

Epidemiological Profile of Female Fatal Poisoning: A Retrospective Autopsy-Based Study from Assam, India

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ABSTRACT

Background: Fatal poisoning remains an important public health and medicolegal concern in India, particularly among women in rural communities. This study evaluated the epidemiological profile of female fatal poisoning cases undergoing medico-legal autopsy at a tertiary care teaching hospital in Assam.

Methods: A retrospective autopsy-based study was conducted on 43 female fatal poisoning cases from January 2020 to December 2021. Data regarding age, marital status, residence, type of poison and hospitalization were analyzed using descriptive statistics and the Chi-square test.

Results: Most victims were aged 20–29 years (39.5%), married (60.5%) and from rural areas (83.7%). Organophosphorus compounds were the commonest poisoning agents (60.5%), followed by carbamates. Hospitalization was documented in 65.1% of cases. No significant association was observed between age group and hospitalization status ($p=0.713$).

Conclusion: Female fatal poisoning predominantly affected young rural married women, with organophosphorus pesticides remaining the principal toxic agents, highlighting the need for targeted poison prevention and improved emergency care.

Keywords: Fatal poisoning, Female, Organophosphorus compounds, Autopsy, Epidemiology, Assam

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INTRODUCTION

Poisoning remains a major global public health problem and is an important cause of preventable morbidity and mortality. According to the World Health Organization (WHO), suicide accounts for more than 700,000 deaths annually worldwide, with poisoning constituting one of the common methods of self-harm, particularly in low- and middle-income countries where access to highly toxic substances is relatively unrestricted. In addition to intentional self-poisoning, accidental and occupational poisonings continue to contribute substantially to injury-related mortality, imposing a significant burden on healthcare systems and forensic services worldwide.(1,2)

India bears a considerable share of the global burden of poisoning owing to its large agrarian population and widespread availability of agricultural pesticides. The National Crime Records Bureau (NCRB) has consistently identified poisoning as one of the leading methods of suicide in the country, highlighting its continuing medico-legal and public

health significance.(3) Organophosphorus compounds remain the most frequently implicated toxic agents because of their extensive agricultural use, easy accessibility and high toxicity. Although

advances in emergency medical care have improved survival in many cases, fatal poisoning continues to account for a substantial proportion of unnatural deaths undergoing medico-legal autopsy.

The epidemiological profile of fatal poisoning varies according to geographical location, socioeconomic status, agricultural practices and accessibility to healthcare facilities. Previous studies have consistently demonstrated that poisoning predominantly affects young adults and is particularly common among individuals residing in rural communities where pesticides are readily available. Guntheti and Singh reported that young women constituted the majority of unnatural female deaths in their study from Telangana, while Kumar et al. observed a similar demographic profile in Lucknow.(4,5) Comparable findings have also been reported by Kitulwatte et al. from Sri Lanka,

suggesting that the epidemiological characteristics of female unnatural deaths are broadly similar across South Asian countries.(6)

Autopsy-based studies specifically evaluating fatal poisoning have likewise demonstrated the predominance of pesticide poisoning among young adults. In a retrospective medico-legal autopsy study from Northeast India, Goswami et al. reported that organophosphorus compounds accounted for the majority of poisoning deaths and that young adults represented the largest affected age group.(7) Similarly, Radhika and Kashyap identified organophosphorus pesticides as the commonest poisoning agents in an autopsy-based study from Bangalore, with the highest incidence occurring among young adults.(8) More recent studies by Satish et al. and Rizwi have also confirmed that organophosphorus compounds remain the leading cause of fatal poisoning despite improvements in medical management and public awareness.(9,10) These observations indicate that poisoning continues to represent a major medico-legal challenge, particularly in regions where agriculture remains the principal occupation.

Women constitute an important subgroup in poisoning research because their epidemiological profile, social circumstances and healthcare-seeking behaviour may differ from those of the general population. However, most published studies have evaluated poisoning among mixed populations or have examined all unnatural female deaths rather than fatal poisoning exclusively. Consequently, information regarding the demographic characteristics, poisoning profile and treatment patterns among female fatal poisoning victims remains relatively limited, particularly from Northeast India.

