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Comparative Analysis of Pediatric Acute Poisoning Cases: Before and During the COVID-19 Pandemic

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Original Research

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Abstract

Objectives: Acute poisoning is a major cause of pediatric emergency department (PED) visits, with the COVID-19 pandemic potentially altering exposure risks and care-seeking behaviors. This study compares pediatric poisoning characteristics before and during the pandemic.
Methods: A retrospective analysis was conducted at the Gazi University PED between January 2018 and June 2022. Patients aged 1 month-18 years diagnosed with poisoning were identified via ICD codes grouped into before pandemic and during pandemic cases. A systematic random sampling yielded 178 BP (before the pandemic) and 94 DP (during the pandemic) cases with complete data. Demographic and clinical properties of cases were analyzed.
Results: The mean age was significantly higher during the pandemic (BP:7.63±0.49; DP:9.27 ±0.69). A higher prevalence of chronic diseases was noted in DP cases (BP:0.29±0.049; DP:0.57 ±0.100). Hotline consultations were higher in DP period (54.5% vs.72.5%) while hospitalization rates were lower (55% vs. 35.2%). While suicide attempts were significantly higher in women compared to men before the pandemic, this difference disappeared during the pandemic period (BP:8.6% of males vs. 37.2% of females; DP: 25% of males vs. 39% of females).
Conclusion: The COVID-19 pandemic significantly impacted pediatric poisoning profiles, underscoring the need for targeted prevention strategies and adaptive emergency protocols.

Acute poisoning cases are among the leading causes of death or hospital admission in emergency departments (ED). In one study, the incidence of acute poisoning was reported as 178 per 100 000 patients, with 44.3% of cases occurring in children aged 14 or below.[1] Another study found that children comprised 31.6% of all poisoning-related visits.[2] According to World Health Organization data, 3.9% of deaths among those aged 0-17 are due to poisoning, and poisoning ranks 13th among causes of death in the 15-19 age group.[3] One investigation reported that drugs (53.2%), pesticides (22.2%), carbon monoxide (11.8%), and alcohol (5.4%) were the main poisoning agents.[4] Furthermore, a Canadian study estimated the direct cost per poisoning case at USD 2409, thus highlighting the financial burden.[5]

The recent COVID-19 pandemic has markedly altered social behavior and overall health. In this change, people being confined to their homes had a major effect. For example, one study noted that in 2020, emergency department visits for high-morbidity conditions (e.g., asthma attacks, foreign body ingestion, severe anemia) were significantly higher than in 2019, possibly due to increased time spent at home. Most acute poisoning cases during the pandemic also occurred in the home because people had to spend more time in their houses.[4,6,7] In this direction, a significant rise in acute alcohol and opioid poisonings was observed during the pandemic.[8]

In addition, the pandemic has negatively impacted mental health, with COVID-19 emerging as a risk factor for psychiatric disorders and suicide attempts.[9,10] A previous study demonstrated that significant pandemic-related changes occurred in poisoning and suicide cases, including differences in substances, timing, and case numbers.[11] Another study showed that between March and October 2020, the proportion of emergency department (ED) visits related to mental health rose by 24% among US children aged 5-11 years and by 31% among adolescents aged 12-17 years, compared to the same period in 2019.[12] Another study demonstrated that calls to Poison Control Centers significantly increased in correlation with the rise in COVID-19 cases, with the trend being more pronounced among children and adolescents compared to adults.[13] A nationwide study of high school students revealed that 44% reported ongoing feelings of sadness or hopelessness, nearly 20% had seriously contemplated suicide, and 9% had made a suicide attempt during the pandemic era.[14]

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It has also been reported that the profiles of poisoning cases underwent significant changes during the COVID-19 pandemic. For example, a study conducted in Iran demonstrated an increase in methanol and ethanol poisoning rates during the pandemic period.[15] Similarly, a study from the US reported a rise in unintentional poisonings among children under the age of 6, attributed to exploratory behavior during the pandemic.[16]

As outlined, the COVID-19 pandemic brought about a dramatic transformation in daily life, altering the characteristics of emergency department visits. Changes were observed in poisoning cases and the types of substances involved, alongside a deterioration in the psychiatric well-being of the younger population. However, to date, no study has specifically examined the impact of this challenging period on pediatric poisoning cases that required emergency department admission.

