

## Research Paper

# Poisonings During the COVID-19 Pandemic: Attention to Children and Adolescents Admitted to the Referral Teaching Hospitals of Yazd and Taft Cities, Iran



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## ABSTRACT

**Background:** With the onset of the first wave of COVID-19 in Iran, along with the preventive quarantines, children who had to stay at home were in contact with drugs, alcohol, and disinfectants. This study compares the prevalence rates of poisoning for children and adolescents hospitalized during the first wave of COVID-19 to the previous year (pre-COVID-19 period in 2019).

**Methods:** This analytic, cross-sectional study was conducted based on the administrative data obtained from the referral teaching hospital in Yazd and Taft cities, Iran. This study was conducted on children under the age of 15 years who were admitted to the hospital because of poisoning. The study was conducted from February 19, 2020, to February 18, 2021 (12 months during the COVID-19 pandemic) compared to 2019 as the reference period (pre-COVID-19). The data were analyzed by the SPSS software, version 20.

**Results:** Multivariate regression analysis showed that by adjusting the effects of age and sex, the chance of alcohol poisoning (odds ratio [OR]=0.3, P=0.03), poisoning with oil and its derivatives (OR=0.33, P=0.05), and drugs-opioids poisoning in the period before the outbreak of COVID-19 was lower than during the outbreak of COVID-19. Additionally, the chance of poisoning with medications in the period before the outbreak of COVID-19 was 67% higher than during the outbreak of COVID-19 (OR=1.67, P=0.01).

**Conclusion:** The results indicated a significant increase in poisoning with alcohol, drugs-opioids, oil, and its derivatives in children and adolescents in Yazd City, Iran, during the 12 months of the COVID-19 pandemic.

**Keywords:** COVID-19, Poisoning, Methanol, Outbreak, Pediatric, Child

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## 1. Introduction

The new coronavirus 2019 (COVID-19) was recorded for the first time on December 26, 2019, in Wuhan City, China [1]. The virus gradually expanded to other countries until the World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020 [2]. The first COVID-19 case in Iran was reported on February 19, 2020, in Qom City, Iran [3]. WHO suggested preventive measures and healthy lifestyles to protect individuals against the infection. One of the best WHO advice was to disinfect hands with soap or ethanol-based (>60% ethanol) hand sanitizers [4]. A study in China demonstrated that the best way to reduce the transmission of COVID-19 among people in the community is to carry out health measures, impose quarantine, avoid gatherings, timely diagnosis, and patient care in hospitals [5]. Alimohamadi et al. reported that the spread of COVID-19 in Iran can be reduced by various interventions, such as health education, preventing the formation of human gatherings, quarantine, and separation of patients during the period of the disease from the rest of the community [6].

With the increase in COVID-19 patients in Iran, several approaches were considered to prevent the disease, including using alcohol-based disinfection solutions commonly available to the general public [7]. By shutting down schools, children who had to stay at home were in contact with hazardous products, such as medications, alcohol, and disinfectants [8]. On the other hand, misconceptions about the use of alcoholic beverages to disinfect the mouth and throat (for instance, gargling alcohol) may increase poisoning in adolescents [9, 10]. Fear of COVID-19 changed people's health behaviors. Excessive cleaning and disinfection of the house and improper use of bleaches and disinfectants became more common [11]. Also, the increasing demand for hand sanitizers led to the production of hand sanitizers with inappropriate proportions of ethanol (<60%) or hand sanitizers containing methanol [12]. Alcohol-based disinfectants affect human health through ingestion, inhalation, or skin contact [13]. After the onset of the COVID-19 pandemic in Iran, alcohol poisoning increased in some areas, leading to deaths. All provinces reported cases of methanol poisoning [14]. The lack of public awareness about the prevention and treatment of COVID-19, subjects' lack of awareness about different types of alcohol, the sale of illegal and non-standard alcohol, and the spread of rumors and disinformation through social media about COVID-19 and its prevention methods were among the reasons for the increase of alcohol poisoning during the pandemic in Iran [15].

