



Research Paper

Poisoning Patterns Before, During, and after the COVID-19 Pandemic in the Poisoning Centers in Urmia: A Six-Year Retrospective Study

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ABSTRACT

Background: Poisoning is one of the main causes of emergency admissions and deaths worldwide, which could be affected by the COVID-19 pandemic. This study aimed to assess poisoning patterns before, during, and after the COVID-19 pandemic at poisoning centers in Urmia.

Methods: In this retrospective, descriptive-analytical study, all poisoned patients hospitalized in Urmia poisoning centers from 2018 to 2023 were studied. Patients were categorized into groups before, during, and after the COVID-19 pandemic. Then, statistical analyses were performed using SPSS version 21.

Results: This investigation evaluated 13197 patients (51.7% males, 48.3% females). The mortality rate was 323 (2.45% total; 75.9% males; 24.1% females). The patients' Mean± standard deviation age was (28 ± 14.05) years (min=14, max=96). Most patients were aged 21-30 years, and approximately half were male. The number of hospitalizations during the COVID-19 pandemic (2,665) decreased significantly compared with before (5,697) and after (4,835). Pesticide (41.1%), Pharmaceuticals (20.6%), Substance abuse (17.8%), Mixed poisonings (12.2%), and Alcohol (6.5%) were the most common causes of death during the COVID-19 pandemic, respectively. Mortality among males was higher than among females at all times. But the mortality rate during the COVID-19 pandemic (4%) increased significantly compared to before (1.7%) and after (2.5%). Significant relationships were detected between the patients' outcomes and age>60 years, Male, Widowed status, Higher (Academic) education, and Alcohol poisoning, Gases, Pesticides, Bites, and Foods/Mushrooms.

Conclusion: Despite a decline in hospitalizations due to fears of COVID-19, it was able to change patterns of poisoning and mortality. Therefore, education to prevent pesticides, Alcohol, and drugs during public health crises can reduce morbidity and mortality.

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Introduction

Poisoning is a major health problem and one of the most common causes of hospitalization and mortality worldwide [1]. According to the World Health Organization in 2022, unintentional poisoning alone was responsible for 84,000 deaths worldwide, with a reported incidence ranging from 0.6 to 1.8 per 100,000 population [2]. Poisoning is also considered the second leading cause of death in the United States. In Iran, poisoning is also one of the most common causes of hospitalization and the second leading cause of death [3]. Poisoning can occur through a variety of routes, including ingestion, inhalation, contact, or injection of a wide range of harmful substances, such as drugs, chemicals, toxins, or gases [4]. Mental health problems in the community are a main cause of intentional poisoning, which can be affected by widespread social stressors, such as a global pandemic [5]. In the COVID-19 pandemic and fear of an unpredictable future, economic downturn, loss of jobs, income, and one or more family members have led to social isolation and, consequently, increased levels of anxiety and depression in the general population [6]. Therefore, during the COVID-19 pandemic, we have seen an increase in mental health disorders, suicidal behaviors, alcohol consumption, and drug abuse [7]. A study conducted in Spain showed that the number and the mortality rate from poisonings increased during the COVID-19 pandemic [8]. Another study conducted in Iran also revealed that the COVID-19 period, compared to the pre-COVID period, has seen significant changes in mortality patterns due to poisoning, especially methanol poisoning, and an increase in other poisonings such as opioids, stimulants, and medicines [9]. Finally, given that no similar study has been conducted in Iran and West Azerbaijan Province, the present study was conducted.

Materials and Methods

Our retrospective, descriptive-analytical study was performed on 13197 intoxicated patients hospitalized in the poisoning centers at Urmia, Iran, from 2018 to 2023. Patients were categorized into groups before, during, and after the COVID-19 pandemic. After obtaining the code of ethics from the Ethics and Research Committee of Urmia University of Medical Sciences (IR.UMSU.REC.1402.307), this study recorded no personal identification data and kept all data confidential. All admitted intoxicated patients aged 14 years or older were included. If they met the inclusion criteria (visit by specialist, having routine

care in the poison department and laboratory diagnostic measures) and did not meet the exclusion criteria (discharge with personal consent, incomplete clinical and laboratory records). All data were collected in the period before the COVID-19 pandemic (2018 to 2019), the period of severe COVID-19 quarantine (2020 to 2021), and the post-severe COVID-19 period, with the end of the COVID-19 pandemic according to WHO (2022 to 2023). During the coronavirus pandemic, priority was given to hospitalizing coronavirus patients; this could have reduced admissions of poisoned patients. In this investigation, differences in quantitative variables with normal and abnormal distributions were assessed using the T-test and Mann–Whitney U-test, respectively, and the correlations between categorical variables and the patients' outcomes were assessed using the Chi-square test. The Pearson correlation coefficient will be used to assess the data's correlation, and Poisson regression will be used to compare the frequency of poisoning across time intervals. Logistic regression will also be used to assess the effect of underlying factors on mortality rates from poisonings. Finally, an ANOVA t-test will be used to compare 3 periods (before, during, and after the COVID-19 pandemic). In all patients, a 95% confidence interval and a p-value <0.05 were considered significant. Finally, the data were analyzed using SPSS version 21.

