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ORIGINAL RESEARCH

# Poisonings with malicious or criminal intent in the emergency department

Chih-Yang Mao[1], Lu-Chen Chen[1], Yen-Chia Chen[2,3], Chia-Hung Lin[4], Shi-Ying Gao[1], Wei-Chen Chen[1], Tzung-Hai Yen[5,6], Hsien-Yi Chen[1,6,*]

[1]Department of Emergency Medicine, Linkou Chang Gung Memorial Hospital, 333 Taoyuan, Taiwan
[2]Emergency Department, Taipei Veterans General Hospital, 112 Taipei, Taiwan
[3]Department of Emergency Medicine, School of Medicine, National Yang Ming Chiao Tung University, 112 Taipei, Taiwan
[4]Department of Nursing, Taipei Veterans General Hospital, 112 Taipei, Taiwan
[5]Department of Nephrology and Clinical Poison Center, Linkou Chang Gung Memorial Hospital, 333 Taoyuan, Taiwan
[6]College of Medicine, Chang Gung University, 333 Taoyuan, Taiwan

***Correspondence**
m7082@cgmh.org.tw
(Hsien-Yi Chen)

## Abstract

Patients with malicious poisoning (MP) are individuals who are the victims of another person's intent to harm them through poisoning. Limited studies have investigated the clinical features and outcomes of MP. We evaluated the characteristics and outcomes of MP cases presented to emergency departments (EDs). This multicenter retrospective study enrolled MP patients who presented to three EDs in northern Taiwan. Patients with uncertain or unreasonable exposure histories and those who remained asymptomatic throughout the incident were excluded. In total, 14,329 poisoning cases were recorded between 2012 and 2019; of these, 82 (0.57%) were identified as MP cases. The incidence of MP was highest among individuals aged 13–49 years. Friends (37.8%) were the most common perpetrators, followed by family members (15.9%) and colleagues (4.9%). Sedative/hypnotics were the most frequently used substance (36.6%), followed by stimulants (26.8%) and street ketamine (6.1%). Most patients (75.6%) were discharged from the ED after a thorough assessment, while 11 (13.4%) were admitted. Of those admitted, six (7.3%) required admission to an intensive care unit. No mortalities were reported. Preschool victims (aged <6 years) exhibited more severe poisoning, with lower Glasgow Coma Scale scores and higher rates of intubation compared to non-preschool victims. Patients with MP exhibited characteristics that differed significantly from other forms of poisoning. Healthcare providers must remain vigilant for signs of MP in ED patients, particularly preschool children.

## Keywords

Malicious; Criminal; Poisoning; Intoxication; Emergency department; Child abuse

## 1. Introduction

Malicious poisoning (MP) is defined by America's Poison Centers (APC) as when an individual is the victim of another person's intent to harm them through poisoning [1]. According to a report by the National Poison Data System (NPDS), most human poisonings result from unintentional exposures or suicide attempts, and instances of MP are comparatively rare. In 2022, the APC reported 7918 MP cases, accounting for 0.38% of all human exposures [1]. Similarly, the 2022 Swiss Toxicological Information Center annual report attributed 128 (0.38%) of 33,865 poisoning cases to criminal intent [2].

Although MP patients may present to an emergency department (ED), identifying malicious intent is often difficult due to limited exposure history. MP symptoms may mimic common diseases, delaying toxicological analysis and investigations [3]. Furthermore, determining the specific substance, dose and exact exposure time can be challenging. It has been reported that MP carries a higher mortality risk compared with overall poisonings, particularly in infants and young children [4, 5]; their limited competence and awareness increase their vulnerability to intentional harm. Munchausen by proxy syndrome, a specific form of maliciously intentional poisoning, occurs when a parent or caregiver fabricates or exaggerates symptoms or signs of a nonexistent illness in a child. This manipulation often leads to harmful examinations and treatments and is associated with high mortality, morbidity, child abuse, and family disruption [6].

