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## A study of patients poisoned with household products in emergency department of a tertiary care hospital in eastern Nepal

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### Abstract

**Introduction:** Poisoning due to household substances is frequently observed, especially in low- and middle-income nations such as Nepal. Nevertheless, there is a scarcity of information regarding their clinical characteristics, treatment approaches, and patient outcomes.

**Method:** A descriptive cross-sectional study was conducted in the Emergency Department of Nobel Medical College Teaching Hospital, Eastern Nepal. All adult patients presenting with confirmed or suspected household product poisoning during the study period were included. Data on demographics, poisoning agents, clinical features, management, and outcomes were collected using a structured proforma.

**Result:** Among 70 cases analyzed, 47(67.14%) were female, with the 15-30 years age group most affected. Corrosive agents such as phenyl, acid, and kerosene were the most frequently implicated. Intentional ingestion accounted for 59(84.28%) of cases, largely with suicidal intent. Common symptoms included nausea, vomiting, oral burns, and respiratory distress. Gastric lavage and supportive care were primary treatments. Most patients recovered with timely intervention; however, 5(7.14%) developed complications, and the case fatality rate was 3(4.28%).

**Conclusion:** Household product poisoning is a significant public health issue in Eastern Nepal, especially among young females. Corrosive agents are the leading cause. Early diagnosis and prompt treatment are vital. Public awareness and stricter regulation of toxic household chemicals are strongly recommended.

**Keywords:** Acid; Corrosive; Household products; Hydrocarbons; Kerosene; Phenyl

## INTRODUCTION

Poisoning from household products is an emerging yet under-recognized public health issue in Nepal.<sup>1</sup> In this study, household products refers to non-agricultural, domestically used chemical substances such as cleaners, disinfectants, toilet and bathroom acids, phenyl, bleaching agents, kerosene, turpentine, hydrocarbons, detergents, and cosmetics. These items are often stored without proper safety measures or labeling, increasing the risk of exposure through ingestion, inhalation, or skin contact.

Weak regulatory controls, low public awareness, and limited mental health support further compound the problem in Nepal.<sup>2</sup> Although poisoning is a known burden, most research has focused on agricultural agents, leaving household-product poisoning understudied. This gap is especially pronounced in Eastern Nepal, where emergency departments frequently encounter such cases but lack reliable, context-specific data to guide prevention, policy, and clinical management.

Given this gap, the present study aims to characterize the patterns, risk factors, clinical presentations, and outcomes of household-product poisoning in Eastern Nepal. These cases can range from mild gastrointestinal symptoms to life-threatening complications, making prompt recognition and intervention essential. Specifically, the study seeks to describe the demographic, clinical, and toxicological profiles of affected patients and identify clinical predictors of poor outcomes.

## METHOD

This descriptive, cross-sectional study was conducted in the Emergency Department of Nobel Medical College Teaching Hospital (NMCTH), a tertiary care center located in Biratnagar, Eastern Nepal, over two years from 1 January 2019 to 31 December 2020. All consecutive patients who presented with household chemical exposure during the study period and met the eligibility criteria were included; no sampling was performed. Patients aged 15 years or above who presented within 24 hours of exposure to household chemical products such as toilet cleaners, bleaching agents, acids, alkalis, phenyl, kerosene, hydrocarbons, and other cleaning agents, and who provided informed consent (or whose guardians provided consent), were eligible for inclusion. Cases involving agricultural pesticides or herbicides, pharmaceutical drug overdoses, animal bites or envenomation, chronic or occupational chemical exposures, or incomplete records were excluded from the study.

Ethical approval for the study was obtained from the Institutional Review Committee of Nobel Medical College (Ref. No. 235/2018). Written informed consent was obtained directly from adult participants aged 18 years and above. For participants aged 15–17 years, written assent was obtained, accompanied by written consent from a parent or legal guardian. Confidentiality of all patient information was

strictly maintained throughout the study.

Household poisoning in this study was defined as acute, intentional or unintentional ingestion, inhalation, dermal, or ocular exposure to chemical substances commonly used in households, including cleaning agents such as toilet cleaners, bleach, disinfectants, corrosives like acids and alkalis, hydrocarbons including kerosene and turpentine, and phenyl or similar disinfectant solutions. Time to presentation was defined as the duration in hours between exposure and arrival at the Emergency Department, categorized as <1 hour, 1–4 hours, 4–12 hours, or 12–24 hours. The severity of poisoning was assessed based on clinical features, vital signs, Glasgow Coma Scale (GCS), presence of systemic toxicity, and complications, and was categorized as mild (stable vitals with minimal symptoms and no systemic involvement), moderate (abnormal vitals or mild systemic effects requiring observation), or severe (hemodynamic instability, respiratory compromise, GCS  $\leq 12$ , or organ-system complications). Short-term outcomes at discharge were classified as recovery without complications, recovery with complications, requirement of ICU admission, leaving against medical advice (LAMA), or death.

