



**St. Paul Hospital Millennium Medical College
Post Graduate Study Program**

**Treatment outcome and associated factors among patients
admitted with acute poisoning in three selected tertiary hospitals
in Addis Ababa, Addis Ababa, Ethiopia, 2023.**

**A Research Paper submitted to the Department of EMCC St.
Paul Hospital Millennium Medical College in Partial Fulfilment
of the Requirements for the degrees in Emergency and critical
care specialty training**

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Addis Ababa, Ethiopia

April, 2024



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DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE

Name of investigator	Dr. Daniel Adugna Emergency medicine and critical care Resident
Full title of the research project	A two year multicenter cross sectional study on treatment outcome and associated factors among patients admitted with acute poisoning in three selected tertiary hospitals in Addis Ababa
Study area	Three selected tertiary hospitals in Addis Ababa (saint Paul's hospital millennium medical college, AaBET hospital and saint peter hospital.
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Abstract

Background: Poisoning is one of public health problem worldwide with a significant impact on developing countries. By this time there is no published multicentre study done on the outcome and associated factors of acute poisoning cases presenting to the emergency room in Addis Ababa and this study will fill the gap in this area.

Objective: the aim of the study is to assess the outcome and associated factors among patients admitted with acute poisoning in three selected tertiary hospitals in Addis Ababa, Ethiopia, from January 2021 to January 2023.

Methods: Hospital based multicentre cross sectional study design was conducted on outcome and associated factors of acute poisoning cases in 371 adult patients in three selected Addis Ababa tertiary hospitals from January 2021 to January 2023 using systematic random sampling technique. Data was collected from patient's chart and was analysed by version 25 SPSS. Descriptive statistics like frequencies and cross tabulation was made for most selected variables. Bivariate and multivariate logistic regression analysis are also used to assess the association between the dependent variable and each independent variable. A p-value <0.05 was considered significant. The result is presented by using number, tables, charts and graphs.

Results: A total of 371 patient's medical records were reviewed and were included in analysis. The majority participants 205 (55.3%) were in the age group of 19–34 years. More than half of the participants 220 (59.3%) were females. Most study participants 343(92.5%) took greater than one hour to arrive to ED. Medications were the most common identified 32% type of poison among the study participants. From medications paracetamol accounts for 30% (36 participants) followed by NSAIDs 12.6% (15 participants). A total of 22 patients (5.9%) required mechanical ventilation. Death was recorded in 16 (4.3%) cases. Multivariable analysis was done to identify determinant factors for adverse outcome, hence mortality was strongly associated with mechanical ventilation requirement AOR 26.310 (95%CI 5.003-138.346) P-value 0.002, type of poisoning being aluminium phosphide AOR 37.366 (95%CI 3.901-357.876) P-value 0.002 and being from rural area AOR 2.532 (95%CI 0.547-11.711) P-values 0.0235.

Conclusion: The mortality rate of acute poisoning was found to be high. Residence, type of poison taken and requirement of mechanical ventilation were significantly associated. Improving access to the rural areas and providing well equipped intensive care units should be a focus for all responsible bodies. **Key words:** poisoning, outcome

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ABBREVIATIONS AND ACRONYMS

CO: Carbon Monoxide

EC: Ethiopian Calendar

GC: Gregorian calendar

GI: Gastro Intestinal

JUSH: Jimma University Specialized Hospital

NSAIDs: Non-Steroidal Anti-inflammatory Drugs

OP: Organophosphate

OPC: Organophosphate Carbamate

SPHMMC: St. Paul Hospital Millennium Medical College

AaBET: Addis ababa burn emergency and trauma hospital

SPSS: Statistical Package for Social Science

WHO: World Health Organization

Zn₃P₂: Zinc Phosphide

2-4-D: 2-4-Dichlorophenoxyacetic acid

1. INTRODUCTION

1.1. Background

Poison is a substance that causes damage or injury to the body and endangers one's life due to its exposure by means of ingestion, inhalation, or contact (1). It is called acute poisoning if the toxic effects occur immediately, usually within hours from the time of exposure. It is a common reason for visits to emergency departments and for hospitalization worldwide becoming a major public health issue in many countries (2).

Poisoning can occur as a result of a wide range of causative agents. Those include chemicals such as cleaning agents, cosmetics and other household products (3). Medications are other major causative agents of poisoning in many countries and are expected to be available in every house. Pesticides are more prevalent in agricultural countries and are encountered in many acute poisoning cases (4).

Adults get poisoned through intentional poisoning that could be a suicidal attempt (3, 5). Globally, there is a scarcity of information on the magnitude of both intentional and unintentional poisoning, as well as on the relative importance these factors. This information is particularly lacking from most of Africa (5).

WHO reports estimate poisoning as one of the most common causes of increased morbidity and mortality rate worldwide. Various agents such as pesticides, drugs have been used for intentional and accidental poisoning in different countries (1). Acute mortality is low but repetition of self-harm is common and long-term mortality is high (6). The burden of poisoning exposures in Africa is a significant public health concern, but only 10 of 58 countries have poisons information centres (7).

1.2. Statement of the problem

Poisoning is a significant global public health problem. In many countries, poisoning is one of the main causes of emergency attendance at hospitals. Poisoning is a time-dependent emergency and may require a specialist for appropriate diagnosis and treatment. WHO estimates that, in 2016, unintentional poisoning caused 106 683 deaths and the loss of 6.3 million years of healthy life (disability-adjusted life years) (8).

The human toxicology of many chemicals and natural toxins is poorly understood. There are estimated to be 40 000–60 000 industrial chemicals in commerce globally, of which about

6000 account for most of the total volume (9). In addition, there are over 6000 approved drugs, about 730 new psychoactive substances, an estimated 2000 poisonous plant species, 1200 species of poisonous and venomous animals and countless household and industrial products and cosmetics. (10, 11). Humans may be exposed to many of these substances and products, resulting in illness or death.

It is reported that unintentional human poisoning caused 0.098% of all deaths in south Africa and self-harm accounted for 1.51% of all deaths (12).

WHO has estimated that there were 3.5 deaths per 100,000 persons due to unintentional poisoning in 2004 (13). Poisoning was identified as the second most common method of attempted suicide in a district of Ethiopia, accounting for 42.4% of the 332 lifetime suicide attempt respondents from a community based survey which covered a total of 5259 houses with 12 531 residents above 15 years of age (14). Poisoning from organophosphates was also identified as an important cause of poisoning. Poisoning was second only to hanging which was reported in 48% of the suicide attempts (15).

1.3. Significance of the study

In developing countries where organized poisoning center is not available, timely management and analysis of cases for scientific world is poor. Furthermore proper handling and auditing of chemicals is way more behind than expected. In Ethiopia there are few institution-based studies.

Some studies under went in different hospitals across the country, most of them being single centered. These studies are eye opening since they showed a significant burden of acute poisoning for the subject hospitals but lacking applicability for the rest of the population.

In the capital city Addis Ababa there are multiple academic tertiary hospital which receive patients from their respective catchment areas of the country as emergency and with referral. There is no multicenter study done which involves these hospitals to compare and give the real burdens of this poisoning on emergency department of the hospitals in Addis Ababa.

It is the responsibility and day to day challenge of Emergency and critical care physicians to deal with patients with varieties of poison exposure. Knowing the patterns of those cases and their outcome through treatment course will enable Emergency physicians to provide better

care and update their knowledge on the area as well as establishing protocols in accordance with the resources available in the country.

