

## Original Article

## Accidental poisoning in children: An eight-year experience from a tertiary care institute of north India.

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## ABSTRACT

**Introduction:** Accidental poisoning is an important Paediatric emergency worldwide resulting in high mortality and morbidity. As no recent data is available from our region regarding the substance responsible for accidental poisoning. So, the present study was planned to describe the profile of accidental poisoning in children. **Methodology:** A retrospective analysis was conducted on records of children (up to 18 years of age) admitted to Paediatric Emergency from January 2015 to December 2022 with a diagnosis of poisoning was done and information recorded on a data collection form. **Results:** Two-third of the children (68.4%) belonged to the age group of 1-3 years, were males (62.1%), and from rural background (70%). The mean age was  $3.2 \pm 2.73$  years. Highest number of admissions were due to the consumption of hydrocarbons 26.8% followed by mosquito repellent (18%) and prescription drugs (17.3%). In children less than 5 years of age, hydrocarbons were the main reason of poisoning, in those aged 5-10 years, it was insecticides which led to maximum poisoning cases and children over 10 years, pesticides were the leading cause. Mechanical ventilation was required by 9% children with mean duration  $0.14 \pm 0.5$  (0-3) days. Mean duration of ICU stay was  $0.19 \pm 0.78$  (0-5) days. Mean number of days of hospital stay was  $2.91 \pm 2.74$  (1-19). Mortality was 3.3%. **Conclusion:** Hydrocarbons were the leading cause of accidental poisoning. Poisoning in children was caused by the common household chemicals which should not be accessible to the children. So community mass awareness programs can be initiated to educate the parents regarding storage of such poisonous substances.

**Key words:** Accidental, Poisoning, Children, Hydrocarbons, Household Chemical

Poison is a substance that, if it enters the body by any route, can impair organs or cause death. With development in every sector of the society, there is a surge in the use of variety of chemicals, insecticides and drugs which may be poisonous. Accidental poisoning is an important paediatric emergency worldwide and results in high mortality and morbidity in children, despite the fact that it is a preventable condition [1]. In addition to the unnecessary trauma to children and their parents, it also causes a considerable amount of burden on the paediatric health services [2]. Literature shows that accidental poisoning accounts for 10% of the total burden of unintentional injuries among children in Lower Middle Income Countries with mortality ranging from 0.64-11.6% and is the cause of 1-6% annual bed occupancy including 3.9% Paediatric Intensive Care Unit (PICU) admissions [3, 4].

It is most common in children below five years of age, especially in toddlers due to their developmental phase of life, as they are mobile, curious and are not able to differentiate between edible/non-edible and harmful/harmless

substances [5]. In majority of the cases of accidental poisoning, it is the ingestion of familiar household products by children at home [5, 6]. The main reason reported is careless storage, parental negligence in supervision of children, or ignorance. Children get attracted to these substances due to their visual appeal (glossy packaging or colour) [5-7].

With changing times there is an expected change in the trends of type of poisonous substances consumed [8]. Even different part of the country report variations in the nature of poisonous substances consumed by children. The few studies from our region of the country are at least a decade old. One such study showed toilet cleaner as the most common substance, while another showed prescription drugs behind such poisoning cases [9, 10]. So we planned the current study to update available information on recent patterns of accidental poisonings in children and the commonly implicated substances responsible for it in our part of the country.

## MATERIAL AND METHODS

This retrospective, observational study was conducted after

## Access this article online

Received – 22<sup>nd</sup> July 2025  
Initial Review – 02<sup>nd</sup> August 2025  
Accepted – 08<sup>th</sup> August 2025