Calculating the sample size for finite population, using previous records available,<sup>3</sup> total sample size was 69. But we enrolled all cases with household products poisoning meeting our study criteria over the study period and total sample was 70.

Data were prospectively collected using a pre-validated structured proforma that captured socio-demographic characteristics (age, sex, occupation, literacy), exposure-related details (chemical involved, intention, place of exposure, time to presentation, and any pre-hospital gastric lavage), clinical parameters (vital signs, GCS, AVPU scale, symptoms, and complications), and final outcomes. Data were entered into Microsoft Excel 10 and analyzed using SPSS version 30. The results were summarized using frequencies and percentages for categorical variables and means or medians with standard deviations for continuous variables. Inferential statistical tests were applied to assess associations or predictors.

## RESULT

A total of 70 cases of household product poisoning were recorded during the study period. Females accounted for the majority, with 47 (67.1%) cases, yielding a female-to-male ratio of approximately 2:1. The most commonly affected age group was 15–30 years, comprising 56 (80%) cases, with a mean age of  $25.38 \pm 10.86$  years. Married individuals accounted for 38 (54.3%) cases, and most patients were literate (69, 98.6%). Regarding occupation, students represented the largest group (32, 45.7%), followed by homemakers (22, 31.4%) and laborers (11, 15.7%). Most poisoning incidents occurred at home (61,

**Table 1. Association of demographic variables with patient outcomes (n = 70)**

Variables	Parameters	Recovered n(%)	Mortality n(%)	Unknown n(%)	Total n(%)	p-value* 95% CI
Compound	Acid	8(11.42%)	2(2.85%)	0	10(14.28%)	p=0.035
	Phenyl	36(51.42%)	0	10(14.28%)	46(65.71%)	
	Others	11(15.71%)	1(1.42%)	2(2.85%)	14(20%)	
Intention	Suicide	46(65.71%)	1(1.42%)	12(17.14%)	59(84.28%)	p=0.017
	Accident	9(12.85%)	2(2.85%)	0	11(15.71%)	

\*Small expected cell counts (Chi-square assumptions not met due to small cell counts; p-values should be interpreted with caution)

**Table 2. Association of clinical variables with patient outcomes (n = 70)**

Variables	Parameters	Recovered n(%)	Mortality n(%)	Unknown n(%)	Total n(%)	p-value* 95% CI
Heart Rate [bpm]	60-100	50(71.42%)	1(1.42%)	9(12.85%)	60(85.71%)	p=0.011
	>100	5(7.14%)	2(2.85%)	3(4.28%)	10(14.28%)	
	<12	0	1(1.42%)	0	1(1.42%)	
Respiratory Rate [/min]	12-24	54(77.14%)	0	12(17.14%)	66(94.28%)	p<0.001
	>24	1(1.42%)	2(2.85%)	0	3(4.28%)	
Body Temperature [° F]	≤98	53(75.71%)	3(4.28%)	12(17.14%)	68(97.14%)	p=0.75
	>98	2(2.85%)	0	0	2(2.85%)	
Systolic Blood Pressure (SBP)[mmHg]	<90	1(1.42%)	3(4.28%)	0	4(5.71%)	p<0.001
	90-140	51(72.85%)	0	11(15.71%)	62(88.57%)	
	>140	3(4.28%)	0	1(1.42%)	4(5.71%)	
Diastolic Blood Pressure (DBP)[mmHg]	<60	1(1.42%)	3(4.28%)	0	4(5.71%)	p<0.001
	60-90	44(62.85%)	0	11(15.71%)	55(78.57%)	
Oxygen Saturation (SpO2) [%]	≥90	10(14.28%)	0	1(1.42%)	11(15.71%)	p<0.001
	<90	1(1.42%)	2(2.85%)	0	3(4.28%)	
Total (n=70)		55(78.57%)	3(4.28%)	12(17.14%)		

(Chi-square assumptions not met due to sparse cells; p-values descriptive only)

