



Original Research Article

PROFILE OF POISONING CASES: CLINICAL AND SOCIODEMOGRAPHIC INSIGHTS FROM A TERTIARY HOSPITAL IN KUMAON

Deepika¹, Arun Joshi², S.C. Joshi³, Paramjeet Singh⁴

¹PGJR3, Department of General Medicine, Government Medical College, Haldwani, Nainital, India.

²Professor, Department of General Medicine, Government Medical College, Haldwani, Nainital, India.

³Professor, and HOD, Department of General Medicine, Government Medical College, Haldwani, Nainital, India.

⁴Assistant Professor, Department of General Medicine, Government Medical College, Haldwani, Nainital, India.

Received : 23/10/2025
Received in revised form : 15/11/2025
Accepted : 18/11/2025

Corresponding Author:

Dr. Arun Joshi,
Professor, Department of General
Medicine, Government Medical
College, Haldwani, India.
Email: arunjoshi1960@gmail.com

DOI: 10.70034/ijmedph.2025.4.291

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 1613-1619

ABSTRACT

Background: Poisoning remains a major public health problem in India, especially in agrarian regions. However, region-specific data from Uttarakhand is scarce.

Objective: To analyze the clinical and sociodemographic profile of poisoning cases admitted to a tertiary hospital in Kumaon.

Materials and Methods: A cross-sectional study was conducted over 18 months at Dr. Susheela Tiwari Memorial Government Hospital, Haldwani. A total of 234 patients aged >16 years with confirmed poisoning were included. Data on demographic factors, intent, agents, clinical features, and outcomes were analyzed using SPSS.

Results: Males constituted 60% of cases, with most patients aged 21–40 years. Students (32%) and housewives (22%) were the most affected groups. Suicidal intent was predominant (92%), with organophosphorus compounds as the leading agents. About 39% required ICU care, 20% needed ventilatory support, and the overall mortality rate was 20.9%.

Conclusion: Poisoning in Kumaon predominantly affects young adults, with high suicidal intent linked to pesticide use. Strengthened mental health services, early referral systems, and tighter regulation of toxic agents are essential to reduce mortality.

Keywords: Poisoning, sociodemographic profile, organophosphorus, suicide.

INTRODUCTION

Poisoning is recognized as one of the most significant and preventable causes of morbidity and mortality worldwide, constituting a major burden on emergency medical services and healthcare systems. It is defined as a pathological condition caused by the ingestion, inhalation, injection, or dermal absorption of toxic substances, whether accidental or intentional. The toxic agents involved may include agricultural chemicals, pharmaceuticals, industrial products, household cleaning agents, plants, or animal toxins, with clinical effects depending on the nature of the agent, dose consumed, and the susceptibility of the exposed individual. Despite improvements in toxicological care and the availability of modern antidotes, poisoning continues to be a pressing public health

challenge, particularly in developing nations where regulation, awareness, and healthcare access remain limited.^[1]

According to the Global Burden of Disease (GBD) Study 2019, unintentional poisoning was responsible for more than 84,000 deaths globally in that year alone, with millions of non-fatal exposures also reported.^[2] Although the mortality burden of poisoning has declined in several high-income countries due to the establishment of poison control centers, stringent regulatory frameworks, and effective public awareness programs, the incidence remains disproportionately high in low- and middle-income countries (LMICs), including India.^[3] The epidemiological burden in LMICs is amplified by weak health infrastructure, poor occupational safety standards, and the unrestricted availability of

hazardous substances, particularly agricultural pesticides.

