ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE

Assessment of availability of treatment resource in emergency department for the management of acute toxic exposures and poisoning detection in selected governmental hospitals, Addis Ababa, Ethiopia.

A research thesis submitted to school of graduate studies of Addis Ababa University, Department of emergency medicine and critical care in partial fulfillment of the requirements for degree of masters in Emergency medicine and critical care nursing.

BY TESFAYE GIRMA (BSC)

ADDIS ABABA, ETHIOPIA

JUNE, 2017

Acknowledgment

My special gratitude and appreciation goes to my advisor Achamyelesh Tadele and Dr. Sofia Kebede for their encouragement, provision important documents and reference as well their constructive comments and guidance from the beginning of my proposal development to final this research work.

I would like to express my heartfelt gratitude to Addis Ababa University for giving me the opportunity to carry out my MSc education and for their financial Support that enabled me to conduct my thesis research. I would like thank also Ejarsa lafo woreda health office for supporting me with material.

Health professionals who participated in the data collection process, at St Peter's hospital, Yakutat 12 and Zewditu Memorial Hospital ,Ras desta Damtaw Memorial hospital and Minilik II Hospitals Management and all staff working in Emergency Department of these Hospitals.

At last but not the least, I would like to thank my beloved family and friends for their valued comments from the inception of my project.

Acronyms

AAU	Addis Ababa University
ABC	Air way, Breathing, Circulation
ASTSDR	Agency for toxic substances and Disease registry
DALYS	Disability adjusted life years
ED	Emergency Department
EE	Essential in Ethiopia
EW	Essential in WHO
FDA	Food Drug Administration
GI	Gastrointestinal
HIC	High income country
LIC	Low Income Country
LMIC	Low and Middle income countries
MOH	Ministry of Health
NPDS	National Poison Data System
OSHA	Occupational safety and health Administration
PCC	Poison Control Center
PIC	Poison information Center
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
TC	Toxicology Center
UN	United Nation
WHO	World Health Organization

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Abstract

Background: Poisoning exposures continue to be a significant cause of morbidity and mortality worldwide. The lack of facilities, treatment resources, and antidotes in hospitals may affect the treatments provided and outcomes.

Objective: Assessment of availability of treatment resource in emergency department for the management of acute toxic exposures and poisoning detection in selected governmental hospitals, Addis Ababa, Ethiopia.

Methodology: Hospital based descriptive cross sectional study was applied to assess availability of treatment resource for the management of acute toxic exposures and poisoning in selected governmental hospitals from December 2016 to June 2017. Data were collected using semi-structured questionnaire and the data obtained was analysed using SPSS and the result was presented using tables Chart and graph.

Result: Over the study period, 920 poisoning cases were listed in the selected hospital registries. Among them, Organo phosphate poisoning was the most top leading cause of acute poison (18.8%, 173/920), Followed by Bleach (Sodium hypochlorite) poison (18.6%, 172/920). In all the hospitals all form of Charcoal and Sodium Sulphate were not available. Four of the five hospitals have had Orogastric tube and magnesium Sulphate. Only Nasogastric tube out of the ten decontamination resource had available in all hospitals. None of the studied hospitals have the stock of all either WHO or Ethiopian essential drug list recommended antidotes and none had fomepizole, pralidoxime, charcoal, sorbitol, ipecac, polyethylene glycol, deferoxamine dimercaprol, glucagon, and Protamine sulphate. In surveyed hospitals peritoneal dialysis was not available.

Conclusion: For the majority of the surveyed hospitals the resources which are essential for treatment and management of poisoned patient are not sufficient. Furthermore, the available resources and the pattern of causes of poisoning show discrepancy.

Recommendation: Based on the pattern of causes of poisoning it is better if the selected anti-dotes, stabilization, decontamination and elimination resource are available.

Keywords Decontamination _ Elimination enhancement _ Stabilization resources _ Availability_ Hospital _ Ethiopia _Poisoning.

1. Introduction

1.1 Background

A poison is a substance (other than an infectious substance) that is harmful to human health if ingested, inhaled, injected, or absorbed through the skin. Substances that are benign or therapeutic at low levels (for example, pharmaceuticals and herbal remedies) may be poisonous at higher concentrations. Toxins are poisons that are produced by living organisms. *Venoms* are toxins that are injected by an organism (1).

Poisoning and toxic exposures are major health problems worldwide (2). In fact, every individual is exposed to toxic chemicals in sub-toxic doses. The expansion in pharmaceutical and chemical industry during the last century has led to an increased accidental and intentional exposure to these chemicals (3).

It is a common reason worldwide for visits to emergency departments and for hospitalization and its morbidity and mortality is becoming a major public health issue in many countries. It is estimated that some forms of poisons are directly or indirectly responsible for more than 1 million illnesses worldwide annually (4).

The world health organization (WHO) estimates that the total number of acute unintentional poisonings throughout the world ranges from 2 – 3 million cases annually, of which 1 million are severe poisonings resulting in 20000 deaths annually, while the estimated annual intentional poisonings number is about 2 million resulting in 200 000 suicides (5,6). The exact number of incidences can be higher, because most cases of the poisoning actually go unreported. The problem is getting worse with time as newer drugs and chemicals are developing. Poisoning cases are increasing day-by-day due to changes in the life style and social behavior (7). The Chemical Abstract Service (CAS) registry, a division of the American chemical society has listed 83 million chemical substances (8). The overall toxicity data of these chemicals is limited and commonly called “data gaps”. The toxicity data on high production volume chemicals is limited to only 14 to 25% of products (9). In the United States, poisoning is a second leading cause of injury-related morbidity and mortality (10).

In developing countries, mortality due to poisoning is even higher than developed countries. Among the reasons responsible for these are scarcity of resources used to treat or manage poisoned patient share upper hand. Pesticide and hydrocarbons are leading agents in developing countries (11, 12, 13,). Although there are good data bases in developed countries concerning

poisoning such as the toxic exposure surveillance system; for most of the low income countries there are no formal and well established poison control centers to collect such data. Hence information on this very important public health issue remains insufficient (14).