A study examining alcohol poisoning in Iranian children and adolescents demonstrated that the prevalence of alcohol poisoning during the COVID-19 pandemic was associated with increased hospitalization rates among children and adolescents [16]. Given that the prevalence of poisoning and its causes in children and adolescents during the COVID-19 pandemic in Iran remains unknown, the researchers decided to compare the poisoning on children under the age of 15 years who were admitted to the referral teaching hospitals of Yazd and Taft cities, Iran, during the first wave of COVID-19 versus its previous year (pre-COVID-19 period in 2019).

## 2. Methods

### Study design

This analytic, cross-sectional study was conducted based on the administrative data obtained from the referral teaching hospital in Yazd and Taft cities, Iran. In this study, the data were collected by census. The information of all children under the age of 15 years admitted to the referral teaching hospital in the selected two cities (Shahid Sadoughi Hospital in Yazd City, Iran, and Shahid Beheshti Hospital in Taft City, Iran) due to poisoning was examined. Accordingly, 312 cases in pre-COVID-19 and 205 cases during the COVID-19 pandemic were examined. The study period was from February 19, 2020, to February 18, 2021 (12 months of the COVID-19 pandemic) compared to 2019 as the reference period (pre-COVID). The inclusion criteria were being under the age of 18 years, being a native of Yazd Province, Iran, and being hospitalized with a diagnosis of poisoning in the hospital record. Outpatients with alcohol exposure and incomplete records (such as not mentioning the cause of poisoning) were excluded from the study.

### Data collection

The data collection method in this study included a checklist comprised of age, gender, duration of hospitalization, location (urban, rural), the season of occurrence of poisoning, cause of poisoning (medications, alcohol, oil and its derivatives, food, drugs-opioids, detergents, pesticides, CO gas, plants, chemical materials, and bites), route of exposure (swallowing, breathing, injection, skin, and eyes), death due to poisoning, type of poisoning (accidental, suicide), and clinical symptoms (gastrointestinal symptoms, headache, dizziness, delirium and hallucinations, seizures, respiratory problems, ocular symptoms, a lack of consciousness, cyanosis, fever and chills, urinary symptoms, restlessness and lethargy, gait disturbance, drowsiness). The data were

extracted from the medical files. Patient records in [Shahid Sadoughi Hospital](#) were paper medical files, while they were electronic files in [Shahid Beheshti Hospital](#).

### Data analysis

The SPSS software, version 20 was used for data analysis. The descriptive statistics, chi-square test, independent t-test, and binary logistic regression were used. A  $P < 0.05$  was considered significant. An independent t-test was used to compare the age of the patients and the length of hospitalization between the two periods. The chi-square was used to compare the frequency of poisoning between two periods based on qualitative variables (gender, living area, season, and type of poisoning). The logistic regression model was used to investigate the effect of the period on the cause of poisoning. For this purpose, the univariate analysis was performed first, and the variables with a significance level above 0.3 were included in the final model.

### 3. Results

The results of this study showed that the prevalence of hospitalization because of poisoning in children under the age of 15 years during the COVID-19 pandemic and pre-COVID-19 was 2.39% and 2.6%, respectively. The Mean $\pm$ SD age of poisoned children during the COVID-19 pandemic and pre-COVID-19 was 5.8 $\pm$ 1.5 and 6.5 $\pm$ 1.9 years ( $P=0.01$ ), respectively, and the Mean $\pm$ SD

duration of hospitalization was 38.08 $\pm$ 8.2 and 29.01 $\pm$ 7.3 hours, respectively ( $P=0.008$ ). According to [Table 1](#), no statistical difference was observed between the poisonings of the two time periods regarding gender, location, and poisoning season. In terms of clinical symptoms, gastrointestinal symptoms, drowsiness, a lack of consciousness, restlessness, and lethargy were the most common in both studied periods; however, no statistically significant difference was observed between the two periods. Regarding the route of exposure to poisonous agents, the result indicated that most people were poisoned by swallowing in both periods (97.4% in pre-COVID-19 and 95.6% in the COVID-19 pandemic).