Understanding the epidemiological characteristics of female fatal poisoning is essential for identifying vulnerable populations, strengthening poison prevention strategies and improving both clinical management and medico-legal investigation. Region-specific evidence is particularly important because patterns of poisoning are influenced by local agricultural practices, socioeconomic conditions and availability of toxic agents. Therefore, the present study was undertaken to evaluate the demographic profile, poisoning agents and hospitalization status of female fatal poisoning cases subjected to medico-legal autopsy at a tertiary care teaching hospital in Assam.

METHODOLOGY

Study design and setting

A cross-sectional record-based study was conducted in the Department of Forensic Medicine and Toxicology of a tertiary care teaching hospital in Assam, India. The study included **all female fatal poisoning cases subjected to medicolegal autopsy over a two-year period from January 2020 to December 2021.**

Study population

The study population comprised all female victims of fatal poisoning who underwent medicolegal autopsy during the study period and in whom the cause of death was established based on autopsy findings, police inquest reports, hospital records (where available), circumstantial evidence, and confirmation by the Forensic Science Laboratory (FSL).

Inclusion criteria

- Female medicolegal autopsy cases with poisoning established as the cause of death.
- Cases occurring during the study period (January 2020–December 2021).
- Cases with complete medicolegal records and FSL confirmation of poisoning.

Exclusion criteria

- Male poisoning cases.
- Cases in which the cause of death was other than poisoning.
- Highly decomposed bodies in which the cause of death could not be conclusively established.
- Cases with incomplete medicolegal records or unavailable toxicological confirmation.

Data collection

Data were collected from medicolegal autopsy reports, police inquest reports, hospital treatment records (where available), and Forensic Science Laboratory reports. The information was entered into a structured data collection proforma after anonymization to ensure confidentiality.

The following variables were recorded:

- Year of autopsy
- Age
- Marital status
- Duration of marriage
- Religion
- Occupation
- Place of residence
- Place of poisoning
- Type of poison
- Manner of death
- Hospitalization status
- Survival period
- Forensic Science Laboratory findings

Statistical analysis

The collected data were entered into Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) and analysed using IBM SPSS Statistics version XX (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as frequencies and percentages. Age was categorised into five groups (<20, 20–29, 30–39, 40–49, and ≥50 years). The association between age group and hospitalization status was analysed using Pearson's Chi-square test. A p-value of <0.05 was considered statistically significant.

Ethical considerations

The study was approved by the Institutional Ethics Committee prior to commencement. Since the study was based entirely on anonymized medicolegal records, informed consent was waived. Strict confidentiality of all collected data was maintained throughout the study.

RESULTS

A total of **43 female fatal poisoning cases** were included in the present retrospective autopsy-based study conducted over a two-year period.

The socio-demographic profile of the study population is presented in **Table 1**. The victims ranged from adolescence to older adulthood, with the highest proportion belonging to the **20–29-year age group (39.5%)**, followed by the **30–39-year age group (20.9%)**. Females aged less than 20 years constituted **18.6%** of the cases, while those aged 40 years and above accounted for **20.9%**. The majority of the victims were **married (60.5%)**, whereas **37.2%** were unmarried and **2.3%** were widowed. Most of the victims were residents of **rural areas (83.7%)**, with only **9.3%** and **7.0%** belonging to semi-urban and urban areas, respectively.

The epidemiological characteristics of poisoning are summarized in **Table 2**. **Organophosphorus compounds** were the most frequently encountered poisoning agents, accounting for **60.5%** of all fatalities. Carbamate compounds constituted **20.9%**, while aluminium phosphide and corrosive agents accounted for **11.6%** and **7.0%**, respectively. A majority of the victims (**65.1%**) received hospital

cases occurring in a field and at the workplace.

The occupational profile of the victims is depicted in **Table 3**. **Housewives constituted the largest occupational group (57.1%)**, followed by students (**21.4%**). Unemployed women accounted for **11.9%**, while **9.5%** of the victims were engaged in private employment. One case had missing occupational information.

