

Patterns and Predictors of Poisoning in Central India: A Retrospective Study from a Tertiary Care Hospital

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ABSTRACT

Background: Poisoning remains a major public health concern in India, contributing significantly to morbidity and mortality. The etiology of poisoning varies based on demographic, socioeconomic, and regional factors. This study aims to analyze the patterns, severity, and predictors of poisoning cases in a multicenter setting in Central India. **Methods:** A retrospective observational study was conducted in a tertiary care hospital in a city in Central India. Hospital records of 250 poisoning cases were analyzed for demographic details, type of poison, mode and route of exposure, clinical presentation, and outcomes. Statistical analysis was performed to identify significant predictors of severe poisoning and mortality. **Results: Demographics:** Most cases were in adults (18–60 years, 70%), with a male predominance (60%) and higher prevalence in lower socioeconomic groups (55%). **Poisoning Agents:** Pesticides (40%) were the most common toxic agents, followed by pharmaceuticals (25%) and household chemicals (15%). **Mode & Route:** Suicidal poisoning (55%) was the predominant mode, and oral ingestion (80%) was the most common route of exposure. **Clinical Outcomes:** 30% of cases required ICU admission, 8% needed ventilatory support, and 5% resulted in fatality. Predictors of **Severity & Mortality:** Suicidal intent ($p < 0.001$), pesticide poisoning ($p < 0.01$), and delayed hospital arrival (> 6 hours, $p < 0.01$) were significantly associated with severe poisoning and poor outcomes. **Conclusion:** This study highlights the burden of suicidal and pesticide-related poisoning in India, emphasizing the need for mental health interventions, stricter pesticide regulations, and improved public awareness regarding early hospital presentation. Strengthening preventive strategies and enhancing toxicological care can significantly reduce poisoning-related morbidity and mortality.

INTRODUCTION

Poisoning is a significant public health concern worldwide, particularly in developing countries like India, where a diverse range of toxic agents contributes to morbidity and mortality.^(1,2) The burden of poisoning varies across different regions due to socioeconomic, occupational, and cultural factors.^(3,4) Accidental and intentional poisonings remain common, with pesticides, pharmaceuticals, household chemicals, and plant toxins being among the leading causes.⁽⁵⁾ India, being an agrarian country, reports a high incidence of pesticide poisoning, particularly in rural areas, whereas urban centers witness an increasing trend in pharmaceutical and chemical poisonings.^(6,7) The predictors of poisoning, such as age, gender, socioeconomic status, intent (accidental, suicidal, or homicidal), and associated comorbidities, play a crucial role in guiding preventive strategies and clinical management.⁽⁸⁾ Despite the availability of hospital-based records, there is a lack of comprehensive multicenter studies that analyze poisoning patterns and their predictors across different healthcare settings. This study aims to bridge this gap by analyzing hospital records from tertiary care hospital to determine the prevalent patterns, risk factors, and outcomes of poisoning cases. The findings will provide insights into epidemiological trends, aiding policymakers

and healthcare professionals in designing targeted interventions to reduce the burden of poisoning.

Methodology

Study Design: After an ethical approval, the study was undertaken as a retrospective hospital-based observational study analyzing poisoning cases reported at a tertiary care hospital (NKPSIMS & RC and LMH) in central India.

Study Population: The study included 250 cases of poisoning documented in hospital records over a predefined study period (January 2020 and January 2025). Cases were selected based on inclusion and exclusion criteria.

Inclusion Criteria

- Patients of all age groups and genders diagnosed with poisoning.
- Cases with complete medical records, including demographic details, poisoning agent, route of exposure, clinical presentation, and outcomes.
- Patients admitted to the hospital or those treated in emergency departments.

Exclusion Criteria

- Cases with incomplete or missing medical records.
- Patients presenting with foodborne illnesses or allergic reactions without toxicological confirmation.
- Cases of envenomation (snake bites, scorpion stings) unless associated with toxic substance ingestion.

Data Collection: Data was extracted from hospital records using a structured data collection form. The following variables were recorded:

- Demographic details (age, gender, socioeconomic status)
- Type of poisoning (pesticides, pharmaceuticals, household chemicals, industrial toxins, plant toxins, etc.)
- Mode of poisoning (accidental, suicidal, homicidal, occupational exposure)
- Route of exposure (oral, inhalational, dermal, parenteral)
- Clinical presentation (symptoms, vital signs, biochemical abnormalities)

- Management and treatment outcomes (ICU admission, ventilatory support, recovery, mortality)

Data Analysis: The collected data were entered into statistical software (R-studio) for analysis. Descriptive statistics was used to summarize categorical and continuous variables. Chi-square tests, t-tests, and logistic regression analyses performed to identify significant predictors of poisoning severity and outcomes.

