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# Epidemiology and Trend of Acute Poisoning in Children from 2019 to 2024: A Hospital-Based Study

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## ABSTRACT

**Background and Objective:** Ensuring children's health is a critical indicator of public health improvement, underscoring the importance of conducting studies in this area. The aim of this study was to examine the epidemiology of poisoning among children admitted to Esfarayen Hospital from 2019 to 2024.

**Methods:** This cross-sectional study investigated the medical records of all children <18 years with poisoning admitted to Imam Khomeini Hospital in Esfarayen between 2019 and 2024 and the number of patients was 1140. Data including age, sex, cause of poisoning and poisoning outcomes were collected using hospital records, and analysis was performed using SPSS 26, R software.

**Findings:** In this study, the incidence of poisoning was higher in girls (59.6%) compared to boys (40.4%). Among the 1,140 children hospitalized due to poisoning, 593 pediatric (52%) were older than 13 years, 83 cases (7.3%) were between 6 and 12 years old, and 464 children (40.7%) were younger than 6 years. The most common causes of poisoning were, respectively, opioid medication (31.1%), alcohol (4.4%), gasoline and kerosene (1.2%), carbon monoxide (0.9%) pesticides (4.4%), detergents (2.9%), non-opioid medication (55.1%). Given the time series model, poisoning cases are showed a stable trend and forecasts shows around 4 opium and 9 drug poisoning cases in 2025.

**Conclusion:** The high prevalence of drug poisoning, education on proper drug storage and psychological issues is important. Furthermore, considering the high rate of opium poisoning in children under five, social welfare interventions are necessary to identify at-risk children and provide essential family counseling.

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## Introduction

The main goal of this study is to identify the main causes of poisoning in children. Acute poisoning in children is one of the leading causes of emergency hospital visits, complications, and child mortality worldwide, making it a fundamental public health issue [1, 2]. The World Health Organization (WHO) has reported that unintentional poisonings, with an incidence rate of 1.8 per 100,000 people and nearly 45,000 deaths globally, are a growing concern in the pediatric population and are recognized as the fourth leading cause of injury in children [3, 4]. In the United States, approximately 1 million children are treated annually for acute poisoning, with a mortality rate of 0.5 per 100,000, while tragically, the mortality rate in Iran exceeds that of the U.S. [5, 6]. According to WHO reports, limited access to healthcare, insufficient knowledge, and poor sanitation in developing countries contribute to more than 3 million cases of acute poisoning in these regions [6].

Poisoning occurs when harmful substances enter the body through ingestion, inhalation, mucosal contact, or other pathways, leading to toxic effects that can result in life-threatening complications. Poisoning can be classified into two categories: intentional and unintentional [7]. While both types of poisoning can occur in children of all age groups, their occurrence varies with age. Unintentional poisonings are more common in children under the age of 12, whereas intentional poisonings are more prevalent in those over 12, with an overall increase in the incidence of intentional poisonings as children age [8, 9]. Most intentional poisonings occur in developing countries, where the high toxicity of substances and limited access to medical care result in a significant number of fatalities [5].