In line with all these considerations, the aim of this study is to identify the differences in demographic characteristics, clinical presentations, exposure agents, suicidal status, and other features of pediatric acute poisoning cases presenting to the PED during the pandemic compared to the pre-pandemic period, and to inform future responses regarding potential changes in emergency department admissions during pandemics.

Materials and Methods

Study Design and Participants

Approval was obtained from the Gazi University Clinical Research Ethics Committee (Meeting Date: 25.07.2022, No: 601).

The first COVID-19 case in Turkey was reported on March 11, 2020. Accordingly, the study population comprised all patients aged 1 month-18 years presenting with poisoning diagnoses to the Pediatric Emergency Department of Gazi University Faculty of Medicine between January 1, 2018 and June 23, 2022. To identify the patients, appropriate ICD codes related to acute poisoning were used, yielding a total of 646 patients (Supplement). All cases were divided into 2 groups based on their admission dates: patients presenting between January 1, 2018 and March 11, 2020 were classified as the "before the pandemic group (BP)" and those presenting between March 12, 2020 and June 23, 2022 were classified as the "during the pandemic group (DP)."

Before conducting a simple systematic randomization, a sample analysis was performed; with a 95% confidence level, a 50% ratio estimate, and a ±5 margin of error, a sample of 242 was deemed representative of the population. Based on this evaluation, 300 patients were targeted from the total of 646 cases. Thus, 202 patients were randomly selected from 435 BP cases and 98 from 211 DP cases (with a rate of 46%). Patients' identities were anonymized with code numbers, and their detailed clinical data were obtained.

Due to missing data, 24 patient files from the BP group and 4 from the DP group were excluded from the study. In total, 178 BP and 94 DP patients with complete data were evaluated in detail (Figure 1).

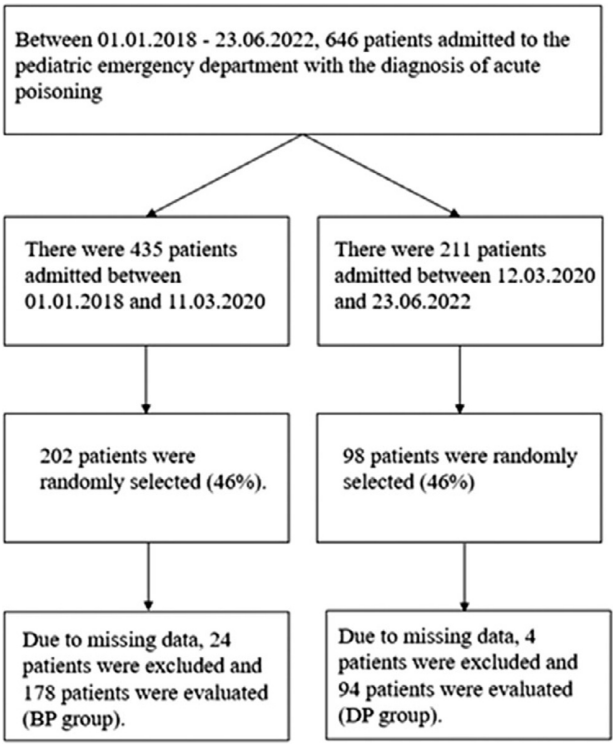

Figure 1. Inclusion process of participants in the study.

Extraction and Analysis of the Clinical Data

The clinical data at admission were recorded on anonymized case report forms, including gender, age, admission date, presence of chronic diseases, medications used, the poisoning chemical, whether it was a suicide attempt, time elapsed since poisoning, Glasgow Coma Scale at admission, whether the national poison control hotline was consulted by a physician, and hospital admission status. Chronic diseases were defined as conditions requiring continuous medical intervention for 1 year or longer due to a specific diagnosis. Additionally, the season of admission was recorded, with December-February defined as winter, March-May as spring, June-August as summer, and September-November as autumn. BP cases from March 2020 were evaluated within the 2019-2020 winter season, while DP cases from June 2022 were considered part of the 2022 spring season.

