
# Clinical outcomes of acute poisoning among hospitalized patients/ emergency room at Northern Ethiopia: Prospective Observational Study

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This is to certify that the thesis prepared by Habte Dejene, entitled: "**Clinical outcomes of acute poisoning among hospitalized patients/ emergency room at Northern Ethiopia: Prospective Observational Study**" and submitted in partial fulfillment of the requirements for the Degree of Master of Pharmacy in Pharmacy Practice complies with the regulations of the University and meets the accepted standards concerning originality and quality.

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## Abstract

**Background:** In developed countries mortality rate from poisoning is 1-2% whereas about 17% of hospital admissions are due to acute poisoning in Sub-Saharan Africa. In Ethiopia, studies indicate variable mortality rate across the regions and shows an increasing trend.

**Objective**: To assess clinical outcomes of acute poisoning among hospitalized patients/ emergency room at Northern Ethiopia.

**Method**: Health facility-based prospective observational study was conducted from September 20, 2022 to March 10, 2023 among patients admitted with acute poisoning at Kuyu, Fitche, Dera and Muka Turi Hospitals. A convenient sampling method was employed to identify participants. The data were analyzed by Statistical Package for the Social Sciences (SPSS) version 25. Linear and Cox regression were performed to identify predictors of length of hospital stay and mortality or complication, respectively. Then statistical significance was declared at p-value <0.05.

**Result:** Of 208 (58.2% female) victims, the majority 125 (60.1%) of them were urban residents. The mean (SD) age of the victims was 27.11 ± 14.20 years while the prevalence rate of acute poisoning was 13.6%. Among the victims, 49 (23.6%) have mixed clinical presentations involving gastro intestinal tract and central nervous system. In hospital complication was developed among 71(34.1%) of victims while the fatality rate of poisoning was 39(18.75%). The hazard of mortality was increased by 11.66 among victims exposed to rodenticide (AHR=11.665; 95% CI: 1.372, 99.164) as compared to alcohol. Length of hospital stay (LOS) is reduced by 1.67 times for victims arrived hospital before 2 hours (β = -1.67; 95%CI: -2.98, -0.396).Similarly, patients who did not develop in hospital complication had 12.8 times shorter LOS (β= -12.818; 95%CI: -23. 807,-1.828).Moreover, the hazard of in hospital complication was increased by 11.64 times among victims suffered with carbon monoxide poisoning (AHR=11.642; 95%CI: 1.238, 109.515).

**Conclusion**: This study found that significant clinical outcomes were observed. These impacts were related mainly with poisoning agents such as rodenticide, aluminum phosphate and carbon monoxide. Thus, hospitals should have to assure with caution among health professionals and community on the impacts posed by these fatal chemicals.

**Keywords:** Acute Poisoning, Clinical feature, outcomes, Northern Ethiopia.

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## Abbreviations and Acronyms

AaBET----------Addis Ababa Burn, Emergency and Trauma

AAU----------Addis Ababa University

AAPCC----------American Association of poison control centers

CVD----------Cardiovascular Disorder

CNS ----------Central Nervous System

ED----------Emergency Department

ERC----------Ethical review committee

GIT----------Gastro Intestinal System

ICU---------- ----Intensive Care Unit

IQR ----------Inter Quartile Range

JUSH ----------Jimma University Specialized Hospital

RS----------Respiratory System

SPHMMC ----------Saint Paul's Hospital Millennium Medical College

SOB ----------Shortness of breathing

SD ----------Standard Deviation

SPSS----------Statistical Package for the Social Sciences

TASH ----------Tikur Anbessa Specialized Hospital

2, 4-D ----------Dichloride Phenoxy Acetic Acid

WHO ----------World Health Organization

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# 1. Introduction

## 1.1. Background

Poisoning is either functional disturbance or damage to the body after exposed to any substance or chemicals [1]. The time between exposure , the resulting toxicity or effects determine if an exposure is acute or chronic poisoning [2]. Moreover, the amount of exposed substance is also vital while defining the poison [3].

Acute poisoning frequently results in visits to emergency rooms and causes more than 1 million illnesses annually throughout the world [3,4]. However, since the majority of poisoning cases on the world were unreported, the actual incidences may be higher. According to American Association of poison control centers (AAPCC) in the United states, over 2.1 million human exposure calls are reported in 2016 [5]**.** The clinical features of the poisoning vary owing to different factors. A study found that common signs &complications due to acute poisoning were Cyanosis of the lips (100%),foaming at the mouth (50.8%) , pulmonary edema ( 88.4%) & aspiration pneumonia 10%,respiratory distress (77%),miosis (100%) [2,6]**.**

Morbidity and mortality due to poisoning appeared to be a public health issue in different areas [7]. The World Health Organization (WHO) reports that more than 563,000 deaths occur worldwide each year as a result of poisonings. The majority of poisoning-related deaths (84%) occur in developing countries [8]**.**

Evaluation of acute poisoning include case observation, identification of responsible agents and prediction of toxicity [2].The initial management involve cardio-respiratory stabilization, decontamination with activated charcoal, gastric lavage, administration of ipecac and poison-specific treatment with administration of antidotes. Atropine and pralidoxime chloride are the main antidote for poison like Organophosphate [9]. Management of acute poisoning with milk is not useful, despite a persistent traditional notion to this effect [10].

Although acute poisoning is well-documented in affluent nations, most developing nations failed to recognize the hazards and consequences that follow it; one rationale for this was the absence of epidemiological data on acute poisoning [8,11] and the same is true in Ethiopia.

## 1.2. Statement of the problem

Globally it is estimated that poisoning is responsible for more than one million cases annually [9,12]. The workload of 10% at ED and 20% in the medical department of the United Kingdom are related to intentional poisoning [11]. Study from Belgium also revealed that of the victims came with poisoning, 20.9% were hospitalized with average cost of 1,287 pound per admission [13].In developing countries self suicide by chemical poisoning is 15 times more than in developed countries and mortality rate due to acute poisoning is the second to road accidents [14].In Sub-Saharan countries, about 17% of the total patient hospital admission is due to acute poisoning [15].

The death rate due to poisoning is from 1% to 2% in developed nations, but it is fairly high in developing nations due to a lack of critical care services and time delays. [16]. Studies done in India revealed that mortality rate due to acute poisoning ranges from 15% to 18% [17].In Ethiopia, the mortality rates vary across the regions. It ranges from 1.5 % to 18.6 % and it shows an increasing trend [4,14,17,18].

Predictors of poisoning case like type of chemical agents and their effect vary considerably across the world. A study done in India showed among 224 (5.1%) patients died due to acute poisoning, the highest number of deaths (46.9% ) was due to organophosphate [17].In another from Ethiopia, among deaths associated with acute poisoning , 4(40%) of the cases were due to 2, 4-D (Dichloride Phenoxy Acetic Acid) ,implying the need of continuous surveillance on poisoning cases [19].

Other retrospective study done in Ethiopia revealed that independent predictors of poor treatment outcome of acute poisoning were age ≥35 years [p-value= 0.049], female gender [p-value= 0.027], and hospital stay longer than 48 hours [p-value= 0.035].

Though few epidemiological studies were done on acute poisoning in Ethiopia, the existing studies are of weak design. These retrospective studies reported the prevalence and mortality rate of acute poisoning but have limited information concerning length of hospital stay and in hospital complication.

Even the pattern and risks of poisoning are different with time and place of the same region, hence local data are needed [3,20].

Furthermore, prospective studies design were recommended to identify predictors of outcome due to acute poisoning [4,8,18].Therefore, this study is aimed to investigate the clinical features of patients presented with poisoning and their outcomes.

Interestingly, even if there is no data to substantiate it; investigators' observation from routine practice in Kuyu General Hospital showed that poisoning cases were common and its mortality rate seemed to be high. Considering these, the need for a study to describe the magnitude or severity of poisoning and identify related factors in the hospitals cannot be overemphasized.