Poisoning by means of hazardous chemicals through ignorance, mishap or intentionally is becoming a serious health problem worldwide. Epidemiological data on this important health issue are, however, scarce in Ethiopia (15). Poisoning cases have been on increase with each passing day owing to changes in lifestyle and social behaviors (16). It has been reported that the rate of poisoning is between 0.07% and 0.7% in developing countries (17).

1.2 Statement of the problem

Studies have shown that acute poisoning has been identified as a significant global public health problem. According to the WHO, over 350,000 people died worldwide from unintentional poisoning in 2004 resulting in the loss of over 7.4 million years of healthy life (disability adjusted life years (DALYs). Furthermore, nearly a million people die each year as a result of suicide. Although data on the prevalence of poisoning on a global scale may seem to be well established, updated data from developing countries is largely unexplored (18). A recent report by the American association of Poison Control Centers' National Poison Data System (NPDS) showed that since 2000, cases with more serious outcomes have increased by 4.6 % from 108, 148 cases in 2000 to 170, 956 cases in 2012 (19).

On an African perspective, Malangu (2009) stated that acute poisoning has been identified as a significant cause of both morbidity and mortality, and the hospital prevalence of poisoning has been known to vary up to 17%. In Botswana, poisoning by various agents contributes to 7% of morbidity and ranks third among injuries leading to hospitalization (20)

The burden of poisoning exposures in Africa is a significant public health concern. However, only ten of 58 countries (17.2%) have poisons information centers (PICs). The true extent of acute poisonings in Africa is not known. It is difficult to obtain accurate figures since poisoning cases are usually poorly documented. Reasons include lack of resources and knowledge to diagnose poisoning, the fact that only certain acute poisonings are required to be reported to the local or national department of health, and low levels of death registration. Hence, it is difficult to obtain reliable epidemiological data. According to WHO estimates based on data from 2012, unintentional poisoning accounts for 39,800 deaths and 27,949,000 DALYs in the UN Africa region (21. 22)

Acute poisoning is a manifestation and result of the interplay between psychological, economic, cultural, policy/legislation, and other regional factors. This is illustrated by the marked inter-population differences in the nature and magnitude of the problem, particularly when contrasting developed and developing countries. Studies have revealed that deliberate self-harm is a common form of acute poisoning in the developing world (23).The mortality rate is often high, due to: the inherent toxicity of the poisons taken, the greater availability of highly toxic chemicals and products because of weak regulation, ingestion of large doses, and poor medical care (23). The lack of infrastructure and financial resources are further limitations that may have a profound effect on health strategies in Africa. Many countries have very limited resources to detect, measure, and manage the effect of chemicals on health, as exemplified by the lack of PICs, toxicological expertise among health professionals, and laboratory analytical facilities (24)

Similarly, in Ethiopia, few studies have reported the epidemiology of human poisonings exposure and the exact incidence of this problem remains uncertain due to under-diagnosis and underreporting. (15, 38, 15). Furthermore, there is no sufficient data on institutional availability of resources for management of poisoned patient in Ethiopia.

1.2 Significance of the study

A few studies conducted in Ethiopia reported that acute poisoning is a common public health problem or medical emergency. However, there is significant scarcity of data on availability resources for management of poisoned patient. Therefore, this study identified available resource and identified the gaps and challenges at five selected governmental hospital in Addis Ababa. The result of this study could be used as a base line data for regional and national health bureau, none governmental organization working on acute poisoning. Furthermore, the respective studied hospitals can use the results as a feedback to strengthen their resources and service provision for acute poisoned patient.

2. LITERATURE REVIEW

With the availability of a vast number of chemicals and drugs, acute poisoning is a medical emergency (25) and is considered one of the most common reasons for visiting emergency departments (EDs). Poisoning exposures continue to be a significant cause of morbidity and \mortality worldwide (26). The National Vital Statistics Reports showed that poisoning was the fifth leading cause of injury and death in the United States of America in 2010 (27), while the exact incidence of this problem in Ethiopia remains uncertain and information available is limited due to under-diagnosis and underreporting. The growing incidence of poisoning has highlighted the importance for countries to have special programs for poison control and, in particular, the facilities for diagnosis, treatment, and prevention of poisoning (28).

Epidemiology of Acute poison

Survey conducted in 18 hospital of Pakistan to assess availability treatment resource showed that paracetamol poisoning was ranked first followed by bee stings and organophosphates [29]. Another observational, retrospective study conducted in Gondar teaching hospital emergency room shows , Organo-phosphates were the most frequent cause of poisoning and accounted for 89 cases (38.2%). Sodium hypochlorite was the second most frequent cause of poisoning (34.8%, 81 cases), followed by drug (6.9%, 16cases) and CO (6.0%, 14 cases).In the remaining sixteen cases of poisoning (6.9%), the substance involved was unidentified [30].

Other study conducted in Gonder shows the causative poison was documented in 87% (298/344) of cases. Ingestion of organophosphate pesticides and bleach accounted for 35% (121/344) and 25% (84/344) of cases, respectively. Other types of poisoning occurred using prescription medications, organo-chlorines, foodborne toxins, carbon monoxide, alcohol, herbal medications, hydrogen peroxide, kerosene, and benzene. [15]

The other study conducted in jimma university specialized hospital shows that most common involved toxic agents were house hold cleansing agents (43, 41.7%), organophosphates (28, 27.2%) and drugs (phenobarbitone and antidepressants) (13, 12.6%), alcohol (9, 8.7%), and hydrocarbons (Benzene, kerosene) (6, 5.8%) [31]

Availability of decontamination resources

The study conducted in Pakistan 18 hospitals on the availability of resource for management of poisoned patient vary according to hospital type. For example, concerning the resources for performing decontamination through gastric lavage in the poisoned patient,

nasogastric tubes were available in both (in governmental and private) types of hospitals. The availability of orogastric tubes was less than that of nasogastric tubes. According to activated charcoal (AC) dosage form, AC syrup was found to be more common than the tablet and powdered forms, and it was available in the majority of EDs in the hospitals investigated (83.3%). Furthermore, sorbitol, ipecac syrup, and polyethylene glycol were almost never available, especially in governmental hospitals. [29]