Patients' ages were divided into 3 groups: 0-5 years, 5-12 years, and over 12 years. These age groups were determined by considering the periods of "before-school," "during-school (including preschool)," and adolescence.

After identifying the poisoning chemicals and substances used in suicide attempts, exposure rates were calculated, with the percentages of total, BP, and DP exposures determined for each substance (Table 1 and 2).

Statistics

Statistical analyses were performed using SPSS v.23 software. Descriptive statistics were presented as mean, percentage, and standard error. Normality of data was assessed using the Kolmogorov-Smirnov test, which indicated non-parametric distribution for all data. Consequently, the Mann-Whitney *U* test was used for comparative statistical analysis. Spearman correlation analysis was conducted to assess the correlation between the total number of poisoning cases and suicide attempts across seasons. A *P* value of <0.05 was considered statistically significant.

Results

Patient Demographics and Characteristics

Between January 1, 2018 and June 23, 2022, a total of 120 720 pediatric emergency department visits occurred at the Gazi University Faculty of Medicine Pediatric Emergency Department.

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Table 1. Number and rates of poisoning chemicals in total, before the pandemic, and during the pandemic periods

	TOTAL		BP		DP	
CHEMICALS	*N*	%	*N*	%	*N*	%
Paracetamol	32	7,9	17	6,4	15	10,8
Ethyl alcohol	25	6,2	14	5,3	11	7,9
Cleaning agents	24	6,0	18	6,8	6	4,3
Sertraline	16	4,0	11	4,2	5	3,6
Carbon monoxide	12	3,0	7	2,7	5	3,6
Ibuprofen	11	2,7	7	2,7	4	2,9
Dexketoprofen	10	2,5	6	2,3	4	2,9
Escitalopram	9	2,2	6	2,3	3	2,2
Methylphenidate	8	2,0	5	1,9	3	2,2
Amoxicillin	7	1,7	4	1,5	3	2,2
Iron	7	1,7	7	2,7	0	0,0
Diclofenac	7	1,7	5	1,9	2	1,4
Levocetirizine	7	1,7	3	1,1	4	2,9
Risperidone	7	1,7	4	1,5	3	2,2
Unknown	6	1,5	3	1,1	3	2,2
OTHER	215	53,3	147	55,7	68	48,9
TOTAL	403	100	264	100	139	100

The percentage values given in total, BP and DP columns refer to the proportions in total, in before the pandemic period and in during the pandemic period respectively.
N: Number, BP: Before Pandemic, DP: During Pandemic

Table 2. Number and rates of substances used in suicide attempts

	Total		BP		DP	
Chemicals used in suicide attempts	N	%	N	%	N	%
Paracetamol	19	10,8	11	9,8	8	12,5
Sertraline	13	7,4	8	7,1	5	7,8
Escitalopram	8	4,5	6	5,4	2	3,1
Ibuprofen	7	4,0	4	3,6	3	4,7
Amoxicillin	6	3,4	3	2,7	3	4,7
Dexketoprofen	6	3,4	4	3,6	2	3,1
Methylphenidate	6	3,4	4	3,6	2	3,1
Other	111	63,1	72	64,3	39	60,9
Total	176	100	112	100	64	100

The percentage values given in total, BP, and DP columns refer to the proportions in total, before the pandemic period, and during the pandemic period respectively.

Of these, 32% (39,207) were during pandemic (DP) cases, while 68% (81,513) were before pandemic (BP) cases. Overall, poisoning cases accounted for 0.535% of all visits, with BP and DP rates of 0.533% and 0.538%, respectively, indicating similar proportions. Of the patients admitted, 39% were male and 61% were female. The mean age was 8.19±0.4 years. Regarding age groups, 47.4% were 1 to <5 years, 9.9% were 5 to <12 years, and 42.6% were 12 to <18 years old. There was a significant difference between the ages of the cases before and during the pandemic (BP: 7.63±0.49 vs. DP: 9.27±0.69; p=0.04; Figure 2A). However, there was no significant difference in terms of age groups (BP cases were 51.1% in 1 to <5 years, 10.1% in 5 to <12 years, and 38.8% in 12 to <18 years; DP cases were 40.4% in 1 to <5 years, 9.6% in 5 to <12 years, and 50.0% in 12 to <18 years; Figure 2B). Although the proportion of female patients was higher during the pandemic, the difference was not statistically significant (57.3% vs. 68.1%).