Thus, this study assessed data on clinical characteristics and admission outcomes of patients hospitalized with acute poisoning at Northern Ethiopia**.**

## 1.3. Significance of the study

This study may reveal the severity of acute poisoning and related clinical effects.
Thus it is useful in identifying gaps and intervention areas linked to acute poisoning.
Moreover, the study may provide an input for further research with related topic.

# 2 Literature Review

## 2.1. Clinical characteristics

Acute poisoning is one of the causes for patients to visit emergency department (ED) of health facilities globally [18,21,22]. It may present with a wide array of clinical features and unspecified symptoms[22]. A prospective study design conducted at a tertiary hospital, in South Indian, among patient hospitalized with acute poisoning showed that gastrointestinal symptoms (181; 48.2%), followed by the central nervous system symptoms (72; 19.2%), and respiratory system were the common clinical presentations (69; 18.4%) [23].

A retrospective cross-sectional data done at the University Teaching Hospital, Zambia, showed that symptom of poisoning cases in ED ranges from asymptomatic patient to a comatose patient [14].

On the other hand, discoloration of the lips (n = 130, 100%), flow of urine (n =13, 10%), foaming (n = 66, 50.8%) and pulmonary edema in 88.4% of the cases were the commonly signs stated by retrospective study done at Farhat Hached University Hospital in Sousse, Tunisia [15].

Hospital-based cross-sectional study conducted in Western Ethiopia, among 211 patients admitted with acute poisoning, revealed clinical feature such as generalized abdominal pain (28.91%), unconsciousness (19.43%), and change in skin color (16.59%) [7].

Another retrospective study done in Jimma, Ethiopia, identify that of 103 patients the most signs and symptoms were Diarrhea and vomiting (49.5%) ,altered consciousness (16.5%) and epigastric pain (13.6%) [6].

## 2.2. Outcomes

### Mortality

A descriptive, retrospective design on acute poisoning done at the Jeddah, Saudi Arabia, showed that 11 (1.1%) patients died [24] . Another retrospective study done at tertiary care hospital in north India revealed that among 256 cases of acute poisoning, fatality rate was reported to be 12.8% [25]. Furthermore, the cross sectional study done in three African countries, fatality rate was 2.1% (1.4% in Uganda, 2.4% in South Africa and 2.6% in Botswana) [26]. Some cross sectional studies conducted at the Emergency wing of hospitals, Ethiopia, revealed that fatality rate of acute poisoning was range from 1.5%(2) to 18.6% (19) [3,4,17]**.**

### Length of hospital stay

A cross-sectional study conducted on 631 patients with poisoning at Azar Hospital, Iran, revealed the mean length of hospital stay was 4.21±3.45(3-9 days) [27].

Another cross-sectional study carried out at South valley University hospital in Egypt, showed that mean length of hospital stay was 3.51± 1.75 ( 2-10 ) days [9].A systematic review study conducted on acute poisoning in Ethiopia revealed LOS stay range from 1 -18 days [3].

### Complication

Changes in poisoning trends may result different outcomes in patients with acute poisoning [28]. Study has shown that exposure to pesticides can have a variety of long-term health impacts, including effects on the neurological system, respiratory system, endocrine system, and a variety of malignancies. [29].

A cross-sectional multicenter study done in Oslo shows that among 912 cases, complications developed in 30%; mainly respiratory depression (12%), prolonged QTC interval (6%) and hypotension (5%) while 0.8% patients died and 0.5% survived with permanent sequealae, mainly anoxic brain damage [28].

Hospital based multi-center study conducted in Sri Lanka also revealed that acute poisoning related complication such as aspiration pneumonia 20 (5.2%), acute hepatic injury 10(2.6%) and cardiac case 5(1.3%) were reported [30].

## 2.3 Predictors of outcome

### 2.3.1 Predictors of in hospital mortality

Different studies have shown the admission outcome of acute poisoning varies among the age group of the participants [3,4,31,32]. A prospective study done in southwest Taiwan revealed that among patients with acute poisoning, 63 fatalities (4.2%) occurred among age group over 61 years and it was one of the significant predictor for fatality[31].On the other hand, study done in India showed, among patients died due to acute poisoning, 66.7%(16) were in the age of 20-40 years. Another retrospective study done in Tunisia revealed that among 310(4.5%) cases who died with acute poisoning, most of the deaths (34%) were in the 21-30 years age group [15]. Patients aged ≥ 35 years was found to be one of the independent predictors of poor treatment outcome for acute poisoning, according to a cross-sectional study done at Ambo University in Ethiopia [p-value= 0.049] [4].

A cross-sectional study conducted on patients with acute poisoning admitted to the ICUs of Azar Hospital in Gorgan, Iran, report that 70 (11.1%) patients died and of these 78.6% were males [27].

A retrospective cross sectional study done in western of the country showed that female gender were factor of poor outcome of acute poisoning [4].

A cross sectional study done in Iran introduced aluminum phosphate as the main cause of death (44.3%) in the intensive care unit so that it accounted for about half of deaths. Similar study conducted at different period of the same area indicated that aluminum phosphate along with other pesticides was the main cause of death [28,33].A retrospective cross-sectional study done in India showed that among 224(5.1%) patients died due to acute poisoning, the highest number of deaths (46.9% ) was due to organophosphate [23].

Another retrospective study done in Kenya revealed that among the ICU cases admitted with acute poisoning, organophosphates was the main offending agent accounting for 51.5% (17/33).Moreover, 27.3% (9/33) of all ICU admissions died, Organophosphates accounted for 44.4% (4/9) [32].

The cross-sectional study conducted in AaBET(Addis Ababa Burn, Emergency and Trauma) Hospital, Ethiopia, revealed that among case fatalities due to acute poisoning, 4(40%) of the cases were died due to 2,4-dichlorophenoxyacetic (2, 4-D) poisoning[19].

A retrospective study conducted at a tertiary hospital in South India revealed that, of the patients who died from acute poisoning, 15 (22.7%) had visited the hospital's emergency room after 24 hours. [33].Another cross-sectional study done in South valley University hospital, Egypt, revealed the mean time from toxic exposure to hospital presentation was significantly higher in non survivors [9].

A retrospective study done in Ethiopia showed that individuals who were arrived at the hospital within 5 hours had good treatment outcomes and stayed for a short duration (≤48 hours) [4]. Delayed initiation of resuscitative measures, type of treatment given and availability of antidote are the possible contributing factor for the mortality rate. According to the data from Easter Nepal state that the need of vaso active drugs for refractory shock secondary to poisoning was the independent factor for determining mortality [34]. A retrospective study done at a tertiary hospital in South India showed that mortality rate is high among patient treated with atropine than pralidoxime ( 14.2% vs. 11.6%) [33].

Different methods were used in treatment of acute poisoning [4].Study done in Iran showed that pre hospital treatment of poisonings decrease severity and mortality [35] while systematic literature review done in German showed that treatment of acute poisoning with milk is not useful, despite traditionally used to this effect [10].The study done in Ethiopia revealed pre-hospital treatment at home with milk, water and different home remedies were used[3]but their importance were not analyzed further. When a poisoning is present for which an antidote is available and the anticipated therapeutic benefits outweigh the risk involved, antidote delivery is needed. According to a retrospective study conducted in Ethiopia, 66 (26.2%) patients were treated with supportive medications in addition to fluid resuscitation, 27 (10.7%) patients received only fluid resuscitation, and 18 (7.1%) patients received intra nasal oxygen, atropine, gastric lavage, supportive medications, and fluid resuscitation [2].Another retrospective study done at Debra-tabor hospital, Ethiopia, showed that mortality is low in patients who undergo gastric lavage compared to those who did not lavage (12.8% vs. 35%) [18].

### 2.3.2 Predictor of length of hospital stays (LOS) .

According to a prospective observational study conducted in Eastern Nepal, pulmonary problems such as increased secretion, pneumonia, and acute respiratory distress syndrome result in longer duration of stays in the intensive care unit (ICU). [34].A study done in London revealed that among 96 hospitalized victims due to acute poisoning, having pulmonary complications (11–17%), rhabdomyolysis (11%), and seizures (5.1–8%) lead to prolonged ICU and hospital stay [36].

