Mortality rate and Its predictors among acutely poisoned patients admitted to North Shewa Zone public hospitals, Oromia Regional State, Ethiopia

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ABSTRACT

Background: Exposure to poison is a severe and life-threatening condition. However, there is insufficient evidence on mortality due to exposure to poison and factors associated. Thus, this study was aimed to determine the mortality rate and contributing factors among patients who have been acutely poisoned at hospitals in the North Shewa Zone, Oromia Regional State of Ethiopia.

Methods: An institutional-based retrospective cross-sectional study was conducted among 260 acutely poisoned patients who admitted to North Shewa Zone public hospitals for acute poison treatment from January 1, 2020, to April 30, 2024. The participants were selected by simple random sampling technique. The data was collected from medical records of the patients. The collected data were entered into Epi Data version 4.6 and analyzed by SPSS version 26. Logistic regression model was used to assess the factors associated with mortality due to acute poisoning. Statistical significance was set at p-value < 0.05.

Results: A total of 268 patient medical records were reviewed, and 260 (97.1%) had complete information, and enrolled to this study analysis. The mortality due to acute poising was 16.2% (95% CI: 11.9–20.8). Living in a rural area [AOR = 2.2, 95% CI 2.5–6.3], being poisoned on purpose [AOR = 3.2; 95% CI: 2.5–11.2], being unconscious upon hospital admission [AOR = 6.1, 95% CI: 8.3–17.2] and arriving at the hospital more than two hours after poisoning [AOR = 8.8, 95% CI: 8.3–14.2] were significantly associated with mortality due to acute poisoning.

Conclusion: Mortality rate related to acute poisoning in this study was comparable with previous reports. Interventions that targeted rural resident, intentionally poisoned individuals, unconscious patients upon hospital admission, and delayed hospital arrival (>2 hours) are required to reduce mortality rate due to acute poisoning.

Keywords: Acute poisoning, Mortality, Suicide attempt, Mental health

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BACKGROUND

Poison is any substance that is harmful to the body when it is ingested, inhaled, injected, or absorbed through the skin (1). The global markets are saturated with a multitude of toxic industrial substances and licensed pharmaceuticals. There are also approximately 730 new psychoactive substances, 1200 venomous animal species, 2000 toxic plant species, and countless cosmetics and household and industrial products on the market (1,2). Consumption of these substances and products

by humans may result in illness or even be fatal. Immediate effects of acute poisoning are typically seen within hours of exposure to a toxic substance (3). Poisoning can occur intentionally or accidentally as occupational and environmental exposure (4).

Types of poisoning substances differ geographically, with therapeutic medicines, pesticides, and alcohol being the most frequently consumed toxic substances in developed regions, (5,6), whereas pesticides and household cleaning products are commonly used as poisons in developing countries (3,7). Organophosphate (pesticide) is the predominant agent of acute poisoning in Ethiopia (3,8,9).

Globally, acute poisoning poses a substantial public health concern, with unintended poisonings alone resulting in approximately 193,000 death each year (10). The majority of these fatalities due to chemical exposures could have been prevented, highlighting requirement for enhanced safety protocols and increased awareness (16). Besides claiming numerous lives, unintentional acute poisoning caused a substantial loss of 3.5 million disability-adjusted life years (DALYS), highlighting severe and long-lasting impacts on both short-term and long-term health of individuals and communities (16).

In Sub-Saharan Africa (SSA), the prevalence of acute poisoning in emergency departments ranges from 0.6% to 1.7%. (7,8,12,13). Death rates from acute poisoning vary across different regions in Ethiopia, with rates of 10.2% reported in Addis Ababa (7), 7.10% in Wollega (15), 16.7% in Dire Dawa (9), and 27.6% in Metu (16). The varying levels of poisoning in the region highlight the importance of implementing targeted solutions, which may be frequently overlooked or inadequately handled.

The outcomes of patients who have experienced acute poisoning in hospitals are highly influenced by various factors, such as age, (8,14,17), sex(8), place of residence (15), method of ingestion (9,17), delayed hospital admission (14), referrals from other healthcare facilities (18), the type of poisoning (9,17,18), the development of liver failure (14), the requirement for mechanical ventilation (14), and the duration of hospitalization (8).