The mean number of chronic diseases per case was 0.39 ±0.048, and the mean number of medications used for these chronic conditions was 0.34±0.048. The 3 most common chronic conditions were depression (n = 20), anxiety disorder (n = 18), and epilepsy (n = 7). The 3 most common chronic conditions remained the same in both periods (BP: depression/anxiety/epilepsy: 13, 7, 3; DP: depression/anxiety/epilepsy: n = 7, 11, 4). The mean number of chronic diseases per case was significantly increased during the pandemic period (BP: 0.29±0.049, DP: 0.57 ±0.100; P<0.05). The mean number of medications used for chronic conditions was increased similarly (BP: 0.23±0.044, DP: 0.54±0.104, P<0.05).

Clinical Presentation and Evaluation

Overall, 27.6% of poisoning cases were suicide attempts, with rates of 24.7% before pandemic and 33% during pandemic periods. Although an increase is noted, the difference was not statistically significant. Regarding suicide attempts by gender, before the pandemic, 8.6% of males and 37.2% of females presented due to suicide attempts, which constitutes a significant difference (P<0.001, OR:0.144, 95% CI [0.057-0.364]). However, during the pandemic, 25% of males and 39% of females presented with suicide attempts, with no significant difference (P = 0.067, OR:0.390, 95% CI [0.140-1.088]). Although male suicide attempt rates nearly tripled during the pandemic, the difference was not statistically significant (P = 0.076; Figure 3).

The emergency physicians consulted the National Poison Control Hotline for 54.5% of patients in the BP group (78 of 143 patients, with 35 missing), whereas they significantly increased this consultation rate to 72.5% in the DP group (66 of 91 patients, with 3 missing) (P = 0.006, OR = 0.455, 95% CI [0.258-0.800]; Table 3).

In the BP group, 55% of patients (N = 82, Total = 149, 28 missing) were hospitalized, whereas in the DP group the hospitalization rate significantly decreased to 35.2% (N = 32, Total = 91, 3 missing) (P = 0.003, OR:2.257, 95% CI [1.318-3.864]; Table 3).

Patients in both periods generally presented with preserved consciousness and similar levels of neurological function, as indicated by comparable Glasgow Coma Scale scores (BP: 14.80±0.74, DP: 14.81±0.85; Table 3).

Additionally, the time between poisoning and hospital presentation remained consistent across both groups (BP: 179.1 ±30.6 min, DP: 176.1±29.0 min; Table 3).

Substances Causing Poisoning

Table 1 lists the chemicals causing poisoning and their rates. Each chemical counted separately in cases of multiple substance use and/or exposure. Accordingly, the top 3 poisoning causes in both BP and DP periods were paracetamol, ethyl alcohol, and cleaning agents. However, in the BP period, cleaning agents ranked first at 6.8% of all poisonings, whereas in DP period, paracetamol ranked

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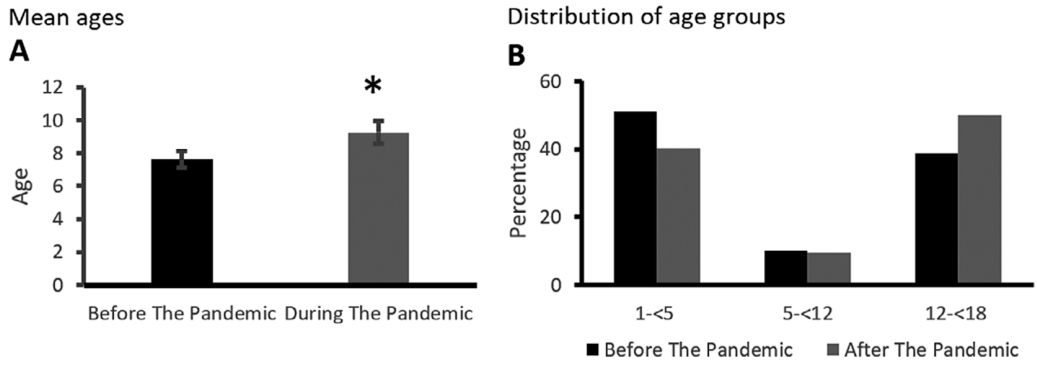