India contributes substantially to the global burden of poisoning. Several hospital-based studies indicate that poisoning accounts for nearly 15–30% of medico-legal cases and emergency admissions in tertiary care centers across the country.^[4] The commonest toxic agents implicated in Indian settings include organophosphates, aluminum phosphide, rodenticides, corrosives, and sedatives, reflecting both the agrarian economy and the widespread domestic use of household chemicals.^[5] In urban areas, patterns shift towards alcohol toxicity, drug overdoses, and carbon monoxide poisoning, while in rural regions pesticide-related poisonings remain the predominant cause.^[6]

The socio-demographic profile of poisoning victims highlights its strong linkage to age, gender, occupation, literacy, and psychosocial stressors. Young adults, especially those in the 15–35 years age group, are disproportionately affected. This segment of the population is particularly vulnerable due to multiple intersecting risk factors, including impulsivity, easy access to lethal agents, and heightened psychosocial stress.⁷ Several Indian studies have demonstrated that females are more frequently involved in suicidal poisoning, whereas males predominate in accidental and occupational exposures.^[8] Cultural and gender-based expectations, along with domestic stressors, may explain the higher rate of suicidal poisonings among women, while men's predominance in agriculture and industrial labor settings increases occupational exposure risk.

Psychological determinants also play a crucial role. Psychiatric illnesses such as depression, anxiety, and substance abuse are strongly associated with intentional poisoning. Research from southern and western India consistently reports that the majority of poisoning cases admitted to tertiary care hospitals are intentional, particularly involving organophosphates, reflecting the psychosocial stressors of financial hardship, familial discord, and occupational uncertainty.^[9] The phenomenon of deliberate self-harm by ingestion of easily available pesticides highlights both the mental health burden and the gaps in regulation of toxic agents.^[10]

Clinically, poisoning is a diagnostic and therapeutic challenge. Early presentations may be nonspecific, including nausea, vomiting, abdominal pain, altered sensorium, seizures, or respiratory distress. Without timely recognition and management, these cases may progress rapidly to multi-organ failure or death. Highly lethal agents such as aluminum phosphide and organophosphates continue to be associated with case fatality rates exceeding 20% in many Indian hospitals.^[11] The use of scoring systems such as the Glasgow Coma Scale (GCS) and Poison Severity Score (PSS) has been shown to improve early risk stratification and predict outcomes.^[12] Despite these advances, delays in presentation to healthcare facilities—particularly in rural and hilly

regions—remain a significant factor contributing to poor outcomes.^[13]

From a public health perspective, poisoning imposes both direct and indirect costs. In the United States, the annual economic cost of poisoning, including healthcare expenditure and productivity loss, is estimated at over \$12 billion.^[14] While exact figures are not available for India, the burden is likely to be substantial given the high incidence and mortality rates. Beyond the economic dimension, poisoning has significant psychosocial consequences, affecting families, communities, and healthcare providers.

The epidemiology of poisoning is influenced by geographical location. Rural agrarian states such as Maharashtra, Andhra Pradesh, and Tamil Nadu have consistently reported high incidences of pesticide poisoning. In contrast, urban regions report greater incidences of drug overdoses, alcohol toxicity, and household chemical exposures.^[15] However, data from northern hill states, particularly Uttarakhand, remain limited. The unique geographical, cultural, and occupational context of Uttarakhand—characterized by dispersed rural settlements, dependence on agriculture, limited mental health infrastructure, and delayed access to tertiary care facilities—makes it critical to generate region-specific data. Existing literature has disproportionately focused on southern and western India, leaving a significant gap in understanding poisoning trends in hill states.^[16]

Furthermore, seasonal and cultural factors may influence poisoning epidemiology. Studies from Maharashtra and Karnataka have demonstrated a peak incidence during the monsoon season, coinciding with agricultural cycles and increased pesticide use.^[17] In states like Uttarakhand, where agricultural activities are strongly tied to seasonal rhythms, similar patterns may be expected but have not been systematically studied. The use of locally available plant toxins and traditional remedies also remains underexplored in this region.

The need for region-specific studies in Uttarakhand is reinforced by its socio-demographic vulnerabilities. High levels of unemployment, migration-related family disruption, and agricultural dependency contribute to psychosocial stress, especially among young adults. Suicide rates in the state are higher than the national average, and pesticide ingestion is a common method.^[18] However, systematic data regarding the clinical and socio-demographic profile of poisoning patients in tertiary hospitals of Kumaon is lacking. Without such localized evidence, it is difficult to formulate preventive strategies, improve clinical outcomes, or strengthen public health responses.