DOI: 10.32677/ijch.v12i8.7757

Quick Response Code



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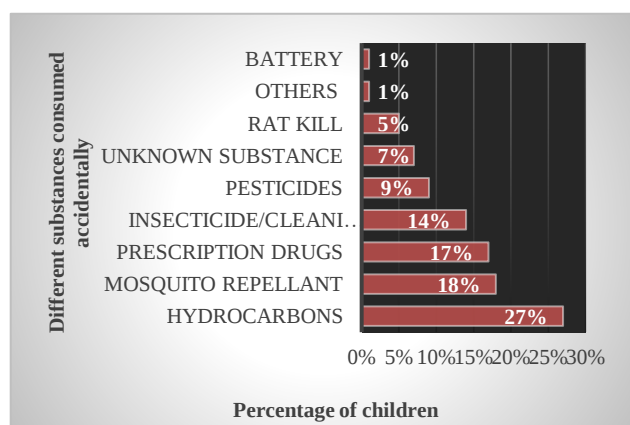
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obtaining ethical clearance from Institute Ethical Committee (GMCH/IEC/2023/1120R). Hospital records of children (up to 18 years of age) admitted to paediatric emergency of Government Medical College & Hospital, Chandigarh, India with accidental poisoning from January 2015- December 2022 were reviewed. Children who had intentional poisoning, food poisoning, allergic reaction to prescribed drugs, envenomation due to animal/insect bites and stings were excluded. Data regarding age, gender, residence, type of substance consumed, presenting symptoms, and outcome was noted on a pre-designed Performa. All data was entered into SPSS 20.0 for analysis. Descriptive data is described by using mean along with standard deviation (SD) and median (IQR), whereas categorical data is described by in terms of percentages.

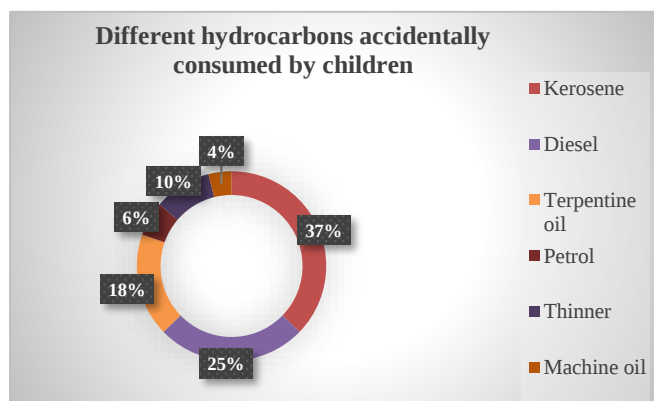
## RESULTS

During the 8-year study period, 190 children were admitted in paediatric emergency with accidental poisoning. They ranged in age from 9 months to 17 years with a median age 2.5 (IQR; 2-4) years. A majority of these children (89%) were in the age range of 1-6 years and from rural areas (70%). Male to female ratio was found to be 1.6:1.



**Fig 1: Different substances consumed accidentally by children**

Figure 1 represents the different substances consumed accidentally by children. It shows that hydrocarbons were the leading cause of accidental poisoning (27%), followed by mosquito repellent (18%) and prescription drugs (17%).



**Fig 2: Different types of hydrocarbons consumed by children accidentally (N= 51)**

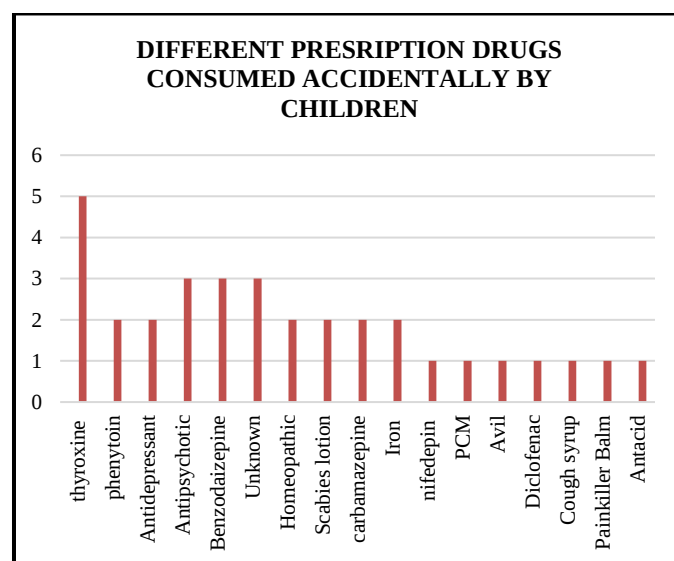
Figure 2 depicts the different types of hydrocarbons ingested. It shows that among these, the majority of the children consumed kerosene (37%), probably reflecting the fact that kerosene is still a commonly used fuel in households.