Numerous previous studies (4,7,9,15,19–21) have investigated the prevalence, patterns, and predictors of acute poisoning. Only a few studies have looked into the treatment outcomes for patients who have been poisoned acutely in Ethiopia (9,22). As a result, this current study specifically examines treatment outcomes and associated factors, offering vital data to enhance patient care.

METHODS

Study area, period and design

A retrospective cross-sectional study design was conducted, among acutely poisoned patients who were admitted to three public hospitals (Salale University Comprehensive Specialized Hospital, Kuyu General Hospital, and Muka Turi Primary Hospital) between 1 January 2020 and 30 April 2024. The zone comprises a total of 21 districts, with a total of 1,639,587 residents. The zone has 6 hospitals, 63 health facilities and 267 health post. From January 1, 2020, to April 31, 2024, a total of 280 acutely poisoned individuals were admitted to public hospitals in the North Shewa and data was collected from March 01 to April 01, 2024.

Study population and sampling

The source population consisted of all patients who had been acutely poisoned and had visited public hospitals within the North Shewa. The study population comprised of all randomly selected individuals who had been acutely poisoned and were admitted to specific public hospitals between January 1, 2020, and April 30, 2024. All acutely poisoned patients who were admitted during this period were involved in the study, while patients with partially complete or missing medical records were excluded. In estimating sample size, the proportion of death related to acute poisoning (27.6%) derived from a previous study in Ethiopia (16), an estimated precision of 5%, and a 10% non-response rate were considered. Finally, 268 patient medical record were determined to be eligible for enrollment.

The determined sample size (268) was distributed proportionally to each hospital

(Salale University Comprehensive Specialized Hospital, Kuyyu General Hospital, and MukaTuri Primary Hospital) based on the number of medical records identified with acute poisoning in the hospitals over the preceding four years. A simple random sampling technique was used to select the required number of medical records from each hospital, using the list of all poisoning cases as a sampling frame.

Data collection procedure

Data on sex, age, residence, route of poisoning, type of poisoning, clinical presentations, status of patients when coming to the hospital, reason for taking the poison, time of arrival to the emergency unit of the hospital, source of poisoning agents, length of hospital stay, treatment given for the acute poisoning, and treatment outcome was collected using data abstraction checklist adapted from previous study (7,9,23,24). The medical records of acutely poisoned patients were captured by taking medical records from the registration manual of the inpatient department (IPD) and Emergency Department (ED). Trained health professionals were collected the data, under the supervision of senior nurse.

Data quality control

To ensure the quality of the data, the data collection checklist was pretested at Adama General Hospital on 5% of the participants in the total sample. The pretest was conducted on randomly selected medical records of acutely poisoned patients to ensure the agreement of the data abstraction format with the objective of the study. Any errors found during the pre-test were corrected, and modifications were made to the final version of the data abstraction checklist. The data collectors had trained before the process of data collection. The data collection process was supervised to ensure the completeness and consistency of the data. All collected data were examined for completeness and consistency during data management, storage, and analysis.

Data processing and analysis

The collected data were entered into EpiData statistical software, version 4.6, and then exported to SPSS, version 26, for analysis. Frequencies, percentages, means with standard deviations, and medians with inter-quartile ranges were computed using descriptive statistics. A logistic regression analysis was conducted to identify the variables associated to mortality resulting from acute poisoning. Variables with a P value less than 0.25 from the bivariate analysis were incorporated into the multivariate logistic regression model using a stepwise approach. A variance inflation factor (VIF) was used to detect multi-collinearity, showing a value of less than 5. The fit of the model was evaluated using the Hosmer and Lemeshow goodness-of-fit test. The outcomes of the associations are reported as adjusted odds ratios (AORs) along with 95% confidence intervals (CL). A p value of less than 0.05 was taken to indicate statistical significance.