Limited studies have investigated the clinical features and outcomes of MP, including small case series [5], research based on poison center data [7–9], and forensic medicine reports [3, 4, 10, 11]; notably, most of these studies originated from Western countries. However, significant regional disparities exist in intentional poisoning patterns [12]. For instance, analgesics are the drugs most commonly involved in human exposure in the United States [1], whereas sedatives/hypnotics are the leading cause of acute poisoning presentations in EDs in Taiwan [13]. Additionally, established patterns of drug abuse and misuse diverge across the United States, Europe and Taiwan [14–16]. Therefore, we evaluated the characteristics and outcomes of MP cases presented to EDs in Taiwan.

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## 2. Materials and methods

This multicenter retrospective study enrolled MP patients who presented to the EDs of Keelung Chang Gung Memorial Hospital (a regional medical center with 75,000 ED visits annually), Linkou Chang Gung Memorial Hospital (a tertiary medical center with 180,000 ED visits annually), and Taipei Veterans General Hospital (a tertiary medical center with 85,000 ED visits annually) between January 2012 and December 2019. These hospitals offer in-house toxicology consultation services within the ED and record cases of poisoning.

### 2.1 Selection of participants

We searched ED poisoning case records in each participating hospital to identify cases suspected of MP. An experienced toxicologist reviewed the medical records of these "MP case candidates". Patients with a high probability of poisoning due to the malicious intent of another person were included. The determination of malicious or criminal intent was based on the clinical history provided by the patient, family members, friends, relatives, paramedics, or bystanders. Patients with uncertain or unreasonable exposure histories and those who remained asymptomatic were excluded. Exposures and substances used were adjusted by aligning clinical history, symptoms, signs, relevant laboratory data, urine drug screen results, and confirmatory laboratory test results, when available. A toxicologist made the final determination regarding the inclusion and exclusion of cases and the identification of causative substances.

### 2.2 Data collection and study protocol

Researchers at each participating hospital reviewed the medical records of included patients and completed a standardized data extraction form. Baseline data included age, sex, marital status, exposure history, perpetrator, time of exposure, exposure route, estimated exposure amount, underlying medical or psychiatric diseases, vital signs, clinical presentations, laboratory data, poisoning-related therapies, disposition, length of hospital stay, and outcomes. Furthermore, clinical characteristics and outcomes were compared between preschool (age $<6$ years) and non-preschool (age $\geq 6$ years) victims.

### 2.3 Statistical analyses

Statistical analyses were conducted using the SAS software (version 9.4; SAS Institute, Cary, NC, USA). The Mann-Whitney U test was employed to compare continuous variables among groups, while the chi-square or Fisher's exact test was utilized to compare categorical variables, as appropriate.

## 3. Results

### 3.1 Demographic data

During the study period, 14,329 poisoning cases were recorded by the EDs of the three hospitals. Of these, MP was suspected in 95 cases. After excluding patients with an uncertain exposure history and those who remained asymptomatic (Fig. 1), we identified 82 MP cases, accounting for 0.57% of all poisoning cases. Of these cases, 8.5% (n = 7) were aged $<6$ years, whereas 79.3% were aged 13–49 years; male patients comprised 42.7% of MP cases. The temporal distribution of cases and ED arrival times are presented in the **Supplementary material**. All cases were isolated incidents; none was recurrent poisoning or presented by parents during a child-protective-investigation period. Table 1 presents the demographic data and clinical characteristics of the study participants. Common presenting symptoms included dizziness, nausea, general malaise, and altered mental status. Most patients (75.6%) were discharged from the ED after a thorough assessment, whereas 11 (13.4%) were admitted. Of those admitted, six patients (7.3%) required admission to an intensive care unit (ICU). No mortalities were reported. Table 2 summarizes the clinical characteristics of the six critical patients admitted to ICUs following MP.