In light of these gaps, the present study was undertaken to analyze the clinical and socio-demographic profile of poisoning cases attending Dr. Susheela Tiwari Memorial Government Hospital, Haldwani, a tertiary care center in Kumaon, Uttarakhand. By documenting patterns of age, gender, occupation, intent, type of poison,

clinical presentation, and outcomes, this study aims to provide insights that can inform regional health policy, guide preventive programs, and improve clinical management strategies.

MATERIALS AND METHODS

The present study was a hospital-based cross-sectional study conducted at Dr. Susheela Tiwari Memorial Government Hospital (GMC Haldwani), Nainital, Uttarakhand. Data were collected from all poisoning patients who presented to the Department of General Medicine during the study period. The study was carried out over a period of 18 months following institutional ethics committee approval, and a total of 234 patients with poisoning were included. Ethical clearance was obtained from the Institutional Ethical Committee of GMC Haldwani, and informed written consent was taken from all patients or from attendants in cases where the patient was unable to provide consent.

All patients admitted to the Department of General Medicine with a history of poisoning, aged above 16 years, and willing to provide informed consent were included. Patients who did not provide consent, those under the age of 16 years, and those with cognitive impairment that could interfere with accurate reporting were excluded. Cases of idiosyncratic or adverse drug reactions and food poisoning were also not considered for inclusion. Patients were selected using convenience sampling, and all eligible cases presenting to the hospital during the study period were enrolled until the required sample size was reached.

Data were collected prospectively through direct patient interviews, information provided by attendants, and hospital medical records, using a structured proforma. Each participant underwent detailed history-taking and clinical examination. Information was gathered on demographic characteristics such as age, sex, residence, education, occupation, marital status, and socioeconomic status, along with details of the poisoning, including the type of agent, route of exposure, intent, and time interval between exposure and hospital arrival. Clinical features, Glasgow Coma Scale (GCS) score, prior treatment received, management provided in the hospital such as use of antidotes, intensive care admission, ventilatory support, or dialysis, and final outcomes were documented.

Routine laboratory investigations were performed in all patients, including hemoglobin, total leukocyte count, prothrombin time/international normalized ratio, liver function tests (SGOT/SGPT), renal function tests (serum creatinine, blood urea), pancreatic enzymes (amylase and lipase), and creatine kinase-N-acetylcysteine. These tests were carried out to assess organ involvement and aid prognosis. GCS at presentation was used as an indicator of severity. The primary outcome assessed

was in-hospital mortality, while secondary outcomes included the need for intensive care, requirement for mechanical ventilation or dialysis, and duration of hospital stay.

Data were entered into a secure database and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were applied, with means and standard deviations calculated for continuous variables and frequencies and percentages for categorical data. Inferential statistics included t-tests for continuous variables and appropriate statistical tests for categorical comparisons. A two-tailed significance level of 0.05 was used, and results with $p \leq 0.05$ were considered statistically significant.

RESULTS

The analysis of gender distribution of the study population reveals that out of 234 patients, 141 (60%) were males and 93 (40%) were females. This indicates a clear male predominance among poisoning cases attending Dr. Susheela Tiwari Government Hospital, Nainital. The higher proportion of males could be attributed to several factors. Males, especially in rural and semi-urban areas, are more likely to be engaged in occupations such as agriculture, manual labor, or industrial work, where there is greater exposure to pesticides, chemicals, and other toxic substances. Additionally, males are often found to engage in risk-taking behaviours and may act impulsively during periods of psychological stress, increasing the likelihood of both accidental and intentional poisoning.

The age distribution in this study is also consistent with established patterns, with the majority of cases (56.4 percent) belonging to the 21–40 years age group. This age group represents individuals in their most active and productive years of life. Emotional instability, high expectations from society and family, academic pressure, early career challenges, relationship conflicts, and lack of coping mechanisms may contribute to the psychological vulnerability of this age bracket.