RESULTS

Socio-demographic characteristics

Table 1: depicts socio-demographic characteristics of the patient. A total of 268 poisoned patient medical records were retrospectively reviewed. Of these, 260 (97.1%) had complete information. The majority, 197 (75.8%) participants were females, with 174 (66.9%) aged between 19–34 years. Approximately a quarter (24.6%) of the patients lacked formal education, with 158 (60.8%) of the patient reside in rural catchment.

Table 1: Socio-demographic characteristics of patients with acute poisoning at North Shewa Public hospitals, Oromia Region, Ethiopia, 2024 (n=260)

Variables	Categories	Frequency	Percent
Sex	Male	63	24.2
	Female	197	75.8
Residence	Urban	102	39.2
	Rural	158	60.8
Age	< 19	44	16.9
	19-34	174	66.9
	>35	42	16.2
Education level	Illiterate	64	24.6
	Primary school	86	33.1
	Secondary school	96	36.9
	College and above	14	5.4
Marital status	Single	109	41.9
	Married	107	41.2
	Divorced	29	11.2
	Widowed	15	5.8
Occupation	Maid/Servant	44	16.9
	Housewife	70	26.9
	Merchant	12	4.6
	Farmer	46	17.7
	Laborer	65	25.0
	Student	23	8.8
Living condition	Alone in the house	44	16.9
	Alone on the street	15	5.8
	With family/friends	201	77.3
History of psychiatric disorder	Yes	17	6.5
	No	243	93.5
Previous history of suicide attempt	Yes	60	23.1
	No	177	68.1
	Unknown	23	8.8

Poison-related characteristics

Of the poisoning incidents, 176 (67.7%) were unintentional. Most poisonings occurred at home 173 (66.5%), followed by unidentified sites 67(25.8%). Ingestion accounted for 218 (83.8%) of the poisoning cases, making it the most frequent route. Regarding the source of poisoning, 108 (33.8%) involved household items, whereas 105 (40.4%) patient involved medications purchased from pharmacies. The majority of patients 196 (75.4%) did not receive any home remedies, and 152 (58.5%) poisoning incidents happened at night. Table 2 depicts poison related characteristics of the clients.

Table 2: Poison-related characteristics of patients admitted to North Shewa Zone public hospitals, Oromia Region, Ethiopia, 2024 (n=260).

Variables	Categories	Frequency (n)	Percent (%)
Manner of poisoning	Unintentional	176	67.7
	Intentional	84	32.3
Place of poisoning	Home	173	66.5
	Hotel	20	7.7
	Unknown	67	25.8
Route of poisoning	Ingestion	218	83.8
	Direct contact	10	3.8
	Inhalation	13	5.0
	Injection	19	7.3
Source of poison	Household materials	88	33.8
	Shop	67	25.8
	Pharmacy	105	40.4
Time of poisoning	Day time	108	41.5
	Night time	152	58.5
Home based remedies	Attempted	64	24.6
	Not attempted	196	75.4

Mode of hospital arrival	People shoulder	156	60.0
	Public transport	61	23.5
	Public ambulance	43	16.5
Frequency of exposure to toxins	One	172	66.2
	Two	49	18.8
	Three	30	11.5
	Four and above	9	3.5

Reasons for poisoning

Among the reported reasons for poisoning, 44 (16.9%) were attributed to mental health issues, and 60 (23.1%) were linked to marital disharmony, while a significant 66 (25.4%) had unknown causes (Fig 1).

Types of poisoning agents and treatment practices

Pesticide poisoning accounted for 161 (61.9%) of the poisoning cases, making it the most prevalent poisoning agent. Organophosphate 77 (47.8%) and herbicides 64 (39.8%) were the most common sub-types of pesticide poisoning. Of the 75 (28.8%) cases of household poisoning, the most common sub-types were kerosene oil poisoning 16 (21.3%) and alcohol poisoning 33 (44.0%). Gastric lavage 101(38.8%), fluid resuscitation 89 (34.2%), and anti-emetics 17(8.5%) were the most often used treatments, with antidotes being used in only 10 (3.8%) of the patients (Table 3).