Thus, this study showed the treatment outcome and associated factors of acute poisoning cases at Addis Ababa tertiary hospital over the last two years and helped in identifying the major gaps in the area. It clearly showed the burden of poisoning over the country since tertiary hospitals in Addis Ababa receive patients from different regions of the country. It can also be used as input for the institutions future community service package in terms of identifying common poisonous substances and planning public health intervention strategies in line with the responsible authorities and policy makers. In addition, it can also be used as input for future researchers on similar problems.

2. LITERATURE REVIEW

New insights in medicine necessitates an adjustment of the existing definition of clinical or forensic poisoning to 'An individual's medical or social unacceptable condition as a consequence of being under influence of an exogenous substance in a dose too high for the person concerned'. There are three ways of causing medical poisoning, accidental poisoning, including iatrogenic poisoning, experimental and intentional poisoning (16). Theophrakis Bombastus von Hohenheim postulated that every substance is poisonous, and that it is just the dose that controls the degree of poisonous effect. He defined 'toxic' as being simply a case of 'too much' (17).

According to WHO data an estimated 193,460 people died worldwide from unintentional poisoning. Of these, 84% of death occurred in low- and middle-income countries. Poisons such as pesticides and household detergents and drugs such as anticonvulsants, antidepressants, analgesics, antibiotics, and antihypertensives and illegal street drugs of abuse are among the common ones. The WHO estimated that deliberate ingestion of pesticides causes 370,000 deaths each year which makes poisoning a top 50 cause of death worldwide (18).

In one large cross sectional study on Indian population a total of 1010 cases were reviewed over a span of 3 years. The sex, age, reason of poisoning, route of poisoning, seasonal variation and agents involved in poisoning was evaluated. Thirteen cases were reported dead on admission. The age of patients ranged from 0 – 72 years with a median age of 27 years. Poisoning in males was predominant. Maximum number of cases was observed in the age group of 20-35 years followed by 13-19 years. Increased female cases were reported in age category 13-19 years. Poisoning was more during summer season. Household and agricultural agents followed by bites and stings were associated with most poisoning. Organophosphates and carbamates were the most common causes. Drug poisoning was reported in 10.8% cases and maximum abuse was by NSAIDs and antipyretic agents. Drugs were widely used by children of 13-19 years as self-harm (19).

In another cross sectional study done in one of the developing country, Pakistan, A total of 364 cases of poisoning were included in the study. The average age of the patients was 31.67 ± 12.92 . There were 132 males and 232 females. Out of these 364 patients; 259 took the poison intentionally while remaining took it un-intentionally which make 88% and 12% respectively. 201 (55%) had no pharmacological agents and there were 163 (45%) patients

who were found to be positive with pharmacological agents. Out of these 163 patients; alcohol was found in 2%, barbiturates in 9%, benzodiazepine in 15%, cannabine in 6%, rodenticides in 23%, kerosene Oil in 12% and organophosphate was found in 33% patients (20).

Significant morbidity and mortality is associated with acute pesticide poisoning, especially in developing countries. WHO has estimated that there were 3.9, 3.7, 3.4, 1.3 and 11.4 deaths per 100,000 people in Djibouti, Eritrea, Kenya, Rwanda and Uganda respectively due to unintentional poisoning in 2004.(15). Based on data from 2012, WHO estimated that unintentional poisoning accounts for 39,800 deaths and 27,949,000 DALYs in the Africa region (21). As part of the developing world, even though the burden of poisoning exposures in Africa is a significant public health concern, only ten of 58 countries (17.2%) have poisons information centres. In this region, since poisoning cases are usually poorly documented, the genuine epidemiology and accurate figures of acute poisoning is unknown (22).

In Ethiopia, epidemiological data on acute poisoning is few and it is very difficult to find primary data. The culprits of this problem are unavailability of well-organized poison control centre and routine screening & confirmatory tests (22). WHO has estimated that there were 3.5 deaths per 100,000 persons due to unintentional poisoning in 2004. Poisoning was identified as the second most common method of attempted suicide in a district of Ethiopia (23).

A cross-sectional study was conducted in Hiwot Fana Comprehensive Specialized Hospital, Eastern Ethiopia. In the study a total of 175 patient's medical records were reviewed. Among these, 150 patient's medical records had complete information and were included in the final analysis. The majority of participants were in the age of 19–37 years. More than half of the participants 86 (57.3%) were females. Half of the participants 76 (50.7%) lived in rural areas. The mode of poisoning was suicidal in 77 (51.3%) participants. Oral ingestion was the most common route of poisoning which occurred in 111 participants (74%). More than half of the study participants 81 (54%) obtained poisoning agents from their home. The most common reason for accidental poisoning was mental disorder 41 (56.2%). Eighty-three patients were admitted with conscious status. Eighty percent of this study participants were hospitalized for 1 day at emergency departments. The majority of participants 107 (71.3%) arrived at the hospital 1 h after the intake of the poisoning agent. Histamine 2 receptor blocker particularly

cimetidine was administered for 34% of the cases. Nearly 20% of cases were treated by antidote and normal saline. Of all the poisoning cases admitted during the study period, 56.7% were recovered and discharged while death was recorded in 25 (16.7%) cases. Pesticide poisoning was the commonest poisoning which accounted for 72 (48%) cases and followed by household poisoning 54 (36%). Organophosphate was the most common poisoning agent from the overall poisoning agents as well from pesticide poisoning which was encountered in 62 cases. The most common household poisoning agent was food 21 (14%). Acetaminophen was the predominant drug poisoning agent encountered in 10 participants. Poisoning due to snakebite occurred only in one participant (24).

A Prospective cross-sectional study was conducted in four hospitals selected from three administrative zones of Wollega in the western part of Ethiopia involving a total of 211 poisoned cases who presented to the selected hospitals during the study period were consecutively included. The highest proportion (45.97%) of the poisoning cases was in the age category of 16–30 years. about two third of the participants were female. Regarding their marital status, more than half were single. Regarding living condition of the victims, 56.40% of them have reported that they were living with their family in rural areas. The highest monthly income of about 32.23% respondents was between 500 and 750 Ethiopian birr. As shown in this study, 32.70% of the poisoning cases have history of previous suicidal attempt among which 63.77% have got counselling services. Relatively largest proportions (30%) of the admitted cases were in the months from December to February. Out of 193 people in whom the causes of poisoning were identified, pesticides and food poisoning have, respectively, contributed to 32.70% and 20.91% of the incidence. Out of 211 poisoning cases, 196 (92.90%) survived and the remaining 15 (7.10%) died of poisoning they have encountered (25).