Childhood poisoning is influenced by various risk factors, including social, demographic, and industrial factors, and its prevalence differs based on the geographic and cultural characteristics of different societies [5, 10, 11]. In most cases, poisoning in children is caused by exposure to drugs, alcohol, petroleum products, pesticides, carbon dioxide, detergents, rodenticides, and other harmful substances. Factors such as a lack of public awareness, easy access to toxins, caregiver negligence, and technological and industrial advancements exacerbate the incidence of poisoning [12]. Over 75% of childhood poisoning cases occur due to the ingestion of toxic substances, often resulting from the inability of children to distinguish between edible and non-edible items or due to curiosity and imitation of adults' use of drugs, combined with improper storage of drugs at home [11, 13]. In addition to various drugs, hydrocarbons such as petroleum, bleach solutions, pesticides, insecticides, and cosmetics are the most common causes of poisoning in children worldwide [14]. The primary causes of childhood poisoning differ between developed and developing countries, with drug abuse and organophosphate exposure being the leading contributors, respectively [11]. In many countries, including Malaysia, Iran, and Turkey, drug poisoning is the most common type of poisoning. Among children, poisonings are typically unintentional in those under five, but more often intentional in the 13-18 age group [15, 16]. Opioid (especially methadone) poisoning is rising in Iran, increasingly affecting children. Hospitalizations for this poisoning are up, with methadone often inadequately addressed. Opioids are a leading cause of half of Tehran's childhood poisonings. Boys are mainly poisoned by drugs, girls by over-the-counter/herbal medications. Overall, drugs and detergents are key poisoning causes. Easier access to new substances has shifted and increased childhood poisoning, causing serious harm despite mostly non-fatal outcomes. [11, 14, 17, 18]. Given the importance of the issue and the need to assess the current situation to identify the associated risk factors better and to use this information for the prevention and development of targeted interventions to reduce unintentional poisonings, this study aimed to determine and examine the epidemiology of poisoning among children admitted to Imam Khomeini Hospital in Esfarayen from 2019 to 2024.

## Methods

### *Design and participant*

This cross-sectional study was conducted following the approval of the project and the acquisition of ethical clearance. Data were collected by reviewing the medical records of all children who visited the emergency department of Imam

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Khomeini Hospital in Esfarayen for poisoning-related issues between 2019 and 2024. A complete census of the cases was retrieved from the Ministry of Health's database, and the relevant information was documented using a checklist based on the registered data. The collected information includes the type of poisoning, the outcome and cause of poisoning, as well as the age and gender of the patients.

### *Statically Analysis*

The data were then transferred to SPSS 27 for statistical analysis. Descriptive statistics were presented using frequency tables, and the chi-square test and Fisher's exact test and Poisson Regression were employed to examine relationships between variables. The trend of changes in the number of children admitted to the hospital due to poisoning was also analyzed using time series models, specifically the ARIMA model, with the "autoarima" function from the "forecast" package in R 4.4.0.

## Results

Most of the pediatrics admitted to the hospital due to poisoning were girls (59.6%), and the highest incidence of poisoning occurred in children over the age of 13 (52%) (Table 1).

The findings indicate that the most common cause of poisoning in children under 18 in Esfarayen was Non-opioid Medication poisoning (55.1%), followed by opioid medication poisoning (31.1%). Alcohol and pesticides were also among the most common causes (Figure 1).

The results also revealed a significant association between the cause of poisoning and factors such as gender and age (p-value < 0.001). Among girls, non-opioid medications were the most common cause of poisoning (66.5%), while among boys, opioid medications were the leading cause (42.6%).

When analyzed by age group, opioid medications were the most frequent cause of poisoning in children <6 years old (56.5%). In contrast, non-opioid medications were the predominant cause in children aged 6 to 12 years (47%) and in those over 13 years old (75.5%) (Table 2).

Out of 1140 poisoning cases, only 7 (0.6%) resulted in death. The majority of patients (53%) recovered fully, while 32.4% were discharged based on personal consent. (See Table 3).

Additionally, Fisher's exact test showed a significant relationship between the poisoning cause and poisoning outcome (p-value < 0.001). The highest percentages of mortality were associated with carbon dioxide, gasoline, and kerosene poisoning. (Figure 2).

Additionally, trends and forecasts for the two leading causes of poisoning-opioid medications and non-opioid medications-were analyzed for the next 24 months. The graphs indicate a relatively stable trend, with opioid medication poisoning cases projected to reach approximately 4 cases per month (CI: -0.3–9.58), while non-opioid medication poisoning cases are expected to reach 9 cases per month (CI: 2.02–15.75) by the end of 2025.