A retrospective study of medical records at University hospital in Malatya, Turkey, showed that among 211 of poisoned patients stayed longer and admitted to the ICU, 51 (24.2%) were confused & 26 (12.3%) were unconscious at admission [37].

Length of hospital stay may also be affected by certain victim's socio-demographic. A retrospective study done at Cukurova University of Adana, Turkey, showed that the mean length of hospital stay was longer for males. The study also revealed that mean length of hospital stay was longer for patients older than 30 years[38].

Chemical agent responsible for acute poisoning may resulted with different admission outcomes. The cross-sectional study conducted in Birjand, Iran, revealed that the median length of hospital stay was higher in patients with pesticide poisoned [39].

Moreover, prospective study done in Nepal revealed that Patients with organophosphorous poisoning had a significantly longer duration of ICU stay [34].

### 2.3.3 Predictor of in hospital complication

The cross-sectional study conducted in the referral poisoning emergency center of the province, Iran, showed that patients with low level of consciousness underlying disease and abnormal respiration had greater risk of complications. Again this study revealed that patients with longer duration of hospitalization had greater risk of complications [35].

The study done in Norway revealed that the frequency of complications was highest with opioids (56%), tricycle antidepressants (54%) and cardiovascular drugs (50%), while the mean number of complications per admission was highest for tricycle antidepressants[28]. According to a prospective observational research conducted in Eastern Nepal, individuals with organophosphate poisoning frequently experience consequences such as increased secretion, pneumonia, and acute respiratory distress syndrome [34].

Moreover, duration of admission to hospital since poison ingested was also important factor for clinical course and outcome[4]. The hospital based multi-center study done in North Central province of Sri Lanka showed that delayed presentation to emergency unit following acute poisoning is associated with increased risk of complications [30].

# 3 Objective

## 3.1 General Objective

To assess clinical outcomes of patients hospitalized with acute poisoning at emergency room of Kuyu, Fitche, Dera and Muka Turi Hospitals from September 20, 2022 to March 10, 2023

## 3.2 Specific objective

- To describe admission outcomes of patients hospitalized with acute poisoning at northern Ethiopia from September 2022 to March 2023

-To identify predictors of outcomes among patients hospitalized with acute poisoning at northern Ethiopia from September 2022 to March 2023

# 4 Methodology

## 4.1 Study area and period.

This study was conducted at four hospitals; namely Kuyu General Hospital (KGH), Fitche General Hospital (FGH), Dera primary hospital (DH) and Muka Turi primary hospital (MTH) from September 20, 2022 to March 10, 2023. All hospitals are located in Selale zone, Northern part of Oromia region, Ethiopia. KGH is providing services for people living in 5 different wereda of Oromia and its neighboring areas including southern Amhara region. It mainly serves the rural population whose living is primarily based on agriculture. Around 150,000 patients are served annually at KGH. The hospital has 112 beds.FGH is the oldest hospital which is going to be changed into Selale University comprehensive hospital. It has been providing service to all people in Selale zone as it is found at the capital city of the zone (Fitche). More than 300,000 patients are served annually at FGH and it has 154 beds.

DH is providing services for people living in Dera wereda and its neighbor (southern Amhara region). Around 160,000 patients are served annually at DH and it has 97 beds.MTH mainly serves the rural population living primarily on agriculture and around 100,000 patients are served annually. It has 85 beds. Moreover, there is no poison control center in the four hospitals and confirmatory tests, to identify the specific agent, is lacking.

## 4.2 Study design

Prospective observational design was employed to do this study

## 4.3 Eligibility

### 4.3.1 Inclusion criteria

All patients admitted with confirmed diagnosis of acute poisoning at KGH, FGH, DH and MTH during the study period.

### 4.3.2 Exclusion criteria

All patients admitted with poisoning due to animal such as dog, snake or insect bite (due to infrequent report), intoxications due to organ failure, and who didn’t give consent.

## 4.4 Variable

### 4.4.1 Dependant variable

Outcome variables include mortality, in hospital Complication and length of hospital stay

### 4.4.2 Independent variable

Independent variables are Socio demographic variables (Age, Sex, and Residence, Monthly income, educational status, occupation and marital status), base line Clinical features variables (Co morbidity, Sign and symptom, Poisoning substance, Source of poisoning) and Management practice (Pre hospital treatment given, In hospital treatment given).

## 4.5 Population

### 4.5.1 Source population

All patients visited emergence department of KGH, FGH, DH and MTH during the study period.

### 4.5.2 Study population

All acute poisoning patients visited emergency department of KGH, FGH, DH, MTH, and fulfill the inclusion criteria during the study period.

## 4.6 Sampling technique and Sample Size Determination.

A convenient sampling technique was applied to select patients who visit the hospital during the study period. Since acute poisoning is a rare case, all patients who fulfill the inclusion criteria were selected and included into the final sample of study. Patients recruited for this observational study were shown in figure 1.

## 4.7 Data Collection Instruments

Data collection tools contain socio demographic, admission history and baseline clinical features, treatment given and admission outcomes. Data including patient's socio demographic details, symptoms, and admission history were collected through interviewing the patients or caregiver. Additional data like signs, complication and admission outcome were observed from patient and asked physician assigned at the room. When patients were unable to communicate or give responses, attendants were asked about the circumstances after informed consent and then history was confirmed by the patient after stabilization. Four pharmacists and four nurses of data collectors (two for each hospital) were assigned.

### 4.8 Data Quality Assurance

The data were collected using data collection tool which was developed from the previous literatures [2,4] and patient medical charts. The tool was pre –tested on ten (10) patients at Chancho hospital and necessary modification was done to ensure its alignment with the study objective. The patients' medical card number was used to get patient medical registry and avoid repetition of data. Training was given to assigned nurses and pharmacists on how to collect data. Frequent checks were done by principal investigator to identify and correct data errors.

All collected data were monitored daily and examined for completeness and consistency during data management, storage and analysis. The data collection process was supervised by the principal investigator.

### 4.9 Data analysis and interpretation

Once the data completeness and accuracy was ensured, data were entered into SPSS version 25 for analysis. Continuous variables were presented using the mean and standard deviation (SD), while categorical variables were presented using frequency and percentage.

Regression analysis was performed to identify the association between admission outcomes and their risk factors. Bivariate regression analysis was also performed to identify candidate variables for multivariable regressions. Variable having p value less than or equal to 0.25 were analyzed by multivariable regression. The independent predictors for Length of hospital stay and mortality or complication were assessed using multivariate linear regression and Cox regression models, respectively. Statistical significance was declared at p-value <0.05. Finally, texts, tables, and figures were used to present the data.

## 5 Ethical clearance

The Addis Ababa University's (AAU) Ethics Review Committee granted approval with reference number ERB/SOP/450/15/2022. Additionally, permission and ethical approval was acquired from the Kuyu, Fitche, Dera, and Muka Turi Hospitals. All subjects provided verbal agreement, and patient confidentiality was upheld.

## 6. Operational Definitions.

**Poison**: Substance capable of producing damage or dysfunction to the body by its chemical activity with its minimum dose.

**Pre hospital treatment:** Giving any substance including drug or home remedies with intention of surviving the victim from the risk of acute poisoning before arrival of hospital.

**Admission outcome:** For this study, length of hospital stays, in hospital Complication and death.

**Length of hospital stay**: the duration of days that patients spend in hospital since admission till discharge or death

**In hospital Complication:** any new morbidity occurred after exposed to poison, diagnosed based on complaints of patients, in the hospital or during discharge.

# 7. Results

## 7.1 Patients enrollment

As shown in figure 1, among the 15,984 patients visited ED of the four hospitals, 218 of them were due to acute poisoning and hence assessed for the eligibility. Then, 52 victims from KGH, 55 victims from FGH, 57 victims from DH and 44 victims from MTH were selected and included in the final study. The prevalence rate of acute poisoning was 13.6% over the past six months (Figure1).