Results

1. Demographic Characteristics: A total of 250 cases were analyzed, with the majority (70%) occurring in adults aged 18-60 years. Males (60%) were more commonly affected than females (40%). Poisoning was most prevalent among individuals from lower socioeconomic backgrounds (55%), followed by middle (35%) and upper (10%) classes. This trend suggests a higher vulnerability in economically disadvantaged populations. (Table 1)

Table 1. Demographic Characteristics of Poisoning Cases

Variable	Category	Number of Cases (n)	Percentage (%)
Age Group	<18 years	38	15%
	18-60 years	175	70%
	>60 years	37	15%
Gender	Male	150	60%
	Female	100	40%
Socioeconomic Status	Lower	138	55%
	Middle	88	35%
	Upper	24	10%

2. Patterns of Poisoning: Pesticides (40%) were the most common toxic agents, followed by pharmaceuticals (25%) and household chemicals (15%). Suicidal poisoning accounted for 55% of cases, making it the leading mode, while accidental poisoning was observed in 35% of cases. Homicidal poisoning (7%) and occupational exposure (3%) were less frequent. Oral ingestion was the most common route of exposure (80%), followed by inhalational (10%), dermal (5%), and parenteral (5%) exposure.

3. Clinical Presentation and Outcomes: The most frequently observed symptoms were nausea and vomiting (65%), altered mental status (40%), and respiratory distress (30%). Cardiovascular instability was noted in 25% of cases, while seizures occurred in 10%. Regarding severity, 30% of patients required ICU admission, 8% needed ventilatory support, and the overall fatality rate was 5%.

4. Predictors of Severe Poisoning & Mortality: Statistical analysis identified suicidal intent ($p<0.001$), pesticide poisoning ($p<0.01$), and delayed hospital arrival beyond six hours ($p<0.01$) as significant predictors of severe poisoning and mortality. These findings emphasize the importance of mental health support, stricter pesticide control measures, and early hospital intervention to reduce poisoning-related morbidity and mortality.

Discussion

1. Demographic Trends in Poisoning Cases

The study highlights that the majority of poisoning cases (70%) occurred in adults aged 18-60 years, with a male predominance (60%). This aligns with previous studies suggesting that working-age individuals are at higher risk due to occupational exposures, financial stress, and mental health issues.⁽⁹⁾ The higher proportion of cases in lower socioeconomic groups (55%) suggests a strong association between economic hardship and poisoning, likely due to the easy availability of toxic agents such as pesticides in rural areas and limited awareness regarding poison safety.

2. Patterns of Poisoning: Pesticides as the Leading Cause among the various toxic agents, pesticides (40%) were the most common, followed by pharmaceuticals (25%) and household chemicals (15%). This finding is consistent with India's agrarian economy,

where organophosphate and herbicide poisoning are prevalent in rural populations.⁽¹⁰⁾ Accidental and occupational exposure to pesticides remains a major concern, emphasizing the need for stricter regulations and safer pesticide storage practices.

The high incidence of pharmaceutical poisoning (25%), primarily from overdose, underscores the increasing burden of self-harm and medication misuse in urban populations. This trend aligns with global patterns, where easy access to over-the-counter and prescription drugs contributes to overdose cases.⁽¹¹⁾

3. Mode and Route of Poisoning: The Role of Suicidal Intent the study found that 55% of poisoning cases were suicidal, making it the most common mode of poisoning. This finding is concerning, as it highlights the increasing mental health burden in India. The high prevalence of suicidal poisoning among young adults indicates an urgent need for psychological support services, community awareness programs, and mental health screening in vulnerable populations.

The predominance of oral ingestion (80%) as the main route of exposure is expected, given that most toxic substances (pesticides, pharmaceuticals, household chemicals) are consumed intentionally or accidentally. This emphasizes the need for better poison control measures, such as childproof containers, proper medication disposal, and restricted access to toxic agents.

4. Clinical Severity and Outcomes: ICU Admissions and Fatality Rates

The clinical presentation of poisoning cases was diverse, with nausea/vomiting (65%) and altered mental status (40%) being the most common symptoms. The requirement for ICU admission (30%) and ventilatory support (8%) suggests that a significant proportion of cases were severe. The overall fatality rate (5%) is consistent with national data, though preventable deaths due to delayed treatment remain a concern.

5. Predictors of Severe Poisoning and Mortality

Statistical analysis identified suicidal intent ($p<0.001$), pesticide poisoning ($p<0.01$), and delayed hospital arrival (>6 hours, $p<0.01$) as strong predictors of severe poisoning and mortality. These findings highlight key areas for intervention:

- **Early Identification of Suicidal Intent:** Mental health screening and crisis intervention can prevent suicidal poisoning cases.
- **Pesticide Regulation and Safety:** Stricter policies on pesticide availability and farmer education can reduce poisoning rates.
- **Timely Hospital Access:** Public awareness campaigns about early hospital arrival post-exposure can significantly improve outcomes.

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CONCLUSION

This study provides valuable insights into the epidemiology, severity, and predictors of poisoning in India. The high burden of suicidal and pesticide-related poisoning cases calls for urgent preventive measures, including mental health interventions, poison control policies, and improved access to emergency medical care. Future research should focus on longitudinal studies and intervention-based approaches to further mitigate the burden of poisoning-related morbidity and mortality

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