A five years retrospective single centred study was done at Jimma university referral hospital for the study period of 2010 to 2015. The reviewed data includes patient's medical record and additional laboratory data sets. Majority of patients 186 (78.9%) were in the age group between 12-30 years and females were more affected (65.4%). The commonest poisoning agents used were household cleaning agents (40.4%) followed by Organophosphates (24%). Most cases (76.7%) were intentional exposures and most patients (96.1%) presented to hospital in the first 24 h and psychiatric referral was made for 49.8% of patients. Supportive cares and GI decontamination were the approaches employed for management. Intentional exposure accounted for the majority of cases.(26)

one systematic review of a total of 9 studies 6 of which retrospective, 2 cross-sectional and 1 case series was done in 2018 in Ethiopia without putting time limit, the data were searched on pubmed and scopus. Studies included in the review were conducted in six different well known referral teaching university hospitals in Ethiopia. Gondar university hospital, Tikur Anbessa Specialized Hospital (TASH) and Adama Hospital Medical College (AHMC). In emergency department, the patients are evaluated on arrival and after stabilization they are referred to the appropriate department. The highest prevalence of poisoning was observed in persons under age of 30 years. That occurrence of acute poisoning are higher in females than males. Education level of victims of acute poisoning was reported in one study and they were Illiterate (59.2%), primary school (21.4%), secondary school (16.5%), and higher institute (2.9%) level personnel. Organophosphates and household cleansing agents were the predominant agents of acute poisoning identified. Other agents stated as cause of acute poisoning in the included studies were pharmaceuticals, hydrocarbons, alcohols, and snake bite. Intentional poisoning was reported responsible for majority of acute poisonings. Oral ingestion was identified as the primary route of poisoning. Pre-hospital treatment at home with milk, water and different home remedies was reported. Time of presentation to health institution after poisoning, length of hospital stay and case fatality rate reported lies in the ranges between 0.2–24 h, 0.5– 17.7 days, 0–14.8%, respectively.(22)

Another retrospective study done with time duration of January 2007 to December 2008 at one of one of academic tertiary hospital in capital city of Ethiopia, the emergency department, medical intensive care unit (MICU), medical wards, follow-up clinic and sub-specialty round records and registration books were reviewed by the investigators. 116 acutely poisoned adult patients were reviewed. The number of females outnumber males. The mean age was 21 + or - 7 years. Majority were below 30 years of age (87.9 %). Out of 44 patients on whom marital status data were retrieved, 32 (72.2%) were single and 10(22.7%) were married. Divorced and widowed account one patient each. Majority of patients were from Addis Ababa (89.6%). Out of 35 patients on whom occupations reported, 19 (54.3%) were students, house wife, daily labourer, farmer, waitress, government employee, house maid, merchant , prisoner, and unemployed. The median time from poison exposure to hospital presentation was 3 hours. Majority of patients (94.3%) presented to the hospital within 12 hours of exposure. Twenty-seven (23.3%) patients received pre-hospital treatment at home. Most patients (76%) stayed only 1 day in the hospital. Among the 10 deaths, 7 stayed 1 day, 2 stayed 2 days and 1 stayed 3 days in the hospital prior to their death. Thirteen

patients had diagnosed mental illness comprising six psychotic disorders and seven major depression disorders. Seven patients had recurrent poisoning episodes for intentional self-harm. The types of poison currently used in patients with history of recurrent poisoning were organophosphate, phenobarbitone and household cleansing agent. Of 116 patients, 87 (75%) were treated at emergency unit, 16 (13.8%) were admitted to MICU and 13 (11.2%) were admitted to the medical wards. The following complications were noted despite incomplete data, mental status derangement (32 patients), respiratory distress (14 patients), anemia (6 patients), hypokalemia (4 patients), seizure (2 patients), upper gastrointestinal bleeding (2 patients), arrhythmia (2 patients), shock (2 patients) and renal failure (1 patient). The case fatality rate was 8.6%. (27)

A cross-sectional multicentre study was conducted in the Paediatric Emergency Departments (PEDs) at three major paediatric referral hospitals in Addis Ababa, Tikur Anbessa, Yekatit 12, and Zewditu Memorial hospitals. Children below the age of 14 years who were admitted to the hospitals for poisoning over the three year study period (2010–2013) was included to the study. A total of 128 children were retrieved. The mean age of the victims was 65.5 months. Females had 66 (51.6%) of the total incidents. About 95 (74.2%) poisoning accidents happened at home; 8 (6.3%) and 25 (19.5%) occurred outside of home and were unrecorded respectively. Thirty-eight (29.7%) of the children were poisoned by prescribed drugs for themselves and other family members. Atropine was given as an antidote for 8 (6.3%) children with organophosphate poisoning and oxygen was given for all children with carbon monoxide poisoning. Diphenhydramine was used in carbamezipine poisoning. Gastric lavage using a nasogastric tube was done for 23 (18%) children. In children who suffered from detergent poisoning, 8 (53.3%) received antacids. The median time to hospital visit from the time of poisoning was 15.5 hours; it ranged from one hour to one month. Home remedies were given to 24 (18.7%) of the children. Twenty-two (83.3%) children were given milk, and at last 2 (1.6%) of them induced vomiting. All the included children survived after treatment. The mean duration of hospitalization for the children was 17.7 days (28).

A one year cross sectional study was conducted on Addis Ababa burn emergency and trauma hospital which is the affiliation of another tertiary hospital in the capital, Saint Paul's hospital medical millennium colleagues. in the study period there were a total of 1543 emergency visits of which 98 (0.6%) poisoning incidents were reported, of which 51 were males. 59 (60.2%) of the instances, the patients were from Oromia, and 38 (38.8%) cases were from Addis Ababa. 79 were referred from health facilities, From those referred, 16/79 (20.2%) of

them came within two hours of exposure, and 63/79 (79.8%) of the cases came after two hours of exposure. However, 16/19 (84.2%) patients of the non-referred cases came within two hours of exposure, and 15 (78.9%) were from Addis Ababa. Seventy-three (74.5%) patients got the poison from home, and 25 (25.5%) bought it from drug stores. Seventy-two (73.4%) of the patients and/or the attendants had an awareness of the complications of the poison in humans, including fatalities and long-term sequels. Organophosphate poisoning was most common poison identified. This is similar to previous studies. The second most common poison was prescribed drugs. The other two commonly identified poisonous chemicals in the study were 2,4-D and aluminium phosphide (AlPO₄). Six patients had a previous suicide attempt, and two of the patients had known psychiatric problems. Both of these patients presented with an overdose of their medication. 50 (51%) patients stayed for less than 24 hours in the ED, and 48 (48.9%) patients stayed for more than 24 hours in the ED, a maximum of six days. Fourteen (14.2%) patients were admitted to the Intensive Care Unit (ICU). 88/98 (89%) cases were discharged improved from the hospital, and 10/98 (10.2%) patients died. 2,4-D poisoning was responsible for 40% of deaths, while aluminium phosphide poisoning was responsible for 20% (29).

2.1 Conceptual frame work

This is the conceptual framework developed specifically for this study by the principal investigator after reviewing related studies in which this study is intended to revolve (7, 26, 29-32, 34). The framework tries to depict factors that can potentially contribute to mortality among patients admitted to ED of the three selected hospitals, and it is believed to support the present study entitled ‘Treatment outcome and associated factors among patients admitted with acute poisoning in three selected tertiary hospitals in Addis Ababa, Addis, Ethiopia, 2023.’