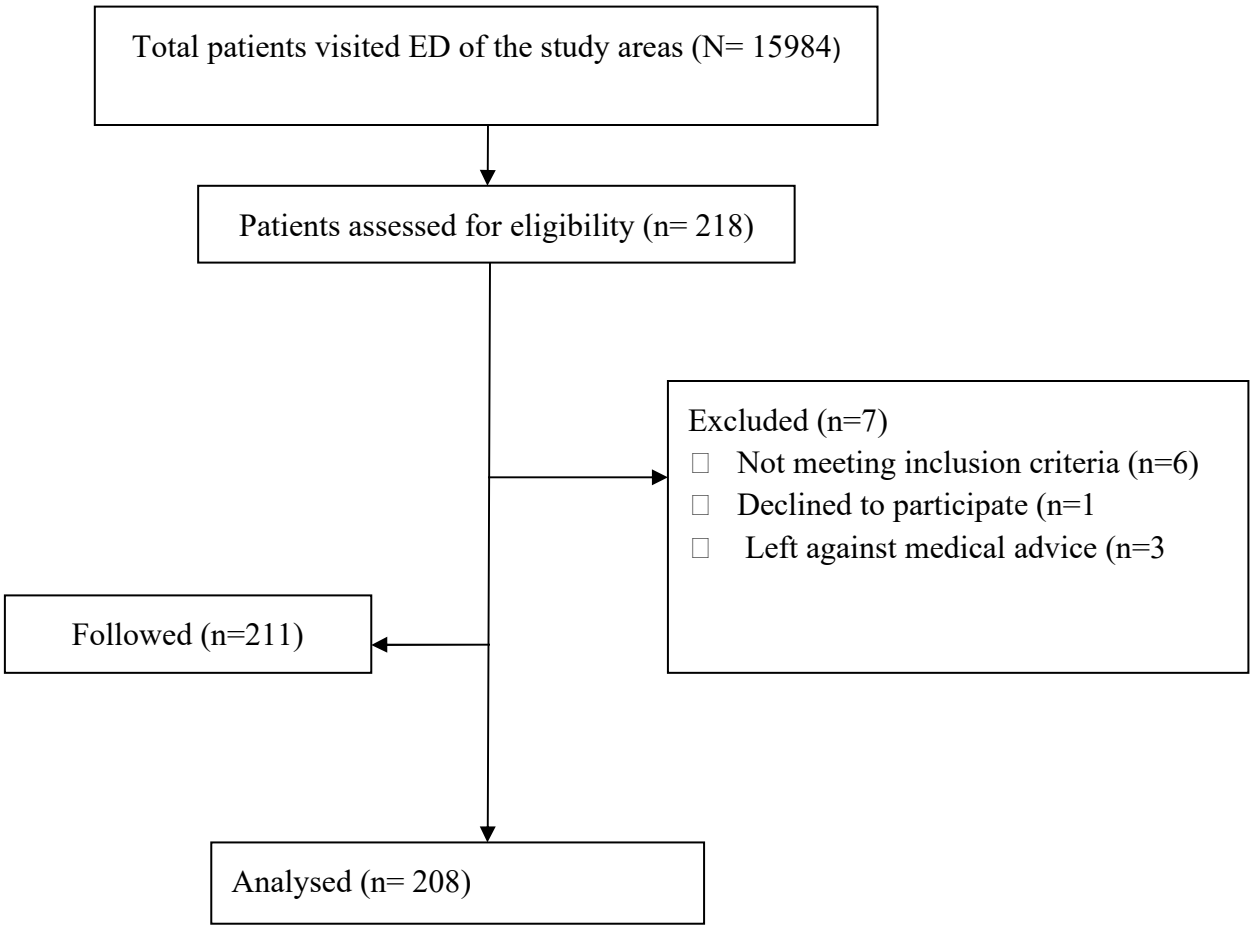


Figure 1 patients selection process of the final sample study used for analysis

## 7.2 Socio demographic characteristics of the study participants

Of 208 victims, 125(60.1%) live in urban area and more than half (58.2%) of them were female. Patients aged from 18-35 years were more vulnerable to poisoning (52.4%). The patients' mean (SD) age was 27.11 ± 14.20 years. More than half 57 (27.4%) of them were students. Around 97(46.6%) of patients were married and 150(72.1%) of them were literate [Table1].

Table 1 Socio demographic characteristics of the victims with acute poisoning at Northern Ethiopia, 2023 (N=208)

| variables | Category | Frequency (%) |
|---|---|---|
| Age (year) | < 18 | 53(25.5) |
| | 18-35 | 109(52.4) |
| | ≥35 | 46(22.1) |
| Sex | Male | 87(41.8) |
| | Female | 121(58.2) |
| Marital status | Single | 96(46.2) |
| | Married | 97(46.6) |
| | Separated | 15(7.2) |
| Education status | literate | 150(72.1) |
| | illiterate | 58(27.9) |
| Residence(currently) | Rural | 83(39.9) |
| | Urban | 125(60.1) |
| Employment status | farmer | 50(24.0) |
| | merchant | 22(10.6) |
| | student | 57(27.4) |
| | employed | 5(2.4) |
| | Unemployed | 74(35.6) |
| Monthly income | <=1500 | 10(4.8) |
| | 1501-3000 | 82(39.)4 |
| | 3001-6000 | 50(24.0) |
| | +6000 | 7(3.4) |
| | Not applicable( age) | 59(2.4) |

Majority of the patients 97 (46.6%) got the poison from the home. The most common poisoning agents were alcohol 60(28.8%), aluminum phosphate 58(27.9%) and organophosphate 39 (18.8%).

The study also revealed that the main reason for suicide with poison was quarrel or family disharmony 82 (39.4%). About 55(26.4%) of the patients didn't eager to tell the reason behind taking the poison.

Table 2 Source, reason and chemical agents for acute poisoning at Northern Ethiopia, 2023

| No | Socio demographic (N=208) | Category | Frequency (%) |
|---|---|---|---|
| 1 | Source of poisoning | Home | 97(46.6) |
| | | Shop/market | 70(33.7) |
| | | hotel | 29(13.9) |
| | | Other* | 12(5.8) |
| 2 | Reason of poisoning | Family disharmony | 82(39.4) |
| | | Financial problem | 11(5.3) |
| | | Exam failure | 4(1.9) |
| | | Unplanned pregnancy | 9(4.3) |
| | | Recreational | 44(21.2) |
| | | Conflict at work | 3(1.4) |
| | | Unknown | 55(26.4) |
| 3 | Poisoning agent identified | Aluminum phosphate | 58(27.9) |
| | | Organophosphate | 39(18.8) |
| | | Carbon monoxide | 10(4.8) |
| | | Detergent | 19(9.1) |
| | | Rodenticide | 18(8.7) |
| | | Fertilizer | 4(1.9) |
| | | Alcohol | 60(28.8) |

*--- working area and neighbor

## 7.3 Baseline clinical characteristics

Among the victims, 37 (17.8%) have co morbid conditions which involve some body system such as gastrointestinal system (GIT) 12(5.8%) and central nervous system (CNS) 12(5.8%) co morbidities. About 49 (23.6%) of victims have mixed clinical presentations involving GIT (nausea, vomiting, dyspepsia,) and CNS (altered mental status, headache anxiety). Only 7 (3.4%) of victims had symptoms involving GIT, CNS, CVS (Cardiovascular system), RS (Respiratory system), musculoskeletal (Cyanosis of lips).

The mean (SD) and median (IQR) duration from poison exposure to hospital presentation was 5.66(3.638) and 5.38 hours respectively while the mean duration for starting treatment since arrival to hospital was 0.8 minute. Among the patients, 46 (22.1%) were presented to the hospital within 2 hours since poison ingested [table3]. The mean cost of management per patient was 1110 with minimum and maximum of 300 and 3000 Ethiopian Birr (EBR), respectively.