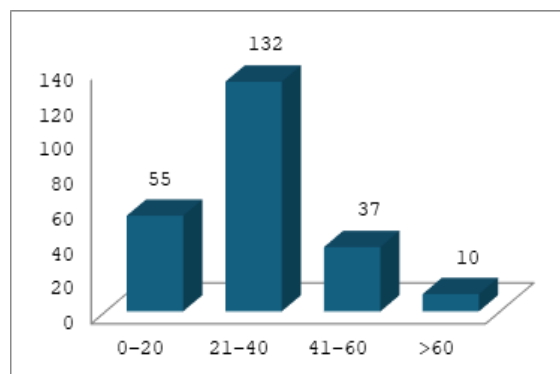


Figure 1: Age-wise distribution of Study Population

The second most affected group, the 0–20 years category, accounted for 23.5 percent of cases, which

is also a significant concern. In children and adolescents, poisoning may often be accidental, resulting from curiosity or lack of supervision, but among older adolescents, it may be intentional and associated with academic stress, bullying, family issues, or psychiatric illnesses.

The analysis of marital status revealed that married males formed the majority within their gender group, while unmarried females formed the majority among women.

Table 1: Sex-wise Distribution of Marital Status in the Study Population

Sex	Married	Unmarried	Total
Male	96	45	141
Female	37	56	93
Total	133	101	234

Married men may be exposed to greater financial and familial stressors, including the pressure to provide, work insecurity, and personal responsibilities, which may increase their risk of poisoning either through self-harm or occupational exposure. On the other hand, unmarried women may be more susceptible to poisoning due to emotional turmoil, relationship breakdowns, family disputes, or social isolation.

Most patients had education up to the 10th or 12th standard. A substantial number were also graduates, while very few were postgraduates or illiterate.

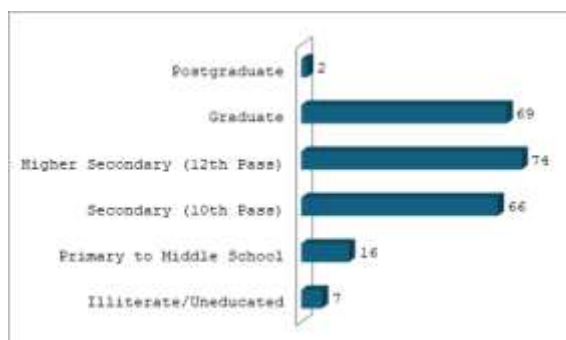


Figure 2: Education Classification of Study Participants

The occupational analysis revealed that students formed the largest group among poisoning cases, followed by housewives and employed individuals. The high proportion of student cases is an alarming trend, reflecting the psychological pressures and emotional instability prevalent among young individuals. Academic failure, peer pressure, parental expectations, and a lack of mental health support in educational institutions may contribute significantly to this issue.

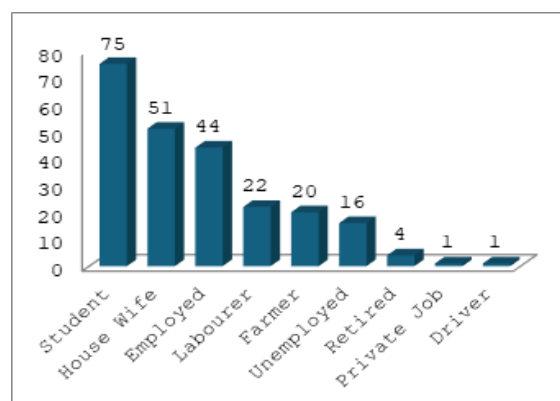


Figure 3: Distribution of Poisoning Cases According to Occupation

The socioeconomic profile of patients revealed a predominant representation from the middle class, accounting for over 90 percent of cases. This reflects the growing pressures faced by individuals in this segment of society, including economic instability, high social expectations, and inadequate mental health support.



Figure 4: Distribution of Socioeconomic Status Among Poisoning Cases

One of the most concerning findings of this study is the overwhelming predominance of suicide as the motive for poisoning. Over 92 percent of cases were intentional, with very few classified as accidental. This finding underscores a growing mental health crisis, where individuals, especially the young and middle-aged, are increasingly resorting to poisoning as a method of self-harm.