**Table 1. Distribution of Demographic Variables**

| Variable | | Frequency (%) |
|---|---|---|
| Gender | Girl | 680 (59.6) |
| | Boy | 460 (40.0) |
| Age | < 6 years | 464 (40.7) |
| | 6-12 years | 83 (7.3) |
| | ≥ 13 years | 593 (52) |

**Table 2. Relationship between Poisoning Causes, Gender, and Age**

| Poisoning | Gender | | Age | | |
|---|---|---|---|---|---|
| | Girl (%) | Boy (%) | < 6 years (%) | 6-12 years (%) | ≥ 13 years (%) |
| Opioid Medication | 159(23.4) | 196(42.6) | 262 (56.5) | 30 (36.1) | 63 (10.6) |
| Alcohol | 7 (1.0) | 43 (9.3) | 3 (0.6) | 2 (2.4) | 45 (7.6) |
| Gasoline and Kerosene | 3 (0.4) | 11 (2.4) | 13 (2.8) | 1 (1.2) | 0 (0.0) |
| Carbon Monoxide | 5 (0.7) | 5 (1.1) | 5 (1.1) | 3 (3.6) | 2 (0.3) |
| Pesticides | 34 (5.0) | 16 (3.5) | 19 (4.1) | 2 (2.4) | 29 (4.9) |
| Detergents | 20 (2.9) | 13 (2.8) | 21 (4.5) | 6 (7.2) | 6 (1.0) |
| Non-Opioid Medication | 452(66.5) | 176(38.3) | 141 (30.4) | 39 (47) | 448 (75.5) |
| Chi-Square Test Value | 125.84 | | | 347.22 | |
| **P-Value** | < 0.001 | | | < 0.001 | |

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**Table 3. Distribution of Poisoning Outcomes**

| Poisoning Outcome | Frequency | Percentage (%) |
|---|---|---|
| Recovered | 604 | 53 |
| Death | 7 | 0.6 |
| Discharged (by personal consent) | 369 | 32.4 |
| Transferred to another hospital | 114 | 10 |
| Unknown | 17 | 1.5 |
| Escaped/Unsettled | 28 | 2.5 |