Table 3 Base line clinical features of the victims in Northern Ethiopia, from September 2022 to March 2023 (n=208)

| S. no | Clinical features | Category | Frequency Percent (%) |
|---|---|---|---|
| 1 | Presence of co morbidity | Yes | 37(17.8) |
| | | No | 139(66.8) |
| | | unknown | 32(15.4) |
| 2 | Body system involved in co morbidity | GIS | 12(5.8) |
| | | CNS | 12(5.8) |
| | | CVS | 5(2.4) |
| | | Other * | 8(3.8) |
| 3 | Body system involved based on Sign and symptoms | GIS and CNS | 49(23.6) |
| | | GIS and CVS | 42(20.2) |
| | | GIS only | 36(17.3) |
| | | GIS and RS | 24(11.5) |
| | | CNS only | 1(0.5) |
| | | CVS only | 1(0.5) |
| | | RS only | 6(2.9) |
| | | All the above | 42(20.2) |
| | | Above and other | 7(3.4) |
| 4 | Time elapsed since exposure to arrival at hospitals (hour) | <2 | 46(22.1) |
| | | ≥2 | 162(77.9) |

* --- hematology, renal disease , GIS- Gastro intestinal system, CNS--Central nervous system, CVS-- Cardiovascular system, RS-Respiratory system

## 7.4 Management practice

During this study, persistent traditional notion was observed. Accordingly, 96(46%) of the victims got pre hospital treatment. From these, 40 (19.2%) of them received milk while 28(13.5%) of them used either flour of bean, coffee and ash.

Once admitted, more than half 114 (54.8%) of the victims were given fluid resuscitation and medications (antidote). About 48 (23.1%) of them were treated with fluid resuscitation, gastric lavage and different medications in the hospital. Among these, 12(5.8%) of them took cimetidine and Omeprazole whereas 97(46.6%) of them took other medications such as antibiotics, magnesium sulphate, adrenaline, and diazepam.

The study identified that 52(28%) of the victims took atropine while 22(10.6%) and 9(4.3%) of them treated with thiamine and oxygen respectively. Moreover, majority of the victims 182(87.5%) didn't linked to psychiatric clinic [Table 4]

Table 4-Management practice among patients admitted with acute poisoning, Northern Ethiopia

| Management (N=208) | Category | Frequency (%) |
|---|---|---|
| Pre hospital treatment given | Yes | 96(46.2) |
| | No | 112(53.8) |
| Supportive therapy given before admission | Milk | 40(41.7) |
| | Hot water | 9(9.4) |
| | Medication | 11(11.5) |
| | Milk and Hot water | 6(6.3) |
| | Milk and medication | 2(2.1) |
| | Flour of bean | 5(5.2) |
| | Ash | 4(4.2) |
| | unknown | 19(19.8) |
| Type of treatment given after admission to ED | fluid resuscitation only | 39(18.8) |
| | gastric lavage only | 5(2.4) |
| | fluid resuscitation & medication or antidote | 114(54.8) |
| | fluid resuscitation, gastric lavage & medication | 48(23.1) |
| Antidote given to victims | Atropine | 52(28) |
| | Thiamine | 22(10.6) |
| | Oxygen | 9(4.3) |
| Medications Other than antidote | Cimetidine | 16(7.7) |
| | Anti acid syrup | 10(4.8) |
| | Omeprazole | 1(0.5) |
| | Cimetidine and Omeprazole | 12(5.8) |
| | Cimetidine, Omeprazole and metoclopromide | 7(3.4) |
| | Cimetidine &ant acid syrup | 11(5.3) |
| | Other* | 97(46.6) |
| Council/link of victim to psychiatric clinic | Yes | 26(12.5) |
| | No | 182(87.5) |

* ----antibiotics, adrenaline, magnesium sulphate, diazepam

## 7.5 Admission Outcome

Out of the 208 victims in this study, 169 (81.2%) were survived and discharged. Among these, 20(11.8%) of them were discharged with unspecified sequalae and hence, referred.

The incidence rate of mortality was 18.75% while high mortality of 11(5.3%) was observed with aluminum phosphate when compared to the other agents attributed the case.

The mean (SD) duration of hospital stay was 29.82 ± 41.87 hours with minimum and maximum of 1 hour and 216 hours respectively. Majority of the victims 177 (85.1%) stayed in the hospitals for less than 48 hours. It was observed that patients were stayed at emergency room for at least 24 hours before transferring to other units.

Among the victims, 71(34.1%) developed in hospital complication. The most commonly encountered complications were aspiration pneumonia 38(53.5%) followed by respiratory depression 19 (26.8%) [Figure 2]

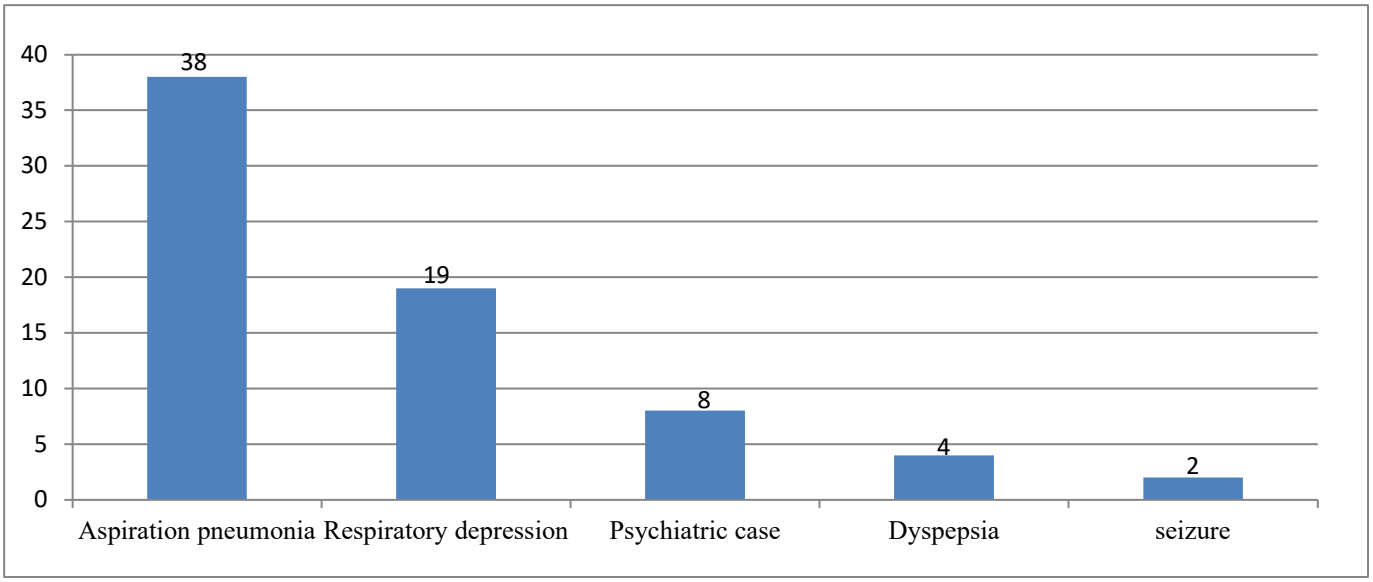


Figure 2- complication emerged on the victims in the hospitals from September 2022 to March 2023 at northern Ethiopia.

### 7.6 Predictors of admission outcomes

#### 7.6.1 Predictors of mortality

A bivariate Cox regression was done to identify association covariates with in hospital mortality. Age, educational status, employment, elapsed time to reach hospital, pre hospital treatment, poisoning agent were identified and they were fitted to multivariate Cox regressions model to identify the independent predictors of mortality.

The analysis found that the hazard of mortality was decreased by 83.5% among adolescent (18-35 years) patients (AHR=0.165; 95% CI: 0.040-0.678; p=0.013).

