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Demographic and Clinical Characteristics of Pediatric Poisoning: A 20-Year Retrospective Analysis with Literature Review

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Abstract

Aim: This study aims to evaluate the demographic characteristics, types of poisoning, exposure routes, clinical findings, treatments, and outcomes of pediatric patients presenting to a pediatric emergency department for poisoning.

Methods: This retrospective cohort study analyzed 467 pediatric poisoning cases presenting to a tertiary hospital pediatric emergency department. Food poisoning cases were excluded. Data were collected from emergency department records.

Results: Of 467 cases, 240 (51.4%) were male and 227 (48.6%) were female, with a mean age of 5.4±4.6 years. The 1-5 age group had the highest incidence (58.2%). In the 0-1 age group, there were 26 cases (5.57%), 272 cases (58.24%) in the 1-5 age group, 96 cases (20.56%) in the 6-10 age group, and 73 cases (15.63%) in the >10 age group. Intentional poisoning occurred in 5.4%, predominantly in females aged >10 years (18/25, 72%). Common toxic agents were medications (37.5%), carbon monoxide (28.9%), and corrosives (23.6%). Most patients (255, 54.6%) presented within 2 hours of exposure. Gastric lavage was performed in 210 cases (45.0%), activated charcoal was administered to 218 cases (46.7%), and antidotes were given to 16 cases (3.4%). One fatality occurred (0.2% mortality rate) due to tricyclic antidepressant overdose.

Conclusions: Pediatric poisoning predominantly affects children aged 1-5 years, with medications being the leading cause. Early presentation resulted in low mortality (0.2%). While our historical data provides valuable baseline information, continuous surveillance and adaptive prevention strategies remain essential for addressing evolving poisoning patterns in pediatric populations.

Keywords: Pediatric poisoning, emergency department, toxic agents, intentional poisoning, accidental ingestion

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Introduction

Pediatric poisoning represents one of the most frequent reasons for pediatric emergency department visits and is recognized as a significant public health concern in both developed and developing countries. Globally, the majority of childhood poisoning cases occur accidentally, with children under 5 years of age being the most vulnerable population to such risks [1-3]. Poisonings are highly prevalent due to children's developmental characteristics, curiosity, and environmental factors; they occur as a result of contact with various toxic substances such as medications, household chemicals, pesticides, and heavy metals [2-4].

Recent studies demonstrate that while most pediatric poisoning cases have mild or asymptomatic clinical courses, some cases can lead to serious morbidity and mortality [1, 2, 4]. The type of intoxication, nature and amount of the exposed substance, route of exposure, along with the patient's age and general health status play critical roles in determining clinical outcomes [2]. Contact with corrosive household chemicals, pesticides, and industrial products increases the risk of severe clinical presentations and hospitalization requirements [2]. Rising intentional poisoning rates among adolescents require psychiatric evaluation and multidisciplinary approaches [1, 3, 4].

Epidemiological data reveal seasonal variations in poisoning cases, with some studies reporting increases during spring and summer months [1, 4]. The majority of poisonings occur at home, with oral ingestion being the most common route of exposure [1-3]. Furthermore, an increase in poisoning cases involving alcohol-containing substances has been reported in the post-pandemic period, potentially related to increased disinfectants and hand sanitizer use [5].

Given the dynamic nature of poisoning patterns influenced by sociocultural, environmental, and temporal factors, periodic evaluation of pediatric poisoning trends is essential for effective prevention strategies and healthcare planning. This study aims to evaluate the demographic characteristics, types of poisoning, exposure routes, clinical findings, treatments, and outcomes of pediatric patients presenting to a pediatric emergency department for poisoning.

METHODS

This retrospective cohort study was conducted at Haydarpaşa Numune Training and Research Hospital Pediatric Emergency Department, a tertiary care center in Istanbul.

All patients aged 0-18 years who presented to our pediatric emergency department between January 1, 2002, and December 31, 2003, with poisoning complaints (including accidental or intentional exposure to toxic substances, presenting with symptoms such as altered mental status, gastrointestinal distress, or other toxin-related manifestations) or were diagnosed with poisoning during subsequent follow-up were included in the study.