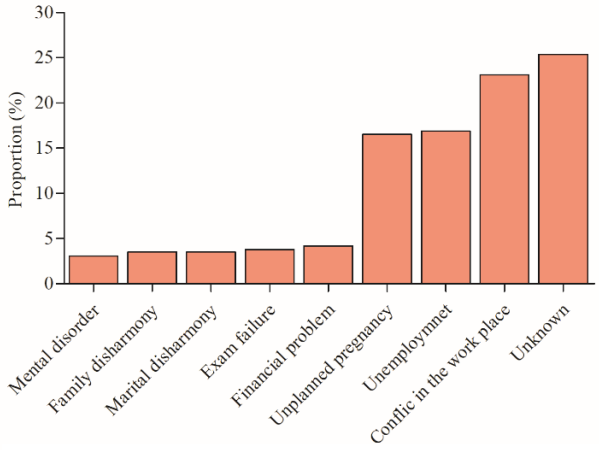

Figure 1: Justified reasons for poisoning among patients admitted to North Shewa Zone public health facilities, Oromia Region, Ethiopia, 2024.

Table 3: Type of poisoning and treatment administered to patients admitted to North Shewa Zone public hospitals in Oromia Regional State, Ethiopia, 2024.

Categories		Frequency (n)	Percent (%)
Pesticides poisoning	Organophosphate	77	47.8
	Rat Poisoning	20	12.4
	Herbicides	64	39.8
Household things Poisoning	Kerosene oil	16	21.3
	Food poisoning	10	13.3
	Carbon monoxide	16	21.3
	Alcohol	33	44.0
Drug poisoning	Analgesic	16	66.7
	Anti-retro viral therapy	8	33.3
Treatment given	Gastric lavage	101	38.8
	Antidotes	10	3.8
	Proton pump inhibitors	22	8.5
	Anti-emetics	17	6.5
	Fluid Resuscitation	89	34.2
	Mechanical ventilation	21	8.10

Clinical characteristics of acutely poisoned patient

Vomiting 62 (23.8%), respiratory distress 51 (19.6%), and seizures 29 (11.2%) were the most frequent clinical symptoms the patient presented with. About half of the patients, 146 (56.2%), were admitted to the hospital within two hours of the poisoning event, and 153 (58.8%) were discharged within forty-eight

hours of their admission. The majority of patients 174 (66.9%) were conscious upon arrival and did not develop complications (Table 4).

Table 4: Clinical symptoms related to acute poisoning among patients who were admitted to North Shewa Zone public hospitals, Oromia Regional State, Ethiopia, 2024.

Clinical symptoms	Category	Frequency	%
Clinical presentation	Vomiting	62	23.8
	Respiratory distress	51	19.6
	Seizures	29	11.2
	Excessive salivation	15	5.8
	Altered sensorium	18	6.9
	Headache	20	7.7
	Fever	13	5.0
	Restless/agitation	22	8.5
	Diarrhoea	30	11.5
Time of arrival	≤ 2 hours	146	56.2
	> 2 hours	114	43.8
Hospital stay duration	≤ 48 hours	153	58.8
	> 48 hours	107	41.2
Status upon arrival	Conscious	174	66.9
	Unconscious	86	33.10
Complication	Developed	86	33.10
	Not developed	174	66.9

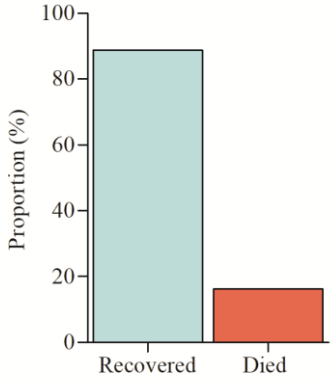

Figure 2: Mortality related to acute poisoning in North Shewa Zone public hospitals, Oromia Regional State, Ethiopia, 2024.

Magnitude of mortality related to acute poisoning

The study indicated that mortality related to acute poisoning was determined to be 16.2% CI: (11.90-20.80) (Fig 2).

Predictors of acute poisoning-related mortality among acute poisoned patients

Bivariate and multi-variable logistic regression analyses were used to determine the factors associated with mortality related to acute poisoning. Variables exhibiting a p-value lower than 0. 25 in the bivariate analysis include: age, educational attainment, living in a rural area, intentional poisoning, having attempted any home remedy, poisoning occurring during night time, having a time of arrival greater than 2 hours, and being unconscious, all identified as predictors of mortality related to acute poisoning.