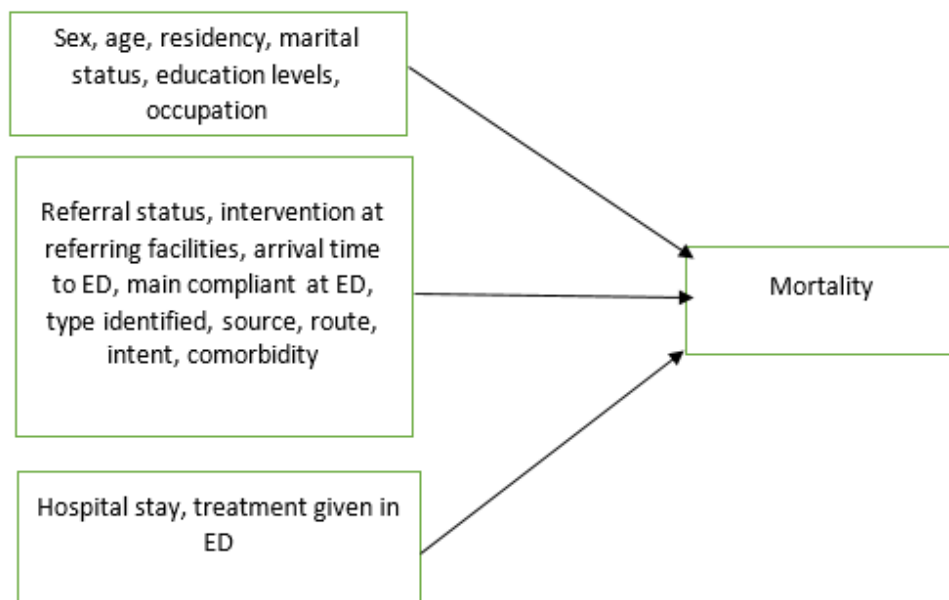


Figure 1 A conceptual framework for factors that could affect mortality among patients admitted with acute poisoning based on literature review

3. OBJECTIVES

3.1.General objective

To assess the outcome and associated factors of acute poisoning cases among adult patients admitted to three selected tertiary hospitals in Addis Ababa, Addis Ababa, Ethiopia, from January 2021 – January 2023.

3.2.Specific objectives

To determine the outcomes of acute poisoning cases among adult patients at three selected tertiary hospitals in Addis Ababa, Addis Ababa, Ethiopia, from January 2021 – January 2023.

To establish factors associated with acute poisoning cases among adult patients at three selected tertiary hospitals in Addis Ababa, Addis Ababa, Ethiopia, from January 2021 – January 2023.

4. METHODOLOGY

4.1. The study setting

The study was conducted in three selected governmental tertiary hospitals found in Addis Ababa. Addis Ababa is the capital city of the country. Based on 2012 Ethiopian calendar figures from the Central Statistical Agency (CSA) of Ethiopia, the Addis Ababa Region has an estimated total population of 3,686,068 consisting of 1,389,817 male and 1,527,478 female. 100% of the populations are urban dwellers. An estimated area of 526.99 square kilometers, this region has an estimated density of 5,535.8 people per square kilometer. Addis Ababa has 13 Hospitals, 98 Health Centres. According to food, medicine and healthcare administration and control (FMHACA), (2017) report three hospitals namely Tikur Anbesa Specialized Hospital (TASH), St. Paul's Hospital Millennium Medical College (SPHMMC) and Torhayiloch Comprehensive Specialized Hospital (TCSH) provide tertiary care. This data is not updated yet. The other referral tertiary academic hospital in Addis Ababa are St. Peter specialized hospital. The study was conducted on three of mentioned tertiary hospitals, namely SPHMMC, AaBET hospital and Saint Peter's specialized hospital. SPHMMC is located in Gulele sub city woreda 07. It is established through a decree of the council of Ministers in 2010, although the medical school opened in 2007 and the hospital was established in 1968 by the late Emperor Haile Selassie. It gives a comprehensive speciality and sub speciality services. It is academic hospital giving undergraduate schools for medicine, nursing and public health students and also more than 15 speciality and more than 5 sub speciality trainings and also master's program in public health. It receives patients from all corners of the country as emergency and with referral, mostly patients from nearby health

centres and from the west and south west urban and rural parts of the country. The inpatient capacity is more than 700 beds and an average of 1200 emergency and outpatient clients are seen daily in the hospital. The emergency department has 30 beds with 10 being critical beds with monitors. AaBET hospital, is found in Arada sub city, Addis Abeba, Ethiopia. The hospital was inaugurated as a public hospital under SPHMMC in 2015, and it is one of the first health sector with an entire trauma and burn unit. It includes departments in Emergency medicine and critical care (EMCC), neurosurgery, orthopedics and traumatology and an academic program in plastic and reconstructive surgery. It has a well-structured emergency and ICU setup with more than 50 beds in the ED organized as red, orange and yellow green with 11 ICU beds and 3 semi-ICU beds. It provides 24 hours 7 days a week service. Saint Peter's specialized hospital is found in Gulele sub city woreda 6. It is known to be a tuberculosis management center by ministry of health. Since 4 years back St Peter's specialized hospital is the only hospital in the country which has isolated toxicology ward and ICU and it is taken as the only poison center in the country by the ministry of health. The emergency department receives poisoned patients from all over the city and other patients mostly from northern parts of Ethiopia. Due to the financial and administrative issues the research was conducted on SPHMMC and It's affiliation AaBET hospital and St. peter specialized hospital. The first two hospitals specialized in emergency services and the late is known to be specialized in poisoning services.

4.2. Study design and study period

A hospital based multicentre cross-sectional study design was conducted in three selected tertiary hospitals found in Addis Ababa from January 2021 to January 2023. The actual data collection period was from September 2023 to November 2023.

4.3. Source population

All adult patients who visited emergency department of the three selected tertiary hospitals in Addis Ababa from January 2021 to January 2023.

4.4. Study population

All adult patients with acute poisoning who visited the three selected tertiary hospitals in Addis Ababa from January 2021 to January 2023.

4.5. Sample population

All adult patients with acute poisoning who visited the three selected tertiary hospitals in Addis Ababa from January 2021 to January 2023 and selected with simple randomized method.

4.6. Inclusion criteria and exclusion criteria

Inclusion criteria

All acute poisoning diagnosed cases aged above 14 years who visited ED in the selected three tertiary hospital in Addis Ababa in the study period.

Exclusion criteria

Incomplete charts

All patients presented with snake bite, bee sting and animal bite

4.7. Sample size and sampling strategies

Medical records of patients who fulfilled the inclusion criteria during the study period are included in the study and the minimum sample size determined by using single population proportion formula was;

$$n = (Z_{\alpha/2})^2 \times p \times q / d^2$$

Where: n = required number of sample size.

$Z_{\alpha/2}$ = desired 95% confidence, $Z=1.96$.

p = taking p as death it was reported 7.1% (30)

$$q = 1 - p = 1 - 0.071 = 0.929$$

d = is the margin of sampling error tolerated (5%) = 0.05

$$\text{So, } n = (1.96)^2 \times (0.071) \times 0.929 / 0.0025 = 101.3$$

The minimum sample size is determined by using single population proportion formula;

- 102 sample size

For the independent variables associated factor study proportion of intent of poisoning, deliberate self-harm taken, with p value of 46.45% and odds ratio of 2.44 and design effect of 2 with power of 80% was calculated using statulator.com calculator. (31)

- 368 adding 10% for possible contingency that might that happen due to lost charts.
- Approximately 408 patients will be the sample size
- 368 sample size

Adding 10% no respondent rate, it was calculated to be 408.

Therefore 408 patient medical records were included in the study.

It was calculated for residency, ED stay, intent of poisoning and drug poisoning, the sample size using intent of poisoning gave higher number.

Sampling Technique and Procedure

A stratified sampling was used to select the study participants in each stratum from each ED of the three selected tertiary hospitals. From each stratum, the calculated sample size was proportionally allocated to the study participants. The first lists each poisoned patient that was found in each hospital and determines how many poisoned patients in each stratum, which use proportionally allocated and the medical charts of poisoning cases were selected by a simple random sampling technique were implemented for charts found in the study hospital using random number generator. ([Figure 2](#)).