Intentional Poisoning is defined as cases where the patient deliberately ingested or was exposed to toxic substances, typically seen in adolescents with suicidal intent, as defined in previous epidemiological studies [1].

Inclusion Criteria: Age 0-18 years, presentation to emergency department with suspected or confirmed poisoning, and complete medical records available.

Exclusion Criteria: Food poisoning cases, incomplete medical records, and patients transferred from other hospitals without primary evaluation data.

Data were extracted from emergency department protocol records and patient medical files.

The following variables were systematically collected:

Toxic Agent Categories:

Medications: Further subcategorized into analgesics, barbiturates, tricyclic antidepressants, neuroleptics, cardiovascular drugs, anticholinergics, antibiotics, endocrine drugs, sedative/hypnotics, multiple drugs, and others

Carbon Monoxide Poisoning

Corrosive Substances: Including cleaning agents, thinner, kerosene, and similar substances

Mushroom Poisoning

Insecticides

Statistical Analysis

Data were analyzed using SPSS 12.0 and Microsoft Excel 2003. While these software versions are dated, they were standard at the time of data collection and provided adequate functionality for the descriptive analyses performed.

Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. The normality of continuous variables was assessed using histogram visualization and skewness values. Chi-square tests were used to compare categorical variables, with Fisher's exact test applied when expected cell counts were less than 5. A p-value <0.05 was considered statistically significant.

Ethical Considerations

This retrospective observational study was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Patient confidentiality was maintained throughout the study, and all data were anonymized prior to analysis.

RESULTS

Overall Characteristics

During the study period, 42,311 patients presented to our pediatric emergency department, of whom 467 (1.1%) were diagnosed with poisoning. The mean age was 5.4±4.6 years, with 240 (51.4%) males and 227 (48.6%) females.

Age and Gender Distribution

The highest incidence of poisoning occurred in the 1-5 years age group, accounting for 272 cases (58.2%) of all cases. The second highest incidence was observed in the 6-10 years age group with 96 cases (20.6%). Children over 10 years comprised 73 cases (15.6%), while the lowest poisoning rate was observed in the 0-1 years age group with 26 cases (5.6%) (Table 1).These findings show that young children have a higher risk of poisoning.

Gender distribution showed male predominance (54%) in children under 10 years, while female predominance (59%) was observed in the adolescent group (over 10 years). This difference was statistically significant (p<0.05).

Table1. Distribution of Poisoning Cases by Gender and Age Groups

Age Group	Male, n (%)	Female, n (%)	Total, n (%)
0-1 years	14 (54)	12 (46)	26 (5.6)
1-5 years	146 (54)	126 (46)	272 (58.2)
6-10 years	50 (52)	46 (48)	96 (20.6)
>10 years	30 (41)	43 (59)	73 (15.6)
Total	240 (51.4)	227 (48.6)	467 (100)

Intentional vs. Accidental Poisoning

Of all cases, 25 (5.4%) were intentional poisonings. Among intentional poisoning cases, 2 (0.4% of all cases) occurred in the 5-10 years age group and 23 (4.9% of all cases) occurred in children over 10 years. Intentional poisoning cases were predominantly female (18/25, 72%).

Temporal Distribution

Seasonal Distribution: Winter months showed the highest incidence with 139 cases (30%), followed by autumn with 120 cases (26%). Summer and spring months had 108 cases (23%) and 100 cases (21%), respectively. These results reveal that poisoning cases occurred more frequently during winter and autumn seasons. (Table 2)

Table 2. Seasonal Distribution of Poisoning Cases

Season	Number of Cases	Percentage (%)
Winter	139	30
Spring	100	21
Summer	108	23
Autumn	120	26

Daily Time Distribution: The majority of cases occurred between 18:00 and 24:00 (165 cases, 35%), followed by 12:00 to 18:00 (149 cases, 32%). The morning period (06:00–12:00) accounted for 82 cases (18%), while the late night/early morning hours (00:00–06:00) comprised 71 cases (15%). These findings indicate that poisoning cases were most frequent during the evening hours (Table 3).