### 3.2 Substances used for malicious poisoning

Fig. 2 depicts the substances administered to MP victims. Sedative/hypnotics were the most frequently used substance (n = 30, 36.6%), followed by stimulants (n = 22, 26.8%) and street ketamine (n = 5, 6.1%). Fifteen patients (18.3%) were exposed to multiple substances. Among patients exposed to stimulants, methamphetamine/amphetamines were the most common substances (86.4%), followed by ecstasy (3,4-Methylenedioxymethamphetamine) (27.3%) and synthetic cathinones (13.6%).

### 3.3 Comparisons between preschool victims and non-preschool victims

Preschool victims (aged $<6$ years) were more likely to be poisoned by their parents, compared to patients aged $\geq 6$ years (Table 3). They exhibited more severe poisoning, with lower Glasgow Coma Scale scores and higher rates of intubation, compared to non-preschool victims. Additionally, preschool victims were more frequently admitted to the hospital following MP.

## 4. Discussion

In this study, we evaluated the clinical characteristics and outcomes of MP patients presenting to EDs in Taiwan. MP affected individuals across all age groups, with a higher incidence observed among those aged 13–49 years. Preschool victims exhibited more severe poisoning outcomes following MP, including increased rates of intubation and admission to an ICU. Although friends were the most frequent perpetrators, parents were involved in approximately 80% of preschool MP cases. Sedatives/hypnotics and stimulants were the most frequently used agents in MP cases.

Identification of MP patients poses a significant clinical challenge. Although investigating malicious or criminal intent is typically the domain of law enforcement and judicial institutions, such information is often unavailable in clinical settings; moreover, exposure histories can be unreliable or deliberately concealed, complicating diagnosis. Moreover, because the incidence of MP is significantly lower than other forms of poisoning [1], healthcare providers may lack the requisite