Results

Of the total 13,667 patients, 470 were excluded from the study due to incomplete records or discharge with personal consent. This investigation evaluated 13197 patients, including 6817 males (51.7%) and 6380 females (48.3%). The mortality rate was 323 (2.45% total; 75.9% males; 24.1% females). The mean± standard deviation of patients was (28 ± 14.05) years (min=14, max=96), and the most extensive age range was 21-30 years with 4487 cases (34%). The duration of hospitalization was (2 ± 5.44) days. In this study, Pharmaceuticals (7155, 54.2%), Substance abuse (2394, 18.1%), Pesticides (1093, 8.3%), Mixed poisonings (762, 5.8%), and Alcohol (735, 5.6%) were the most common causes of poisoning, respectively. Also, Pesticides (128, 39.6%), Substance abuse (72, 22.3%), Pharmaceuticals (44, 13.6%), Alcohol (36, 11.1%), and Mixed poisoning (36, 11.1%) were the most common causes of poisoning-related deaths, respectively. Pesticide (41.1%), Pharmaceuticals (20.6%), Substance abuse (17.8%), Mixed poisonings (12.2%), and Alcohol (6.5%) were the most common causes of death during the COVID-19 pandemic, respectively. One of the reasons for the large variations in mortality during the COVID-19 period (Table 3) was

Table 1. Demographic characteristics and outcome before, during, and after the COVID-19 pandemic in hospitalized patients.

Characteristics	Before the pandemic (2018-2019) (n= 5697)	During the pandemic (2020-2021) (n= 2665)	After the pandemic (2022-2023) (n= 4835)	P value (Logistic regression)
Sex:				
Male	2970 (52.1%)	1397 (52.4%)	2447 (50.6%)	0.000
Female	2727 (47.9%)	1268 (47.6%)	2388 (49.4%)	0.352
Age (years) (median ± SD)	27 ± 13.3	31.2 ± 14.7	29 ± 14.3	
14 – 20	19.3 %	15.3%	18%	0.323
21 – 30	34.1 %	36.5%	34%	0.421
31 – 40	22.6 %	17.3%	22.6%	0.171
41 – 50	13 %	15%	13.2%	0.251
51 – 60	5.6 %	7.1%	7.3%	0.120
Up to 60	5.4 %	7.7%	4.8%	0.033
Duration of hospital stay (days)	2 ± 2.73	2 ± 13.3	2 ± 7.47	0.395
Admission service:				
ICU	2.5%	14.9%	9.1%	0.176
Ward	97.5%	85.1%	90.9%	0.295
Marital status:				
Single	33%	47.8%	40%	0.206
Married	53%	50%	55.6%	0.51
Widowed	0.1%	0.3%	1%	0.024
Divorced	1.6%	2.5%	3.4%	0.614
The motivation for poisoning:				
suicidal	66.1%	60.6%	52.3%	0.870
Accidental	3.1%	0.7%	0.2%	0.174
Educational level:				
Base Illiterate	20%	2.1%	9.3%	0.118
Primary and Secondary	73.3%	93%	80.8%	0.372
Higher education	6.7%	4.9%	9.9%	0.008

patients' reluctance to be hospitalized, as most hospitalized patients were in critical or complicated conditions. Finally, significant relationships were detected between the patients' outcomes and age>60 years, Male, Widowed status, Higher (Academic) education, and Alcohol poisoning, Gases, Pesticides, Bites, and Foods/Mushrooms.

Discussion

This study showed that hospitalizations decreased during the COVID-19 pandemic (2020–2021). As mentioned, during the COVID-19 pandemic, mortality increased despite fewer hospitalizations, which could be due to (delayed presentation, fear of being hospitalized alongside COVID-19 patients). Because most hospitalized patients had unstable conditions, this is consistent with the study by Chen et al. in Taiwan (145 poisoning cases per month during COVID-19,

compared to 572 before COVID-19) and the study by Motawi et al. (a 26% decrease in patients). In this study, the median age increased during COVID-19 compared with before and after COVID-19, a pattern similar to that observed in studies by Chen et al. and Motawi et al. [10, 11]. Interestingly, in their study, despite the decrease in the number of patients during the COVID-19 pandemic, the number of contacts with health centers increased by almost 50% compared to previous years [11]. According to Table 3, despite the decrease in admissions, the higher mortality rate of 107/2665 (4%) during the COVID-19 pandemic was worrying. Also, in all periods, men were the majority of poisoned patients compared to women. Interestingly, mortality in women has increased during the COVID-19 pandemic [12]. However, unlike the present study, in the study by Morsi et al, the majority of patients were women [13]. These changes may reflect psychosocial stressors that disproportionately affect women during quarantine, as

Table 2. Effect of the cause of poisoning on the outcome. Evaluation of mortality rate (%) in hospitalized patients before, during, and after the COVID-19 pandemic.