Availability of stabilization resources

The study conducted in Pakistan for stabilization resources, 11 items which are useful in monitoring or treating poisoned patients were considered. Differences in availability of such resources did not reach significant difference by hospital type, as most resources were found in both (Gov and Private) types of hospital. Six items out of the 11 were available in all 18 hospitals (100%). These items were blood pressure apparatus, IV cannula, crystalloid, nasal catheter, oxygen mask, and endotracheal tube. In addition, 3 items of the 11 were available in more than 80% of all types of hospitals. However, the availability of the remaining resources, which include colloids, and, in particular, pacemakers, was found to be less common. However, the availability of such resources was much better compared to decontamination and elimination resources [29]

Availability of elimination enhancement resources

The study conducted in Pakistan for the availability of techniques used to enhance the elimination of toxic substances, there were variations between the hospitals types. However, these differences did not reach statistical significance, except for haemodialysis ($p = 0.003$), where the availability of this technique was far better in governmental hospitals compared to private hospitals (90% vs. 12.5%). Haemoperfusion, haemofiltration, alkaline diuresis, acid diuresis, and peritoneal dialysis were almost never available, especially in private hospitals in Pakistan.[29]

Availability of antidotes and essential drugs

The study conducted in Pakistan the overall availability of each antidote in varied widely; it ranged from zero (for fomepizole, cyanide kit and dimercaprol) to 100% (for atropine sulphate, calcium gluconate and sodium bicarbonate). However, four antidotes were severely deficient in hospitals (available in less than 20% of all hospitals). Those included digoxin immune Fab, polyvalent snake anti-venom, pralidoxime, and pyridoxine. None of the responding hospitals

stocked all of the antidotes on the list. In relation to hospital type, there is variability in the availability of antidotes. However, these differences did not reach statistical significance except for deferoxamine ($p < 0.001$). Deferoxamine was available in all governmental hospitals, but none of the private hospitals stocked it. Atropine sulphate, calcium gluconate and sodium bicarbonate were available in all governmental and private hospitals. [29]

The study conducted in Pakistan the availability of other antidotes in the second list varied widely from zero (for calcium disodium edetate) to 100% (for flumazenil and vitamin k). All hospitals stock flumazenil and vitamin k. In contrast, calcium disodium edetate was the only antidote on the list that was not available at any hospital. By hospital type, the availability of essential drugs varied substantially. However, these differences did not reach statistical significance in all cases. Overall, the availability of most items was excellent, ranging from more than 70% to 100%, except for thiamine, isoproterenol, leucovorin, and physostigmine.[29]

The other descriptive cross-sectional study that is conducted in Malaysia shows. Seventy-four (58.3%) out of the targeted 127 hospitals replied and completed the questionnaire. The availabilities of most items related to stabilization resources were far better in general hospitals compared to district hospitals with specialists and district hospitals without specialists. These items were mechanical ventilators ($p = 0.011$), non-invasive positive pressure ventilators (0.024), pacemakers ($p = 0.019$), and transcutaneous cardiac pacing (p\0.001).

On the same study shows the availability of decontamination resources varied substantially with hospital type. Nevertheless, these differences did not reach statistical significance in any of the cases, whereas sodium sulphate, sorbitol, and polyethylene glycol were almost never available. The availabilities of most items related to elimination enhancement resources were far better in general hospitals and district hospitals with specialists compared to district hospitals without specialists. These items were haemodialysis ($p = 0.046$), haemoperfusion ($p = 0.002$), haemofiltration ($p = 0.002$), acid diuresis ($p = 0.04$), peritoneal dialysis (p\0.001), and exchange transfusion (p\0.001).

3. OBJECTIVES

3.1. General Objective

The general objective of this study was to assess the availability of treatment resource in emergency department for the management of acute toxic exposures and poisoning detection in selected governmental Hospital (St. Peter's specialized hospital, Zewditu Memorial Hospital, Dagimawi Minillik Medical college Hospital, Yekatitti 12 Hospital Medical College, Ras Desta Damtew Hospital) , Addis Ababa, Ethiopia**.**

3.2. Specific objectives

- To assess availability of key resource for decontamination
- To assess availability of key resource for stabilization
- To assess availability of key resource for elimination
- To assess availability of specific antidotes and essential drugs

4. METHODOLOGY

4.1. Study Design

Hospital based descriptive cross sectional study was used to assess availability of treatment resource in emergency department for the management of acute toxic exposures and poisoning detection in selected governmental hospitals, Addis Ababa, Ethiopia.

4.2. Study area and period

The study was conducted in selected government public hospitals found in Addis Ababa city. St Peter's specialized Hospital, Yekatit 12 Hospital Medical Collage, Minillik II Referral Hospital, Zewditu Memorial Referral Hospital and Ras Desta Damtew Hospital were selected for the study periods scheduled from December 2016 to June, 2017.

4.3. Source population

- All Governmental hospital in Addis Ababa

4.4. Study area

- St Peter's specialized hospital, Yekatit 12 Hospital's Medical Colleage, Minillik II Referral Hospitals, Zewditu Memoria Referral Hospitals and Ras Desta Damtew Hospital

4.5. Study subjects

4.6.1. Inclusion and Exclusion criteria

- All material and instrument that is functional during the study period that are found in the selected hospitals
- Antidotes that is recommended and not expired

4.6.2. Exclusion criteria

- All material and instrument that is out of function/ expired at the moment of the study
- Selected anti-dotes and essential drugs that is expired at the study period

4.7. Sample size determination

The study was done on 5 hospitals (45% of the 11 Hospitals) are select by lottery method from the 11 governmental public hospital in Addis Ababa. This selection is done based on WHO 2013 standards (37). (Above 30% is possible according to WHO)

4.8. Sampling procedure

Out of 11 public hospitals 5 (St peter's Specialized, Minilik II medical college, Yekatit 12 Medical college , Ras desta Damtaw M. and Zewditu memorial) hospitals were selected by

using simple random sampling technique; all public hospital found in Addis Ababa; those 5 hospitals or 45 % of hospitals were selected by using lottery methods.