The year-wise distribution of cases is shown in **Table 4**. A total of **20 cases (46.5%)** were recorded during 2020, while **23 cases (53.5%)** occurred during 2021, indicating a marginal increase in the number of fatal poisoning cases during the second year of the study.

The association between age group and hospitalization status is presented in **Table 5**. Hospitalization was observed across all age groups, with the highest number of hospitalized cases occurring among women aged 20–29 years. However, statistical analysis using Pearson's Chi-square test demonstrated **no significant association** between age group and hospitalization status ($\chi^2 = 2.124$; $df = 4$; $p = 0.713$).

Overall, the findings indicate that fatal poisoning among females predominantly affected **young married women from rural areas**, with **organophosphorus compounds** emerging as the principal poisoning agent. Most poisoning episodes occurred within the home environment, and approximately two-thirds of the victims were hospitalized before death. No statistically significant

Variable	Category	n	%
Age group (years)	<20	8	18.6
	20–29	17	39.5
	30–39	9	20.9
	40–49	5	11.6
	≥50	4	9.3
Marital status	Married	26	60.5
	Unmarried	16	37.2
	Widow	1	2.3
Residence	Rural	36	83.7
	Semi-urban	4	9.3
	Urban	3	7.0

treatment prior to death, whereas **34.9%** died without hospitalization. Poisoning occurred predominantly **at home (95.3%)**, with only isolated

relationship was observed between age group and hospitalization status.

Table 1. Socio-demographic characteristics of the study population.

Variable	Category	n	%
Type of poison	Organophosphorus	26	60.5

Variable	Category	n	%
	Carbamate	9	20.9
	Aluminium phosphide	5	11.6
	Corrosive	3	7.0
Hospitalized	Yes	28	65.1
	No	15	34.9
Place of poisoning	Home	41	95.3
	Field	1	2.3
	Workplace	1	2.3

Table 2. Epidemiological characteristics of fatal poisoning cases

Occupation	n	%
Housewife	24	57.1
Student	9	21.4
Unemployed	5	11.9
Private job	4	9.5

Table 3. Occupational profile of the victims (n = 42*) No record was available for 1 person

Year	Number of cases	Percentage (%)
2020	20	46.5
2021	23	53.5
Total	43	100

Table 4. Year-wise distribution of fatal poisoning cases

Age group	Hospitalized	Not hospitalized	Total
<20	5	3	8
20–29	12	5	17
30–39	6	3	9
40–49	3	2	5
≥50	2	2	4
Total	28	15	43

Table 5 Age group versus hospitalization**DISCUSSION**

Fatal poisoning continues to be an important cause of unnatural mortality and a major public health challenge in developing countries. The

epidemiological characteristics of poisoning vary according to regional agricultural practices, accessibility of toxic substances, socioeconomic conditions and healthcare infrastructure. The present

retrospective autopsy-based study evaluated the demographic and toxicological profile of female fatal poisoning cases in a tertiary care teaching hospital in Assam. The findings revealed that fatalities occurred predominantly among young married women residing in rural areas, with organophosphorus compounds being the principal toxic agents. These observations are broadly consistent with previous studies from India and neighbouring South Asian countries, indicating that pesticide poisoning remains a significant medicolegal and public health concern.

The predominance of women aged 20–29 years (39.5%) observed in the present study is consistent with the epidemiological pattern reported in previous studies. Guntheti and Singh reported that young adult women constituted the largest proportion of unnatural female deaths in Telangana, while Kumar et al. similarly found that women in the second and third decades of life were most frequently affected in Lucknow.(4,5) Kitulwate et al. also demonstrated that unnatural female deaths predominantly involved young adults in Sri Lanka, suggesting that this age group remains particularly vulnerable across South Asia.(6) Similar age-related trends have been described in poisoning-specific studies by Goswami et al., Radhika and Kashyap, Satish et al. and Rizwi, all of whom reported the highest frequency of fatal poisoning among young adults.(7–10) The predominance of this age group may reflect increased exposure to emotional, social and economic stressors, including marital adjustment, employment-related pressures, financial responsibilities and interpersonal conflicts. Furthermore, impulsive behaviour combined with easy access to toxic pesticides in rural households may contribute to the high incidence of fatal poisoning during early adulthood.

