of the deaths. This may be due to the stringency of the government to punish those who sell, buy, or consume alcoholic beverages. However, fear government prosecution and late onset of the symptoms mandating a late referral to the toxicologist in this poisoning are among the causes that make this poisoning a highly toxic and fatal one.

The increase (almost two-fold) in the poisoning by venomous

**Table 2.** Trend of consumption of toxins and medications between 2006 and 2011.

Diagnosis Code	2006	2007	2008	2009	2010	2011	Statistics
T36	245 (1.22)	185(0.88)	124 (0.69)	159 (0.98)	150 (0.87)	160 (0.97)	$F(5-2.76)=0.54, P=0.74^*$
T37	81 (0.40)	52 (0.24)	46 (0.25)	40 (0.24)	73 (0.42)	76 (0.46)	$F(5-2.65)=0.60, P=0.71^*$
T38	200 (1.00)	188 (0.89)	169 (0.94)	203 (1.25)	224 (1.30)	197 (1.20)	$F(5-2.76)=0.29, P=0.99^*$
T39	3426 (17.19)	3689 (17.57)	3307 (18.58)	2576 (15.98)	2563 (14.97)	2777 (17.00)	$F(5-2.57)=2.36, P=0.28^*$
T40	2508 (12.58)	2235 (10.64)	2108 (11.84)	1916 (11.88)	2288 (13.36)	2371 (14.51)	$F(5-2.78)=0.02, P=0.99^*$
T41	5 (0.02)	7 (0.03)	4 (0.02)	2 (0.01)	7 (0.04)	6 (0.03)	$F(5-2.71)=0.61, P=0.71^*$
T42	4468 (22.42)	4140 (19.72)	3934 (22.10)	3874 (24.03)	4010 (23.42)	3759 (23.01)	$F(5-2.70)=0.22, P=0.93^*$
T43	2819 (14.15)	2712 (12.92)	2496 (14.02)	2541 (15.76)	2708 (15.82)	2247 (13.75)	$F(5-2.54)=6.51, P=0.93^*$
T44	1117 (5.60)	1085 (5.16)	940 (5.28)	877 (5.44)	870 (5.08)	835 (5.11)	$F(5-2.80)=0.05, P=0.99^*$
T45	498 (2.49)	406 (1.93)	393 (2.20)	374 (2.32)	404 (2.36)	402 (2.46)	$F(5-2.79)=0.04, P=0.99^*$
T46	287 (1.44)	318 (1.51)	254 (1.42)	209 (1.29)	207 (1.20)	183 (1.12)	$F(5-2.43)=0.04, P=0.28^*$
T47	277 (1.39)	238 (1.13)	253 (1.42)	169 (1.04)	202 (1.18)	140 (0.85)	$F(5-2.47)=17.88, P=0.03^*$
T48	233 (1.16)	230 (1.09)	187 (1.05)	145 (0.89)	226 (1.32)	243 (1.48)	$F(5-2.46)=0.38, P=0.83^*$
T49	44 (0.22)	43 (0.20)	37 (0.20)	13 (0.07)	35 (0.20)	20 (0.12)	$F(5-2.51)=6.71, P=0.09^*$
T50	1166 (5.85)	2453 (11.68)	621 (3.48)	477 (2.95)	540 (3.15)	443 (2.71)	$F(5-2.65)=2.77, P=0.24^*$
T51	461 (2.31)	443 (2.11)	381 (2.14)	390 (2.42)	394 (2.30)	440 (2.69)	$F(5-2.80)=0.01, P=1^*$
T52	65 (0.32)	66 (0.31)	48 (0.26)	60 (0.37)	42 (0.24)	43 (0.26)	$F(5-2.68)=0.18, P=0.95^*$
T53	1 (0.00)	1 (0.00)	2 (0.01)	1 (0.00)	4 (0.02)	0 (0)	—
T54	148 (0.74)	123 (0.58)	135 (0.75)	119 (0.73)	90 (0.52)	64 (0.39)	$F(5-2.57)=14.03, P=0.04^*$
T55	0 (0)	4 (0.01)	1 (0.00)	0 (0)	0 (0)	1 (0.00)	—
T56	39 (0.19)	94 (0.44)	60 (0.33)	17 (0.10)	35 (0.20)	26 (0.15)	$F(5-2.75)=2.88, P=0.23^*$
T57	40 (0.20)	40 (0.19)	32 (0.17)	23 (0.14)	24 (0.14)	18 (0.11)	$F(5-2.60)=0.33, P=0.87^*$
T58	0 (0)	147 (0.70)	70 (0.39)	84 (0.52)	47 (0.27)	74 (0.45)	—
T59	23 (0.11)	12 (0.05)	7 (0.03)	17 (0.10)	38 (0.22)	21 (0.12)	$F(5-2.69)=1.09, P=0.51^*$
T60	774 (3.88)	784 (3.73)	803 (4.51)	815 (5.05)	996 (5.81)	935 (5.72)	$F(5-2.59)=8.62, P=0.07^*$
T61	1 (0.00)	0 (0)	2 (0.01)	3 (0.01)	0 (0)	4 (0.02)	—
T62	33 (0.16)	32 (0.15)	22 (0.12)	30 (0.18)	56 (0.32)	55 (0.33)	$F(5-2.75)=0.35, P=0.86^*$
T63	61 (0.30)	85 (0.40)	107 (0.60)	75 (0.46)	93 (0.54)	114 (0.69)	$F(5-2.75)=0.11, P=0.98^*$
T64	0 (0)	1 (0.00)	1 (0.00)	1 (0.00)	0 (0)	1 (0.00)	—
T65	902 (4.52)	1174 (5.59)	1250 (7.02)	905 (5.61)	791 (4.62)	675 (3.94)	$df=1, P=0.52^{**}$
<b>Total</b>	<b>19922 (100)</b>	<b>20987 (100)</b>	<b>17794 (100)</b>	<b>16115 (100)</b>	<b>17117 (100)</b>	<b>16330 (100)</b>	<b><math>df=1, P=0.38^{**}</math></b>