4.9. Variables

4.9.1. Independent Variables

- Decontamination resources
- Stabilization resources
- Elimination enhancement resources
- Availability of recommended antidotes and essential drugs

4.9.2. Dependent variables

- Availability of treatment resource for the management of acute toxic exposures and poisoning.

4.10. Data collection methods

4.10.1. Data collection procedure and tools

The data was collected using checklist prepared based on WHO recommendation of acute poisoning management resource assessment tools. The checklist has four parts. The first section focused on the epidemiological data pertaining to the types of poisoning cases admitted over the last two years at the hospital (2015 and 2016). The data was collected from patient's record who were seen at emergence department. The second part of the checklist assessed equipment for decontamination and elimination enhancement available in the hospital. The third section of the check list was use to assess commonly required antidotes and the fourth one assessed essential drugs used for treating poisoning complications. This checklist was filled by principal investigator through observation and/or interview of the respective concerning sites and body respectively**.**

4.10.2. Data processing and Analysis

The data was checked for completeness, cleaned and entered into computer for analysis. The data analysis was done using SPSS version 20.0 for windows where appropriate. The results presented using tables and graphs, percentages where appropriate.

4.11. Ethical consideration

Ethical clearance was obtained from departmental research and ethical review committee of the department of emergency medicine and critical care, Addis Ababa University. Official letter of permission from the department was submitted to St. Peter's specialized hospital, Zewditu

Memorial Hospital, Dagimawi Minillik Medical college Hospital ,Yekatitti 12 Hospital Medical College, Ras Desta Damtew Hospitals in order to conduct the research. All the collected data kept confidential and no one except the members of the research team had access to the collected information. All paper and computer records of the study kept in a secured place under lock.

4.12. Dissemination plan

The finding of the study will be presented to the department of Emergency Medicine and Critical care / AAU and those selected hospitals. It will also be disseminated through presentations in different professional association meetings and annual conferences. The paper will also be submitted to national or international peer reviewed scientific journals for possible publication.

4.13. Operational definitions

A poison is any substance that causes harm if it gets into the body. Harm can be mild (for example, headache or nausea) or severe (for example, fits or very high fever), and severely poisoned people may die

Poison control center: is a center of technical expertise about chemicals and toxins and their harmful effects. As a minimum it is a poisons information service that provides emergency information, but some centers also include a toxicology laboratory and/or a clinical treatment unit.

Decontamination resources: A resource that is needed for removal of the patient from the substance and the substance from the patient

Stabilization resources: material used to monitor poisoned patient

Elimination enhancement resources: A resource that is needed for removal or elimination of toxic substance from the patient body

Antidotes: a drug that stops the harmful effect of poison

5. Result

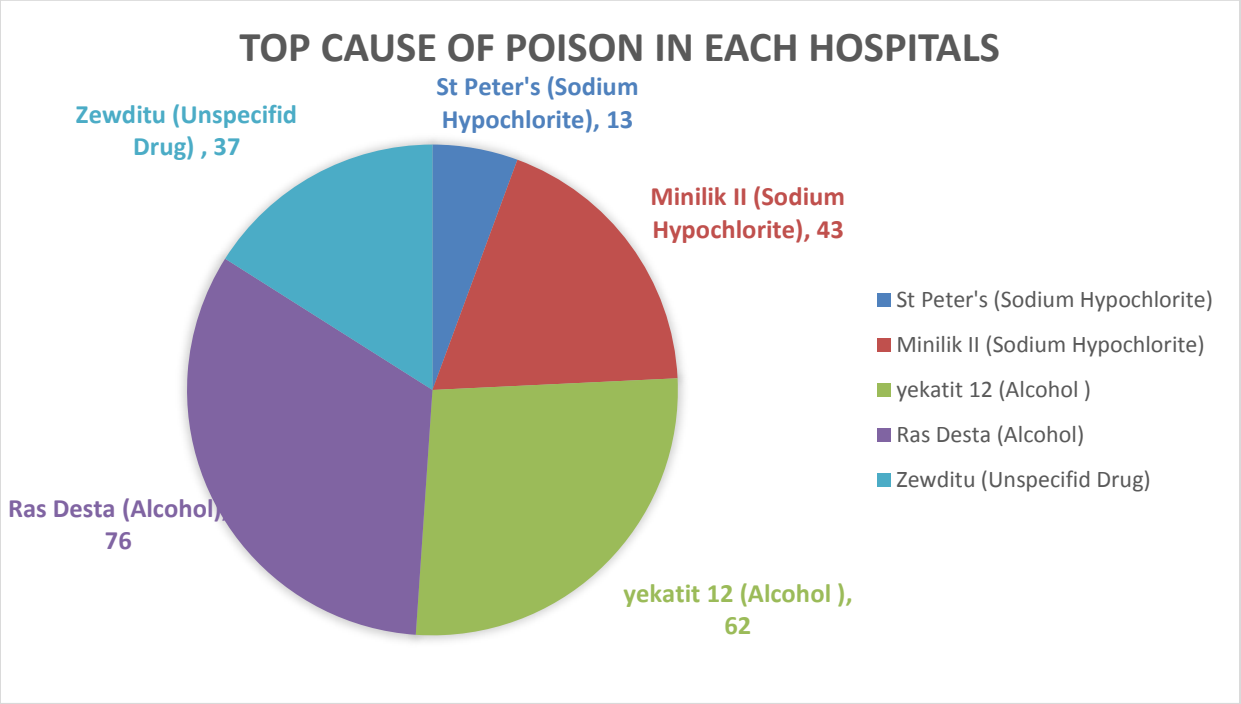
A total of five hospitals were included in this study to assess a top leading cause of acute poising among patients were registered due to cause of poisoning in Addis Ababa, governmental public hospital