Married women accounted for 60.5% of all cases in the present study. This finding agrees with those of Guntheti and Singh and Kumar et al., who also reported a predominance of married women among unnatural female deaths.(4,5) Although these studies evaluated all unnatural deaths rather than poisoning exclusively, they similarly observed that married women represented a substantial proportion of medico-legal fatalities. The predominance of married women in the present study may be explained by the additional social and familial responsibilities associated with marriage, including childcare, household obligations, financial dependence and interpersonal conflicts. While the present study did not investigate the underlying circumstances preceding poisoning, these findings emphasize the need for psychosocial support, early identification of women experiencing emotional distress and improved access to mental health services within the community.

The overwhelming majority of victims (83.7%) belonged to rural areas, highlighting the continued

influence of agricultural communities on the epidemiology of poisoning. Similar rural predominance has been documented by Kumar et al. and Kitulwate et al., who attributed this pattern to the widespread availability of pesticides, dependence on agriculture and delayed access to healthcare facilities.(5,6) Goswami et al. likewise reported that most fatal poisoning cases originated from rural areas in Northeast India.(7) The high proportion of rural victims in the present study probably reflects the unrestricted availability of agricultural chemicals, unsafe storage practices within households and limited awareness regarding pesticide safety. Delayed transportation to tertiary care centres and restricted access to specialised poisoning management facilities may further contribute to the high mortality observed among rural populations. These findings reinforce the importance of strengthening poison prevention programmes, improving safe pesticide storage practices and enhancing emergency medical services in rural communities.

Organophosphorus compounds constituted the commonest poisoning agent, accounting for 60.5% of all fatalities. This observation is in close agreement with the findings of Goswami et al., who reported organophosphorus compounds as the predominant poison in laboratory-confirmed fatal poisoning cases from Northeast India.(7) Radhika and Kashyap similarly identified organophosphorus pesticides as the leading cause of fatal poisoning in Bangalore, while Satish et al. and Rizwi also observed that these compounds remained responsible for the majority of poisoning deaths in their respective studies.(8–10) The persistent predominance of organophosphorus poisoning across different geographical regions reflects their extensive agricultural use, easy availability, relatively low cost and high acute toxicity. Carbamates represented the second most common poisoning agent in the present study, further indicating that agricultural pesticides continue to dominate the poisoning profile in rural India. Despite improvements in critical care management, the continued availability of highly hazardous pesticides remains a major challenge for poisoning prevention.

Nearly two-thirds (65.1%) of the victims received hospital treatment before death, indicating that access to healthcare was available for a substantial proportion of patients. Nevertheless, mortality remained high despite hospitalization, probably because of delayed presentation, ingestion of highly toxic compounds or consumption of large quantities of poison before medical intervention could be instituted. Early diagnosis, prompt administration of appropriate antidotes, intensive monitoring and ventilatory support remain the cornerstones of successful poisoning management. The findings highlight the importance of strengthening referral

systems, improving emergency transportation and ensuring the availability of standardized poisoning management protocols at peripheral healthcare centres, particularly in rural areas.

The association between age group and hospitalization status was statistically insignificant ($\chi^2 = 2.124$, $p = 0.713$), indicating that the probability of hospitalization before death did not differ significantly among different age groups. Although younger women constituted the largest proportion of fatalities, their likelihood of reaching a healthcare facility was comparable to that of older women. This finding suggests that age alone is unlikely to influence healthcare utilization among fatal poisoning victims. Instead, factors such as geographical accessibility, delay in transportation, severity of poisoning, quantity of poison consumed and timeliness of treatment are more likely to determine clinical outcome. Future multicentric studies incorporating these variables may provide a better understanding of predictors of mortality following poisoning.