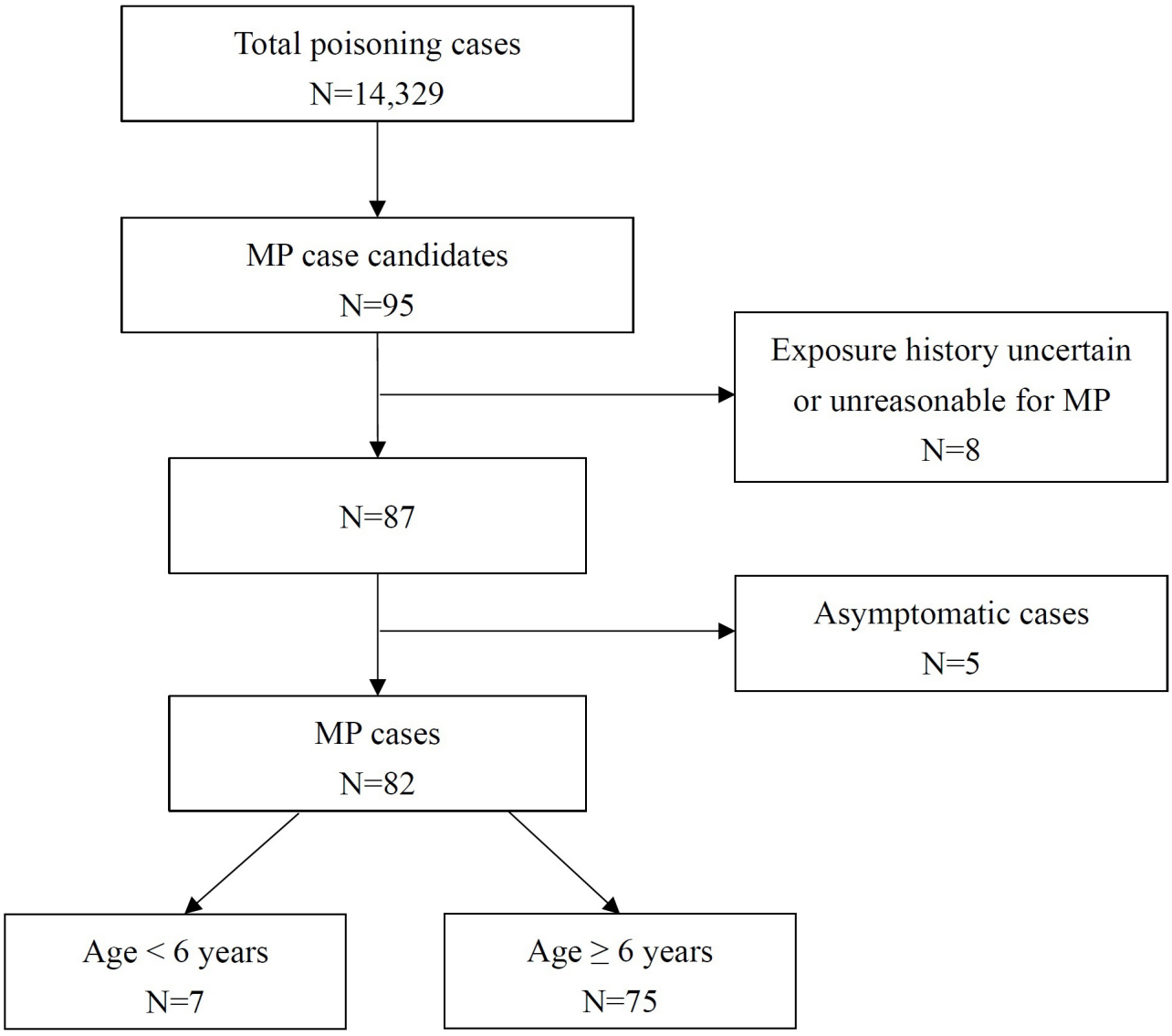


**FIGURE 1. Flowchart of patient inclusion.** MP: malicious poisoning.

familiarity and vigilance to recognize crucial signs associated with MP. All these factors make it difficult to collect sufficient cases for academic analysis. Our study encountered similar challenges. However, we defined meticulous inclusion criteria and conducted comprehensive reviews of all clinical data under the supervision of an experienced toxicologist. Our study population reflects real-world scenarios, rather than including only cases based on law-enforcement agencies' investigations [10].

The substances used in MP differ significantly from those used in suicide attempts. The National Poison Data System (NPDS) data indicate that analgesics, antidepressants, and antihistamines are the most common agents in intentional self-poisoning in the United States [1, 17]. In Taiwan, sedatives/hypnotics and pesticides are frequently used in suicide attempts [13]. However, our study revealed a predominance of sedatives/hypnotics and illicit stimulants in MP cases, whereas other psychotropic agents or over-the-counter analgesics were rarely used. These findings might have been due to the significant number of MP incidents that occurred in entertainment venues, hotels, or friends' residences, where perpetrators may have used sedatives/hypnotics or other illicit drugs to subdue victims for recreational purposes or to facilitate sexual assault. A previous prospective study demonstrated that illicit drugs, including sympathomimetics and opioids, are the primary substances used in MP in children and adults [5]. However, a comprehensive review of pediatric malicious exposures based on NPDS data revealed that household products, such as cleaning substances, cosmetics or personal-care products, and household pesticides are the most frequently encountered substances [7, 8]. This substantial discrepancy likely reflects the differing nature of the two patient populations.

Homicide is a leading cause of injury-related deaths in infants and children in the United States [18, 19]. Infants and younger children are especially vulnerable to MP because of their limited self-protection capabilities and the potential involvement of trusted caregivers, such as parents or guardians. Our study revealed significantly higher rates of intubation and ICU admission among preschool victims compared to other age groups. This aligns with previous studies that demonstrated a higher incidence of MP and greater severity, including increased mortality risk, in infants <2 years [4, 5].