\* Numbers in parentheses are percents. \*Using Welch F test when significance for Levene's test is less than 0.05, \*\* Using one-way ANOVA.

animals is another point for which a possible cause cannot be found. Comparing the trend of the most common toxicities between 2006 and 2011 shows a statistically significant change between these two years ( $P = 0.04$ , Chi-square test) but without a linear trend in 2006–2011 ( $P = 0.38$ ).

It is clear that acute deliberate self-poisoning is a dynamic medical illness that represents an acute exacerbation of a chronic underlying psychosocial disorder. The emergency system must follow an approach that undertakes early decisions addressing potentially time critical interventions, while allowing management to comply with the needs of every single patient in that particular medical setting.<sup>20,21</sup> Our data support previous claims that this center is arguably the most crowded medical toxicology center in the world; and Middle East could be the best place for education and

research in clinical toxicology fields.<sup>22</sup>

The most important limitation of this study was lack of explicit definitions for documentation. Incomplete documentation of some diagnoses and apparent lack of uniform methods for different physicians and staff recording the patients' data made it impossible to define the cases in some occasions.

Evaluation of hospitalized patients only and not all those referring to the center (including those managed in the emergency department and discharged) as well as not considering other poison centers in Tehran are certainly other limitations of this study. Also, not evaluating other demographic characteristics of the patients other than gender is another potential limitation. More multicenter studies from all over Iran are warranted for an accurate mapping of poisoning cases in Iran.

**Table 3.** Trend of consumption of drugs of abuse between 2006 and 2011.

Diagnosis	ICD-10 code	2006	2007	2008	2009	2010	2011
Opium	T40-0	1610 (52.72)*	1312 (47.13)	1255 (45.42)	1047 (37.77)	1059 (32.30)	1052 (34.18)
Heroin	T40-1	134 (4.39)	109 (3.92)	43 (1.56)	48 (1.73)	38 (1.16)	38 (1.23)
Other Opioids (codeine and morphine)	T40-2	683 (22.36)	590 (21.19)	470 (17.01)	385 (13.89)	294 (8.97)	328 (10.66)
Methodone	T40-3	69 (2.26)	162 (5.82)	272 (9.84)	383 (13.82)	641 (19.55)	761 (24.72)
Other synthetic narcotics	T40-4	4 (0.13)	5 (0.18)	2 (0.07)	7 (0.25)	5 (0.15)	12 (0.39)
Cocaine	T40-5	7 (0.23)	6 (0.22)	5 (0.18)	4 (0.14)	10 (0.30)	1 (0.03)
Other and unspecified Narcotics	T40-6†	0 (0)	2 (0.07)	0 (0)	1 (0.04)	237 (7.23)	180 (5.85)
Cannabis	T40-7	42 (1.38)	44 (1.58)	43 (1.56)	47 (1.70)	41 (1.25)	38 (1.23)
Lysergide	T40-8	0 (0)	13 (0.47)	19 (0.69)	8 (0.29)	2 (0.06)	0 (0)
Other and unspecified Psychodyleptics	T40-9	2 (0.07)	9 (0.32)	11 (0.40)	9 (0.32)	8 (0.24)	5 (0.16)
Psychostimulants with abuse potential	T43-6	503 (16.47)	532 (19.11)	643 (23.27)	833 (30.05)	944 (28.79)	663 (21.54)
Total	—	3054	2784	2763	2772	3279	3078

\* Numbers in parentheses are in percent. †Before the year 2009, T40-6 represents the cases with crack overdose. After 2009, crack has been classified as the drugs in group T43-6.

## Conclusion

In conclusion although the rate of suicide is lower in Iran compared to the West,<sup>23</sup> deliberate self-poisoning has been growing faster than the population growth rate. Also, it seems that national policies for drug control and prevention of suicide have not been efficient enough and urgent intervention is needed, especially for high risk groups. While self-poisoning is the commonest method of attempted suicide all over the world, we expect to see Iran in the first 50 countries in regard to suicide and to maintain the first place in narcotic abuse if enough attention is not provided.

## Conflict of interest

None

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