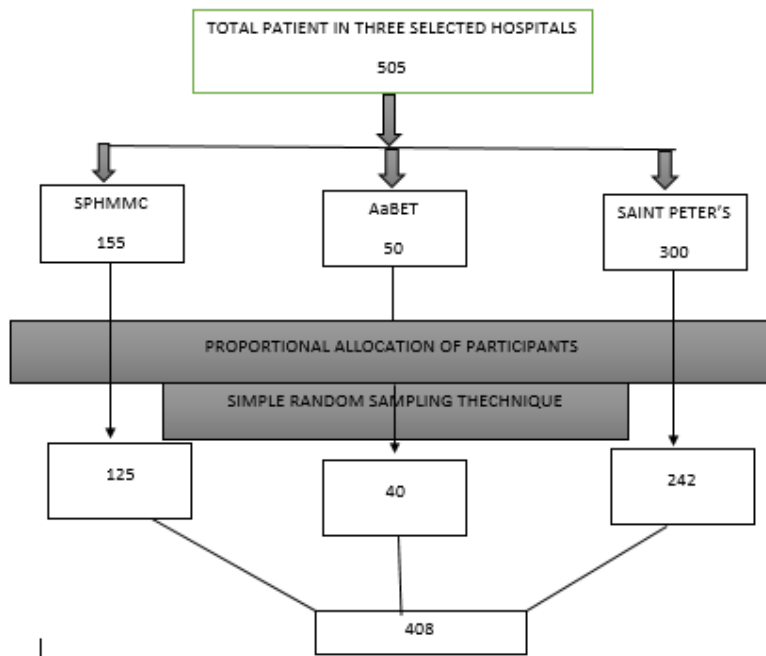


Figure 3: Schematic presentation of sampling procedure Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

4.8. Variables

4.8.1. Independent

Socio-demographic characteristics

- Sex age residency marital status educational level occupation

Known comorbidities

Type of poison

Route of poisoning

Intent of poisoning

Time of presentation
Referral status
Home remedies given
Antidote given
Hospital stay

Dependent
Outcomes

Death

Discharged improved

4.9. Operational definitions

Poison - Any substance that is harmful to the body. It can be swallowed, inhaled, injected or absorbed through the skin.

Acute poisoning - Injury in which the toxic effects occur almost immediately after taking the poisoning agents, usually within hours from the time of exposure.

Recovered - When the acutely poisoned patient was discharged improved.

Unintentional – accidentally over dosed or exposed to potentially harmful substance

Intentional – purposeful exposure to potentially harmful substance

Adult - is defined age 14 and above.

4.10. Data collection

Using previous researches and paper published, a structured and pretested questionnaire was formulated for charts of patients who are diagnosed to have acute poisoning. The questionnaire contained three parts namely Sociodemographic data part, Clinical presentation and associated factors data part and outcome assessment part (7, 25-27, 29-32). The questionnaire was filled by trained data collectors from the charts of the study period using Kobo toolbox data collection tool. Then the questionnaires were checked for completeness and then exported the data to SPSS version 25 for analysis.

4.11. Data quality control issues

Before starting the data collection, data collection format was cross matched with available information on records; then the study questions were rearranged. After collection Completeness and duplication of the data was cross checked. Collected data was sorted and inputted by principal investigator.

4.12. Data analysis

Data entering, coding and clearing was performed using kobotool box and statistical analysis was done using SPSS version 25. Frequency and cross tabulation is used to check for missed value and variables. The demographic and clinical characteristics of patients is computed by using descriptive statistics such as mean, percentage, frequencies, and standard deviation. Bivariate and multivariate logistic regression analysis is used to identify clinically pertinent variables associated with the dependent variable (patient outcome). Adjusted odds ratios and the corresponding 95% confidence intervals is estimated for the strength of association. Statistical significance is set at a p-value of <0.05 . Finally, the study findings are presented using narratives, diagrams, tables and figures.

4.13. Ethical Concerns

The final proposal of this research was presented to ethical board of the college and ethical clearance letter was given with reference number Pm23/138 and also it was submitted and approved by saint peter's hospital research department and approval letter with reference number V768/13/11/2023 was given. After the approval was given, the research was conducted in the hospitals without using patient's name, staff's name or potential identifiers to ensure confidentiality.

4.14. Dissemination

The result of the study will be presented to the community of SPHMMC and will be disseminated to concerned stake holders in order to enhance appropriate intervention and guide future plan for comprehensive prevention and appropriate management of poisoning. Finally, after rigorous review it may be published in reputable medical journals.

5. RESULT

5.1 Socio-Demographic Characteristics

A total of 155, 50, 300 patients were found from SPHMMC, AaBET and St. Petere's registry respectively in the study period. From these with simple random method and proportional allocation technique 125, 40 and 242 patients were selected and from these 10 cards from SPHMMC were lost and 25 cards were lost from st peteres hospital. Making a retrival rate of 91%.

Of total 371 patient's medical records were reviewed and were included in the analysis. The majority participants 205 (55.3%) were in the age group of 19–34 years. The mean age of participants was 24.82 years with an SD of 8.554. The minimum and maximum age is 18 and 70 years consecutively. More than half of the participants 220 (59.3%) were females. Majority of patients 302(81.4%) were from urban area. Most of the study participants 248 (66.8%) marital status were single. Most of the study participants 236(63.6%) were either student at secondary school (155) or secondary school drop outs (81) (See [Table 1](#)).

Table 1: Socio-Demographics Characteristics of Poisoned Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

	Frequency	Percent
Age		
<19	114	30.7
20-34	205	55.3
>35	52	14.0
Sex		
Female	220	59.3
Male	151	40.7
Residency		
Rural	69	18.6
Urban	302	81.4
Marital status		
Divorced	4	1.1
Married	98	26.4
Single	248	66.8
Unknown	17	4.6
Widowed	4	1.1

5.2. Poisoning related factors

The majority of participants 305 (82.2 %) were found poisoned deliberately to self-harm. Accidental exposure accounts for 64 (17.3 %) of participants. Oral ingestion was the most common route of poisoning which occurred in 310 participants (83.6%). And inhalational occurred in 58 participants (15.6%). Almost all of the study participants 365 (98.4%) obtained poisoning agents from their home. (See [Table 2](#)).

