



## Evaluating the Changes and the Trend in Cases With Acute Poisoning Admitted to the Emergency Unit in Sari, Iran



Aroona Chabra<sup>1,2</sup> , Nasrin Pakravan<sup>2</sup>, Amir Shadboorestan<sup>2</sup>, Amirhossein Ahmadi<sup>2</sup>, Farzad Bozorgi<sup>3\*</sup> , Seyed Khalil Mousavi<sup>2</sup>, Mohammad Eghbali<sup>4</sup>

1. Department of Pharmacognosy, Faculty of Pharmacy, Islamic Azad University, Ayatollah Amoli branch, Amol, Iran.

2. Pharmaceutical Sciences Research Center, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran.

3. Department of Emergency, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, Iran.

4. Student Research Committee, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran.

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**Citation** Chabra A, Pakravan N, Shadboorestan A, Ahmadi A, Bozorgi F, Mousavi SK, Eghbali M. Evaluating the Changes and the Trend in Cases With Acute Poisoning Admitted to the Emergency Unit in Sari, Iran Journal of Pharmacoconomics and Pharmaceutical Management. 2018; 4(3-4):58-64.

**Running Title** Acute Poisoning in Northern Iran

**Article Type** Original Article



### Article info:

**Received:** 10.06.2018

**Revised:** 17.08.2018

**Accepted:** 25.08.2018

### Keywords:

Poisoning, Drug overdose, Emergency, Suicide

## ABSTRACT

**Background:** Poisoning and drug overdoses are considered a health problem in modern countries. In this study, we assessed the pattern of poisoning and drug overdoses at Imam Khomeini hospital in Sari city, the northern region of Iran.

**Methods:** To assess the pattern and circumstances of poisoning, the patients' information who were referred to the emergency unit with acute toxic poisoning over four years were randomly obtained retrospectively from their medical records.

**Results:** A total of 1,646 patients were analyzed. The highest rate of poisonings was related to suicidal intentions and mostly occurred at age of 18 to 35 years and in females. Medications were the principal groups of poisons involved (53.15%), including benzodiazepines as the most common agents (30.3%), followed by multiple medications (25.5%) and opioids (10%). Organophosphate compounds (3%), aluminum and zinc phosphide (2.7%), and rodenticide (1.7%) were also among the commonly used poisons; however, they were the main leading cause of overdose deaths. Thirty patients (1.8%) died in total, and death was caused most commonly by zinc and aluminum phosphide (8 cases), followed by opioids (6 cases) and rodenticide (4 cases).

**Conclusion:** The high prevalence of intentional overdoses and mortality among young adults requires considerable attention, and further surveys are needed to address the fundamental underlying causes. More restrictive regulations and increasing public awareness regarding the role of centers providing information about poisoning available in the region can assist to prevent the development of this public health problem.

\* Corresponding Author:

Farzad Bozorgi, MD.

Address: Department of Emergency, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, Iran.

E-mail: [farzad722001@yahoo.com](mailto:farzad722001@yahoo.com)

## 1. Introduction

**P**oisoning commonly involves intentionally or unintentionally exposure to drugs (prescribed or over-the-counter medicine or an illicit drug) or chemicals [1]. According to accidental or deliberate ingestion, injection, or inhalation of drugs or other chemicals, acute poisoning is a common medical emergency. It is estimated that more than one million poisoning cases occur annually worldwide [2]. Each year, 500,000 deaths occur in Asia due to intentional overdose, and 200,000 of these deaths are caused by self-administered Organophosphate (OP) poisoning [3]. Statistics show that drug overdose is the most frequent cause of intentional self-injury after poisoning with pesticides and both are associated with a high death rate. Many serious and harmful poisonings have been occurred in developing communities, especially in farmers and those associated with agricultural jobs. In contrast, the rate of job poisoning has been reported about 1 to 2% in modern countries [4]. The patterns of poisoning are still different in each country due to various environmental and cultural factors and religious believes [5].

Increasing the information about this issue is effective to take further preventive steps accordingly. Iran with a mild climate is very interested in farmers for cultivating; thus, the incidence of poisoning by chemicals and pesticides is well established [6]. Human exposure to household detergents, toxic plants, narcotics, and natural toxins is very common in Iran, particularly in children [7]. Acute household chemical poisonings, particularly in children, by natural toxins, such as poisonous plants and animals also occur very often in some parts of Iran [8].

The City of Sari, the center of Mazandaran Province and is located in the Northern region of Iran, in which agriculture is the main job and resources of money earning; Hence, the usage of pesticides is very common in this province.