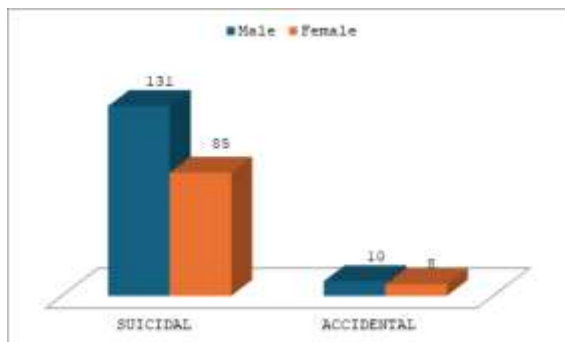


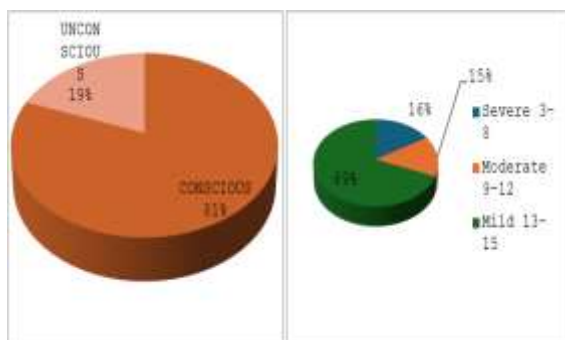
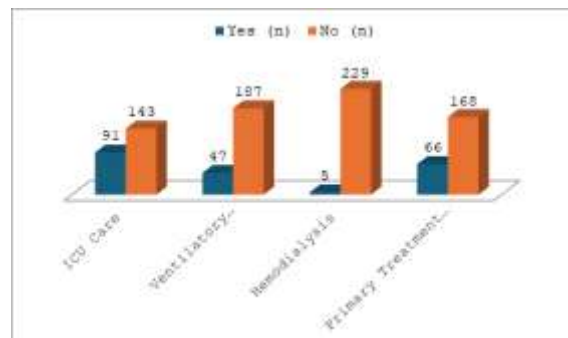
Figure 5: Distribution of Death Motives by Sex

The type of poison consumed in the majority of cases included organophosphorus compounds, zinc phosphide, and corrosive substances. Zinc phosphide and aluminium phosphide, both highly toxic substances commonly used for rodent and grain preservation, also contributed significantly to morbidity and mortality. The high prevalence of these poisons highlights the urgent need for stricter regulation on the sale and storage of hazardous chemicals, particularly in rural areas.

Table 2: Type of Poison Consumed

Type of Poison	Frequency (n)	Percentage (%)
Organophosphorus compounds	77	32.9%
Zinc phosphide	42	17.9%
Corrosive substances	36	15.4%
Aluminium phosphide	32	13.7%
Tablets / Drug overdose	14	6.0%
Pesticide / Insecticide / Herbicide	9	3.8%
Other (copper powder, bhaang, manure etc.)	6	2.6%
Cypermethrin	4	1.7%
Amitraz	3	1.3%
Yellow phosphorus	3	1.3%
Paraquat	3	1.3%
Mushroom poisoning	3	1.3%
Unknown substances	1	0.4%
Lethal Super 505	1	0.4%

At the time of admission, most patients were conscious and had relatively high GCS scores, indicating early presentation and possibly timely referral in many cases. However, a significant number of patients had moderate to severe GCS scores, indicating neurological compromise. ICU admission was required in approximately 39 percent of cases, and around 20 percent required ventilatory support, which indicates the seriousness of poisoning and the need for critical care resources. Hemodialysis was required in a few cases, mostly likely in those with renal complications from phosphide or heavy metal poisoning.



In terms of clinical outcomes, while the majority of patients recovered and were discharged, the mortality rate of nearly 21 percent is concerning. It reflects both the severity of poisonings and the limitations in early intervention, availability of antidotes, and access to intensive care. A small percentage of patients left against medical advice, a pattern often associated with financial constraints or social factors. The single case of referral reflects the hospital's capacity to manage most cases internally but also emphasizes the need for referral pathways for advanced interventions like liver transplant or toxicology support when required.