Among the individual substances responsible behind accidental poisoning, the most commonly responsible agent was mosquito repellent i.e. 18%. Mosquito repellents were mostly the vaporiser forms which are composed of an insecticide usually in 1-2% w/w and mineral oil as a vehicle, usually an aliphatic petroleum distillate, similar to kerosene. Hence, mosquito repellent vaporizer poisoning may be considered as hydrocarbon poisoning due to the presence of petroleum-based solvents as the vehicle, though the added active agents (e.g., pyrethroids) may contribute additional neurotoxic effects. This makes hydrocarbons responsible for almost half the accidental poisonings in children.

**Table 1: shows frequency of different individual substances consumed accidentally by children**

| Substance                    | Frequency n (%) |
|------------------------------|-----------------|
| Mosquito repellent           | 34 (17.9%)      |
| Prescription drugs           | 33 (17.36%)     |
| Insecticide /cleaning agents | 18 (9.47%)      |
| Kerosene                     | 17 (8.94%)      |
| Pesticides                   | 17 (8.94%)      |
| Unknown                      | 14 (7.36%)      |
| Diesel                       | 13 (6.84%)      |
| Rat kill                     | 10 (5.26%)      |
| Turpentine oil               | 9 (4.73%)       |
| Corrosive (Tejab)            | 8 (4.2%)        |
| Petrol                       | 6 (3.15%)       |
| Others*                      | 11(5.78%)       |

\*others include (5) cases of Thinner ingestion, (3) of machine oil, (1) each of sanitizer, hydrogen peroxide and castor seeds.



**Fig 3: Prescription drugs consumed accidentally by children at home (N=33)**

The next most commonly encountered agent was drugs-both prescription medications and over-the-counter drugs (17.36%). A total of 33 children were brought with history of consuming medicines which included tablets, syrup formulations as well as topical medications. Figure 3 shows the relative frequency of different types of drugs responsible for accidental poisoning in the study. This highlights the ignorance of Indian parents in keeping these medications out of reach of children. Even pharmacological industry needs to make the liquid formulations child-safe, as is done in the west.

Out of total of 190 patients, 158 (83.7%) were less than 5 years of age. Most common substance implicated in accidental poisoning in these children was hydrocarbons (48 cases), followed by mosquito repellent (33) and prescription drugs (30). In the age group 5-10 years (13.15%), insecticides were the main reason for accidental poisoning (5 out of 25 cases), followed by unknown substance and rat poison (4 cases each). In children older than 10 years, pesticides were the main reason behind accidental poisoning. The presenting symptoms varied depending upon the nature of the poison consumed with vomiting being the most commonly reported symptom, seen in 30% of the children, followed by difficulty in breathing in 14.2%, drowsiness in 11.6%, seizure in 3.7%, unconsciousness in 2.6%, lip swelling in 2.1%, cough 1.6% and increased salivation in 1.1% cases.

**Table 2: Clinical profile of children admitted with accidental poisoning (N=190)**

| Variable                                              | Frequency (%)      |
|-------------------------------------------------------|--------------------|
| Referral                                              |                    |
| Yes                                                   | 101 (53.15%)       |
| No                                                    | 89 (46.85%)        |
| Mode of poisoning                                     |                    |
| Oral                                                  | 189 (99.47%)       |
| Inhalation                                            | 01 (0.53%)         |
| Mechanical ventilation required                       |                    |
| Yes                                                   | 17 (8.94%)         |
| No                                                    | 173 (91.05%)       |
| Mean number of days of mechanical ventilation (range) | 0.14 ± 0.5 (0-3)   |
| Shifted to ICU                                        |                    |
| Yes                                                   | 12 (6.31%)         |
| No                                                    | 178 (93.69%)       |
| Mean number of days of ICU stay (range)               | 0.19 ± 0.78 (0-5)  |
| Mean number of days of hospital stay (range)          | 2.91 ± 2.74 (1-19) |
| Recovery status                                       |                    |
| Discharge                                             | 166 (87.4%)        |
| LAMA                                                  | 14 (7.4%)          |
| Abscond                                               | 01 (0.5%)          |
| Death                                                 | 07 (3.7%)          |
| Refer to higher centre                                | 02 (1.1%)          |