Figure 2. (A) Mean ages before and after the pandemic (Mann-Whitney *U* test, **P*=0.04, different from before the pandemic group). (B) Distribution of age groups before and after the pandemic *(P*>0.05, Pearson Chi-Square Test).

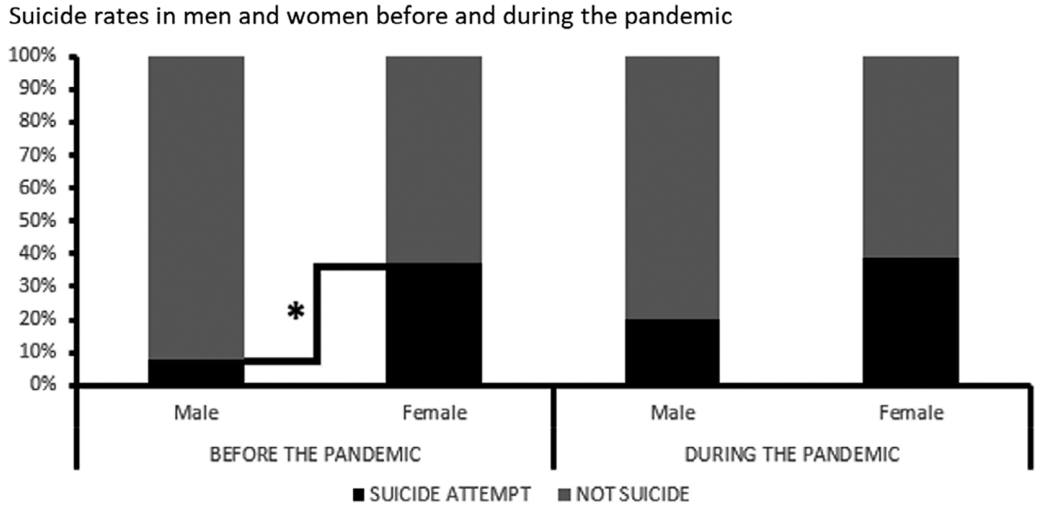

Figure 3. Suicide rates in men and women before and during the pandemic. Before the pandemic – Men vs. Women, Pearson Chi-Square Test, X^2 (1, *N* = 178) = 20.174, **P* < 0.001; During the pandemic – Men vs. Women, Pearson Chi-Square Test, X^2 (1, *N* = 94) = 3.358, *P* = 0.067; Before the pandemic – Men vs. During the pandemic – Men, Pearson Chi-Square Test, X^2 (1, *N* = 106) = 3.140, *P* = 0.076; Before the pandemic – Women vs. During the pandemic – Women, Pearson Chi-Square Test, X^2 (1, *N* = 166) = 0.055, *P* = 0.815.

Table 3. Glasgow Coma Scale scores at the admission, elapsed time to admission, call rates to the National Poison Control Hotline, and hospitalization rates before and during the pandemic

	Before the pandemic	During the pandemic	*P* value
Glasgow Coma scale score at admission (mean score)	14.8±0.74	14.81±0.85	>0.05
Elapsed time to admission (mean minutes)	179.12±30.6	176.06±29.0	>0.05
Call to the National Poison Control Hotline (number of patients; %)	*N* = 78; 54.5%	*N* = 66; 72.5%	**0.006**
Hospitalization (number of patients; %)	*N* = 82; 55%	*N* = 32; 35.2%	**0.003**

first at 10.8%. Ethyl alcohol poisoning rate increased during the pandemic, rising from 5.3% to 7.9% of all cases (Table 1).