Table 3: Clinical Outcomes of Hospitalized Patients

Outcome	Frequency (n)	Percentage (%)
Recovered	170	72.65%
Death	49	20.94%
LAMA	9	3.85%
Referred	1	0.43%

Total	234	100%
-------	-----	------

The study showed a strong correlation between GCS score and outcome. Patients with low GCS scores were significantly more likely to die, and the difference between the mean GCS score of recovered and deceased patients was highly

statistically significant. This affirms the role of GCS as a reliable prognostic indicator in poisoning cases and supports its routine use in early triage and clinical decision-making.

Table 4: Association Between GCS Score and Death

Outcome	Frequency (n)	Percentage (%)
Recovered	170	72.65%
Death	49	20.94%
LAMA	9	3.85%
Referred	1	0.43%
Total	234	100%

The study showed a strong correlation between GCS score and outcome. Patients with low GCS scores were significantly more likely to die, and the difference between the mean GCS score of recovered and deceased patients was highly

statistically significant. This affirms the role of GCS as a reliable prognostic indicator in poisoning cases and supports its routine use in early triage and clinical decision-making.

Table 5: Association Between GCS Score and Death

Outcome	N	Mean GCS Score	Standard Deviation
Discharged	173	14.21	1.70
Death	45	8.51	2.94
t-value		4.28	
p-value		< 0.00001	

Laboratory investigations revealed elevated liver enzymes and renal markers in a significant number of patients, indicating multi-organ involvement in moderate to severe poisoning cases. The wide standard deviations in many lab parameters suggest that while some patients presented with mild abnormalities, others had severe biochemical derangements. Overall, the results of this study point toward a growing public health concern involving both accidental and, more alarmingly, intentional poisoning among the young and middle-aged population in Uttarakhand.

DISCUSSION

This study highlights important clinical and sociodemographic trends in poisoning cases in the Kumaon region. Young adults, particularly those aged 21–40 years, were the most commonly affected, reflecting high psychosocial stress in this age group. The marked predominance of intentional poisoning indicates a growing mental health burden, with easy access to pesticides such as organophosphorus and zinc phosphide contributing significantly to case severity and mortality.

Students and housewives formed major affected groups, suggesting academic pressure, family conflicts, and emotional distress as key triggers. The high proportion of males aligns with national patterns, likely due to occupational exposure and risk-taking behaviour.

A notable number of patients required intensive care and ventilatory support, demonstrating the severity of poisoning in this region. The strong correlation

between lower GCS at presentation and mortality confirms its value as a prognostic indicator. Multi-organ involvement, particularly hepatic and renal dysfunction, also contributed to adverse outcomes. Overall, the findings underscore the urgent need for better regulation of toxic pesticides, improved mental health support, early referral systems, and strengthening of critical care services to reduce poisoning-related morbidity and mortality in Uttarakhand

CONCLUSION

This hospital-based cross-sectional study conducted at Dr. Sushila Tiwari Memorial Government Hospital, Haldwani, revealed that poisoning cases are most common among young adults aged 21–40 years, with a clear male predominance. The majority of cases were intentional self-poisoning, with organophosphorus compounds being the most frequent agents used. A significant number of patients required intensive care and ventilatory support, and the overall mortality rate was found to be high.

Lower Glasgow Coma Scale (GCS) scores at presentation were strongly associated with poor outcomes, emphasizing the importance of early neurological assessment in predicting prognosis. Laboratory findings showed that hepatic and renal involvement were common in severe poisoning cases, highlighting the need for prompt diagnosis and aggressive management.

The findings underline the urgent need for preventive measures, such as restricting access to

highly hazardous pesticides, promoting safe storage practices, and strengthening mental health and suicide prevention programs—especially for vulnerable age groups like students and young adults. At the clinical level, timely triage using simple prognostic indicators like the GCS, early initiation of supportive care, availability of antidotes, and better-equipped critical care facilities are crucial for improving survival rates.

While this study provides valuable insight into the clinico-etiological and sociodemographic profile of poisoning cases in the Kumaon region, its single-center nature and limited sample size may restrict generalization. Future multicentric and community-based studies are recommended to validate these findings and develop effective regional policies for prevention and management. Implementing targeted public health and hospital-based interventions can significantly reduce the burden of poisoning in this region.