\*mean±SD (range)

Table 2 depicts the other clinical details of children admitted with accidental poisoning. Almost half of the children (53.15%) were referred to our centre from some other health

facility, indicating that there could have been a delay in treatment in almost half the patients. In most (99.47%) patients, route of exposure was oral. Nearly 9% of admitted children with accidental poisoning required mechanical ventilation with average of mechanical ventilation being  $0.14 \pm 0.5$  (0-3) days. Twelve (6.31%) children needed intensive care with average duration of ICU stay (range) was  $0.19 \pm 0.78$  (0-5) days. The duration of hospital stay was  $2.91 \pm 2.74$  (1-19) days. Mortality due to accidental poisoning was 3.7%.

**Table 3: Outcome in accidental poisoning according to causative agent**

| Causative agent       | Mechanical ventilation N = 17 | ICU requirement N = 12 | Deaths N = 7 |
|-----------------------|-------------------------------|------------------------|--------------|
| Hydrocarbons          | 4                             | 3                      | 2            |
| Unknown substance     | 4                             | 2                      | 2            |
| Pesticide             | 4                             | 1                      | Nil          |
| Mosquito repellent    | 1                             | 2                      | 1            |
| Rat kill              | 2                             | 1                      | 1            |
| Prescription medicine | 1                             | 2                      | 1            |
| Insecticide           | 1                             | 1                      | Nil          |

Table 3 depicts outcome of children admitted with accidental poisoning according to causative agents. Hydrocarbons were responsible for 4 children requiring mechanical ventilation 2 of them died. Poisoning due to unknown substances led to 4 children needing mechanical ventilations and 2 deaths. Pesticides were reason behind 4 mechanical ventilations and all children of them recovered. Mosquito repellent was the reason for 1 mechanical ventilation, 2 ICU admissions and 1 death whereas rats poison caused 2 mechanical ventilations and subsequently 1 ICU admission and 1 death. Prescription drugs led to 1 mechanical ventilation, 2 ICU admissions and out of them 1 died. Insecticides caused 1 mechanical ventilations and ICU admission and the child recovered.

**Table 4: Outcome of accidental poisoning according to age and gender**

|                  | Mechanical ventilation required N = 17 | ICU requirement N = 12 | Deaths N = 7  |
|------------------|----------------------------------------|------------------------|---------------|
| Age distribution |                                        |                        |               |
| < 5              | 14 (M-10, F-4)                         | 10 (M-6, F-4)          | 05 (M-4, F-1) |
| 5-10             | 03 (M)                                 | 02 (M)                 | 02 (F)        |
| Gender           |                                        |                        |               |
| Male             | 13                                     | 08                     | 04            |
| Female           | 04                                     | 04                     | 03            |

Table 4 represents outcome of children admitted with accidental poisoning according to age distribution and gender. The number of children admitted to the ICU was less than the number of children who were mechanically ventilated due to

limited availability of ICU beds. This reflects on the added burden on limited health infrastructure by a completely preventable problem like accidental poisoning. Most of the remaining children were ventilated in the emergency. The greater number of boys requiring intensive care may be attributable to a higher incidence of poisoning; however, healthcare-seeking patterns, type and dose of exposure, and other unmeasured variables may have influenced this trend.

## DISCUSSION

The current study was undertaken with an objective to update information on the profile of accidental poisonings in children in the region. We found that 68.4% of children belong to the age group of 1-3 years, majority (62.1%) were boys and almost two-thirds (70%) were from rural background. Hydrocarbons were determined to be the leading cause of accidental poisoning (29%), followed by mosquito repellents (18%) and medications (17%). Almost 9% of children required mechanical ventilation.