The top 3 most frequently used substances during suicide attempts were paracetamol, sertraline, and escitalopram. All substances used in suicide attempts and their rates are presented in Table 2.

Temporal Distribution of Cases

The seasonal distribution of all poisoning cases and suicide attempts over the 2-year period was analyzed in consecutive years. Spearman correlation analysis revealed a significant positive correlation between the number of poisoning cases and suicide attempts across all seasons (r(df) = 0.746, *P* = 0.001; Figure 4).

Discussion

This study evaluated pediatric poisoning cases before and during the COVID-19 pandemic in a large tertiary pediatric emergency department, revealing several key findings. While the overall proportion of poisoning cases among emergency visits remained similar between BP and DP periods, notable shifts were observed in patient characteristics and clinical management.

Number of Pediatric Emergency Department Visits

Firstly, overall emergency department visits during the pandemic were nearly half those seen pre-pandemic which is a trend reported in previous studies.[17,18] In a Turkish study, this decline has been attributed to the avoidance of non-urgent visits due to fears of

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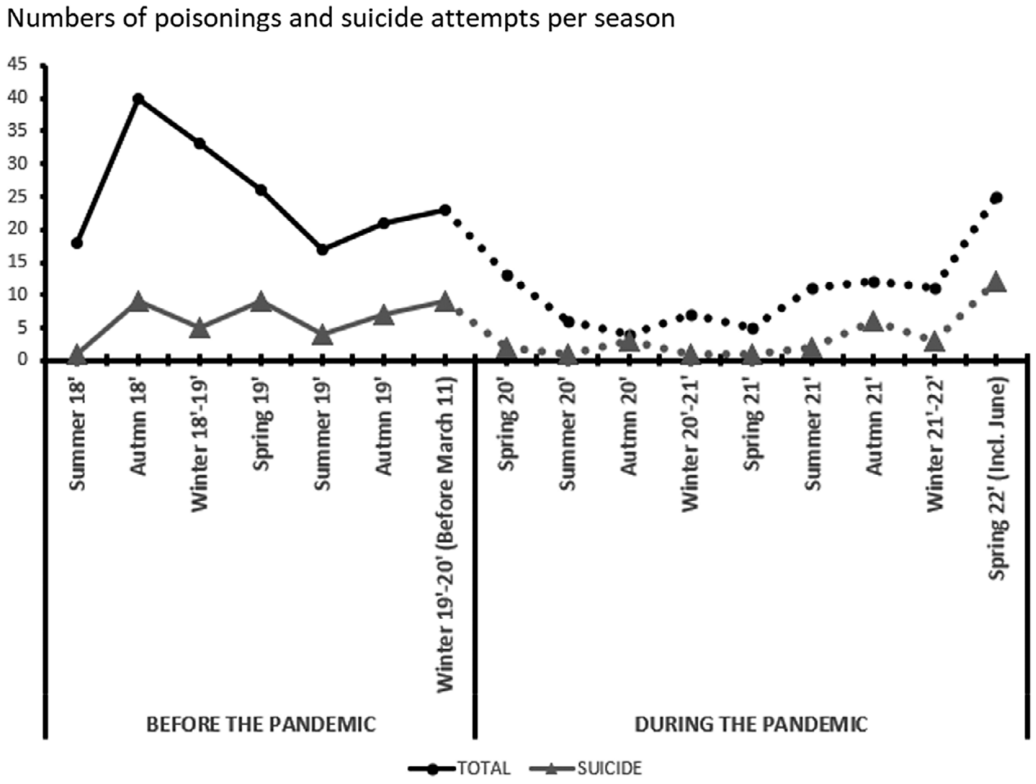

Figure 4. Numbers of poisonings and suicide attempts per season before and during the pandemic. (A significant positive correlation was observed across all seasons between poisoning admissions and suicide numbers, Spearman Correlation Analysis, (r[df]=0.746, *P*=0.001).

infection.[17] Despite this, the proportion of poisoning cases among all pediatric ED visits remained stable in our study, which may suggest that families likely sought care only for more serious poisoning events. Worldwide, delayed ED presentations and related deaths during the pandemic have been reported, indicating that many poisoning cases may have been managed at home.[19] In a study conducted in Turkey, although overall ED visits decreased, studies of home accidents reported an increase in ED visits. Yet, poisoning rates did not change significantly according to same study, implying that families prioritized hospital visits only for severe cases.[20] However, as we present no additional data to support the hypothesis that families brought only severe poisoning cases to the hospital, further research is needed on this subject.