Table 1. Top ten causes of poisoning in each hospital from December 2015-December 2017

Rank	Toxic agent	St peter's	Minilik II	Yekatit 12	Ras desta Hospital	Zewditu	Total
1	Organophosphate poison	7	39	52	50	25	173(18.8%)
2	Bleach (Sodium hypochlorite) poison	13	43	33	57	26	172(18.6%)
3	Alcohol Poison	8	15	62	76	6	167(18%)
4	Unspecified drug poison	6	19	29	27	37	118(12.8%)
5	Carbon Monoxide poison	5	16	41	38	14	114(12.3%)
6	Rodenticide(Rat Poison)	4	8	11	20	12	55(5.9%)
7	Other Detergent(Detol) Poison	0	5	13	10	13	41(4.4%)
8	Organo chloride Poison	0	5	4	8	1	18(1.9%)
9	Carbamazepine Poison	2	6	0	2	4	14(1.5%)
10	Chlorpromazine (CPZ)poison	3	0	5	4	1	13(1.4%)
11	PCM Poison	0	7	0	0	5	12(1.3%)
12	Snake Bite	1	0	2	2	2	7(0.7%)
13	Amoxicillin Over Dose poison	0	5	0	0	0	5(0.5%)
14	Other drug poison	0	4	0	1	0	5(0.5%)
15	Tricyclic antidepressants(TCA)poison	0	0	3	0	1	4(0.4%)
16	Kerosene poison	1	1	0	0	0	2(0.2%)
	Total	50	173	255	295	147	920

During the 24 month study period from December 2015 to December 2017 GC there were a total of 920 poison case admition in surveyed Hospital ED. Out Of 920 poison Case, Organo phosphate Poison were the most frequent cause of poisoning and ac-counted for 173 cases (18.8%). Sodium hypochlorite poison (Bleach) was the second most frequent cause of poisoning (18.6%, 172 cases), followed by Alcohol poison (18.2%, 167 cases) and Unknown drug (12.3%, 114 cases), the fifth leading cause of poison in surveyed hospital was carbon monoxide (114 case 12.3%), the remaining hundred seventy six (176) cases of poisoning (19.1%), the substance involved was Rodenticide (Rat poison) (5.9% 55case),Other House cleanings agent (eg detol) (4.4%,41Case),OrganoChloridepoison(1.9%,18case)Carbamazepine(1.5%,14case),Chlorpromazine (1.4%,13case), PCM (1.3%, 12case), Snake Bite (0.7% ,7case), Amoxicillin Over Dose(0.5%, 5case)and Other Drug Poison kerosene(0.5%, 5case) and other poison case respectively.

Fig 1. The most top cause of poisoning in Hospital by Hospital type From December 2016 December 2017 GC



Over the study period, the most top cause of poisoning cases accounts 920 were registered in the Surveyed hospital ED registries From Desember 2015 to Desember 2017, The Most top cause Of poison in two hospital (St Peter's and Minilik) were Sodium hypochlorite (Bleach) (6%,13 Case from a total of 50 and 18% ,43 Case from a total of 173) Respectively; But in other two hospitals (Ras Desta Damtaw and Yekatit 12 Hospitals) Alcohol Poison Had registered as top cause of poison (33% 76 case out of 295 registered and 27% 62 case Out of 255 Registered Patients) respectively. Unknown drug (37case, 16% from a total of 147) top Leading cause of poison in Zewditu Hospital. (Fig 1)

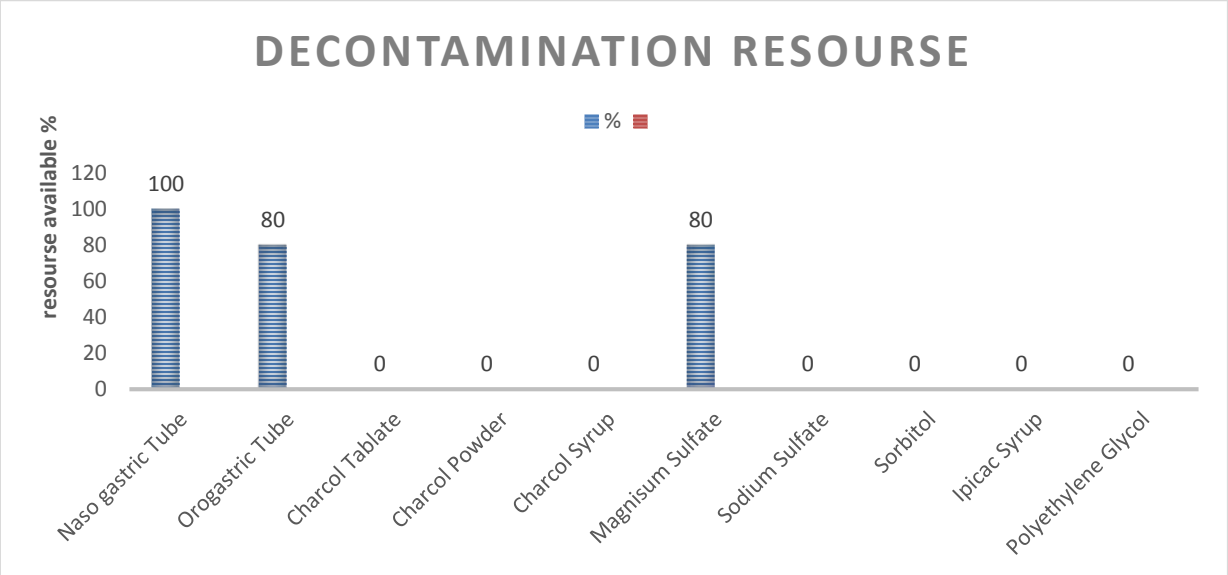
Table 2 Type of health facility

No	Type of hospitals	Number (%)
1	Public	2 (40)
2	Referral	1(20)
3	Medical college	2(40)

1 Availability of decontamination resource

For the availability of techniques used to decontaminate toxic substances, From Materials Nasogastric tube, orogastric tube were included and From Drug all form of charcoal, Magnesium Sulphate, Sodium sulphate, Ipecac Syrup and Polyethylene Glycol were included in the survey. In all the hospitals all form of Charcoal and Sodium Sulphate were not available. Four of the five hospitals have had Orogastric tube and magnesium Sulphate. Only Nasogastric tube out of the ten decontamination resource had available in all hospitals. Almost all of the drugs and material recommended by WHO (table 3).