[Table 2](#) shows the causes of poisoning in the two periods. According to the results, drugs, opioids, and detergents had the highest frequency of causes of poisoning in both periods. The result showed increased hospitalization of children and adolescents due to alcohol poisoning during the outbreak of COVID-19. According to the results, the prevalence of alcohol poisoning in children under 15 years during the COVID-19 pandemic and pre-COVID-19 was 5.4% and 1.6%, respectively. The multivariate regression analysis showed that by adjusting the effects of age and sex, the chance of alcohol poisoning in the period before the outbreak of COVID-19 was 70% lower than during the outbreak of COVID-19 (odds ratio [OR]=0.3,  $P=0.03$ ) ([Table 3](#)).

**Table 1.** Distribution of frequency of poisoning in participants based on socio-demographic and injury characteristics

Variables	No. (%)		P*
	Pre-COVID-19	During COVID-19	
Gender	Boy	167(53.5)	0.48
	Girl	145(46.5)	
Living area	Urban	297(95.2)	0.5
	Rural	15(4.8)	
Season	Spring	84(26.9)	0.09
	Summer	88(28.2)	
	Autumn	71(22.8)	
	Winter	69(81.7)	
Type of poisoning	Accidental	268(85.9)	0.16
	Suicide	44(14.1)	

\*Chi-square.



**Table 2.** Frequency distribution of causes of poisoning in children under the age of 15 years during the COVID-19 pandemic and pre-COVID-19

Variables	No. (%)	
	Pre-COVID-19	During COVID-19
Medication	231(74)	131(63.9)
Alcohol	5(1.6)	11(5.4)
Oil and its derivatives	5(1.6)	9(4.4)
Food	5(1.6)	8(3.9)
Drugs-opioids	17(5.4)	23(11.2)
Detergents	30(9.6)	12(5.9)
Pesticides	10(3.2)	5(2.4)
CO	5(1.6)	1(0.5)
Plants	2(0.6)	3(1.5)
Bites	0	2(1)
Chemical material	2(0.6)	0



Further analysis showed that the mean age of alcohol poisoning during the COVID-19 pandemic and pre-COVID-19 was  $6.8 \pm 1.2$  and  $12.2 \pm 3.2$ , respectively ( $P=0.07$ ). This result indicates a decrease in the age of alcohol poisoning during the COVID-19 pandemic. Additionally, alcohol poisoning in the pre-COVID-19 period occurred only in boys and, in all cases, was accidental; however, during the COVID-19 pandemic, 27.3% of alcohol poisoning occurred in girls. According to Table 3, a case of alcohol suicide was also observed during 12 months of the COVID-19 pandemic. The results showed that most alcohol poisoning during the COVID-19 pandemic was related to the age group under three years; In boys, it was related to the age group above 10 years. Also, all cases of alcohol poisoning in both periods

were swallowing in urban areas, and a doctor prescribed the discharge method.

The results also showed that the frequency of poisoning with oil, its derivatives, and drug opioids increased during the COVID-19 pandemic. Multivariate regression analysis showed that by adjusting the effects of age and sex, the chance of poisoning with oil and its derivatives in the period before the outbreak of COVID-19 was 67% lower than during the outbreak of COVID-19. ( $OR=0.33$ ,  $P=0.05$ ). Also, the chance of drug-opioid poisoning in the period before the outbreak of COVID-19 was 53% lower than during the outbreak of COVID-19 ( $OR=0.47$ ,  $P=0.02$ ) (Table 3).