REFERENCES

1. World Health Organization. Poisoning Prevention and Management: Fact Sheet. Geneva: WHO, 2020.
2. GBD 2019 Diseases and Injuries Collaborators. "Global Burden of 369 Diseases and Injuries in 204 Countries and Territories, 1990–2019: A Systematic Analysis." *The Lancet* 396, no. 10258 (2020): 1204–22.
3. Mew, E. J., J. Padmanathan, A. Konradsen, et al. "The Global Burden of Self-Poisoning with Pesticides 2006–15: Systematic Review." *BMC Public Health* 17, no. 1 (2017): 1–15.
4. Gupta, N., A. Sharma, and P. Singh. "Demographic and Clinical Patterns of Acute Poisoning Cases in Northern India." *Indian Journal of Forensic Medicine and Toxicology* 17, no. 2 (2023): 56–63.
5. Kumar, S., A. Reddy, and B. Prasad. "Clinico-Epidemiological Characteristics of Poisoning Cases in South India." *Journal of the Indian Medical Association* 108, no. 6 (2010): 370–72.
6. Ramesha, K. N., S. Rao, and P. Kumar. "Pattern and Outcome of Acute Poisoning Cases in a South Indian Tertiary Care Hospital." *Indian Journal of Critical Care Medicine* 13, no. 3 (2009): 152–55.
7. Joshi, R., P. Adhikari, and R. Shrestha. "Socio-Demographic Factors and Poisoning in India: A Hospital-Based Study." *Journal of Clinical Toxicology* 5, no. 2 (2015): 112–18.
8. Bashir, M., A. Sheikh, and M. Nazir. "Acute Poisoning Cases in Kashmir Valley: A Hospital-Based Study." *Journal of Clinical and Diagnostic Research* 8, no. 8 (2014): HC01–HC03.
9. Pradhan, M., and M. Feula. "Demographic Characteristics and Trends of Poisoning Cases in Chennai." *International Journal of Forensic and Medical Toxicology* 10, no. 1 (2020): 21–27.
10. Vijay, A., and R. Kumar. "Poisoning-Related Deaths in Bangalore: An Autopsy-Based Study." *Journal of Forensic Medicine and Toxicology* 38, no. 1 (2021): 15–22.
11. Das, A., S. Chakraborty, and R. Paul. "Clinical Profile and Prognostic Indicators in Acute Poisoning Cases: A Study from Northeast India." *Indian Journal of Critical Care Medicine* 26, no. 4 (2022): 421–29.
12. Channabasappa, S. "Clinical Utility of Poison Severity Score in Acute Poisoning Cases." *Journal of the Indian Society of Toxicology* 17, no. 2 (2021): 45–52.
13. Sil, A., S. Mondal, and P. Ghosh. "Determinants of Outcome in Poisoning: A Study from West Bengal." *International Journal of Medical Toxicology* 11, no. 1 (2016): 25–31.
14. Centers for Disease Control and Prevention. "Annual Report of the National Poison Data System." *Morbidity and Mortality Weekly Report* 67, no. 3 (2018): 89–96.
15. Maharani, B., and P. Vijayakumari. "Profile of Poisoning Cases in a Tertiary Care Hospital in Tamil Nadu." *Journal of Clinical Forensic Medicine* 20, no. 8 (2013): 123–29.
16. Dash, S., P. Rath, and R. Behera. "Socio-Demographic Profile of Poisoning Deaths in Odisha." *Journal of Indian Academy of Forensic Medicine* 37, no. 2 (2015): 174–79.
17. Gupta, S., R. Bansal, and P. Mehta. "Seasonal Trends in Acute Poisoning: A Hospital-Based Study in Maharashtra." *Indian Journal of Forensic and Community Medicine* 6, no. 3 (2019): 145–49.
18. National Crime Records Bureau. *Accidental Deaths and Suicides in India 2020*. New Delhi: Ministry of Home Affairs, 2021.