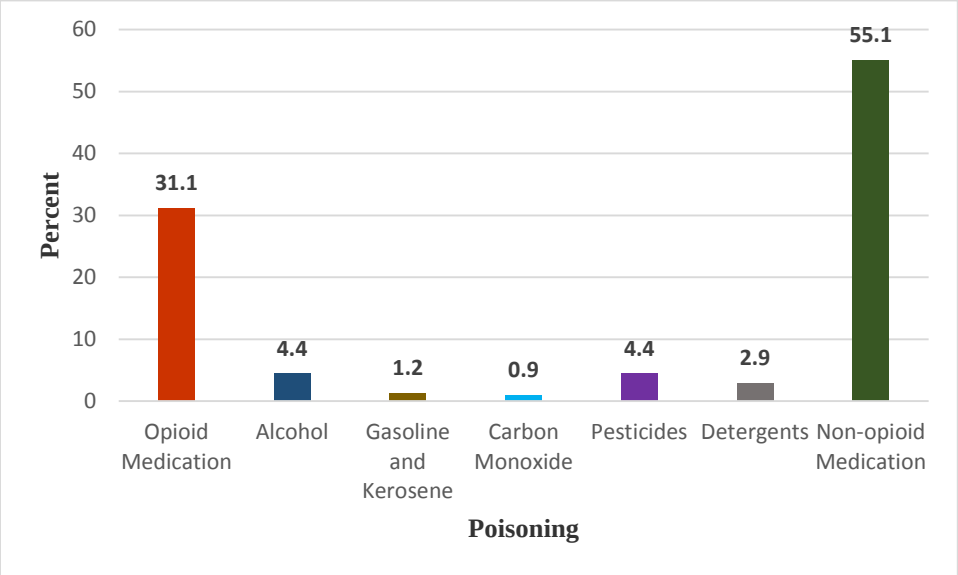



**Figure 1. Percentage of Different Reasons for Poisoning**

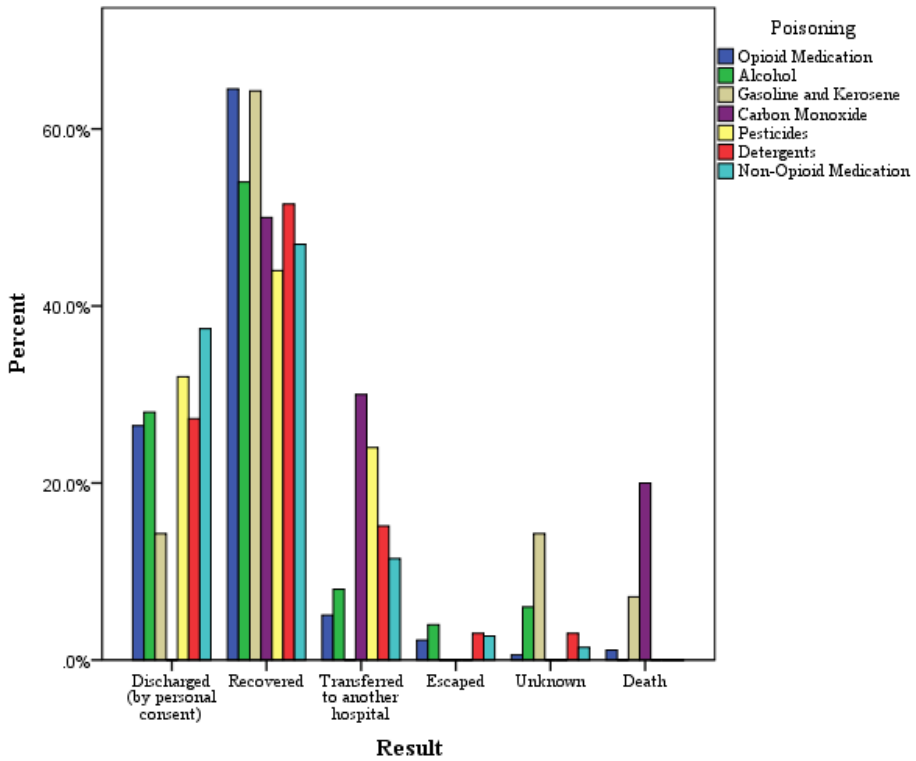



**Figure 2. The outcome associated with each Poisoning Cause**

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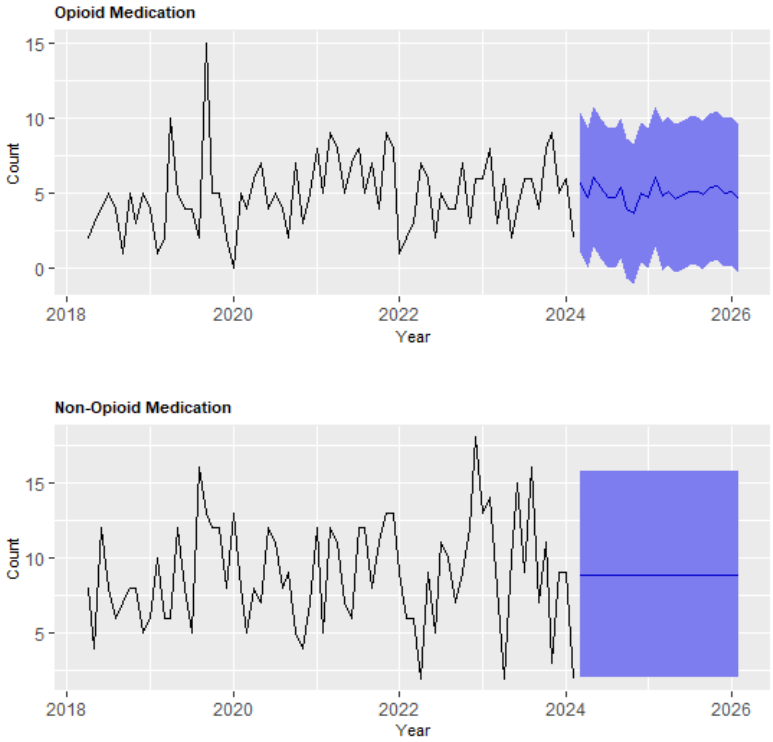