**Table 3.** Adjusted logistic regression analysis for predicting poisoning based on causes of poisoning in children under the age of 15 years

Variables	OR <sup>a</sup>	P <sup>a</sup>	OR <sup>b</sup>	P <sup>b</sup>	OR <sup>c</sup>	P <sup>c</sup>	OR <sup>d</sup>	P <sup>d</sup>	OR <sup>e</sup>	P <sup>e</sup>	OR <sup>f</sup>	P <sup>f</sup>	OR <sup>g</sup>	P <sup>g</sup>	OR <sup>h</sup>	P <sup>h</sup>	OR <sup>i</sup>	P <sup>i</sup>
Constant	0.1	0.001	0.55	0.01	0.08	0.05	0.25	0.02	0.06	0.1	0.24	0.14	0.07	0.6	0.005	0.27	0.015	0.13
Time (h)	0.3	0.03	1.67	0.01	0.34	0.05	0.47	0.02	0.39	0.1	1.7	0.13	1.31	0.62	3.3	0.27	0.43	0.36
Gender	4.87	0.02	0.66	0.05	1.81	0.32	-	-	-	-	1.1	0.74	-	-	-	-	-	-
Age (y)	1.04	0.07	1.07	0.001	0.88	0.1	-	-	0.92	0.2	0.84	0.001	0.79	0.02	-	-	-	-
Living area	-	-	2.85	0.01	0.68	0.72	-	-	-	-	0.47	0.2	--	-	-	-	0.14	0.024

<sup>a</sup>Alcohol, <sup>b</sup>Medication, <sup>c</sup>Oil and its derivatives, <sup>d</sup>Drug-opioids, <sup>e</sup>Food, <sup>f</sup>Detergents, <sup>g</sup>Pesticides, <sup>h</sup>CO, <sup>i</sup>Plants.



**Table 4.** Frequency distribution of intentional poisoning (suicide) in children under the age of 15 years during the COVID-19 pandemic and pre-COVID-19

Variables	No. (%)	
	Pre-COVID-19	During COVID-19
Medication	41(93.2)	21(95.5)
Alcohol	0	1(4.5)
Drug-opioids	3(6.8)	0
Total	44(100)	22(100)

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The results showed that poisoning with oil and its derivatives was higher in boys than girls in both periods. The results also demonstrated that most cases of oil poisoning in both periods were related to children under 5 years old. According to the results, most cases of drug-opioid poisoning were in urban areas and by swallowing in the two periods. Meanwhile, most cases of drug-opioids poisoning in both periods were related to children less than one year of age; however, this prevalence was significantly different between the two time periods ( $P=0.06$ ) (35.3% in pre-COVID-19 and 72.7% in the COVID-19 pandemic).

The results indicated that poisoning due to medication was reduced during the COVID-19 pandemic. Multivariate regression analysis showed that by adjusting the effects of age, sex, and place of residence, the chance of drug poisoning in the period before the outbreak of COVID-19 was 67% higher than during the outbreak of COVID-19 ( $OR=1.67$ ,  $P=0.01$ ) (Table 3).

Further analyses showed that the age and gender distribution of drug poisoning in the two periods were almost the same; however, no statistically significant difference was detected. According to the results, drug poisoning in 22 people during the COVID-19 pandemic and 44 people during pre-COVID-19 was due to suicide, but this difference was not statistically significant (Table 4). Also, 6 deaths occurred due to poisoning in pre-COVID-19, and 2 deaths occurred during the COVID-19 pandemic ( $P=0.48$ ).

#### 4. Discussion

The present study showed that hospitalization rates due to poisoning in children under 15 years were significantly higher during the COVID-19 pandemic compared to

the 2019 reference period. Similar research in Morocco examined the characteristics of poisoning in children during the COVID-19 pandemic. Their study showed that the frequency of hospitalizations due to poisoning in children during the 12 months of the COVID-19 pandemic increased by 28 people compared to last year [3]. These results are consistent with a study conducted in Padova, Italy [17]. Research conducted by Cella et al. showed a decrease in emergency department visits due to poisoning in 2020 compared to 2019 and an increase in hospitalization cases due to poisoning in 2020 compared to 2019 [18].