Cause of poisoning	Before the pandemic (2018-2019) (n= 5697) (Total mortality = 96)	During the pandemic (2020-2021) (n= 2665) (Total mortality = 107)	After the pandemic (2022-2023) (n= 4835) (Total mortality = 120)	P value (Logistic regression)
Pesticides	37 (38.5%)	44 (41.1%)	47 (39.1%)	0.000
Pharmaceuticals	11 (11.4%)	22 (20.6%)	11 (9.1%)	0.385
Substance abuse	21 (21.8%)	19 (17.8%)	32 (26.8%)	0.191
Mixed poisoning	9 (9.4%)	13 (12.2%)	14 (11.7%)	0.81
Alcohol	16 (16.7%)	7 (6.5%)	13 (10.8%)	0.021
Corrosives (Household)	0	1 (0.9%)	2 (1.6%)	0.221
Hydrocarbons	0	1 (0.9%)	0	0.349
Bites	0	0	0	0.004
Food/ plants/Mushroom	1 (1.1%)	0	0	0.007
Gases	1 (1.1%)	0	1 (0.9%)	0.004

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confirmed by El-Sarnaghawy et al., who observed high depression and suicidal risk among female poisoned patients during the pandemic in Egypt. El-Sarnagawy's study showed that a significant number of poisoning patients with suicidal attempts had moderate to severe depressive symptoms, highlighting the importance of providing specialized psychiatric services in poisoning centers, especially among vulnerable populations, to prevent repeated suicide attempts [12]. Also, the

highest rates of hospitalization and mortality in all periods were in married patients and in the age group of 21 to 30 years, which was somewhat similar to the study by Behnouth et al (30 to 34 years) and Morsi et al (15 to 25 years) [13, 14].

Patients who were illiterate or had less than a high school education had the highest rate of hospitalization and mortality. In contrast, patients with university

Table 3. Comparison of mortality rate in survived and non-survived cases from 2018 to 2023.

Date of admission	Survivor group (%) (Number =12874)		Non-survivor group (%) (Number =323)		Mortality Rate (%)
	Men	Women	Men	Women	
Before the pandemic (2018-2019)	2893	2708	77	19	1.7%
During the pandemic (2020-2021)	1323	1235	76	31	4%
After the pandemic (2022-2023)	2356	2359	92	28	2.5%

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Table 4. Comparison of mortality rate in survived and non-survived cases from 2018 to 2023.

Article	Common causes of poisonings (respectively)	Male to Female ratio	Male-to-Female mortality ratio	Total Mortality rate (%)
Our study (2025)	1. Pharmaceuticals (54.2%) 2. Substance abuse (18.1%) 3. Pesticides (8.3%) 4. Mixed poisonings (5.8%)	1.1 to 1	2.4 to 1	4%
Morsi et al.2023 (13)	1. Pharmaceuticals (52.7%) 2. Substance abuse (19.6%) 3. Pesticides (13.4%) 4. Household (11.9%)	0.5 to 1	Unknown	5.4%
Ashry et al.(2019-2022) (18)	1. Pharmaceuticals (34.5%) 2. Substance abuse (14.2%) 3. Household (13.6%) 4. Pesticides (12.7%)	0.9 to 1	1.9 to 1	1%

education had the lowest rates of hospitalization and mortality, consistent with the study by Di Santo et al. [15]. Pharmaceuticals and Substance abuse were the main causes of poisoning in all periods. However, during the COVID-19 pandemic, pesticides and alcohol-related poisoning increased despite a decrease in alcohol-related mortality. This was consistent with the study by Zutrauen et al and indicates increased use of Alcohol and Alcoholic detergents due to behavioral changes during COVID-19 [16]. In this study, the mortality of poisoning with Substance abuse, including methadone and tramadol, was increased, consistent with the study by Moghaddari et al. [17]. Also, in all three periods, the most important cause of death from alcohol poisoning was methanol, which was consistent with the study of Behnoosh et al [14]. Table 4 compares mortality rates and toxicity patterns across similar studies during the COVID-19 pandemic from 2020 to 2021.

Conclusion

As mentioned, during the COVID-19 pandemic, mortality increased despite fewer hospitalizations, which could be due to (fear of being hospitalized

alongside COVID-19 patients, delayed presentation and referral to the hospital at the beginning of poisoning, and priority for hospitalization of COVID-19 patients over poisoned patients). Therefore, they were referred to our referral center in complicated conditions. Also, the rates of poisoning and mortality were higher in males than in females, which could be due to the fear in females of hospitalization during the COVID-19 pandemic. Since, any crisis or pandemic can cause anxiety and depression, especially in young people and also, during the COVID-19 pandemic, mortality due to Pesticide, Medications, Substance abuse and Alcohol were also common among young people, it is therefore essential to implement of drug prescription control policies, strict control of pesticides/Alcohol, mental health screening and prevention of depression and anxiety in young through public education and increasing of poison control counseling services.

Limitations and suggestions

Patients discharged in good general condition or who left the hospital with personal consent were not followed up to determine their outcomes. Also, in this

study, the complications of poisoning were not studied. Therefore, it needs to be investigated in future studies.

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Ethical Approval

The Ethics Committee of Urmia University of Medical Sciences approved this study (Code: IR.UMSU.REC.1402.307).

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Conflicts of Interest

The authors report there are no competing interests to declare.

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