Fig 3 availability of decontamination resource at five government hospitals Addis Ababa, Ethiopia



2. Availability of recommended antidotes

The overall availability of WHO grade and Ethiopian essential drug list recommended antidotes are shown in table 4. The availability of antidotes ranges from 0 (for essential antidotes such as fomepizole, pralidoxime, deferoxamine, Digoxin immune Fab) to 100% (for few antidotes such as Atropine sulphate, Vitamin K and Pyridoxine). However, none of the studied hospitals have the stock of all either WHO or Ethiopian essential drug list recommended antidotes and none had dimercaprol, glucagon, and Protamine sulphate.

Table 4 availability of essential antidotes at five government hospitals Addis Ababa, Ethiopia

Essential antidotes	**Number (%)**	**Essential list in WHO/ Ethiopia**
Atropine sulphate	5(100)	EE
Calcium gluconate	5(100)	EE
Deferoxamine	0 (0)	EW
Digoxin immune Fab	0(0)	EW
Dimercaprol	0(0)	EW
Ethanol100 (IV)	0(0)	EW
Fomepizole	0(0)	EW
Glucagon	0(0)	EW
Methyleneblue	2(40)	EW
N-acetaylcysteine	1(20)	EE/EW
Naloxone	2(40)	EW
polyvalentantiVenom	1(20)	EE
Pralidoxime	0(0)	EW/EE
Pyridoxine	5(100)	EW/EE
Sodiumbicarbonate	4(80)	EW
CyanideKit	0(0)	EE
Calcium disodium edetate	0(0)	
Flumazenil	0(0)	

Leucovorrin	1(20)	
Protamine sulphate	0(0)	EE
VitaminK	5(100)	EE
Physostigmine salicylate	1(20)	

*EE- Ethiopian essential, *EW-WHO essential

3. Availability of elimination enhancement resources

For the availability of techniques used to enhance the elimination of toxic substances, Haemoperfusion, haemofiltration, Haemodialysis, alkaline diuresis, acid diuresis, peritoneal dialysis and Exchange transfusion were included in the survey tool. In all the hospitals peritoneal dialysis is not available. Three of the five hospitals have had Haemoperfusion, haemofiltration, Haemodialysis. Only one out of the five hospitals had alkaline diuresis, acid diuresis and Exchange transfusion (table 5).

Table 5. Availability of elimination enhancement resources

Elimination Enhancement	**Number (%)**	**Essential list in WHO/ Ethiopia**
Haemodialysis	3 (60)	EW
Hemoperfusion	3 (60)	EW
Hemofiltration	3(60)	EW
Alkaline Diuresis	1 (20)	EW
Acid dieresis	1(20)	EW
Peritoneal dialysis	0(0)	EW
Exchange transfusion	1(20)	EW

4. Availability of stabilisation resources in the hospitals

As shown in table 6 stabilization resources which are useful in monitoring or treating poisoned patients were included in the survey tool. Six items out of the 9 were available in all 6 hospitals (100%). These items were blood pressure apparatus, IV cannula, nasal catheter, oxygen mask, endotracheal tube, and Electrical Defibrillation. Furthermore, 80% of the hospitals had all the two resources. Only pacemaker was not available in a single hospital.

Table 6. Availability of stabilisation resources

Stabilisation recourse	**Number (%)**	**Essential list in WHO/ Ethiopia**
Blood Pressure Apparatus	5(100)	EW
IV Cannula	5(100)	
Nasal Catheter	5(100)	EW
Laryngeal mask airway	4(80)	
Oxygen mask	5(100)	EW
Endotracheal tube	5(100)	
Mechanical ventilator	4(80)	
Pacemaker	0(0)	
Electrical Defibrillation	5(100)	

5. Availability of essential emergency medication

Majority of essential emergence medication are available in all hospitals. However, medications such as gelofusine, Isoproterenol, Hydroxyethl starch, Isoproterenol are absent in all the hospitals investigated. In addition, thiamine is only available in one hospital. (Table 7)

Table 7 Availability of essential emergency medication

Drug	**Number (%)**	**WHO recommendation**
Hydroxyethl starch	0(0)	
Gelofusine	0(0)	
Normal saline	5 (100)	
Lactated Ringers Solution	5 (100)	EW
Glucose(dextrose)	5 (100)	
Epinephrine	5 (100)	EW
Isoproterenol	0 (0)	
Dopamine	5 (100)	
Bronchodilators	5 (100)	
Corticosteroid	5 (100)	EW
Antihistamine	5 (100)	
Thiamine	1 (20)	
Diazepam	5 (100)	EW
Phenytoin	5 (100)	EW
Morphine	5 (100)	EW
NSAIDs	5 (100)	EW

6. Discussion

In this study, a two-year epidemiologic pattern of acute poisoning in five selected public governmental hospital in Addis Ababa, Ethiopia were analyzed nine hundred twenty (920) poisoned patients were registered from December 2015 to December 2017 in the selected government hospital. The distributions of poison case were nearly similar (173 case18.8% Organo Phosphate poison, and 172 case18.6 % of Sodium Hypochlorite) in the present study, which was like the other two hospital-based epidemiologic studies on poisoning in Ethiopia, i.e. Organo phosp predominance in the study carried out in Gondar University. (15)

The results of this study indicate that most Ethiopian hospitals have certain important immediate interventions such as gastrointestinal decontamination techniques and resources to enhance poison elimination. Currently, there are no generally recognized specific criteria that define the preparedness of an ED for the management of acute toxic exposures and poisonings.