Table3. Daily Time Distribution of Poisoning Cases

Time Period	Number of Cases	Percentage (%)
00:00-06:00	71	15
06:00-12:00	82	18
12:00-18:00	149	32
18:00-24:00	165	35

Time to Presentation

Analysis of the time interval between exposure and emergency department presentation showed that 255 patients (55%) presented within the first 2 hours, 78 patients (17%) within 2-6 hours, 13 patients (3%) within 6-12 hours, and 10 patients (2%) after 12 hours. The time interval was unknown in 111 cases (24%).

Table4. Time Interval Between Exposure and Emergency Department Presentation

Time Interval	Number of Cases	Percentage (%)
First 2 hours	255	55
2-6 hours	78	17
6-12 hours	13	3
>12 hours	10	2
Unknown	111	24

Toxic Agents

Medications were the most common toxic agents, accounting for 175 cases (37.5%), followed by carbon monoxide with 135 cases (28.9%) and corrosive substances with 110 cases (23.6%). Mushroom poisoning occurred in 24 cases (5.1%) and insecticide poisoning in 23 cases (4.9%). These results demonstrate that medications and carbon monoxide were the primary causative agents in pediatric poisoning cases (Table 5).

Table5. Distribution of Toxic Agents

Toxic Agents	Number of Cases	Percentage (%)
Medications	175	37.5
Carbon Monoxide	135	28.9
Corrosive Substances	110	23.6
Mushroom	24	5.1
Insecticides	23	4.9

Among the 175 medication poisoning cases, analgesics were the most common with 36 cases (21%), followed by tricyclic antidepressants with 24 cases (14%), sedative/hypnotic drugs with 14 cases (8%), neuroleptics with 11 cases (6%), cardiovascular drugs with 10 cases (6%), endocrine drugs with 7 cases (4%), antibiotics with 6 cases (3%), barbiturates with 2 cases (1%), and anticholinergic drugs with 1 case (1%). Multiple drug poisoning occurred in 18 cases (10%), while other medications accounted for 46 cases (26%).

Among analgesic poisoning cases, paracetamol and Non-Steroidal Anti-Inflammatory Drugs (NSAID) each accounted for 13 cases (36%), salicylates for 7 cases (19%), and other analgesics for 3 cases (8%).

Clinical Management

All patients presenting to our emergency department were reported to the poison control center as standard procedure.

Routine supportive care was provided along with gastric lavage, activated charcoal administration, and antidote therapy as recommended by poison control consultation. Of note, gastric lavage and activated charcoal were not performed on patients poisoned with corrosive substances or carbon monoxide, patients transferred to our emergency department after undergoing gastric lavage and activated charcoal administration elsewhere, and selected patients presenting more than 6 hours after exposure.

Gastric lavage was performed in 210 cases (45.0%), activated charcoal was administered to 218 cases (46.7%), and antidote therapy was given to 16 cases (3.4%). The most frequently used antidote was N-acetylcysteine for paracetamol poisoning (13 cases). Other antidotes were used in 1 case of haloperidol poisoning and 2 cases of pesticide poisoning.

Outcomes

Of the 467 poisoning cases, 271 (58.0%) were discharged with recovery, while 114 (24.4%) were transferred to other centers due to medical necessity or family request. Nine patients (1.9%) were transferred to the intensive care unit, 61 patients (13.1%) were discharged against medical advice despite being informed of life-threatening risks, and 11 patients (2.4%) left the hospital without permission. One patient (0.2%) died due to tricyclic antidepressant (amitriptyline) poisoning, resulting in a mortality rate of 0.2%.

DISCUSSION

Pediatric poisoning remains a significant cause of emergency department visits among children both nationally and globally. In our study, poisoning cases represented 1.1% of all emergency department presentations during the study period, which is consistent with the literature reporting rates between 0.2-2.3% [3, 5-7]. Recent multicenter studies from 2020-2025 continue to report similar proportions (0.8-1.5%), suggesting stable epidemiological patterns despite evolving toxic exposures [1, 3].