It is believed that pesticide usage in Mazandaran Province comprises half of the total usage in Iran. Organophosphate compounds are the most common pesticides used by farmers. Therefore, toxicity by pesticides and in particular, organophosphate poisoning is a major health problem in the region as a result of the readily available poisons and the lack of an effective control strategy [7]. Moreover, the prevalence of drug and alcohol abuse is high in the younger population. In 2006-2008, we performed a similar epidemiological study on the prevalence of food, drug, and chemical poisoning in patients presented to a hospital [7].

The results were alarming and based on our observations, we recommended preventive steps, including amendment of a more restricted and controlled regulation on distribution, access to these toxic substances in the region through legislative authority, easy availability to antidotes, increasing public awareness, and educating farmers regarding the safe handling of these agents through the media and regional poison control center. The purpose of the current study was to perform a follow-up study on the same population and to investigate improvements and changes in the pattern of toxicity in the region over time. We conducted a retrospective study on this pattern to evaluate the extent and severity of toxicity and types of combinations that caused poisonings over four years in Imam Khomeini hospital in Sari City, a referral center for poisoning in the Mazandaran Province.

## 2. Methods

This descriptive study was performed on the medical records of 1,646 patients admitted during four years (April 2009 to March 2013) to the Imam Khomeini hospital, affiliated to the Mazandaran University of Medical Sciences in Sari, Iran. Ethical approval was obtained from the ethics board at the Mazandaran University of Medical Sciences. Social and demographic data, such as sex, age, type of exposure (intentional or accidental), route of exposure, place of residence, type of poisons, name of the poisonous substance, Intensive Care Unit (ICU) admission, and outcome were collected from the patient's medical records. Drugs and poisons were categorized based on the Iranian generic pharmacopeia for pharmaceuticals and the International Programme on Chemical Safety (IPCS) / World Health Organization (WHO) classification of poisons. Also, no available data was recorded as unknown. The age of the patients was categorized as less than 6 years (preschool children), 6-17 years (school children), 18-29 years (young adults), 30-39 years (adults), 40-59 years (middle-aged), and more than 60 years (elderly).

The data were registered in a database anonymously and analyzed using Statistical Package for Social Sciences SPSS v. 16.0. The Mean $\pm$ SD of the variables was compared using Student's t-test or one-way Analysis of Variance (ANOVA). Also the  $P < 0.05$  was considered significant.

## 3. Results

The descriptive information, including age, sex, cause of overdose, marital status, ICU admission, the main

type of poisons, and outcome of the poisoned patients is shown in [Table 1](#).

### Age and gender

A total of 1,646 patients with poisoning were admitted over four years. There were 886 (53.8%) female and 760 (46.2%) male patients. Patients aged 18-29 years were

61.2% of the cases, followed by adults (15.4%) and school children (10.5%). The male-to-female poisoning ratio was 1:1.17. In addition, there was a significant relationship between the age and group of patients ( $P < 0.001$ ).

The most prevalent poison type among young adults was pharmaceutical intoxication (814 cases). Of these 814 cases, benzodiazepines (324 cases) were the most

**Table 1.** Demographics information the poisoned patients

	Variables	No. (%)
Gender	Male	760 (46.2)
	Female	886 (53.8)
Age	<6	2 (0.1)
	6-17	172 (10.5)
	18-29	1,007 (61.2)
	30-39	253 (15.4)
	40-56	151 (9.2)
	>60	61 (3.6)
	Type of poisons	Pharmaceuticals
Chemicals		198 (12.03)
Natural toxins		7 (0.43)
Multiple		419 (25.46)
Unknown		106 (6.44)
Other		41 (2.49)
ICU admission	No	1,573 (95.6)
	Yes	73 (4.4)
Outcome	Discharge	1,597 (97.0)
	Death	30 (1.8)
	Transfer to another hospital	18 (1.1)
	Leaving the hospital without examination	1 (0.1)
Type of exposure	Intentional	1356 (82.4)
	Accidental	148 (9.0)
	Drug abuse	123 (7.5)
	Others	2 (0.1)
	Unknown	17 (1.0)

**Table 2.** Number of different type of occurred poisoning

Pharmaceutical		Total
Type of Toxicity	Frequency (%)	
Cardiovascular drugs	18 (1.1)	
Benzodiazepines	499 (30.3)	
NSAIDs	10 (0.6)	
Acetaminophen	39 (2.4)	
Opioid	164 (10.0)	
Antidepressant	59 (3.6)	53.15%
Antipsychotic	11 (0.7)	
Antibiotic	17 (1.0)	
Anticonvulsant	5 (0.3)	
Amphetamine & derivatives	53 (3.2)	
Multiple Drug Overdoses	419 (25.5)	
Chemical		
Carbo monoxide	18 (1.1)	
Organophosphate	50 (3.0)	
Herbicides	12 (0.7)	12.03%
Al-Zn phosphide	44 (2.7)	
Rodenticide	28 (1.7)	
Alcohol	46 (2.8)	
Others	41 (2.5)	2.49%
Unknown	106 (6.4)	6.44%
Natural toxin	7 (0.4)	0.43%
Total	1,646 (100.0)	100%



common drugs consumed by young adults (18-29 years old), followed by multiple drug overdose (270 cases) and opioids (85). There was a significant relationship between the age of patients and the type of exposure ( $P=0.003$ ). The majority of poisoning cases with suicidal intentions were identified among young adults (18-29 years old; 877 cases) followed by adults (30-39 years old; 203 cases).