Table 2 : Poison Related Characteristics of Poisoned Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

	Frequency	Percent
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Intent of poisoning		
Accidental exposure	64	17.3
Deliberate self-harm	305	82.2
Deliberately given by others	1	.3
Recreational	1	.3
Route of poisoning		
ingestion	310	83.6
inhalational	58	15.6
injection	1	.3
Skin contact	2	.5
Source of poison		
Home	365	98.4
Work place	6	1.6

Medications were the most common identified type (32%) of poison among the study participants followed by carbon monoxide (15.1%), home detergents (14.6%), rodenticides (9.4%) and pesticides (8.9%). (See [figure 3](#))

From medications paracetamol accounts for 30% (36 participants) followed by NSAIDs 12.6% (15 participants). (See [figure 4](#))

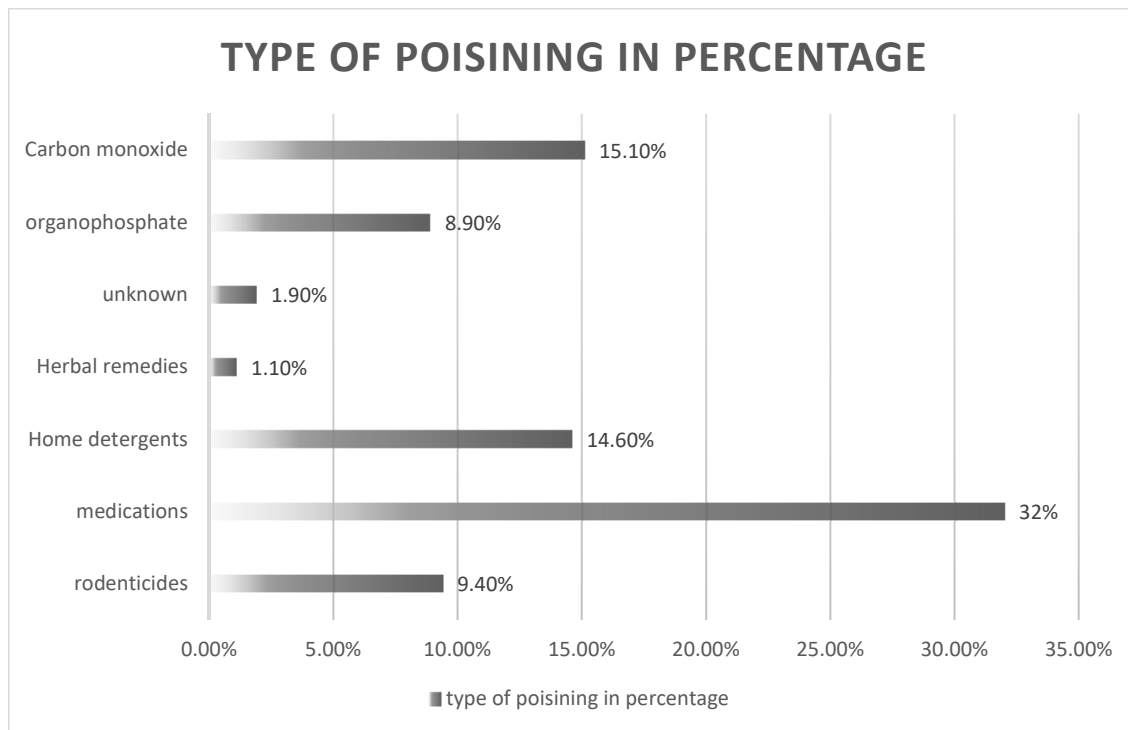


Figure 4 Types of poisoning used by the Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

5.3. Clinical and Treatment related Factors

More than half of the study participants 198(53.4%) came to the emergency department without referral. from those who came with referral 51.3 % of study participants received at least GI decontamination, antidote or fluid resuscitation before referral to ED. 59 patients received fluid resuscitation alone and 3 patients received GI decontamination alone. 67 (38.7%) patients from referred ones were given PPI or antacid alone. 10% of those referred did not received any treatment. Most study participants 343(92.5%) took greater than one hour to arrive to ED. Most of the study participants 267(72%) main complaint at presentation were GI symptoms. The rest were presented with altered mental status and respiratory complaints.

Most patients 348 (93.8%) did not have known comorbidities at their ED presentations. 20.5% (79) of all patients on the study had previously known psychiatric illness. Among these patients 71% (54) of them were not on treatment at ED evaluation.

Only 3% (11) patients took GI decontamination. 89.2% (331) of all participants took PPI, anti-acid or cimetidine. For 10% (37) patients atropine was given as an antidote. And for

15.1% (56) of patients oxygen was given as an antidote for carbon monoxide poisoning. For 1.6% (6) of the total patient Participated in the study dialysis was done. A total of 22 patients (5.9%) required mechanical ventilation and respiratory failure being the top indication (14) followed by airway protection. More than half 240 (64.6%) of this study patients stayed more than 24 hours in the hospital.

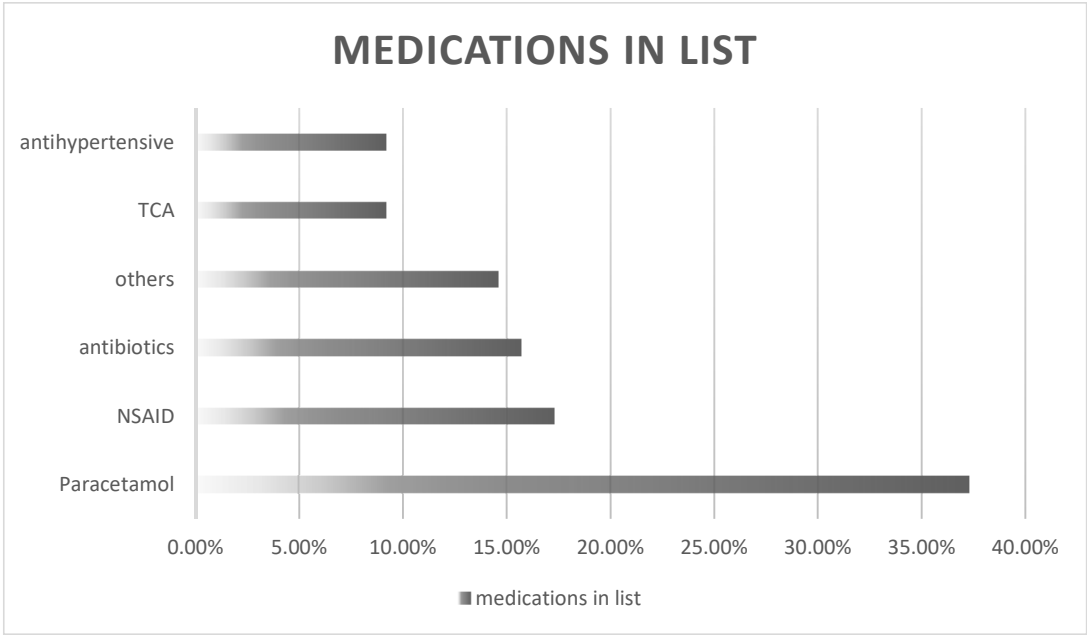


Figure 5: lists of medication used by Poisoned Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

5.4. Outcome of poisoning

Of all the poisoning cases admitted during the study period, 95.7% were recovered and discharged while death was recorded in 16 (4.3%) cases. (See [figure 5](#))