Distribution Among Age Groups

Our age group distribution aligns with previous studies; for instance, a large Egyptian study reported that children under 6 comprised 52% of acute toxicity cases, while those over 12 comprised 37%.[21] In our study, the mean age increased significantly during the pandemic, with fewer cases among children under 5 and more among adolescents. While a US study noted an increase in poisonings in children under 6 during the pandemic, our Turkish data suggest the opposite. A German study proposed that working from home increased parental vigilance and improved mother-child interactions, which may explain the reduced accidental poisonings in younger children in Turkey.[22] Also the significant rise in mean age may indirectly reflect both a decline in accidental poisonings among younger children and an increase in adolescent suicide attempts. Related with this, our data showed a proportional, increase in adolescent suicide rates in accordance with the literature.[23]

Comorbidities and Urgency

Despite emergency department visits being nearly twice as high before the pandemic compared to during it, the consistent rate of poisoning cases may be attributed to public reluctance to seek care for minor issues, suggesting a shift in the perceived need for medical attention.[24]

Notably, during the pandemic, cases with chronic diseases and the number of medications used increased significantly in our study. Therefore, patients presenting during the pandemic were more likely to have comorbidities. The greater clinical complexity of poisoning cases in patients with multiple health conditions may have contributed to increased emergency department visit rates. In accordance with this, our findings also revealed a significant increase in consultations with the poison control hotline during the pandemic, suggesting that more complex cases (especially among those with multiple comorbidities) required additional support, a finding that could inform future health policies and insurance practices.

Hospitalizations for poisoning cases decreased significantly during the pandemic, possibly due to overcrowding and a preference for outpatient management, a trend also noted in other studies.[25,26]

Gender and Suicide

From a gender perspective, no significant difference was observed in the rates of emergency department admissions between women and men before and after the pandemic. However, in both periods, it was found that the rate of emergency service admissions for poisoning complaints was higher in women than in men. This finding supports data previously reported in the literature. In one

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study, this excess in the proportion of women was associated with an increase in suicide attempts among women over the age of 12.[27]

In our study, while suicide attempts were significantly higher in women compared to men before the pandemic, this difference disappeared during the pandemic. The closing gap between men and women may be related to an almost 3-fold increase in the rate of suicide attempts in men. In contrast, no change was observed in the rate of suicide attempts among women. Therefore, the proportional increase in the total number of admissions due to acute poisoning among women does not appear to be related to suicide attempts. These data are not consistent with the European literature. In a study conducted in Australia, a 37% increase in suicide attempts was detected among adolescent females during the pandemic period.[28] Similar data have been reported in a study conducted in Norway.[29] In our sample, however, there is an increase in suicide attempts among men, in contrast to women, while there is an increase in the total number of admissions due to acute poisoning among women. These 2 findings need to be evaluated in further studies to be conducted in Turkey.

Substances Causing Poisoning

Analysis of poisoning agents revealed that paracetamol, other nonsteroidal anti-inflammatory drugs, antidepressants, ethyl alcohol, and cleaning agents were prominent, paralleling patterns seen in suicide attempts. These data are also in line with the literature.[21] While cleaning agents were the most common cause pre-pandemic, paracetamol took precedence during the pandemic. This shift may relate to the widespread use of paracetamol as the recommended analgesic and antipyretic for COVID-19 and reported supply shortages.[30,31] Similarly, ethyl alcohol poisonings increased during the pandemic, possibly reflecting higher consumption of alcoholic beverages.[32] Despite some literature suggesting increased use of cleaning agents during the pandemic, our study did not show an increase in poisoning with cleaning agents.[33] This finding is potentially reflecting enhanced parental caution and vigilance during the pandemic.