This present study showed that the resources required for performing Gastric Lavage, such as nasogastric and orogastric tubes, were more common than other preparations used to decrease the absorption of toxic agents such as charcoal, laxatives, and whole bowel irrigation. This finding is consistent with the result of a previous study of poisoning in Palestine that showed among the cases which had undergone a decontamination procedure, Gastric lavage was the most commonly used (26**)** and, Other study conducted in jimma And Gonder teaching hospital in our country showed the same result with this finding(15, 31)

The data of the present study also show that resources for performing decontamination through gastric Lavage, such as nasogastric tubes, are available in all EDs of hospital (100%). The same study conducted in Pakistan hospitals shows no deference with our finding. (29)

The present study showed that ipecac syrup is not available in all 100% of EDs of our hospitals. These findings are consistent with survey conducted in hospital of Pakistan, 0% available current recommendations that indicate that ipecac syrup should not be used routinely after poisoning exposures due to the lack of evidence of improved outcomes and risks, including reduced effectiveness of Activated Charcoal, delayed administration of oral antidotes, aspiration pneumonitis, and other complication of prolonged emesis (32)

Further, the study showed that Activated Charcoal is not available in all hospital's EDs. the same study Conducted in Pakistan Shows More than 83.3% Had no charcoal in there hospitals and other study Conducted in South Africa shows the availability of activated charcoal

is below 40% Because of poor supply management system. WHO and Ethiopian Essential drugs list include this drug as essential drug to treat poison case (29). Moreover, the data of this study indicate that the resources for performing decontamination through whole bowel irrigation (WBI), such as polyethylene glycol, are not available in all of the EDs of the surveyed hospitals. According to WHO it is listed as essential drug.

There is no sorbitol at all in all surveyed hospital of studded. Sorbitol was rarely available, in governmental hospitals of Pakistan (29). Controversy remains over the use of cathartics to hasten elimination of toxins from the gastrointestinal tract. And listed as essential drug in Ethiopia

The results of our study concerning the availability of GI decontamination resources are consistent with the Malaysian study performed by Awang et al. (32) and Pakistan study (29)

In this study any of the hospital ED had charcoal in any form. The survey that they conducted, reported in Pakistan the availability of charcoal tablets was better than powdered form, and that they were available in more than two-thirds of the EDs of Pakistan , ,but the drug is listed as essential drug in WHO and Ethiopian essential drug list.(29)

This findings regarding the availability of stabilization resources were also compatible with the results of Awang et al. (32), except for volume expanders (colloids), in which their availability was much better and reached 100%, and survey conducted in Pakistan (32)

In the this study, results showed that hemodialysis was widely available in most hospitals 60%, which might result in an increased used of this technique to enhance the elimination of specific toxic agents. Surprisingly, among elimination enhancement resources, acid diuresis was available in 20% or only one of surveyed hospitals. However, acid diuresis is no longer recommended or used in poisoning treatment. It is a therapy which is associated with significant risk and little benefit, and its use has been abandoned (39).

In our study, it is unclear why the respondents indicated that alkaline diuresis is nearly unavailable (20% only 1 hospital), however, the data indicated that intravenous catheters, crystalloid (100% all hospitals) and sodium bicarbonate (80% four out of 5 hospitals) were widely available. This may be because the respondents are unfamiliar with the use of these agents in some poisoning cases treatment, or the therapy is unavailable for some reasons, e.g. inability to check blood gases due to unavailability of arterial blood gas analyzer or other case.

It is clear that the majority of governmental hospitals (e.g. haemodialysis resources 60%) perform some elimination enhancement techniques as they have the proper facilities for that.

There were no apparent differences in the availability of elimination enhancement resources between this study and study conducted in Palestine and Malaysia, except for peritoneal dialysis, which was available in 51.4% of the Malaysian hospitals and was considered one of the most common techniques used to enhance the elimination of toxic substances (32)

This results show that a large percentage of antidotes are not available in the surveyed hospitals. Certain important antidotes, which are included in the essential drugs list implemented by the FMOH, are not stocked by a substantial number of hospitals. Examples of such antidotes include pralidoxime for organophosphate poisoning and calcium Disodium edetate for heavy metal poisoning.

Among the hospitals, Organophosphate toxic exposure was the most frequently reported case by EDs, followed by alcohol and unspecified drug exposure. Surprisingly, there is no hospitals had the antidote for Organophosphate poisoning (pralidoxim) in stock.

In addition, the availability of an antidote to treat individual patients who have been poisoned with cyanide was inadequate, as the 5 hospitals held no antidote. Furthermore, the availability of fomepizole, which is used as an antidote for ethylene glycol and methanol toxicity, was the same as that of the cyanide kit. As previously reported by Al-Sohaim et al. (40) and Sawalha et al. (26)

Antidotes used to treat conditions other than poisoning and toxic drug exposure were more frequently stocked. Atropine sulphate, calcium glyconate, dopamine, diazepam and sodium bicarbonate were available in the majority of hospitals.

Insufficient antidote stocking is not a unique problem to Ethiopia. This findings are also consistent with studies from multiple countries which report variable and inadequate antidote stocking levels. A recent study carried out by Al-Sohaim et al. (40) found that no hospital had sufficient stock of 16 antidotes. Wium and Hoffman (41) conducted a study in South Africa.

The results of the study revealed that there was a problem with regard to the availability and distribution of important antidotes, as none of the responding hospitals stocked all of the antidotes on the list. A similar study performed in north Palestine that was carried out by Sawalha et al. (26) showed that the number of antidotes stocked in all hospitals ranged from 5 to 12, but that no hospital stocked all 25 of the antidotes listed.

An Australian study carried out by Nissen et al. (42) Health 2010, 18:78–84.] Surveyed Queensland hospitals as to the level of stocks held of 13 antidotes. This study reported that while

most hospitals stocked some important antidotes, no hospital stocked all 13 and few hospitals had sufficient stocks to treat an adult patient.

7. Strengths and limitations

The major strength of the current study is that it is the first of its kind to assess the availability of resource in hospitals for the management of acute toxic exposures and poisoning in Ethiopia. Furthermore, this is also the first study to assess the antidotes stock level throughout Ethiopia.