**Table 3. Association of Neurological clinical variables with patient outcomes (n = 70)**

Variables	Parameters	Recovered n(%)	Mortality n(%)	Unknow n(%)	Total n(%)	p-value* 95% CI
AVPU Disability Scale	Alert	55(78.57%)	1(1.42%)	12(17.14%)	68(97.14%)	p<0.001
	V/P/U	0	2(2.85%)	0	2(2.85%)	
Glasgow Coma Scale (GCS)	<9	1(1.42%)	2(2.85%)	0	3(4.28%)	p<0.001
	9-12	7(10%)	0	0	7(10%)	
	13-15	47(67.14%)	1(1.42%)	12(17.14%)	60(85.71%)	
Total (n=70)		55(78.57%)	3(4.28%)	12(17.14%)		

(Chi-square assumptions not met due to small cell counts)

87.1%), and the majority presented during daytime hours (62, 88.6%). Intentional ingestion with suicidal intent accounted for 59 (84.3%) cases, while accidental exposures accounted for 11 (15.7%). Phenyl was the most frequently involved substance (46, 65.7%), followed by hydrochloric acid-based toilet cleaners (10, 14.3%) and kerosene or related hydrocarbons (9, 12.9%). Other household agents accounted for the remaining cases. The most common presenting symptoms were abdominal pain (32, 45.7%), nausea and vomiting (11, 15.7%), burning sensation of the mouth and throat (12, 17.1%), respiratory distress (4, 5.7%), and altered sensorium (2, 2.9%).

Table 1 presents the distribution of demographic and exposure-related variables in relation to patient outcomes. Several categories contained small cell counts (including zero), and therefore the assumptions for chi-square tests (minimum expected cell count ≥5 in at least 80% of cells) were not consistently met. As such, p-values derived from chi-square calculations should be interpreted cautiously,

and Fisher's exact test would have been more appropriate for these small cell sizes.

Clinical variables were also examined. Abnormal heart rate, respiratory rate, hypotension, low GCS, altered mental status, and hypoxia appeared more frequently among cases with poor outcomes. Table 2 summarizes the distribution of these clinical parameters and their relationship to outcomes. As in Table 1, several cells contained sparse data, so chi-square assumptions were not met. Thus, any reported p-values are descriptive and should not be considered robust indicators of statistical significance.

Neurological findings indicated that most patients (60, 85.7%) presented with a GCS score of 13–15, and the majority (68, 97.1%) was alert on the AVPU scale. Only a small proportion presented with significant neurological depression. Table 3 provides the distribution of neurological variables across outcome groups. Again, several categories had very small counts; therefore, chi-square assumptions were not met.

Overall management patterns showed that gastric lavage was performed in only 3 (4.3%) cases. Most patients (53, 75.7%) arrived within 4 hours of exposure, and 66 (94.3%) presented within 8 hours, indicating relatively early access to care. The majority of cases were treated with supportive measures alone, including intravenous fluids, proton pump inhibitors, and oxygen therapy where indicated. Full recovery without complications occurred in 55 (78.6%) patients. Outcomes were unknown in 12 (17.1%) cases due to discharge on request, referral, absconding, or leaving against medical advice. Complications like aspiration pneumonitis, electrolyte imbalance, and renal dysfunction occurred in 5 (7.1%) cases, and there were 3 (4.3%) fatalities, resulting in an overall case-fatality rate of 4.3%.

## DISCUSSION

This study highlights the toxico-clinical profile of patients presenting with household product poisoning at a tertiary care hospital in Eastern Nepal. Although household substances are often perceived as harmless, they can cause significant morbidity and even mortality when misused or ingested intentionally. Similar observations have been noted in studies by Karunakaran et al.<sup>4</sup> and Tangiisuran et al.,<sup>5</sup> reinforcing the public health importance of this issue.

Young adults (15–30 years) constituted the most affected age group, consistent with findings from Eizadi-Mood et al., Chauhan et al., Azarbaksh et al., and Swain et al.<sup>3,6-8</sup> This demographic may be more vulnerable due to psychosocial stress, impulsive behavior, or intentional self-harm. In contrast, studies from Presgrave et al., Peshin et al., Rameshkumar et al., Singh et al., Ahmed et al., and Gupta SK et al.<sup>9-14</sup> reported higher poisoning rates among children, reflecting unintentional exposures from unsafe storage and inadequate supervision. These differences highlight the need for age-specific preventive strategies tailored to local contexts.

Females made up most cases (67.1%), aligning with results from Presgrave et al.<sup>9</sup> but differing from several other studies where males predominated.<sup>3,10,11,14</sup> This pattern may reflect gender-specific vulnerabilities, psychosocial burdens, or greater access to household chemicals in domestic settings. The high proportion of suicidal ingestion further stresses the rising mental health burden and the need for integrated psychosocial and psychiatric support services.