Overall, our findings indicate that most poisoning cases involve commonly available substances. This underscores the need for emergency and pediatric intensive care staff to be well-prepared for managing paracetamol poisoning. The high use of antidepressants in suicide attempts also points to their ready availability in households. Additionally, carbon monoxide, which ranked fifth among poisoning agents, remains significant, with recent Turkish data showing a mortality rate of 0.35 per 100 000, comparable to global averages.[34,35]

Temporal Distribution of Cases

Our results show a marked difference in the seasonal distribution of acute poisoning admissions before and during the pandemic. Pre-pandemic admissions increased during fall-winter, whereas during the pandemic, they rose in spring-summer. According to the literature, most pediatric acute poisoning cases occur at home.[21] The fall-winter increase seen pre-pandemic has been previously reported and may be due to children spending more time indoors in cold weather and increased use and storage of medications during respiratory illness seasons.[36,37] Additionally, because the first pandemic case in our country occurred in March and schools were closed for long periods, children staying home in spring-summer might have led to more poisoning cases. From a parental perspective, being confined indoors was undesirable and demotivating, especially during the beginning of the pandemic. This may have decreased motivation thus caused reduced attention, which may have contributed to more poisoning cases.[38] Similarly, an increase in home accidents during the pandemic has been reported.[39]

Limitations

This study was conducted at a single center; further multi-center studies with larger patient groups are needed. One notable limitation related with this, concerns the representativeness of the sample. Although random sampling was used to select cases from each time period, approximately 50% of all eligible pediatric poisoning cases were included in the final analysis. This sampling may limit the generalizability of the findings, as the included sample might not fully represent the broader population of pediatric poisoning cases during the respective periods. Nevertheless, when we look at the literature, it is seen that the problem of representation has been overcome to a large extent. In a study published in 2021, in which cases admitted to pediatric emergency departments in Turkey were followed up for 5 years, the mean age of the patient population was found 8.65±6.0 years. In the same population, the proportion of girls was 51.5%. These observations are close to our findings in the BP group (Mean age: 7.63±0.49 and Proportion of girls: 57.3%). Our study is cross-sectional, and cohort studies could provide additional insights into poisoning etiologies.[40]

Cost analysis was not performed; while a Canadian study estimated the direct cost of poisoning cases at US $2409 each, a Turkish study reported an average cost of approximately US $150 per pediatric ED poisoning case.[5,41] Comparing these cost differences between regions warrants further investigation.

Conclusion

The COVID-19 pandemic has altered the general profile of poisoning cases. Acute poisoning cases were more likely to involve children with chronic diseases during the pandemic compared to before, potentially requiring physicians to consult Poison Control Hotlines more frequently.

Visits by children under 5 declined, possibly due to heightened parental vigilance from working at home. Emergency department staff increasingly managed poisoning cases on an outpatient basis during the pandemic. Although literature often cites increased female suicide attempts during the pandemic, our data indicate an upward trend in male suicide attempts. Notably, pre-pandemic poisoning was led by cleaning agents, but during the pandemic, paracetamol became the predominant agent. During suicide attempts, while paracetamol remained most common, antidepressants were also frequently used. Our study contributes to regional literature by highlighting differences in pediatric poisoning profiles before and during the pandemic and offers insights for managing future global emergencies.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/dmp.2025.10157.

Declarations.

- The manuscript has been read and approved by all the authors, and that all the conditions as previously stated by the ICMJE have been met.
- The authors have no competing interests to declare that are relevant to the content of this article.
- No funding was received for conducting this study.

Author contribution. A.A.S.: Conceptualization, Investigation, Methodology, Writing – original draft. M.C.G.: Conceptualization, Investigation, Methodology, Writing – original draft. O.D.G.: Conceptualization, Methodology, Writing – review and editing. C.U.: Conceptualization, Methodology, Supervision, Writing – review and editing. S.Ö.İ.: Conceptualization, Methodology, Supervision, Writing – review and editing.

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