**TABLE 1. Demographic and clinical characteristics of patients with malicious poisoning.**

| Total 82 patients | n (%) |
|---|---|
| Age groups (yr) | |
| 0–2 (infant + toddler) | 5 (6.1) |
| 3–5 (preschool) | 2 (2.4) |
| 6–12 (child) | 2 (2.4) |
| 13–19 (teen) | 12 (14.6) |
| 20–29 | 23 (28.0) |
| 30–39 | 19 (23.2) |
| 40–49 | 11 (13.4) |
| 50–59 | 4 (4.9) |
| ≥60 | 4 (4.9) |
| Perpetrator | |
| Friends | 31 (37.8) |
| Parents | 8 (9.8) |
| Colleagues | 4 (4.9) |
| Spouse | 3 (3.7) |
| Other relatives* | 2 (2.4) |
| Others | 19 (23.2) |
| Unidentified | 15 (18.3) |
| Place of exposure | |
| Home | 19 (23.2) |
| Entertainment venue | 10 (12.2) |
| Friend's house | 8 (9.8) |
| Store/restaurant | 5 (6.1) |
| Workplace | 4 (4.9) |
| School | 4 (4.9) |
| Hotel | 3 (3.7) |
| Public place | 3 (3.7) |
| Unavailable | 26 (31.7) |
| Time of exposure (h before ED arrival) | |
| ≤2 | 11 (13.4) |
| >2, ≤6 | 17 (20.7) |
| >6, ≤24 | 19 (23.2) |
| >24, ≤72 | 5 (6.1) |
| >72 | 1 (1.2) |
| Unavailable | 29 (35.4) |
| Associated with alcohol use | 9 (11.0) |
| Associated with trauma | 12 (14.6) |
| Route of exposure | |
| Ingestion | 67 (81.7) |
| Inhalation | 8 (9.8) |
| Dermal | 6 (7.3) |
| Parental | 3 (3.7) |
| Ocular | 3 (3.7) |
| Unidentified | 2 (2.4) |

**TABLE 1. Continued.**

| Total 82 patients | n (%) |
|---|---|
| Significant presentations | |
| Somnolent (GCS 11–15)** | 13 (15.9) |
| Stupor (GCS 8–10)** | 2 (2.4) |
| Comatose (GCS 3–7)** | 4 (4.9) |
| Agitated (GCS 10–15)** | 12 (14.6) |
| Delirium (GCS 15)** | 1 (1.2) |
| Seizures | 3 (3.7) |
| Hypotension*** | 1 (1.2) |
| Treatments | |
| Gastric lavage | 3 (3.7) |
| Activated charcoal | 3 (3.7) |
| Vasopressor | 0 |
| Intubation | 4 (4.9) |
| Hemodialysis | 0 |
| ED patient flow | |
| Discharge (<6 h from ED arrival) | 45 (54.9) |
| Discharge after observation (>6 h) | 17 (20.7) |
| Admission (ward + ICU) | 11 (13.4) |
| ICU admission | 6 (7.3) |
| Left AMA | 9 (11.0) |

**"Other relatives" referred to family members other than spouses or parents.*
***Mental status is presented based on the patients' appearance and the range of their GCS score.*
****Hypotension was defined as SBP <90 mmHg in adults or <70 + 2 × age (in years) mmHg in pediatric patients.*
*Abbreviations: ED, emergency department; GCS, Glasgow Coma Scale; ICU, intensive care unit; AMA, against medical advice; SBP, systolic blood pressure.*

The US Department of Health and Human Services and the American Academy of Pediatrics categorize child maltreatment into neglect, physical abuse, sexual abuse, and emotional abuse. MP can also occur with other forms of maltreatment. A Canadian study reported that other types of maltreatment co-occurred in 48% of physically abused children [20]. Similarly, a review article on pediatric intentional poisonings revealed that 20% of cases co-occurred with physical battering, and the poisoning persisted even after hospitalization in 30% [21]. Considering the vulnerability of younger children to MP, front-line healthcare providers must maintain high vigilance and raise concerns in cases with a discordant history, unusual presentation, involvement of multiple substances, recurrent episodes, or additional physical signs of abuse [22]. Any suspicion of MP should prompt immediate referral to a child-protection team. In the prehospital setting, paramedics should prioritize transporting suspected pediatric victims to a medical facility that is equipped for poisoning management and child protective services.