**Type of poisoning (intentional vs. accidental)**

A total of 82.4% of poisoning cases ( $n=1,356$ ) were intentional, and with significantly higher rates among females ( $P=0.000$ ). Out of 1,356 patients with intentional

overdose, 826 cases (60.9%) were females and 530 cases were males (39.1%), and pharmaceuticals were the most common agents leading to intentional and accidental poisoning comprising 71.44% of the intentional poisoning cases. The common pharmaceutical agents used for intentional overdose cases included benzodiazepines (490 cases), multiple drug overdose (382 cases), and opioids (70 cases). Pesticide poisonings were caused by aluminum and zinc phosphide (42 cases), organophosphate insecticides (35 cases), and rodenticides (26 cases). The most common causes of accidental poisoning were alcohol (34 cases) and carbon monoxide (18 cases).

### Type of poisons

As shown in Table 2, the main groups of poisons were pharmaceuticals (53.15%), multiple drug overdose (25.46%), and chemicals (12.03%). Benzodiazepines were the most commonly used pharmaceutical drugs. More than 25% of the total poisoning cases (n=499) were due to a benzodiazepine overdose. Aluminum and zinc phosphide (42 cases) were the most frequently used toxic chemicals.

### Outcomes

A total of 1,597 patients had been discharged. The hospital mortality rate was 1.8% with 30 deaths consisting of 23 males and 7 females. Also, 18 patients had been transferred to the other hospitals and one patient had left without being admitted.

Antidotes had been used for 257 of the patients. The most widely used antidote was naloxone (163 cases), followed by flumazenil (68 cases) and N-acetylcysteine (26 cases). There was a significant relationship between the age and duration of hospitalization ( $P=0.014$ ). The length of hospitalization in children (<6 years old) and the elderly (60< years old) was longer compared with other age groups. There was no significant relationship between gender and duration of hospitalization ( $P=0.542$ ).

In addition, 4.43% (73 patients) of all patients had been admitted to the ICU of whom 51 were male and 22 were female patients. There was a significant relationship between gender and admission to the ICU ( $P<0.001$ ). Young adults (18-29 years old) constituted a large proportion of the cases (48 cases). The lethal compounds included the aluminum and zinc phosphide (8 cases), opioids (6 cases), rodenticide (4 cases), amphetamine and derivatives (1 case), multiple drug overdose (1 case), alcohol (1 case), carbon monoxide (1 case), other compounds (2 cases), and unknown agents (1 case).

## 4. Discussion

Poisoning is one of the major public health problems in Iran. To prevent this problem, comprehensive information about the nature and extent of the poisonings is needed. Several epidemiological studies have been conducted concerning poisoning patterns in different parts of Iran, including Tehran, Mashhad, Babol, Ahvaz, Urmia, and Shahrekord [8-13]. This study was conducted to investigate the pattern of drug and chemical poisoning in Sari, a northern region of Iran. The epidemiology of poisoning and the identification of the associated risk factors and

treatment options are important factors for policymakers. The susceptibility of women to poisoning was higher than men; however, a significant difference was not observed.

Also, similar results were reported in other investigations conducted in different parts of Iran, including Babol, Mashhad, Rasht, and Tehran [8, 9, 13, 14]. The results of our study showed that the mortality ratio in males was significantly higher than in females. This finding was not consistent with the results of other studies conducted in Shiraz, Shahrekord, and Babol [10, 13, 15]. Poisoning in general, and deliberate toxicity with suicidal intention in particular, had the highest prevalence among young adults (18-29 years). These results are compatible with the findings of other investigations. For the high levels of intoxication among this age group, one predictable reason might be socioeconomic problems. Iran has a relatively high percentage of the young population and the unemployment rate is high among the younger population [7].

Poisoning with pharmaceutical agents is currently one of the most common health problems in many developed and developing countries. In this study, pharmaceutical products were the main cause of poisoning (53.15%). Also, similar findings from different parts of the country have been reported. According to the results of this study, sedatives/hypnotics drugs, especially benzodiazepines, were the most common drugs used for poisoning (499 cases; 30.3% of total poisoning), followed by multiple pharmaceutical overdoses (382 cases; 25.5%) and opioids (70 cases; 10% cases). These data are consistent with the results of a previous study in Sari City [7].