Our findings showed that 58.2% of poisoning cases occurred in the 1-5 years age group, indicating that children in this age group have a significantly higher risk of poisoning. This finding is consistent with studies reported from different centers in Turkey; for example, at Zeynep Kamil Hospital, children aged 1-5 years constituted 87.7% of poisoning cases [8]. The curious and exploratory behaviors of children in this age group and their insensitivity to environmental risks increase the risk of poisoning [8-11].

The gender distribution—male predominance in children under 10 (54%) and female predominance in those aged 10 and above (59%)—is consistent with previous reports [5, 8, 9]. Previous studies from our institution showed different patterns: a 1988-1992 study reported 53.4% male and 46.6% female cases across all age groups [12], while a 1995-2000 study from Hacettepe University found 55.6% female and 44.4% male cases [13]. This distribution is attributed to boys being more active and the increase in psychosocial problems and intentional poisoning in girls during adolescence [3, 8]. This situation is supported by girls having higher rates of poisoning in the 12-18 age groups [9].

In seasonal distribution, 30% of poisoning cases occurred in winter months, followed by autumn (26%) and summer (23%) seasons. The increase in carbon monoxide (CO) poisoning during winter months explains this distribution. Other studies conducted in Turkey have also shown that CO poisoning is concentrated in winter months, affecting the seasonal distribution of poisoning cases [9]. Globally, seasonal distribution shows regional variations, but increased poisoning rates during winter months have been reported worldwide [8]. However, recent studies indicate a shift in seasonal patterns, with some regions reporting increased summer poisoning cases due to outdoor chemical exposures and swimming pool chemicals, highlighting the importance of regional and temporal context in poisoning epidemiology [2, 4].

In the daily distribution of poisoning cases, 35% occurred between 18:00-24:00 hours. This time period is associated with parents returning from work and children being left unsupervised [9]. Similarly, international reports show an increase in poisoning presentations during evening hours [8].

In our study, the most common cause of poisoning was medications (37.5%), followed by carbon monoxide (28.9%) and corrosive substances (23.6%). Mushroom (5.1%) and insecticides (4.9%) were less common. In Turkey and worldwide, medications, especially analgesics (such as paracetamol), are the primary cause of poisoning [5, 13, 14]. CO poisoning is frequently seen during winter months in our country and is recognized as an important public health problem in developed countries. Corrosive substance poisoning is an important risk factor due to cleaning products being accessible to children at home [9].

In medication poisoning, analgesics, especially paracetamol, antidepressants, and antipsychotics are prominent. One death was due to amitriptyline poisoning. Tricyclic antidepressants are among the poisonings with high mortality due to cardiotoxicity and neurotoxicity. Among medication poisoning cases, which constituted 37.5% of all poisoning agents, analgesics were the most frequently involved, consistent with other studies in the literature. In the distribution of analgesic drugs, paracetamol and NSAIDs stand out with 13 cases (36%) each [6, 12-15]. Contemporary data shows a concerning trend toward opioid-related poisonings in adolescents, which were rare in our cohort but now represent 5-10% of medication poisonings in recent studies. Additionally, the emergence of novel psychoactive substances and synthetic cannabinoids presents new challenges not encountered during our study period [1, 4, 16].

Gastric lavage was performed in 210 cases (45.0%) and activated charcoal was administered to 218 cases (46.7%). Notably, the gastric lavage utilization rate exceeded current guideline recommendations (30-35%), which reflects the

treatment protocols prevalent in the early 2000s. This contrasts sharply with current practice, where gastric lavage is performed in less than 5% of cases according to recent studies, reflecting the paradigm shift toward less invasive management strategies [17, 18]. Antidote therapy was administered in 16 cases (3.4%), with N-acetylcysteine being the most frequently employed agent for paracetamol poisoning. This increased utilization of N-acetylcysteine corresponded with the rising incidence of paracetamol-related poisoning cases. While current literature demonstrates limited indications for gastric lavage and activated charcoal administration, their efficacy remains established in cases of early presentation. Specific antidote therapy is indicated for targeted poisonings, including paracetamol, organophosphate compounds, and methemoglobinemia [10]. Current guidelines emphasize enhanced supportive care, with specific antidotes now available for a broader range of toxins including direct oral anticoagulants (idarucizumab, andexanet alfa) and digoxin (digoxin-specific antibody fragments), which were not available during our study period [19, 20]. The observed mortality rate of 0.2% aligns with contemporary studies and demonstrates favorable outcomes attributable to advances in pediatric poisoning management [3, 14, 16].