The findings of the present study have important public health implications. The predominance of young married women from rural communities underscores the need for targeted preventive interventions aimed at reducing access to highly hazardous pesticides, promoting safe storage of agricultural chemicals and improving public awareness regarding poisoning prevention. Community-based mental health services, suicide prevention programmes and counselling facilities should be strengthened, particularly in rural populations where psychosocial support may be limited. Simultaneously, improving emergency medical transport, ensuring adequate availability of antidotes and strengthening poison management capacity at peripheral healthcare facilities may substantially reduce poisoning-related mortality.

The present study has certain strengths. Being an autopsy-based investigation, confirmation of poisoning was supported by medico-legal examination and toxicological analysis, thereby improving diagnostic accuracy. Furthermore, the exclusive evaluation of female fatal poisoning provides epidemiological information regarding a relatively underreported subgroup in forensic literature, while the study also contributes valuable regional data from Northeast India where published evidence remains comparatively limited.

However, certain limitations should be acknowledged. The study was retrospective and conducted at a single tertiary care centre with a relatively small sample size, thereby limiting the generalizability of the findings. Important variables such as socioeconomic status, educational level, occupation, psychiatric illness, motive for poisoning, treatment received and time interval between poison ingestion and hospital presentation could not be evaluated because of incomplete

retrospective records. In addition, only fatal poisoning cases were included, precluding comparison with survivors. Future prospective multicentric studies incorporating clinical, toxicological and psychosocial variables would provide a more comprehensive understanding of female fatal poisoning and facilitate the development of targeted preventive strategies.

In conclusion, the present study demonstrates that female fatal poisoning in Assam predominantly affects young married women from rural communities, with organophosphorus pesticides remaining the principal toxic agents. These findings are consistent with previous studies from India and neighbouring South Asian countries and reaffirm that pesticide poisoning continues to pose a major medicolegal and public health challenge. Strengthening pesticide regulation, promoting mental health awareness, improving poison prevention strategies and enhancing emergency medical care are essential for reducing the burden of fatal poisoning among women.

CONCLUSION

Female fatal poisoning in the present study predominantly affected young married women residing in rural areas, with organophosphorus compounds emerging as the principal poisoning agent. The findings reaffirm that pesticide poisoning continues to constitute an important public health and medicolegal problem in agrarian communities despite advances in emergency medical care. The predominance of rural victims underscores the influence of easy accessibility to agricultural pesticides and the need for improved poison prevention strategies.

Strengthening regulation of highly hazardous pesticides, promoting safe storage and handling of agricultural chemicals, improving community awareness regarding poisoning prevention, and expanding access to timely emergency medical care are essential to reduce poisoning-related mortality. In addition, community-based mental health services and suicide prevention initiatives should be strengthened to address psychosocial factors contributing to poisoning among women. Further multicentric prospective studies incorporating clinical, toxicological and psychosocial variables are recommended to provide a more comprehensive understanding of female fatal poisoning and to support the development of evidence-based preventive strategies.

Strengths of the Study

- The study was based on medico-legal autopsies with toxicological confirmation, ensuring a high degree of diagnostic accuracy.
- It specifically evaluated **female fatal poisoning**, a comparatively underreported subgroup in forensic literature.

- The study provides valuable epidemiological data from **Northeast India**, where published literature on female fatal poisoning remains limited.
- The findings contribute region-specific evidence that may aid public health planning and medico-legal practice.

Limitations of the Study

- The study was retrospective in nature and conducted at a single tertiary care centre.
- The relatively small sample size limits the generalizability of the findings.
- Information regarding socioeconomic status, occupation, educational status, psychiatric illness, motive for poisoning, treatment received and time interval between poisoning and hospital presentation was unavailable because of the retrospective study design.
- Only fatal poisoning cases were included; therefore, comparison with survivors was not possible.

Ethics Approval

The study was approved by the Institutional Ethics Committee of Tezpur **Medical College**. And Hospital. As this was a retrospective record-based study utilizing anonymized medico-legal records, the requirement for informed consent was waived by the Institutional Ethics Committee.

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Conflict of Interest

The authors declare **no conflict of interest**.

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