Furthermore, acute poisoning with rodenticide agent was found to a significant predictor of mortality. Thus, the hazard of mortality was increased by 11.65 among victims exposed to rodenticide (AHR=11.665 at 95% CI: 1.372-99.164; p-value= 0.024) [Table 5]

Table 5 Cox regression analysis of independent risk factors of mortality at Northern Ethiopia

| Variables | | Death | | CHR(95%CI | P-value | AHR(95%CI) | P-value |
|---|---|---|---|---|---|---|---|
| | | No | Yes | | | | |
| Age(years) | <18 | 46 | 7 | 1 | | 1 | |
| | 18-35 | 90 | 19 | 0.476 (0.194-1.194) | 0.113 | 0.165(0.040-0.678 | 0.013 * |
| | >35 | 33 | 13 | 0.647(0.319-1.309) | 0.226 | 0.506(0.182-1.408) | 0.192 |
| Education status | literate | 119 | 31 | 1 | | | |
| | illiterate | 58 | 8 | 0.615(0.282-1.342) | 0.222 | | |
| Occupation | Farmer | 41 | 9 | 1 | | | |
| | merchant | 17 | 5 | 1.310(0.539-3.186) | 0.551 | | |
| | student | 43 | 14 | 1.779(0.614-5,156) | 0.289 | | |
| | Unemployed | 63 | 11 | 1.775(0.804-3.922) | 0.156 | | |
| Elapsed time to arrive(hr) | <2 | 42 | 4 | 1 | | | |
| | ≥2 | 127 | 35 | 2.831(1.006-7.970) | 0.049 | 2.166(0.684-6.862 | 0.189 |
| Poisoning agent | Alcohol | 53 | 7 | 1 | | 1 | |
| | Aluminum phosphate | 47 | 11 | 2.379(0.306-18.02) | 0.408 | 1.798(0.223-14.483) | 0.583 |
| | organophosphate | 35 | 4 | 1.335(0.149-11.980) | 0.796 | 0.959(0.099-9.297) | 0.971 |
| | carbon monoxide | 9 | 1 | 2.146(.134-34.328) | 0.589 | 1.623(0.096-27.383) | 0.73 |
| | Rodenticide | 15 | 3 | 16.777(2.208-127.473) | 0.006 | 11.665(1.372-99.164) | 0.024 * |
| Pre hospital treatment | No | 84 | 28 | 1 | | 1 | |
| | yes | 85 | 11 | 2.026(1.007-4.076) | 0.048 | 2.07(0.94-4.54) | 0.07 |

CHR--Crude Hazard Ratio, AHR--Adjusted Hazard Ratio, CI--Confidence interval,

P---Value significant for <0.005,*--variable statistically significant.

### 7.6.2 Predictors of in hospital complication

In the bivariate Cox regression analysis, socio-demographic variables (age, sex, residence), elapsed time to reach hospital and poisoning agents were found to be associated with in hospital complication.

The adjusted multivariable Cox regression analysis showed that carbon monoxide were independent predictor of in hospital complication.

Therefore, the hazard of in hospital complication was increased by almost 12 times among victims who suffered carbon monoxide poisoning [AHR=11.642, 95%CI: 1.238-109.515, p=0.032) [Table 6].

Table 6 Multiple Cox regression analysis of independent risk factors of in hospital complication at Northern Ethiopia from September, 2022 to March, 2023

| Variable | | Complication | | CHR(95%CI) | P-value | AHR(95%CI) | P-value |
|---|---|---|---|---|---|---|---|
| | | yes | No | | | | |
| Sex | Male | 32 | 55 | 1 | | | |
| | Female | 39 | 82 | 0.733(0.457-1.175) | 0.197 | | |
| Age(years) | <18 | 14 | 39 | 1 | | | |
| | 18-35 | 36 | 73 | 0.712(0.360-1.408) | 0.329 | | |
| | >35 | 21 | 25 | 0.669(0.388-1.153) | 0.148 | | |
| Residence | Urban | 41 | 83 | 1 | | | |
| | Rural | 30 | 54 | 0.721(0.445-1.168) | 0.183 | | |
| Elapsed time(hr) | <2 | 14 | 32 | 1 | | 1 | |
| | ≥2 | 57 | 105 | 1.516(0.842-2.729) | 0.165 | 1.590 (0.910-3.158) | 0.09 |
| Poisoning agent | fertilizer | 0 | 4 | 1 | | 1 | |
| | ALP | 21 | 37 | 3.183(0.427-23.724) | 0.259 | 3.009 (0.403-22.479) | 0.283 |
| | Alcohol | 25 | 35 | 7.852(1.058-58.281) | 0.044 | 6.560 (0.848-50.726) | 0.072 |
| | OPP | 16 | 23 | 4.020(0.529-30.564) | 0.179 | 3.476 (0.449-26.907) | 0.233 |
| | CO | 4 | 6 | 10.953(1.216-98.635) | 0.033 | 11.642(1.238-109.515) | 0.032* |
| | Rodenticide | 4 | 14 | 4.329(0.481-38.916) | 0.191 | 4.010(0.426-37.709) | 0.225 |
| Co morbidity | No | 41 | 98 | 1 | | | |
| | yes | 17 | 20 | 0.850(0.570-1.268) | 0.426 | | |

CHR-Crude Hazard Ratio, AHR-Adjusted Hazard Ratio CI –Confidence interval P- Value significant for <0.005, ALP –Aluminum phosphate, OPP-Organophosphate, CO---Carbon monoxide, * -statistically significant

### 7.6.3 Predictors of length of hospital stay.

In this study, the overall analysis revealed that late arrival to hospital was negative predictor of duration of hospital stay.

Thus, length of hospital stay among victims who reached hospital before 2 hours was reduced by 1.677 times (β = -1.677, 95%CI:-2.98, -0.396, p=0.011).

The analysis also found that patients who did not develop in hospital complication had significantly lower length of hospital stay. Thus, length of hospital stay was decreased by 12.8 times among patients who didn't develop complication (β=-12.818, 95%CI: -23. 807,-1.828, P=0.02) [table 7]

Table 7multiple linear regression analysis for associated factors of length of hospital stay

| Variable | | Unadjusted | | Adjusted | |
|---|---|---|---|---|---|
| | | β (95% CI) | p-value | β(95% CI) | p-value |
| Sex | Male | 1 | | 1 | |
| | Female | 3.883(-7.349-15.115) | 0.496 | -4.678(-15.555,6.198) | 0.397 |
| Age (in years) | | 0.176(-.214,0.657) | 0.375 | -0.106(-0.469,0.237) | 0.564 |
| Residence | urban | 1 | | 1 | |
| | Rural | 8.803(-2.437,20.042) | 0.124 | 5.519(-4.007,15.045) | 0.255 |
| Elapsed time to arrive hospital (hrs) | <2 | 1 | | 1 | |
| | ≥2 | -1.452(-2.967, 0.063) | 0.060 | -1.677(-2.958, -0.396) | 0.011* |
| time treatment started at hospital (min) | | -77.346(-167.382, 12.689) | 0.092 | -45.623(-122.289,31.043) | 0.242 |
| Pre hospital treatment | No | 1 | | 1 | |
| | Yes | 7.554(-3.524,18.632) | 0.180 | 2.926(-7.372,13.224) | 0.576 |
| Complication | No | 1 | | 1 | |
| | Yes | -29.610(-40.578,-18.642) | 0.000 | -12.818(-23. 807,-1.828) | 0.022* |
| Poisoning agent | fertilize | 1 | | 1 | |
| | ALP | 17.473(5.339,29.607) | 0.005 | 7.150(-3.599,17.898) | 0.191 |
| | OPP | 7.932(-6.237,22.107) | 0.271 | 7.931(-5.467,21.344) | 0.244 |
| | Alcohol | -11.345(-23.489, 0.798) | 0.067 | 3.246(-12.459,18.952) | 0.408 |
| | Co | -14.477(40.328,11.374 | 0.271 | 0.467(-26.987,27.920) | 0.973 |
| | Rodenticide | -7.819(-27.518, 11.88) | 0.435 | -0.215(-40.429,41;022) | 0.989 |

β –the slope of regression line, CI –Confidence interval P- Value significant for <0.005, ALP – Aluminum phosphate, OPP-Organophosphate, CO-Carbon monoxide, hrs-hours, min-minute.