**Figure 3. Trend of Opioid Medication and Non-Opioid Medication poisoning**

## Discussion

This study aimed to investigate the epidemiological patterns of acute poisoning among children admitted to the emergency department of a hospital in Esfarayen over six years. The findings revealed that non-opioid drugs were the most common cause of poisoning, followed by opioid drugs. Similar studies conducted in Yasuj, Urmia, and Kermanshah also identified medications as the leading cause of poisoning in children.

The results further indicated that in the age group above 13 years, non-opioid drugs were responsible for the majority of poisoning cases. Given that some girls in Esfarayen marry before the age of 18, it is crucial to address their emotional needs, ensure proper spousal care, foster parental understanding, and provide pre- and post-marital counseling. For boys, parents should pay closer attention to their social interactions and friendships. Therefore, parental education and awareness play a vital role in prevention.

The study also highlighted a significant correlation between the causes of poisoning and factors such as age and gender. In children under six years of age, opioids—including opium and methadone—were the most common cause of poisoning. In this age group, poisonings often occur accidentally by the child or intentionally by parents for medicinal or pain-relief purposes. A widespread misconception about the "miraculous" pain-relieving and healing properties of narcotics, leading to their unsupervised use, contributes to the high incidence of poisoning in this demographic. Traditional practices, such as using opium and its derivatives to soothe restless children, are prevalent in some regions [6]. Methadone, often formulated as a palatable liquid, poses a significant risk when stored carelessly, particularly in households undergoing methadone treatment for addiction recovery. Additionally, some parents may mistakenly administer methadone syrup to children instead of safer alternatives like acetaminophen or diphenhydramine syrup, potentially leading to poisoning [2]. Furthermore, Iran's proximity to Afghanistan, one of the world's largest opium producers, has resulted in significant health and

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social challenges. The easy accessibility of opium for many Iranian families may explain the high prevalence of opioid-related poisonings. The frequency of drug poisoning in this age group aligns with findings from other studies and can be attributed to children's natural curiosity, inadequate parental supervision regarding medication storage, and the easy accessibility of drugs and their packaging [1, 4, 5].

After opioids and non-opioids, alcohol emerged as the second most common cause of poisoning, with cases predominantly occurring among boys aged ≥13. This trend may be influenced by cultural factors, such as less stringent parental supervision of boys. Beyond the economic burden, these poisonings also impose psychological costs on families. Implementing practical preventive measures-such as reducing access to drugs and toxic substances, providing appropriate education in schools and health centers, and targeting effective interventions for vulnerable groups, particularly adolescents-can help mitigate these issues.

On the other hand, considering that the trend of drug and opium poisoning has remained relatively stable, it is anticipated that efforts will be made to reduce this trend through the implementation of effective health policies and targeted education for children and adolescents.

### *Conclusion*

Given the findings of this study and the higher prevalence of poisoning caused by opioid and non-opioid medications, effective prevention strategies are essential. Supervising the storage of medications—keeping them out of children's reach—and educating children from an early age about the dangers of unsupervised drug use can significantly reduce the risk of such poisonings. Therefore, increased attention from parents, psychologists, and school educators is crucial in minimizing both intentional and unintentional poisonings involving various substances.

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## Ethical Considerations

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## Authors' contributions:

FM wrote some sections in this article and helped to correct interpretation errors. MM analyzed and interpreted the results of the article. FE helped with the elaboration of the original idea and interpretation of the results and their presentation.

## Conflict of interest:

The authors declare that they have no conflict of interest.

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