After controlling for potential con-founders, residing in a rural area [AOR = 2. 2; 95% CI 2. 53-6. 31], intentional poisoning [AOR = 3. 2; 95% CI: 2. 53-11. 22], being in an unconscious state [AOR = 6. 1; 95% CI: 8. 33-17. 24], and having a time of arrival greater than 2 hours [AOR = 8. 8; 95% CI: 8. 34-14. 2] were identified as predictors of mortality from acute poisoning (Table 5).

Table 5: Independent predictors for acute poisoning related mortality among patients admitted to North Shewa Zone public hospitals, Oromia Regional State, Ethiopia, 2024.

Variables		Acute Poisoning		COR (95% CI)	AOR (95% CI)	P– value
		Improved	Death			
Residence	Urban	92(42.2)	10(23.8)	1	1	
	Rural	126(57.8)	32(76.2)	2.3(1.1-4.9)	2.2(2.5-6.3)	0.001
Age	< 19	44(20.2)	8(19.0)	1	1	
	19-34	132(60.6)	24(57.1)	2.2(1.2-5.1)	1.81(0.81-5.1)	0.250
	>35	42(19.3)	10(23.8)	1.8(1.9-8.2)	0.81(0.91-5.3)	0.570
Education level	Illiterate	64(29.35)	10(23.80)	1	1	
	Primary	44(20.18)	18(42.85)	1.31(1.1-4.9)	0.4(0.21-5.5)	0.250
	Secondary	96(44.03)	7(16.66)	0.71(0.41-1.5)	0.3(0.74-7.13)	0.780
	College and above	14(6.42)	7(16.66)	3.5(1.8-6.9)	0.6(0.82-6.3)	0.580

Poisoning Time	Day time	88(40.4)	20(47.6)	1	1	
	Night time	130(49.6)	22(52.4)	0.71(0.41-1.5)	0.4(0.21-5.5)	0.230
Home remedy	Yes	43(19.7)	12(28.6)	1	1	
	No	175(80.3)	30(71.4)	0.6(0.82-6.3)	0.3(0.74-7.1)	0.250
Poisoning manner	Accidental	158(72.5)	18(42.9)	1	1	
	Intentional	60(27.5)	24(57.1)	3.5(1.8-6.9)	3.2(2.5-11.2)	0.001
Time of arrival to facility	≤ 2 hours	151(69.3)	5(11.9)	1	1	
	> 2 hours	67(30.7)	37(88.1)	16.7(6.3-14.3)	8.8(8.3-14.2)	0.001
Patient status on admission	Conscious	174(79.8)	10(23.8)	1	1	
	Unconscious	44(20.2)	32(76.2)	12.7(5.8-18.2)	6.1(8.3-17.2)	0.002

COR; Crude Odds Ration, AOR; Adjusted Odds Ration

DISCUSSION

This study sought to establish the extent of mortality related to acute poisoning and the associated factors in patients suffering from acute poisoning. The acute poisoning-related mortality rate in this study was found to be 16.20%. Factors such as residing in a rural area, intentional poisoning, being unconscious upon arrival at the hospital, and an arrival time of more than 2 hours were identified as predictors of death from acute poisoning.

The acute poisoning-related mortality rate of 16.20% (95% CI: 11.9-20.8) reported in this study aligns with findings from studies conducted in Eastern Ethiopia (16. 7%) (9), Western Amhara (18% (26), Northwest Ethiopia (17.6%) (27) and Debre Tabor (18.6%) (23). This result also corresponds to studies performed in Turkey (14.6%) (28), India (15%) (18) and Eastern Nepal (16.6%) (14). However, this result is notably higher than the rates observed in earlier studies carried out in Addis Ababa (10.2%) (7), Dessie (6.6%) (19), and Wollega (7.10%) (15). This could be attributed to the variations in healthcare systems across areas, especially in the North Shewa Zone, where restricted access to emergency medical services, insufficient facilities, and a lack of skilled healthcare providers may impede prompt and efficient care for individuals with poisoning. Similarly, the results were greater than the findings reported from countries such as Norway (2%) (17), China (6.7%) (5) and East India (8.4%) (29). The variation might be linked to differences in the types of healthcare available, as this nation had sophisticated healthcare system with better emergency response and treatment protocols.