Intentional poisoning accounted for 84.3% of cases, markedly higher than unintentional exposures (15.7%). This contrast with earlier studies where accidental poisoning was more common.<sup>3,7,10,14</sup> Such variation may stem from differences in mental health awareness, access to toxic agents, and socio-cultural influences on self-harm behavior.

Most poisoning events (87.1%) occurred at home, and all involved oral ingestion. This underscores the domestic environment as a high-risk setting due to easy availability, improper storage, and inadequate labeling of hazardous

products. These findings are consistent with multiple national and international studies, emphasizing the need for robust community education on safe household chemical practices.<sup>3,9,10,14</sup>

Phenyl, acids, kerosene, toilet cleaners, bleach, and disinfectants were the most common poisoning agents. Their widespread use and lack of regulated packaging contribute to the high risk. Although specific substances differ across regions—such as kerosene in some Indian studies, sodium hypochlorite in Iran, or bleach in Latin America—the shared trend is that common household chemicals can cause serious harm when misused.<sup>3,6,9,11,13-17</sup> Regulatory improvements and public awareness are essential to reduce preventable exposures.

Most patients (75.7%) sought care within four hours of exposure, indicating prompt healthcare-seeking behavior, similar to the findings of Presgrave et al.<sup>9</sup> Some studies, such as Halesh MB, reported even earlier presentations.<sup>18</sup> Early care access is critical, as most household toxins have no specific antidote, and outcomes depend heavily on timely supportive management.

Common symptoms included nausea, vomiting, oral burns, abdominal pain, and in severe cases, respiratory distress or altered consciousness. These manifestations reflect the corrosive and irritant nature of many household agents. Although complications were relatively uncommon (7.1%), the presence of corrosive injuries and a mortality rate of 4.3% demonstrate the potentially life-threatening nature of these exposures.

Patterns of household poisoning across Nepal and South Asia share similarities, but outcomes differ based on cultural practices, chemical access, and healthcare quality.<sup>12,14,15,19-21</sup> This study contributes valuable data from Eastern Nepal and highlights the need for preventive strategies, regulatory oversight, and mental health interventions.

Several factors showed significant associations with mortality. Acid ingestion was particularly lethal. Although suicidal attempts were more frequent, accidental exposures had a higher death rate, suggesting greater severity in unintentional cases. Abnormal vital signs—including tachycardia, abnormal respiratory rates, hypotension—as well as low GCS, altered AVPU status, and hypoxia were strong predictors of mortality. In contrast, body temperature did not correlate with outcomes. These findings emphasize the importance of early recognition of clinical warning signs and rapid stabilization. Establishing poison information centers would greatly support clinicians and reduce preventable deaths.

In summary, this study highlights that household product poisoning is a significant yet under-recognized public health concern in Eastern Nepal, predominantly affecting young adults and females, with most cases linked to intentional ingestion of readily available domestic chemicals. Early presentation and prompt supportive care contributed to

favorable outcomes, underscoring the need for community awareness, safer storage, clearer labeling, and improved mental health services.

This study has limitations. The lack of psychiatric assessment limits insight into psychosocial drivers of poisoning and may confound associations involving intent. Absence of toxicological confirmation introduces potential misclassification of substances, which may affect observed links between specific agents and mortality. The use of no standardized severity score (e.g., PSS) restricts objective comparison of clinical severity and may influence interpretation of mortality predictors, as abnormal vital signs or altered consciousness could simply reflect greater initial toxicity.

These limitations may contribute to residual confounding; thus, causal interpretations should be made cautiously. Future research incorporating psychiatric evaluation, laboratory confirmation, and standardized severity scoring would strengthen prognostic accuracy and guide more targeted prevention and management strategies.

## CONCLUSION

This study shows that household product poisoning mainly affects young adult females, with intentional ingestion as the leading cause. Most events occurred at home during daytime and involved phenyl, toilet cleaners, or kerosene. Early presentation with mild to moderate symptoms and preserved consciousness enabled effective supportive care, though a small number of patients developed severe complications or died. Interpretation should consider unmeasured confounders such as psychiatric factors, lack of toxicology confirmation, and absence of standardized severity scoring. These findings highlight the need for safer storage practices, stronger regulatory oversight, and improved mental health support. Larger, multi-center studies are warranted to validate these results and inform national prevention strategies.

## DECLARATIONS

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### Conflict of Interest

None

### Funding

None

### Ethical Clearance

Obtained from IRC of Nobel Medical College Teaching Hospital, Biratnagar(ref: IRC-NMCTH 235/2018).

### Consent of Publication from Authors

Formal written consent for publication was obtained from the patient.

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