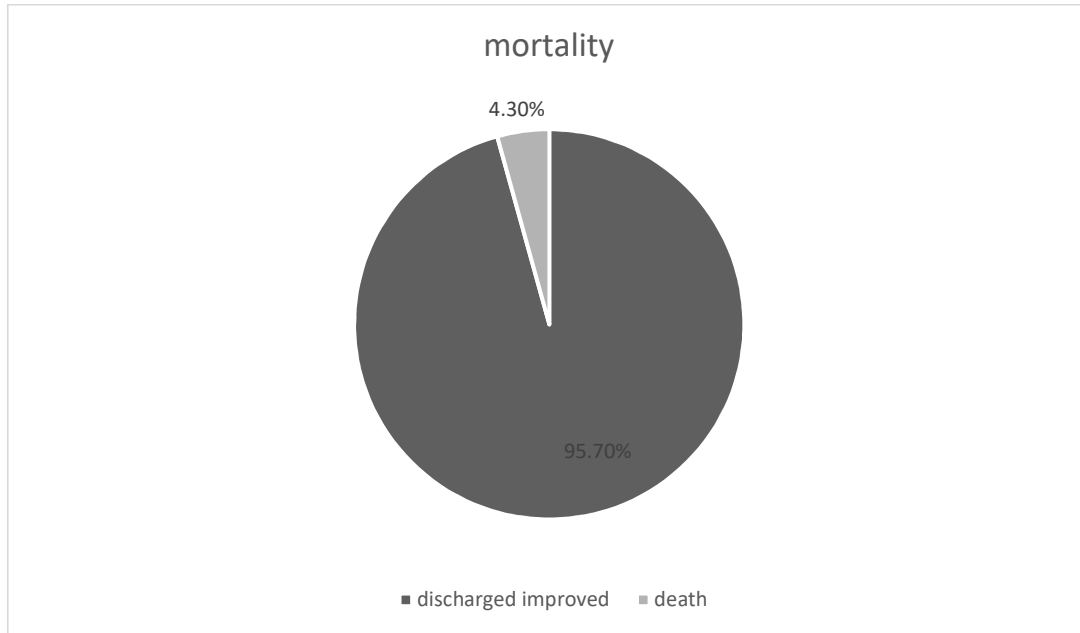


Figure 5: treatment outcome of Poisoned Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

5.5. Bivariate and Multivariate Analysis of Factors Affecting Poisoning outcome

In the bivariable analysis, a total of 19 variables were used and 7 variables, sex, residency, source, mechanical ventilation requirement, type of poison identified, duration of ED stay, intervention at referring health facility and intervention given at ED were found significant using 0.25 and above as a significant level. In the multivariable binary logistic regression analysis, two variables were significantly associated with the outcome. These are the type of poison taken taking aluminium phosphide (AOR: 237.470(3.28-17170.2); P-value: 0.012) and the requirement of mechanical ventilation (AOR: 68.41 (1.35-3451.2909); P-value: 0.034) (See [Table 3](#))

Goodness fit test of the model on multivariate analysis was done by Hosmer and Lemeshow Test and the P value was 0.968206 with sensitivity and specificity of 50.0% and 99.4% respectively and the overall accuracy was found to be 97.3%. Multicollinearity test was also done and collinearity tolerance was found to be >0.1 (0.474-0.863) and variance inflation factor (vif) found to be <10 (1.105-2.255).

Variables		Outcomes		COR (95% CI)	p-values	AOR (95% CI)	P-values
		Death	Discharged improved				
Sex	Female	7	213	0.518 (0.188-1.424)	0.202	0.853 (0.103- 7.017)	0.883

Table 3: Bivariate and Multivariate Analysis of Factors Associated with Treatment Outcome of Poisoned Patients Admitted to the Emergency Department of three selected tertiary Hospitals in Addis Ababa Ethiopia, 2021-2022 (n=371)

	Male	9	142	1		1	
Age	<19	3	111	1	0.338	1	0.261
	20-34	10	195	1.897 (0.511-7.040)		5.746 (0.25-127.562)	
	>35	3	49	2.265 (0.442-11.622)	0.327	11.49 (0.340-388.464)	0.173
Residency	Urban	6	296	1	0.000	1	0.061
	Rural	10	59	8.362 (2.926-23.894)		4.50 (0.932- 21.744)	
Source of poison exposure	Home	15	350	1		1	
	Work place	1	5	4.66 (0.512-42.470)	0.172	12.0 (0.05-2562.70)	0.363
type of poisoning	Medications	6	145	0.969 (0.236-3.970)	0.965	8.77 (0.306-251.705)	0.204
	Rodenticides	1	34	1		1	
	Organophosphate	6	26	7.554 (1.727-33.090)	0.007	1.29 (0.009-177.502)	0.919
	Aluminum phosphide	3	6	33.27 (5.611-197.28)	0.000	237.470 (3.28-17170.2)	0.012
Previously known psychiatric illness	No	14	281	1	0.425		
	Yes	2	74	0.542 (0.121-2.440)			
mechanical ventilation	No	6	341	1	0.000	1	0.034
	Yes	10	12	47.63 (14.86-152.67)		68.41 (1.35-3451.2909)	
Intervention at referring health facility	Fluid resuscitation	13	87	20.88 (1.970-221.36)	0.011	0.94 (0.079-11.199)	0.964
	Antidote	4	14	3.643 (0.88-14.931)	0.072	15.58(0.20-1168.058)	0.212
	Decontamination	0	17	1		1	
Intervention at ED	Fluid resuscitation	13	202	2.703(0.718- 10.17)	0.141	12.71(0.117-1376.39)	0.287
	Antidote	7	30	7.406 (7.406- 22.43)	0.000	0.49 (0.006-42.354)	0.758
	Decontamination	0	11	1		1	
ED stay	>24 hours	15	225	8.66 (1.13- 66.36)	0.037	0.665 (0.043-36.76)	0.998
	<24 hours	1	130	1		1	

6. Discussion

This multicentre study which was conducted on three selected tertiary hospitals in Addis Ababa was worked towards determining treatment outcomes and associated factors in poisoning cases.

In line with one multicentre study from north west Ethiopia number of female patients out number males and most patients are in the age group of 19 to 34 (33). In contrary to available studies in the country Majority of patients 302(81.4%) were from urban area (29, 33). One study from wester Ethiopia, ambo, which is done on two city hospitals found that the dominant poisoned patients were urban dwellers (34). This can be explained by the fact that patients are urban residents and the study setting is also in a densely populated capital city. The intentional deliberate self-harm manner of poisoning type was the most common in this study. Similarly, other studies have confirmed the situation in a different part of the world; India, Pakistan Addis Ababa–Ethiopia, and China (25, 30, 35). The high prevalence of intentional poisoning might be explained by low job opportunity and economic achievement, which contributes to hopelessness among young adults. But one study on acute poisoning in patients admitted to a governmental hospital in Palestine showed that 92% of study patients were poisoned accidentally (3). This finding can be explained by the fact that this study did not include animal bites as a poisoning.

Medications were the most common identified type 32% of poison among the study participants followed by carbon monoxide (15.1%), home detergents (14.6%), rodenticides (9.4%) and pesticides (8.9%). This contradicts with most multicentre studies in the country. The most common poison is found to be pesticides in a study done in the AaBET hospital (29). In another multicentre study in north west Ethiopia, pesticides specifically Organophosphate was found to be the commonest (33). It was also found that Organophosphates and household cleaning agents were the predominant agents of acute poisoning in a systematic review of observational studies (22). This discrepancy can be explained by the difference in study setting and sample size variability. It can also be explained by the residency of the patients. It is also found carbon monoxide poisoning to be 6.09% in single cantered hospital based study in Ethiopia (36). This shows significant discrepancy on carbon monoxide poisoning which could be explained by the weather condition of the capital city and tendency of the community to alleviate cold weather with fire ignition in houses.

Most study participants in this study took greater than one hour to arrive to ED. This study is in line with studies in the country, mentioning most patients took more than one hour to arrive to emergency of health facilities (33, 34). This finding showed the delay in pre hospital setting or in referral system of the country.

More than half of this study patients stayed more than 24 hours in the hospital. This finding is line with almost all reviewed studies in the country.