Prior studies have revealed an elevated incidence of homicidal poisoning deaths among individuals aged >85 years [4]. This vulnerability in older patients probably stems from their frequent residence in nursing homes and healthcare facilities, increasing dependence on caregivers and potentially exposing them to abuse or MP. Furthermore, the higher prevalence of comorbidities in this age group may contribute to increased mortality rates following homicidal poisoning. However, the small sample size (only four patients aged >65 years) limited the ability of our study to investigate outcomes associated with MP in older adults.

Our study has several limitations. The retrospective design with a relatively small sample size may limit the generalizability of our findings. The clinical histories may have included some inaccuracies, which could have led to errors when including or excluding cases. Patients with undiagnosed MP on discharge or death may have been missed. The extent and severity of poisoning events might have been underestimated. Moreover, the substances implicated in MP incidents were not clearly identified in some cases, resulting in suboptimal statistical outcomes. Finally, the absence of fatalities in the cohort precluded assessment of mortality rates across different age groups.

**TABLE 2. Characteristics of patients with malicious poisoning (n = 6) admitted to intensive care units.**

| Case | Age/sex | Exposure time (prior to ED visit) | Perpetrator | Substance | Clinical presentation | Treatment | Length of ICU stay (d) |
|---|---|---|---|---|---|---|---|
| 1 | 22/F | N/A | Friend | Amphetamine, MDMA | AMS, palpitation, diaphoresis, mydriasis, agitation, hyperthermia, elevated blood pressure, and supraventricular tachycardia | Benzodiazepine | 4* |
| 2 | 0.3/M | N/A | Parents | Ethanol | AMS, seizure, and respiratory failure | Intubation | 8 |
| 3 | 2/F | 6 h | Mother | Amphetamine, Benzodi-azepine | AMS, drowsiness, seizure, and blushing | Intubation | 9 |
| 4 | 3/M | N/A | Stepmother | Salt | Diarrhea, general weakness, severe dehydration, and severe hypernatremia | Hydration, correction of electrolyte | 6 |
| 5 | 35/M | 2 h | Debtor | Unknown acid | Severe chemical burn, dyspnea, blurred vision | Intubation, surgery | 98 |
| 6 | 41/F | <1 h | Friend's ex-wife | Hydrogen fluoride | Severe chemical burn, dyspnea | Intubation, calcium gluconate | 9 |

**Discharge against medical advice.*
*Abbreviations: ICU, intensive care unit; ED, emergency department; MDMA, 3,4-Methylenedioxymethamphetamine; AMS, altered mental status; M, male; F, female.*