Both studies reported a high prevalence of mortality in the region. The previous study showed that 2057 patients with acute poisoning were admitted during two years to this referral hospital. The majority of these toxicities were among young adults and with an intentional purpose. Sedatives, in particular benzodiazepines and opioid compounds, were the main groups of the drug leading to an overdose. The main percentage of deaths were due to organophosphate and carbamate pesticides and insecticides. Also, 27 young adults and mostly women died because of organophosphate toxicity, which is widely available in this agricultural region. The results of the current study showed no significant change in the pattern of toxicity in the same studied population.

There were no changes in the trend of variables affecting poisonings, such as age, gender, mortality, intention, and the agent causing toxicity. Our study consistently showed a high prevalence of toxicity, particularly

among young adults (18-29 years old). Similar to the previous study, benzodiazepines followed by opioid compounds were the most common agent involved in toxicity. In both studies, most poisonings were due to suicidal intention, and mainly among young adults.

The rate of hospitalization in the U.S. due to poisoning by prescription opioids, sedatives, and tranquilizers was 65% from 1999 to 2006. This rate was two times higher than the figure observed in hospitalizations for poisoning by other drugs and substances. The largest increase in the number of hospitalized cases over 7 years was observed for benzodiazepine poisonings [8]. Studies in Turkey have shown that medications were the primary cause (60.5%) of poisoning in adults who were admitted to emergency service and tricyclic antidepressants were the most common causative agents (36.3%), followed by analgesics and benzodiazepines [1]. Accessibility and the lack of adequate regulations regarding the distribution and prescription of the drugs are possibly the main causes of a drug overdose and drug abuse in Iran.

However, the pattern of poisoning varies across the country. In Rasht, in the north of Iran and Gilan Province, organophosphorus compounds were the most commonly reported poisons. In the current study, a similar pattern was found because pesticides were one of the main causes of poisoning (39.3%), possibly due to extensive agricultural activity in the Northern provinces. The use of pesticides without adequate protection, lack of information, financial problems, and various psychological stresses are responsible for higher rates of pesticide poisoning, both suicidal and unintentional in this geographical region. Studies conducted in various countries have reported that organophosphate insecticides and drugs of abuse were the main causes of intoxication [16]. Out of 3,885 autopsies performed in the forensic toxicology laboratory of Iran, 51 deaths (1.31%) were due to pesticide poisoning [17].

The Department of Forensic Medicine at the University of China (Tongji Center for Medicolegal Expertise in Hubei (TCMEH) has reported 218 poisoning-related deaths between 1999 and 2008. It has been shown that pesticides were the most common class of substances involved in fatalities [18]. In another study in Southern India, organophosphate insecticides were the main cause of suicidal poisoning [19].

On the other hand, the global epidemic of opiate use continues to rise, especially in developing countries. In 2006, the United Nations Office on Drugs and Crime (UNODC) estimated that approximately more than 1

million Iranians were opiate users, which is expected to increase more [20]. In the current study, opioids were the second cause of poisoning after benzodiazepines.

In this study, it was found that the primary causes of poisoning included benzodiazepines (sedative/hypnotic drug), multiple drug overdoses, and opioids. Aluminum and zinc phosphide were the most lethal agents followed by opioids and rodenticides. It is highly recommended that patients with suicidal intentions undergo psychiatric consultation either during their stay in the hospital or after discharge. Access to tranquilizers drugs and dangerous pesticides, especially organophosphates and aluminum and zinc phosphide must be limited and tightly regulated. Appropriate training must be provided for farmers regarding hazardous effects, safe and effective use, and treatment of dangerous pesticides and chemicals.

## 5. Conclusion

Poisoning is one of the most significant health problems in Sari, northern Iran. Young adults are the most affected age group by poisoning. Unfortunately, our previous warnings were not considered by the relevant public health officials. Additional studies are needed to identify the underlying causes of the higher rate of suicide among the young adult population.

## Ethical Considerations

### Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

### Funding

This study was approved and supported by a grant from the Student Research Committee, Mazandaran University of Medical Sciences.

### Authors' contributions

Data collection: Aroona Chabra, Mohammad Eghbali, and Amir Shadboorestan; Data analysis: Nasrin Pakravan; Writing – original draft: Amirhossein Ahmadi and Farzad Bozorgi; Writing – review & editing: Seyed Khalil Mousavi.

### Conflict of interest

The authors declared no conflict of interest.



## Acknowledgements

The authors appreciate all staff of the medical record unit of Imam Khomeini teaching hospital for their contribution.

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