Treatment outcome of acute poisoning is determined by early identification of the case and seeking of health service, supportive care, patient and poisoning agent-related factors. Thus, provision of appropriate assessment and diagnosis, GI decontamination, providing specific antidotes, and supporting any organ failure were paramount in reducing morbidity and mortality. These managements should be tailored up with standardized poison specific local guidelines. However, the hospitals involved in this study lack standard guidelines. Thus, there was no consistent practice among clinicians. The most commonly used treatment was PPI, followed by atropine. Besides, supportive care like fluid and antiemetic was provided to alleviate the clinical presentation or complication of poisoning agents. This indicates that most of the treatments are supportive or symptomatic treatment. This is in line with the studies done in Ethiopia (25, 30, 31, 35). This can be explained with similar resources and investigation modalities throughout the city hospitals.

Mortality rate was found to be 4.3%. This finding has relatively lower mortality rate than published studies done in the country. In one study done in SPHMMC and AaBET the death rate of acute poisoning was 8.4%, in other study done in black lion it was 6.8% and in isolated AaBET hospital study it reached up to 10.2% (27, 29, 30). Compared to the studies done in country side it showed much lower case fatality rate, in Eastern Ethiopia, Harar 16.7%, and Debre Tabor 18.6% death rates were recorded. On another study done in wester Ethiopia Wollega death was found in 7.1%, similarly it was found to be 18% in northwest Ethiopia Gondor (24, 25, 33). Possible reasons could be the difference in accessibility in emergency and critical care managements and the difference in the demography of the patients. In contrary to this study, another study done on two hospital found in Ambo, western Ethiopia, it is discovered that the case fatality was 1.5% (34). This can be explained by small sample size taken by the mentioned study.

The finding of this study is also much lower with studies conducted in South India 14.6% and in the tertiary care hospital, India, 18.6%. the possible reason for this variation might be sample size variation, the majority were rural dwellers, time of arrival to the hospital after

exposure and nature of poisoning, and referral status (19). The case fatality of this study is relatively higher when compared with studies conducted in china (7.7 per 100000 people) (37). The possible reason for this could be due to sample size difference, the severity of poisoning agents, a lack of early diagnosis and treatments and difference in the poisoning agent.

In this study it is found that patients who live in rural areas were 2.532 times more likely to die as compared to poisoned patients who lived in urban areas. This finding is in line with a study conducted at Referral Hospitals in Northwest Ethiopia (33). This finding might be explained with the fact that rural dwellers have a difficulty in getting timely health care, referral to respective health facility delay, and a potential to be poisoned by deadly products of agricultural pharmaceuticals.

It is also found that those patients who took pesticides particularly aluminium phosphide and organophosphate were 37.3 and 1.9 times more likely to die respectively. This finding is consistent with the study in Aabet (29). This finding is also in line with country side researches in the country. Researches in country sides of china and a report from WHO also are in line with this finding (8, 37).

Patients who required mechanical ventilation were 26.32 times more likely to die than compared to those who were not requiring it during arrival to ED. A possible explanation could be the presence of hypoxia or hypercarbia, respiratory distress, and decreased airway protection posed to aspiration, hence leading to airway obstruction. Moreover, patients with respiratory failure are at risk of developing multi-organ failure sepsis and mechanical ventilation associated complications

7. Strength

This study is a multicentre study involving three tertiary hospitals which are corner stones in management of emergency and poisoning cases. The recruited cases are nearly equal with the minimum sample size calculated making the study generalizable to the study population.

8. Limitations

The retrospective nature of the study design prohibits the necessary variables, like laboratory data, to determine the severity of the cases as a determinant of the treatment outcome of

poisoning. In addition, due to the documentation gaps socioeconomic factors like religion and level of income were not considered among the factors in measuring prevalence and outcome of acute poisoning

9. Conclusion

In this study, the case fatality rate of acute poisoning was found relatively low compared to the country side researches but it is found to be high when compared to the developed countries. The requirement for mechanical ventilation and ICU care is also remarkable. These problems need to be addressed by responsible bodies in planning and implementing action plans to establish better care in the emergency and intensive care areas. The referral system and a facilitated prehospital care should also needs to be reformed to attain the current burden of acute life threatening emergencies like acute poisoning. Creating an awareness for the public on issues like establishing immediate treatment seeking behaviours is also mandatory.

10. Recommendations

The case fatality seen in poisoning cases and the number affected among the public compels us to give more attention to set up interdisciplinary based prevention and strategies. Based on the results of the this study as well as observation during the study period, it is recommended to Create awareness about proper handling of prescribed drugs in the society through different mechanisms especially for the youth. Since most of the patients who died from acute poisoning were from rural areas, it might be important to assess the referral linkage and if there is correctable delay in arrival to emergency departments.

Agriculture stakeholders: must control agrochemical substances to minimize their open market sales and promote their rational use, which in turn might contribute in reducing the burden of acute poisoning.

Ministry of health; It is also recommended to widen the availability and quality of prehospital, emergency and intensive care facilities. Appropriate documentation and improving the record keeping practice is also suggested for a better information access and utilization.

Future studies; should be prospective in design to accurately capture information and thereby able to evaluate treatment appropriateness and its association with outcome of acute poisoning.

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12. Annex

Questionnaire

Part I: Sociodemographic data

1. Patient's age____ Sex____ MRN_____
2. Marital status: a. Married b. Widowed c. Divorced d. Single
3. Residency: a. Urban b. Rural
4. Educational level: a. Can't read and write b. primary school c. secondary school
d. College and above
5. Occupation a. Government employee b. Self-employed c. Unemployed d.
Student d. House wife e. Merchant f. Farmer

Part II: Clinical presentation and associated factors

1. did the patient come with referral? a. yes b. no
2. if yes, what interventions was done in the referring health facility?
a. GI decontamination b. fluid resuscitation c. antidote (specify) d. other,
mention
3. Duration of stay from poison exposure to ER arrival
a. <1hr b >1hr
4. The main complaint at presentation a. change in mentation b. GI symptoms c
.Respiratory symptoms d. Asymptomatic but complaining poisoning
5. Is the type of poison identified?
a. organophosphate b. rodenticide(specify) c. pharmaceutical drugs, specify
d. Herbal remedies e. home detergents
6. Source of poison expose
a. workplace b. home c. other, specify
7. Intent of poisoning
a. accidental exposure b. deliberate self-harm c. recreational d. deliberately
given by others
8. Previously known comorbidity a. yes b. no
9. if yes, what was the diagnosis a, Hypertension b. Diabetes melitus c. Chronic
kidney diseases d. cardiac diseases e. Epilepsy f. other (specify)

10. Previously known psychiatric illness
11. if yes for question number 10, was the patient on treatment?
12. Root of exposure
 - a. ingestion b. inhalational c. skin contact d. injection e. Unknown
13. Any home remedies given prior to arrival to hospital, mention

Part III: outcome assessment

1. Duration of stay in the emergency room a. <24 hr b. > 24hr
2. What interventions were done? (More than one answer is possible)
 - a. supportive care (analgesia, GI ulcer and DVT prophylaxis) b. decontamination c. antidote
 - d. dialysis e. fluid resuscitation f. other, specify
3. did the patient require mechanical ventilation?
 - a, yes b. no
4. if yes, what was the indication for mechanical ventilation?
 - a. airway protection
 - b. respiratory failure
 - c. refractory shock
 - d. for transportation
5. what was the outcome of the patient?
 - a. discharged alive
 - b. death