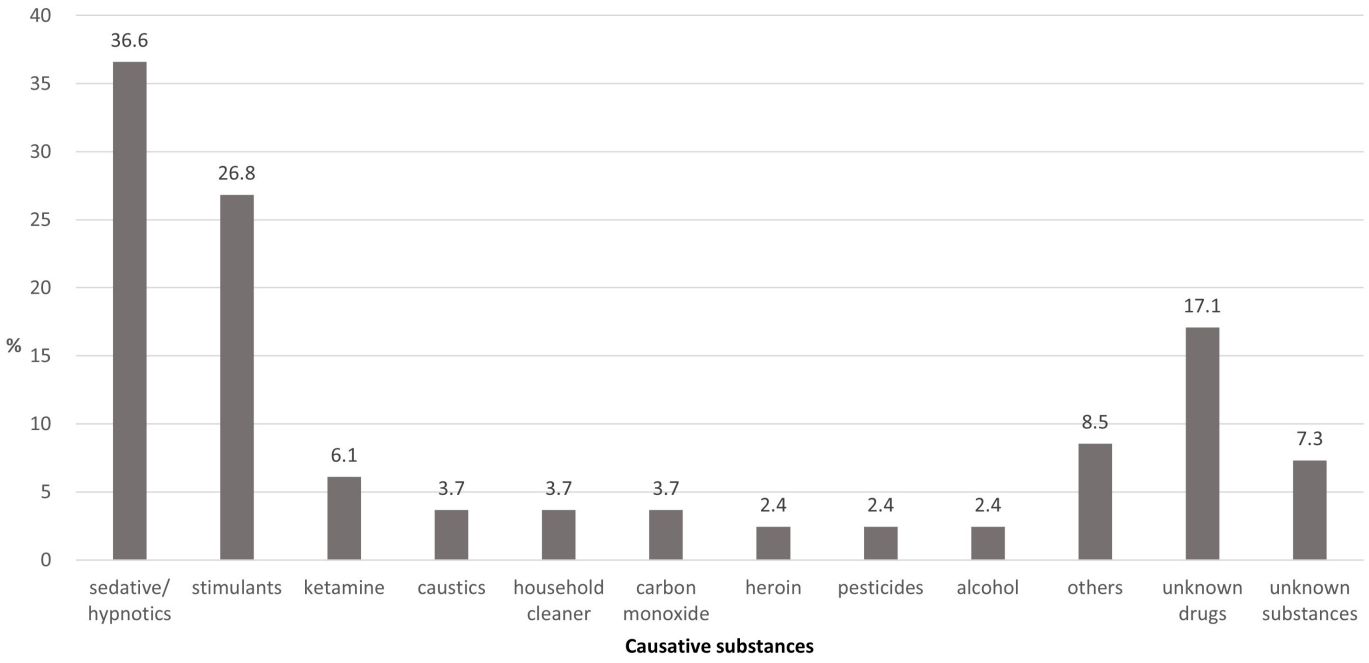


**FIGURE 2. Frequency of substances involved in malicious poisonings.**

**TABLE 3. Comparison of clinical characteristics between preschool victims (age <6 years) and non-preschool victims (age ≥6 years).**

| Variable, n (%) | Age <6 yr n = 7 | Age ≥6 yr n = 75 | *p* value |
|---|---|---|---|
| Perpetrator as parents | 4/5 (80.0) | 4/62 (6.5) | <0.001 |
| Early presentation (<6 h)* | 2/4 (50.0) | 26/49 (53.1) | 0.737 |
| GCS score (median (IQR)) | 15 (6–15) | 15 (15–15) | 0.046 |
| Associated with trauma | 2 (28.6) | 10 (13.3) | 0.271 |
| Intubation | 2 (28.6) | 2 (2.7) | 0.035 |
| Admission (ward + ICU) | 4 (57.1) | 7 (9.3) | 0.005 |
| ICU admission | 3 (42.9) | 3 (4.0) | 0.007 |

*The variable "perpetrator as parents" and "early presentation" are shown as "n/numbers with data available" to minimize the effect of missing data.*
**Early presentation was defined as a patient presented to the emergency department within 6 hours after exposure.*
*Abbreviation: GCS, Glasgow coma scale; ICU, intensive care unit; IQR, interquartile range.*

## 5. Conclusions

We evaluated the characteristics and outcomes of MP in an ED setting. MP was most prevalent among individuals aged 13–49 years, with sedatives/hypnotics and stimulants as the most frequently used substances. Infants and young children were particularly vulnerable to MP, exhibiting more severe poisoning and higher rates of intubation and ICU admission. Healthcare providers must remain vigilant for signs of MP in ED patients, particularly preschool children. Suspected pediatric MP cases warrant immediate referral to child-protective services for further investigation.

### AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

### AUTHOR CONTRIBUTIONS

CYM and HYC—designed the research study. CYM, LCC, CHL and YCC—performed the research. WCC and THY—provided help and advice on resource acquisition and research goals. SYG and HYC—analyzed the data. CYM, LCC and HYC—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Chang Gung Medical Foundation (No. 202200989B0) and Taipei Veterans General Hospital (2018-07-049BC), respectively. The requirement for informed consent was waived due to the retrospective nature of the study.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.signavitae.com/mre-signavitae/article/1840667374872608768/attachment/Supplementary%20material.docx.

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