Previously published studies from around the world also report that accidental poisoning is more common in young children below 3 years of age and in boys [10-12]. This may be due to the reason that boys have more exploratory and impulsive behaviour, which increases the likelihood of encountering hazardous substances. In current study, a majority of accidental poisoning cases were reported from rural areas, with 52.8% of the total cases originating from the state of Punjab. This finding contrasts with earlier studies, which have often reported a higher incidence in urban populations [13]. The difference could be due to the difference in study population or due to the fact that rural households often store hazardous chemicals within easy reach of children, sometimes in unlabelled or reused containers and may have lower awareness about poisoning risks, safe storage, and childproofing practices.

Various studies from around the world and from India show that hydrocarbons are the leading cause of accidental poisoning in children [13-15]. These findings were reaffirmed by our data. Out of the total cases of hydrocarbon led poisoning, 37% children consumed kerosene oil, followed by diesel (25%) and turpentine oil (18%). This may be due to the reason that these substances have water like appearance and often are stored by parents in plastic water/cold drinks bottles. Kerosene was also found to be the most common household item responsible for poisoning in many previous studies, despite the enhanced use of LPG for cooking in India [12, 16].

In our data, mosquito repellent was found to be the cause of accidental poisoning in 18% cases, a finding consistent with previous report.[17] This not only underscores a shifting trend in household exposure risks in India where traditionally household cleaners, and pesticides have dominated paediatric poisoning data, it also points towards the rising incidence of vector borne diseases like malaria, dengue and chikungunya and the urgent need by industry to package these agents in child

safe containers. Poisoning due to medicines is quite common in India as the packaging are not child-proof [18]. Our study documented this cause as the third leading cause of poisoning (17.36%). A variety of prescription medicines were implicated - thyroxine, antipsychotics, benzodiazepines, topical medicines, iron and non-edible topical medications. Ingestion of Iron led to one death. Toddlers imitate their parents; observing them take medicines may prompt them to do the same when the opportunity arises. This underscores the need to raise awareness on proper storage and child safe packaging of these drugs.

Nearly 9% of admitted children with accidental poisoning required mechanical ventilation. Earlier, Bhatt *et al.*, reported that 11% children needed ICU care and 5.9% required mechanical ventilation.<sup>1</sup> A much higher need of intubation (42%) and mechanical ventilation was reported by Jayshree *et al.*, probably due to the study being from a tertiary care referral hospital where the non-seriously affected children do not reach [8]. Mortality in current study was 3.7%, similar to previous study by Randev *et al* (3.8%) [19].

With rising population, better access to health services, the demand for health care is increasing. Better efficiency in utilisation of limited health resources is need of the hour [20]. Poisoning prevention educational programs can play an important role in such scenario. Nurses' involvement is vital in effectively providing health care and health education in developing countries, so nurses can take a lead role in providing such educational programs [21]. Nurse-led educational interventions are found to be effective in increasing knowledge of parents/patients [22].

## CONCLUSION

We conclude that accidental poisoning causes a substantial amount of burden on paediatric hospital services and in majority of cases the substance implicated is a common household product. The most common agent responsible for such poisoning incidents were hydrocarbons. Majority of the affected children were below 5 years of age. Males outnumbered females. Most of these events among children are preventable. In a resource-constrained setting like India, where there are several prevalent health issues, these preventable hospital admissions can be decreased by just creating awareness amongst parents by community based poisoning prevention programs.

All opportunities of imparting this valuable information to parents should be utilised- vaccination visits, outpatient visits and hospitalisation for unrelated causes. So appropriate parental education, adequate storage of household chemicals and drugs and proper supervision by parents can prevent poisoning in children. Henceforth, mortality and morbidity from accidental poisoning can also be reduced.

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*Funding: None; Conflicts of Interest: None Stated.*

**How to cite this article:** Verma P, Randev S, Kaur A, Mehta N. Accidental poisoning in children: An eight-year experience from a tertiary care institute of north India. *Indian J Child Health*. 2025; 12(8):105-109.