Acutely poisoned patients living in rural area had a two times greater likelihood of dying than those in urban settings. This is consistent with results from research carried out in Addis Ababa, Eastern Ethiopia, Dessie, Metu Karl Referral Hospital, and West Ethiopia (7,9,16,19,30). This trend is also observed in other studies conducted, in Norway (2%) (17), China (6.7%) (5) and East India (8.4%) (29). This may be explained by the fact that the higher prevalence of some poisons, particularly pesticides, due to farming activity, along with the delay in rural inhabitants seeking medical service right after the poisoning might result in greater mortality rates compared to urban dwellers (31).

Intentionally poisoned patients had approximately 3.2 times higher chance of dying compared to those who were poisoned by accident. Comparable results were noted from Addis Ababa, Ambo, Western Ethiopia, Harar, Eastern Ethiopia, China, India, Turkey, and Qatar (5,7,9,22,28,29,32). This might be due to the reason that people who deliberately harm themselves with poison might ingest large amount and more dangerous substance that can lead to severe poisoning, raising the chances of fatality.

Arriving at the hospital more than 2 hours after poisoning heightens the risk of death in comparison to arriving within 2 hours or less. The findings of this research were consistent with finding from Harar, Eastern Ethiopia, Ambo, Western Ethiopia, Gondar, Northwest Ethiopia, Northeast India, and Eastern Nepal (9,14,22,27,29). The reason could be that a longer delay following the poisoning event may result in the loss of a critical window period

during which timely medical intervention can effectively mitigate the toxic effects, thus complicating the treatment.

Being in an unconscious state upon hospital arrival could increase the chance of dying from poisoning compared to those who were conscious. Similar results were reported from studies conducted in Northwest Ethiopia, Addis Ababa, Eastern Ethiopia, Dessie, Metu Karl Referral Hospital, and Western Ethiopia (7,9,16,19,27,30). A possible explanation could be that-being in an unconscious state signifies serious poisoning and greater disruption of the central nervous system caused by toxins, indicating that vital functions have been significantly compromised.

Limitations of the study

The retrospective nature of the study limits the use of some variables, to determine the severity of the cases as a determinant of the treatment outcome of poisoning. Thus, the study was limited to only the variables obtained from the records. This means that the determinant factors of mortality related to poisoning are not limited to factors included in this study.

CONCLUSION

The findings of this study highlight a significant concern regarding acute poisoning-related mortality, particularly among populations. Death related to acute poisoning in this study was found to be substantial. Rural residence, intentionally poisoning oneself, being unconscious upon hospital admission, and delayed hospital arrival greater than two hours were identified as predictors of death related to acute poisoning. It is essential to set up and enhance ambulance services in rural area to guarantee prompt transportation of patients to healthcare facilities were crucial. Furthermore, implementing standardized procedures in emergency departments for treating unconscious patients who arrive after suspected poisoning can improve the level of care and may lower mortality rates.

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Declarations

Ethical consideration

An ethical clearance letter was obtained from Salale University Institutional Research Ethics Review Committee with reference number IRB/978/16, and was given to the administration office of the selected public hospitals. And, in turn, the permission letter was obtained from the administration office. The medical directors of the hospitals were informed that the information obtained from medical records was kept completely confidential. Information that could reveal the identity of the patients was not collected. The collected data were deanonymized and stored on a password-protected computer.

Consent for publication: Not applicable

Availability of data: The raw data supporting the conclusions of this article will be made available by the corresponding author, without restriction.

Competing interests

The author declares that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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Author contributions

SA and DH were involved in the generating the study, writing of the proposal, participated in the coordination of the study, analyzed the data, and drafted and draft the manuscript. HHT and ESM assisted with the study protocol development, data analysis and data interpretation and critically reviewed the manuscript.

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