Regarding time to presentation, 255 patients (55%) reached the emergency department within the first 2 hours following exposure. Early presentation is of critical importance for treatment success and mortality reduction [8-10]. The average hospitalization duration was 1.87±1.35 days, which remained shorter compared to some centers due to severe cases being transferred to other institutions.

A single fatality occurred in this study, resulting in a mortality rate of 0.2%. This rate falls within the range reported in Turkish and international literature (0-4.5%), demonstrating that early intervention significantly reduces mortality [8, 9]. Recent systematic reviews report similar low mortality rates (0.1-0.3%) in developed countries with established poison control systems, though rates remain higher (1-3%) in resource-limited settings, emphasizing the importance of accessible emergency care and poison control infrastructure [2,4].

Being a single-center, retrospective study limits the generalizability of the findings. Poisoning patterns can vary significantly by region and healthcare setting, and this study may not fully represent rural populations or community hospitals. Furthermore, the retrospective design inherently depends on the accuracy and completeness of existing medical records.

Clinical severity assessments such as the Poisoning Severity Score (PSS) or Pediatric Risk of Mortality (PRISM) scores were not systematically recorded, limiting our ability to stratify cases based on severity. Additionally, vital signs, Glasgow Coma Scale scores, and laboratory parameters were missing in approximately 23% of cases, which restricts the ability to draw robust conclusions regarding clinical progression and outcomes.

Since the study period predates current poison control guidelines and management protocols, treatment practices (e.g., gastric lavage usage) may not align with modern standards. Therefore, some findings may have limited applicability to current clinical practice.

Food poisoning cases were excluded, possibly underestimating the total burden of pediatric poisoning. Moreover, the lack of standardized data collection on socioeconomic status, parental education, and home safety measures precluded analysis of potential social determinants of poisoning risk.

Conclusions

This study demonstrates that pediatric poisoning predominantly affects children aged 1-5 years, with distinct gender patterns across age groups. Medications, carbon monoxide, and corrosive substances constitute the primary causative agents. Early presentation and appropriate supportive care resulted in low mortality. Effective prevention requires comprehensive strategies including parental education, child-resistant packaging, optimized poison control services, and enhanced healthcare provider training. Special attention to adolescent mental health is crucial for addressing intentional poisoning. While our historical data provides valuable baseline information, continuous surveillance and adaptive prevention strategies remain essential for addressing evolving poisoning patterns in pediatric populations.