This study is subject to a number of limitations. The use of secondary data in the study limited control over the quality of data that were collected due to unsatisfactory record-taking and record-keeping. Pages from registers were torn out and some patient files were missing. Lack of cooperation in same hospital staff. The objectives of the study were only to document the availability of immediate interventions (gastrointestinal decontamination techniques, patient stabilization resources and methods to enhance elimination) and the availability of antidotes. On the availability of these resources for the management of acute toxic exposure and poisonings in in selected governmental Hospital in Addis Ababa. My study did not include other factors that may determine the appropriateness of these resources and whether those resources are specifically used for poisoning or for other indications. Also, I have not performed a study that clarifies the demographic, etiological and clinical characteristics of actual poisoning cases, as some poisoning cases that occur in the in those selected hospitals. The data collected depend upon the knowledge and responsiveness of the respondents, which carries inherent risks of reporting error or bias. Thus, the results might not reveal the current levels of readiness and antidote stocks in those 5 selected governmental hospitals.

8. Conclusions and recommendations

This study looked at 5(St Peter's specialized hospital, Yekatit 12 Hospital's Medical Colleage, Minillik II Referral Hospitals, Zewditu Memoria Referral Hospitals and Ras Desta Damtew Hospital. The availability of treatment resources and antidotes in those hospitals were not adequate, except for stabilization resources. There was variability in the availability of these resources, particularly in the availability of resources that enhance the elimination of poison. Most hospitals stocked some of the surveyed antidotes.

There are no guidelines in place as to which antidotes should be considered essential for use in those selected hospitals except St Peter's Hospital, so specific antidote stocking guidelines might be required and useful in Ethiopia hospitals. Coordination between toxicology center and hospitals should be established regarding emergency facilities for the effective management of poisoning cases, as well as the type and quantity of antidotes in each hospital in order to direct the poisoned patients to the hospital where the appropriate management resources and suitable antidote are available. Since this study is descriptive in nature, it serves as baseline data for further studies related to acute toxic exposure and poisoning.

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10. Annex

10.1 The questionnaire

This questionnaire is designed to assess the availability of resources for the management of acute toxic poisonings in five selected governmental Public hospitals in, Addis Ababa.

Please kindly answer all questions carefully, noting that it will not use for the purposes of scientific research.

First Section

==========

1. **Rank of the most frequent 10 toxic agents registered over the last two years (2015-2016) at five selected governmental Public hospital.**

Rank	Toxic agent
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Second Section

Please indicate the following:

*** Date: ……..**

*** Hospital Name: ……..**

*** Type of Hospital: …….**

*** City: Addis Ababa**

*** Department Supervised Person (Choose only one):**

□ Doctor □ Pharmacist □ Nurse □ Other

*** Does the hospital receive cases of poisoning: □ Yes □ No**

==========

2.1.Put X if the decontamination resources are available or not in the hospital:

Resources	**Yes**	**No**	**Essential list in WHO/ Ethiopia**
Nasogastric tube			
Orogastric tube			
Charcoal tablet			
Charcoal powder			
Charcoal syrup			
Magnesium sulphate			
Sodium sulphate			
Sorbitol			
Ipecac syrup			
Polyethylene glycol			

2.**2 Put X if the stabilization resources are available or not in the hospital:**

Resources	**Yes**	**No**	**Essential list in WHO/ Ethiopia**
Blood pressure apparatus			
IV cannula			

Nasal catheter			
Laryngeal mask airway			
Oxygen mask			
Endotracheal tube			
Mechanical ventilator			
Colloid Hydroxyethyl starch Gelofusine			
Crystalloid Normal saline LactatedRinger's solution Glucose (dextrose)			
Pacemaker			
Electrical defibrillation			

2.3 Put X if the enhancement of elimination resources are available or not in the hospital:

Resources	**Yes**	**No**	**WHO standarde**
Haemodialysis			
Haemoperfusion			
Haemofiltration			
Alkaline diuresis			
Acid diuresis			
Peritoneal dialysis			
Exchange transfusion			

Third Section

Please indicate the following:

*** Date:……..**

*** Hospital Name:……..**

*** Type of hospital:…….**

*** City: Addis Ababa**

*** Does the hospital receive cases of poisoning: □ Yes □ No**

==========

3.1 Put X if these antidotes are available or not in the hospital:

Antidote list	**Yes**	**No**	**Essential list in WHO/ Ethiopia**
Atropine sulphate			
Calcium gluconate			
Deferoxamine			
Digoxin immune Fab			
Dimercaprol			
Ethanol (100%)			
Fomepizole			
Glucagon			
Methylene blue			
N-acetylcysteine			
Naloxone			
Polyvalent anti-venom			
Pralidoxime			
Pyridoxine			
Sodium bicarbonate			
Cyanide Kit			

==========

3.2. Put X if the other antidotes and essential drugs are available or not in the hospital:

Antidote list	**Yes**	**No**	**Essential list in WHO/ Ethiopia**
Availability of other antidotes			
Calcium disodium edetate			
Epinephrine			
Flumazenil			
Isoproterenol			
Leucovorrin			
Protamine sulphate			
Vitamin K			
Physostigmine salicylate			
Availability of essential drugs			
Dopamine			
Bronchodilators			
Corticosteroid			
Antihistamine			
Thiamine			
Dextrose			
Diazepam			
Phenytoin			
Morphine			
NSAIDs			

Declaration

I, the undersigned, declare that this is my original work and that all sources of materials used for this thesis are duly acknowledged

Name: Tesfaye Girma

Signature: _____

Date of submission: _____

Place: Addis Ababa, Ethiopia

This thesis has been submitted for examination with my approval as University advisor.

Name of advisor: 1.Dr. Sofia Kebede 2.Achamyelesh Tadele

Signature_____ Signature_____

Date_____ Date_____

Examiners	**Signature**
1._____	_____
2._____	**_____**
3._____	**_____**