Consistent with this results some other studies showed that outpatient visits to the emergency department due to poisoning were reduced during the COVID-19 pandemic [19-21]. The COVID-19 pandemic has considerably affected children's social environments and access to healthcare and services. Fear of getting COVID-19 in a hospital emergency department will likely reduce emergency room visits, exacerbating the child's condition and ultimately increasing cases of poisoning, leading to hospitalization.

Grasso et al. believe that most cases of poisoning in children during the COVID-19 pandemic are managed at home and as self-medication, and if symptoms worsen, lead to hospitalization [22]. On the other hand, due to the lower weight of children, if poisoning is not treated timely and properly, hypoglycemia occurs sooner, and the symptoms of poisoning intensify, leading to hospitalization [10]. Sabti et al. indicated that the reduction of emergency department visits during the COVID-19 pandemic was a factor in accepting patients with more severe conditions and reducing the financial workload of the emergency department [23]. However, the consequences of increasing self-medication and its impact on children's health should be considered. Medication poisoning is one of the significant causes of poisoning

in children. It may occur due to over-the-counter medication, giving medicine at the wrong time, or in higher doses [24].

After the prevalence of COVID-19, various strategies were made to prevent its expansion. One of these strategies was the use of alcoholic disinfectants [25]. Some of them did not have solid scientific documentation [10]. At the same time as increasing alcoholic disinfectants, some studies reported changes in the number of cases of poisoning, including a significant increase in methanol poisoning due to improper use of disinfectants and health products [26, 27]. A survey at the Center for Control and Prevention of American Diseases showed that nearly half of adults did not know that hand disinfectant should be kept out of the reach of children [28].

The results showed that the rate of hospitalization due to poisoning with alcohol, drugs-opioids, oil, and its derivatives was significantly increased in children under the age of 15 years during the COVID-19 pandemic compared to the same period in 2019. Also, the chance of poisoning with alcohol, which leads to hospitalization during the COVID-19 pandemic, was higher than in the same period in 2019. Mahdavi et al. examined the hospitalization rate due to poisoning in children in 9 hospitals in 5 provinces of Iran. Their study showed that hospitalization rates due to ethanol and methanol exposure in people aged 0 to 18 years increased significantly in 2020 compared to 2019 (375 vs 202 cases) [16]. McCulley et al. found that the increase in alcohol poisoning was in line with the growing demand for alcoholic disinfectants [29]. A study conducted in Morocco showed that poisoning with methanol and alcohol, caustics, and drug opioids increased among children during the COVID-19 pandemic. Also, the highest increase was in oil products and caustics. According to the authors, Moroccans widely used caustics to disinfect the air and surfaces to reduce the virus's diffusion [3].

Coinciding with the spread of COVID-19, governments adopted a policy of closing schools and universities and nationwide quarantine. By shutting down schools, children who had to stay at home were in contact with hazardous products, such as medications, alcohol, and disinfectants [19, 30]. On the other hand, misconceptions about the use of alcoholic beverages to disinfect the mouth and throat (such as gargling alcohol) may increase poisoning in adolescents [31, 32]. People initially thought that COVID-19 was likely to be transmitted from surfaces. This perception led to the storage of disinfectants and alcohols in the home, often impregnated with a fragrant scent, and attracted children [24].

Parental teleworking at home also reduced child care and increased the risk of children being exposed to disinfectants and alcohol [33]. The combination of these factors is likely to increase alcohol poisoning in children and adolescents during the COVID-19 period.

In the present study, the prevalence of hospitalization of children due to drug-opioid poisoning during COVID-19 was significantly increased compared to the same period in 2019. The chance of drug-opioid poisoning in children during the COVID-19 period was higher than in the same period in 2019. Quarantine and staying at home may lead to increased drug use by parents and improve children's access to drugs.