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References

1. Güzel, Y., Battal, F., & Aylanç, H. (2022). Poisoning Cases Admitted to the Pediatric Emergency Department: A Retrospective Evaluation Çocuk Acil Servisine Başvuran Zehirlenme Olgularının Geriye Dönük Değerlendirilmesi. *Journal of Pediatric Emergency and Intensive Care Medicine (Turkey)*, *9*(1).
2. Qu, Y., Tang, R., Duan, Z., Sheng, M., Wang, H., Liu, S., ... & Zheng, S. (2025). Analysis of acute non-pharmaceutical toxic exposures in children: a 5-year retrospective study. *Frontiers in Public Health*, *13*, 1510205..
3. Dağ, Ö. O., Yeşil, Y., & Özdemir, A. A. (2024). Acute Poisoning in Pediatric Emergency Department: A 5-Year Analysis.
4. Soave, P. M., Curatola, A., Ferretti, S., Raitano, V., Conti, G., Gatto, A., & Chiaretti, A. (2022). Acute poisoning in children admitted to pediatric emergency department: a five-years retrospective analysis. *Acta Bio Medica: Atenei Parmensis*, *93*(1), e2022004.
5. Baysal, Ş. G., & Yıldız, F. M. (2018). Çocukluk çağı zehirlenme olgularının epidemiyolojik ve demografik özelliklerinin incelenmesi. *Ege Tıp Bilimleri Dergisi*, *1*(2), 37-42.
6. Kahveci, M., Çeltik, C., Karasalihoğlu, S., & Acunaş, B. (2004). Bir üniversite hastanesi acil servisine başvuran çocukluk çağı zehirlenmelerinin değerlendirilmesi. *Sted*, *13*(1), 19-21.
7. Satar, S., & Seydaoglu, G. (2005). Analysis of acute adult poisoning in a 6-year period and factors affecting the hospital stay. *Advances in therapy*, *22*, 137-147.
8. Büyükçavuşoğlu, S., & Birdane, Y. O. (2023). Acil Servise Gelen Zehirlenme Vakalarının Değerlendirilmesi. *Kocatepe Veterinary Journal*, *16*(4), 563-573.
9. Özkale, M., & Özkale, Y. (2020). Çocuk yoğun bakım ünitesinde takip edilen zehirlenme olgularının demografik, epidemiyolojik ve klinik özellikleri. *Cukurova Medical Journal*, *45*(3), 1191-1201.
10. Öztoprak, Ü., & Energin, V. (2019). Çocuk acil servisine zehirlenme nedeniyle başvuran olguların değerlendirilmesi. *Journal of Contemporary Medicine*, *10*(4), 585-590.
11. Hoy, J. L., Day, L. M., Tibballs, J., & Ozanne-Smith, J. (1999). Unintentional poisoning hospitalisations among young children in Victoria. *Injury Prevention*, *5*(1), 31-35.
12. Vitrinel, A., Karatoprak, N., Yavuz, C., Yavru, S., & Çorbacıoğlu, D. (1994). 1988–1992 yılları arasında kliniğimizde izlenen zehirlenme olguları. *Haydarpaşa Numune Hastanesi Tıp Dergisi*, 34, 30–32.
13. Andıran, N., & Sarıkayalar, F. (2001). Doğramacı Çocuk Hastanesinde son 6 yılda izlenen akut zehirlenmeler. *Katkı Pediatri Dergisi*, 22(4), 396–408.
14. Aydın, K., & Erkut, Z. (2023). Salgın Sürecinde Çocuk Acil Servise Zehirlenme ile Başvuran Çocukların Özelliklerinin Değerlendirilmesi: Retrospektif Bir Çalışma. *İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi*, *8*(2), 421-427.
15. Özcan, T., Tosun, A., İnan, G., Yendur, G., Özbek, E., Can, D., & Önl, H. (2002). Hastanemize başvuran zehirlenme olgularının değerlendirilmesi. *ADÜ Tıp Fakültesi Dergisi*, 3(1), 5–8.
16. Akdeniz, Ş., Şahin, K., & Elevli, M. (2025). Çocuk acile başvuran zehirlenme vakalarının geriye dönük değerlendirilmesi. *Kocatepe Tıp Dergisi*, 26(2), 113–121.
17. American Academy of Clinical Toxicology, & European Association of Poisons Centres and Clinical Toxicologists. (2005). Position paper: single-dose activated charcoal. *Clinical Toxicology*, *43*(2), 61-87.
18. Thanacoody, R., Caravati, E. M., Troutman, B., Höjer, J., Benson, B., Hoppu, K., et al. (2015). Position paper update: Whole bowel irrigation for gastrointestinal decontamination of overdose patients. *Clinical Toxicology*, 53(1), 5–12.
19. Benson, B. E., Hoppu, K., Troutman, W. G., Bedry, R., Erdman, A., Höjer, J., ... & Caravati, E. M. (2013). Position paper update: gastric lavage for gastrointestinal decontamination. *Clinical toxicology*, *51*(3), 140-146.
20. Hoffman, R. S., Howland, M. A., Lewin, N. A., Nelson, L. S., & Goldfrank, L. R. (2023). *Goldfrank's toxicologic emergencies* (11th ed.). New York: McGraw-Hill.