## 8. Discussion

Poisoning is one of the challenging public health problems causing significant morbidity and mortality globally. A systematic review showed that unintentional acute pesticide poisoning is very common in East Africa next to southern Asia [40].Ethiopia is one of the countries in East Africa sharing similar problem. This hospitals-based prospective observational study done over six months summarized the clinical features, admission outcomes and their predictors among patients admitted with acute poisoning at Northern Ethiopia.

In our study, young adults (18 to 35 years) were the most exposed group of age to acute poisoning. This finding was in line with the studies done in Ethiopia [4,8] ,Botswana [41] and Iran [27].This may be due to their exposure to situations such as failure in love, job, exams, and engagement in premarital sex, civil war, or conflict with their family. In contrary, this finding differed as compared to a study conducted in Taiwan, reporting the age of 65 years and above is linked to high rate for acute poisoning [42].The reason behind might be that this age group has multiple illnesses with multiple medications. Besides, low immunity exposes them to volatile and locally available poison.

Some studies identified that the most responsible agents for poisoning were Organophosphate in Ethiopia , Zambia, Taiwan [4,11,14,35] and pharmaceutical chemicals in France [31,42].

In contrary, locally made alcohol and aluminum phosphate were the most common poisoning agents in the current study. This finding is similar to the other studies [10,43].

The reason behind variation may be due to that the contributing chemical agents may vary based on the socio-economic, socio- cultural practice and availability of the chemicals.

The clinical presentations of the patients mainly depends on the poisoning agent involved [44,45].In our study, most 49 (23.6%) of the victims were presented with signs and symptoms of both gastrointestinal system (nausea, emesis, salivation, abdominal pain), and central nervous system(confusion, convulsion, anxiety, headache) which is similar with other studies [33,44].Moreover, clinical presentations involving gastrointestinal and cardiovascular system (hypotension, bradycardia) were also common 20.2%. Only 3.4% of the victims showed mixed signs and symptoms of gastrointestinal system, central nervous system, cardiovascular system, respiratory system (tachypnea, respiratory distress), and musculoskeletal (Cyanosis of the lips).

However, other studies identified the most clinical presentation of acute poisoning were gastrointestinal (diarrhea and vomiting) [13,18,46], musculoskeletal (bluish discoloration of the lips) and pulmonary edema in Tunisia [15], altered mental status (unconsciousness & drowsiness) in Pakistan [45] and respiratory failure in France [47] .This difference is basically related to the variation of the poisoning agents. Besides, the study design (retrospective ones) may also make variation since acute poisoning is an emergence case, all clinical features might not be recorded during critical care which may be otherwise possible with prospective observational study.

In the current study, 46 (22.1%) of the patients presented to the hospitals 2 hours earlier since being poisoned .The mean time from exposure to hospital arrival was 5.66±3.638 hours which is shorter than the other studies 6.06± 3.12 hours in Egypt [9] and 6.96 ± 12.94) hours in Iran [39]. The discrepancy may be due to the fact that most of the victims were from urban residence which is near to the hospitals in our study.

Pre-hospital care which is an undocumented pattern of health-seeking behavior among the community is enshrined in customary practice in the study areas. Accordingly, 96(46%) of the victims received pre hospital treatment and milk was used among 19.2% of the victims. Other substances such as hot water, flour and ash were also commonly used.

Finding from another study showed that 43 (20.40%) of poisoned patient received pre-hospital care with unspecified substance [7].

Cross section study done in Addis Ababa, Ethiopia, revealed that about 101 (17%) of victims had some sort of pre-hospital intervention with 71(12.0%) of them used milk[19].

Provision of appropriate assessment in hospital is based on the patients' time of arrival, nature of poisoning agent, and provision of specific antidotes [4]. According to a retrospective study conducted in Ethiopia, 66 (26.2%) patients were treated with supportive medications in addition to fluid resuscitation while 18 (7.1%) patients received intra nasal oxygen, atropine, gastric lavage, supportive medications, and fluid resuscitation [2].

Contrarily, the current study revealed that most 114 (54.8%) of the victims were given with fluid resuscitation in addition to medications while 39 (18.8%) of them were managed with fluid resuscitation only. About 48 (23.1%) of them were treated with fluid resuscitation, gastric lavage and different medications in the hospital. Furthermore, 12(5.8%) of them took cimetidine and Omeprazole whereas 97 (46.6%) of them took other medications such as antibiotics, magnesium sulphate, adrenaline or diazepam.

The discrepancy may be due to variation in management practice among the health facilities. Besides, there was no uniform management approach for acute poisoning at the studied areas during the study period. Thus, inconsistent practice among the health professionals was observed. For instance, lavage was done for certain victims regardless of the time of arrival while atropine was given empirically for 52 (28%) of the victims to treat organophosphate, aluminum phosphate and other agents. In fact, delayed gastric lavage have no beneficial effect for the patients [4] while atropine is the best antidote for organophosphate substance [6,9].Moreover, 22 (10.6%) of the victims treated with thiamine as antidote for alcohol poisoning while 9(4.3%) of them treated with oxygen for carbon monoxide poisoning.

The study found the mean total management cost per patient was 1110 with minimum and maximum of 300 and 3000 Ethiopian Birr. This is incomparable with other study done in United State which revealed that total expenditure for medical treatment of poisonings in the United States was estimated at $3 billion a year while an average of $925 (49950 EBR) spent per case [28].This difference may be related to economic status of the country.

## 8.1 Mortality and its predictors

In the current study, the fatality rate of poisoning was 39(18.8%) which is comparable with other studies [17,45].The independent predictors for death were rodenticide poisoning agent and younger age (<18 years) group. Hence, rodenticide poisoning was found to be statistically significant risk factor for mortality (AHR=10.413 at 95% CI: 1.263-85.856; p= 0.029).

Although it was statistically insignificant, the hazard death associated with aluminum phosphate poisoning was 79.8 (AHR=1.798, 95%CI: 0.223-14.483), p=0.583). Indeed, the highest number of deaths, compared to other agents, was recorded among patients exposed to aluminum phosphate 11 (23.2%).

This finding is different from the study done in Taiwan which revealed that carbon monoxide poisoning was a significant predictor for mortality [48].Other studies found that the highest number of deaths were due to 2,4-dichlorophenoxyacetic (2, 4-D) poisoning 4(40%) in Ethiopia [19], organophosphate poisoning 105 (46.9%) in Bangladesh[49], aluminum phosphate poisoning 18 (81.8%) in Morocco[16] .

This discrepancy might be due to management practice at the specific hospital and duration between poison ingestion to arrival of the hospital. The other reason may also due to variation in sample size among the studies. Besides, unavailability of specific antidotes at the moment in the healthcare settings probably makes the variation. For instance, there is no definite treatment and antidote for aluminum phosphate poisoning [50].Although a response to empirically administered medication was used to confirm acute poisoning, their indiscriminate use can potentially increase patient morbidity[2].

Wheat pill or aluminum phosphate is widely used as an insecticide and as grain preservative by farmers at the Selale zone, Northern Ethiopia. When it is ingested, its constituents (phosphates) come into contact with gut fluids with liberation of phosphate leading to toxicity[26,47]. It carries high mortality risk compared to other pesticides usually due to myocarditis which occurs within few hours of ingestion[51].

Our study found that younger patients aged <18 years were more likely to die (AHR=0.165; 95% CI: 0.040-0.678; p=0.013).

In contrary, retrospective study done in Ethiopia found that the independent predictor of poor outcomes of acute poisoning were age ≥35 years as compared to age <19 years (AOR=6.6 at 95% C.I 1.006–43.693; p-value= 0.049) [4]. Another prospective observational study done in Taiwan found that significant predictors for poisoning-related fatalities were age ≥ 61 years (OR 4.3, 95% CI 2.6–7.2) [31].The discrepancy may be due to difference with a specific poisoning chemical attributed to poisoning.

## 8. 2 Complication and its predictors

The present study showed that 71 (34.1%) developed in hospital complication. The most commonly encountered complications were aspiration pneumonia 38 (18.3%) followed by respiratory depression 19 (9.1%).