A similar study in Turkey found that drug-opioid poisoning in children during the outbreak of COVID-19 was 3.5 times higher than in the same period in 2019 [9]. Social isolation is a factor in reducing mental health and increasing depression and anxiety during COVID-19, which increases drug use in adults [34]. Some also believe that financial problems and unemployment caused by the COVID-19 outbreak increase depression, followed by increased drug-opioid use in adults [35]. With growing drug use in adults, children's access to drugs will increase, and due to the curiosity of toddlers and their desire to put objects in their mouths, the rate of drug poisoning in children increased during the outbreak of COVID-19.

The results of the present study showed that hospitalization due to medication poisoning in both periods was the most common cause of poisoning, consistent with studies conducted in Brazil and Kuwait [23, 36]. The main culprits of medication poisoning in children are parents because their children do not have access to the medication, and the leading cause of medication poisoning is self-medication, giving medicine at the wrong time, or in higher doses [37]. On the other hand, the attractive form, pleasant taste of some medicines, colored pills, syrups with beautiful labels, and attractive packaging are the factors that attract children to medicines [24].

The results also indicated that the chances of medication poisoning in children under the age of 15 during the COVID-19 pandemic were significantly lower than in 2019, which is consistent with the results of a similar study conducted in Morocco [3]. Fear of COVID-19 infection increases health and self-care behaviors in individuals. This reduces viral diseases, such as colds or influenza, and self-medications (painkillers and antipyretics), thereby reducing medication poisoning.

The results also showed that the frequency of intentional poisoning (suicide) during COVID-19 compared to the same period in 2019 decreased, and the frequency of accidental poisoning increased, consistent with a similar study in Morocco. Amrani Hanchi et al. believed that because most suicides are medication-related, reducing medication poisoning reduces suicides in children [3]. However, Akcaboy et al., who examined changes in child hospitalization in Turkey after the outbreak of COVID-19, found that the rate of intentional poisoning in children during COVID-19 was 2.25 times the same time in 2019. They believe that school closure, quarantine, and travel restrictions are factors in reducing mental health and increasing the frequency of intentional poisonings [9].

In terms of route of exposure to poisonous agents, the result indicated that most people were poisoned by swallowing in both periods, which is consistent with similar studies [3, 33]. The findings also showed that the mean age of poisoned children and adolescents hospitalized during the COVID-19 pandemic slightly increased ( $P=0.01$ ). Amrani Hanchi et al. reported that the mean age of children and adolescents was almost similar before and after the COVID-19 outbreak [3]. The present study showed that the mean age of alcohol poisoning decreased during the COVID-19 pandemic, which is likely due to more children's access to disinfectants and alcohol.

The results also showed that the mean duration of hospitalization in poisoned children during the COVID-19 pandemic decreased by about 9 h compared to the same period in 2019 ( $P=0.008$ ). One of the limitations of the present study is that it did not examine poisoned children who were treated as outpatients in the emergency room.

## 5. Conclusion

The results indicated that the frequency of poisoning with alcohol, drugs-opioids, oil, and its derivatives in children and adolescents in Yazd City, Iran, during the 12 months of the COVID-19 pandemic increased significantly compared to the same period last year. This finding highlights the need to increase knowledge about common poisoning during the COVID-19 pandemic and the dangers of using alcoholic disinfectants. Given that the prevalence of hospitalization of children and adolescents due to poisoning has increased during the COVID-19 pandemic, this is an alarm to prevent delayed referral of poisoned children to medical centers for treatment. There is a need to establish a poison control center in Yazd Province, Iran, that provides specialized medi-

cal care to poisoned patients, provides services such as face-to-face and telephone counseling to patients, poison management, and research activities on poisoning.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of [Shahid Sadoughi University of Medical Sciences](#) (Code: IR.SSU.SPH.REC.1400.077).

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### Authors' contributions

The authors contributed equally to the preparation of this article.

### Conflict of interest

The authors declared no conflict of interest

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