Current study also revealed that the most contributing agents for the outcome were alcohol 25(35%), aluminum phosphate 21 (30%) and organophosphate 16 (22.5%).

This finding was comparable with cross-sectional multicenter study conducted at the emergency department of Oslo, Norway ,which revealed that among the patients hospitalized with acute poisoning, complications were developed in 322 (30%) mainly respiratory depression129 (12%) , prolonged QTC interval 64( 6%), hypotension 50( 5%) and aspiration pneumonia 43( 4%) while the frequency of complications was highest for opioids (56%), tricycle antidepressants (54%) and cardiovascular drugs (50%) [28].

The hospital based multi-center study done in North Central province of Sri Lanka showed that overall complication rate was 12.5% (203) with 5.2% resulting from aspiration/chemical pneumonia mostly secondarily to kerosene oil ingestion[30] which is inconsistent with the current study. This may be due to nature of chemical agents attributed to the case and its effect may vary.

The current study also revealed that victims who ingested carbon monoxide had increased risk of in hospital complication (AHR=11.642, 95%CI: 1.238-109.515, p=0.032).This is incomparable with another study which revealed that the mean number of complications per admission was highest for tricycle antidepressants [28].

### 8.3 Length of the hospital stay and its predictors

It is observed from the current study that the mean (SD) duration of hospital stay was 29.82± 41.87 hours with minimum and maximum of 1hr and 216 hours respectively. Majority of the victims 177 (85.1%) stayed in the hospitals for less than 48 hours which is concordant with the systematic review done in Ethiopia [3].

Current study found that the length of hospital stays among the victims who reached hospital before 2 hours was reduced by 1.677 times (β = -1.677, 95%CI: -2.98, -0.396, p=0.011).

This was in line with a retrospective cohort study done in California which revealed that among patients came with poisoning, those treated within 4 hours of ingestion had a mean Length of hospital stay of 56.0 h (95% CI = 50.1, 61.9) versus 60.1 h (95% CI = 53.1, 67.1) in those who were not [53].

In the areas of our study, gastric decontamination (lavage and inducing) was performed for some patients almost irrespective of poisoning agent especially for those who arrived at the hospital within 5 hours or more.

In fact, gastric decontamination (lavage and activated charcoal) is based on the patients' time of arrival, and nature of poisoning agent. For instance, the preferred time for lavage was 1 to 2 hours of poison ingestion [4,9].

The current study also found that patients who did not develop in hospital complication had significantly lower length of hospital stay (β= -12.818, 95%CI: -23. 807, -1.828, p=0.022). These patients who did not develop complication include those discharged or die early.

Other study revealed that most of the victims exposed to aluminum phosphate do not survive to manifest the delayed complications related to this agent[51] which is in line with our study.

## 9. Limitation

During this study, civil war and security problem was often occurring around the study areas; there might be some patients suffered from acute poisoning and left home without health care. Toxicological analysis is not available in the study areas so that exact chemical identity of the poisoning agents consumed could not be identified. Therefore, the type of poisoning substance reported were solely based on patients' history, clinical presentation and bottle labels brought by the patients or caregivers.

The data might not accurately reflect the issue facing the general public because they were only acquired from health facilities.

Recall bias may occur during our study especially with past event responded by patients.

Moreover, patients were followed up only during hospitals stay. Thus, the study did not show the course of referred cases or victims discharged against medical advice.

## 10. Conclusion

In the current study, the incidence rate of mortality was high. Among the victims, one third developed in hospital complication with aspiration pneumonia as common sequalae. Interestingly, majority of the victims stayed in the hospitals for less than two days. Young adult patients were more vulnerable to acute poisoning while younger patients years were more likely to die. Other important factors were time elapsed to reach hospital and fatal poisoning agents including aluminum phosphate, rodenticide and organophosphate.

## 11. Recommendation

Control authority (FMHACA) found at each level should take measurement consist of restricting the sale without permission and availability of the hazardous chemicals to general population. Besides, hospitals should have to create awareness and caution among health professional and community on the impacts posed by these fatal chemicals.

Further research should be conducted for poisoning related complication and sequealae for longer duration of study with sufficient sample size. Moreover, study which is supported by toxicological analysis should be done so that exact chemical identity of the poisoning agents will be identified; hence morbidity and mortality due to acute poisoning will be reduced.

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# 13Annex
## 13.1 Tool

**Information sheet and informed consent**

Data collector name…….....profession…….……Sign----------

Name of investigator: **Habte dejene**, **PG pharmacy student at Addis Ababa University**, sign--

**Title**: Assessment of clinical features & admission outcomes of patients admitted with acute poisoning at Northern Ethiopia.

I respectfully ask that you answer the following inquiries honestly. Your response will have a significant influence on the study's outcome because the data collected will be used for research. With you, there is no effect and confidentiality is maintained. Response time is up to ten minutes. I would like to thank you for your eagerness. Are you Volunteer? Yes_ No__

**: Data extraction tool**

**Socio demographic**

**Name of hospital----------** **Date----------**

**(1) Patient's Card No**_____ (**2**) **Age** (in year):**--------** (3) **Sex**: **I)** Male **II)** Female

**(4) place of Residence (current)**: I) Rural II) urban

**(5) Employment status** a) farmer b) merchant c) student d) employed e) unemployed

**6/Marital Status:** **I)** Single **II)** Married **III)** separated

7) **Educational status**) educated **II**) Non educated (illiterate)

8) **Monthly income** (ETB) **I**) <1500 II) 1501-3000 III) 3001-6000 IV)>6000 **II**) Not relevant

**History during ED visit**

9/ **Reason of poisoning** **I)** Family disharmony **II)** exam failure **III)** Un-planed pregnancy **IV)** Financial problem **V)** Conflict on a work area **VI)** Recreational **VII**) other (specify….

10/ **Source of poisoning**: **A**/ home **B**/ shop & market **C**/ other (specify)….

11/**Time elapsed to arrive hospital:** --------- (hr, min or sec)

12/**Time treatment started since poison was taken**--------- (hr, min or sec).

**13. presence of co morbidity (I)** YES **II)** NO III) unknown

**14/ Body system involved by co morbidity (If yes to Q13)** **I**) CNS **II)** GIS **III)** CVD **IV**) other (specify).…….

**15) Poisoning Substances Identified**:

**A**. Organophosphate **B.** Aluminum phosphate C**.** Fertilizer **D**.carbon monoxide E**.** Rodenticide F. Alcohol Intoxication **G.** Others (Specify) ----------

**Baseline information**

16**/ Sign and symptom at admission**

**I)** GIS (vomiting, diarrhea, abdominal pain**) II**) CVS(hypotension, tachycardia,)**III)**RS (tachypnea, SOB) **IV)** CNS (alter mental status, headache) **V**) the appearance of more than two system (GIS, CVS, CNS or RS) **VI)** others (specify) ---

**Management related**

17/ **Pre hospital treatment given (at home or other health care)**: yes -- No------

18/**Substance given** a) Milk b) water c) medication d) Other (specify) -----

19/ **Type of Treatment given after admission:**

**A**) Fluid Resuscitation **B**) Gastric Lavage **C**) Antidote (Specify) ------ ----

**E**) Medications Other than antidote (Specify) ------- **F)** Fluid resuscitation and gastric lavage **G**) Fluid resuscitation and medication/or antidote **H**) all the above **I**) Others (Specify) ------

20. **Counseling /link to psychiatric clinic** **I**) yes **II)** No

**Admission Outcome**

21/ **in hospital complication)** Yes **B)** No

22/problem emerged (If yes toQ21**) I)** respiratory depression **II)** Aspiration Pneumonia **III)** dyspepsia **IV)** Psychosis **V)** others (specify) -------

**23**/Total cost **(**cash or out pocket**)** per patient service ---------EBR

**24/ Hospital stays since admission** -------- (hour, minute or second.)

25) Survived I**)** without complication II) with complication

26/ **Death**

END