Original article

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Availability of treatment resources in the emergency department for the management of acute toxic exposure and poisoning in governmental hospitals in Dessie town

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ABSTRACT

***Background**: Accessibility of drugs and over-the-counter drugs in hospitals are not enough and such accessibility of drugs acts as the preparedness of a hospital emergency department in health facilities in controlling of emergency poisoning.*

***Methods:** An institution based retrospective cross-sectional study design was conducted. Data were collected using a semi-structured questionnaire. Three nurses were trained for the data collection of this study and data entry was done by using SPSS version 20.0. Descriptive statistics were performed and findings were presented using tables & graphs.*

***Results:** There were a total of 520 toxic cases who had the service (169 from Boru Meda Hospital and 351 from Dessie Referral Hospital). The first cause of poisoning was organophosphate poison 140 (26.9%). From decontamination resources, sodium sulfate, sorbitol, ipecac syrup, polyethylene glycol, and colloids were not present in both hospitals. From stabilization resources, there were no colloids in both hospital. From antidots, only atropine sulfate, calcium gluconate, polyvalent antivenom, and sodium bicarbonate were accessible throughout all time of the study period in both hospitals.*

***Conclusion and Recommendation:** The supply of drugs and over-the-counter drugs in those hospitals were partially present, apart from stabilization resources. It is recommended that selected antidotes, stabilization, decontamination, and elimination treatments are accessible.*

Keywords: Poisoning, De-contamination, elimination enhancement, stabilization resources, antidotes

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1. Introduction

A poison is a substance that, when swallowed, inhaled, injected, or absorbed via the pores and skin, is harmful to human health. At higher quantities, substances that are benign or helpful at low levels can become poisonous. (1) The availability of treatment resources and antidotes in hospitals is insufficient, and their availability serves as a barometer for the extent to which sanatorium Emergency Departments (EDs) in fitness centers are prepared to deal with acute poisonous publicity and poisoning. (2 & 3)

Poisoning and poisonous exposures are major health concerns, as well as the most common means of suicide in the world. (4- 6) Poisoning of children under the age of five is the leading cause of death worldwide, accounting for 80% of all cases7. In actuality, every man and woman is exposed to toxic chemicals in sub-lethal doses8. Poisoning is a common reason for visits to emergency rooms and hospitalization around the world, with significant morbidity and mortality in many countries9. Poisoning is the third most common emergency in children, resulting in morbidity and mortality. (10)

The World Health Organization (WHO) estimates that the total number of acute accidental poisonings in the industry ranges from 2 to 3 million per year, with 1 million severe poisonings resulting in 20000 deaths per year, while the annual number of intentional poisonings is expected to be around 2 million, resulting in 200 000 suicides. (10 &11)

Poisoning, particularly organophosphate poisoning, is a major health concern around the world, and poisoning cases are increasing daily. According to WHO estimates from 2012, around 193,460 individuals died worldwide as a result of poisoning, with 84 percent of those deaths occurring in low- and middle-income countries. (12 – 14)

Because of a lack of resources to buy poison-fighting treatments, mortality from poisoning in developing nations is even higher than in developed countries if not treated early with removal and other ways. This is due to a lack of resources to acquire poison-fighting drugs. In emerging countries, pesticides and hydrocarbons are the most popular products. (15-19) Ethiopia, like other low-income international locales, lacks epidemiological data on poisoning. (20-22) Poisoning is claimed to cost between 0.07% and 0.7% of one's income in impoverished countries. (22) In Africa, the exact number of acute poisonings isn't usually known. (23 &24)

In numerous studies, the most common cause of acute poisoning in developing countries was self-harm. Because toxic compounds are readily available and clinical care is poor in these overseas regions, the fatality rate is high. (25) Similarly, few studies have looked into the epidemiology of human poisonings publicized in Ethiopia, and the exact prevalence of the problem is unknown due to under-analysis and under-reporting. (22) Furthermore, there are insufficient records in Ethiopia on the institutional availability of sources for poisoned patient management.

2. Methodology

Study area & period

The study was conducted in Dessie town on selected government public hospitals. Dessie town is organized into five sub-cites. Major health care providing institutions are seven governmental health centers, two governmental hospitals, three non-governmental general hospitals, and nine subspecialty clinics. This study is intended to be conducted on government public hospitals found in Dessie. Both Dessie Referral Hospital and Boru Meda Hospital were included during the study period. These hospitals serve about 8 million people who come from Amhara Region South & North Wollo, Oromia, North Shoa, and Afar

Region. (29) This study was conducted from January 2018 to December 2019 at Dessie Referral Hospital and Boru Meda Hospital. The epidemiological data pertaining to the types of poisoning cases admitted over the last two years at each hospital from 2018 to the end of 2019 were collected from archived reports with the help of the member of the hospitals' health management informatics system (HMIS) & planning department).

Study Design

The hospital-based retrospective cross-sectional study design was carried out to assess the availability of treatment resources in the emergency department for the management of acute toxic exposures and poisoning in Dessie Referral hospital and Boru Meda Hospital during the study period.

Eligibility Criteria

All materials and instruments from each hospital that became operational at some time during the examination periods, as well as antidotes that had not expired in any of the hospitals, were included in the examination. On the other hand, materials and instruments that were out of function at the moment of the study and anti-dotes and essential drugs that expired during the study period from each hospital were excluded.

Sample size and sampling technique

The study was done in Dessie town governmental hospitals. Since there are two governmental hospitals, both hospitals were considered. Hence, sample size and sampling technique determination were not required as per the nature of the study.

Data Quality Assurance

To ensure the quality of the study, a pretest was conducted at Hidar eleven Hospital to assess the uniformity and readability difficulty. Before starting data collection, data collectors and interviewers got a clear orientation. Daily, the gathered statistics were examined for completeness and consistency by the supervisor and the most significant investigator and then wiped clean and coded for evaluation.

Data collection procedure & tools

After reviewing the literature of previous similar studies on the availability of remedy assets for the management of poisoning, a semi-structured questionnaire was developed and used, and those questionnaires were written in English. Face validity was made by experts before commencing actual data collection. Data were gathered based on hospital assets, including gastrointestinal (GI) decontamination, stabilization, elimination enhancement assets, and antidote. The questionnaire was divided into three parts as a result.

Section 1: The first section inquired about epidemiological data pertaining to the types of poisoning cases that had been reported. The first phase concentrated on epidemiological data on the various poisoning cases admitted throughout the previous years at each clinic from 2018 to the end of 2019, and a list of common poisonous dealers was produced from previously published studies. (18 & 26) The data was gathered at the emergence branch from the apex of hospitals' HMIS and planning department.

Section 2: This section was created to propose which resources are available in their Emergency Departments, such as decontamination equipment, life guides, and removal enhancement units. From several studies (32 & 33), a list of commonly required sources for the treatment of acute poisoning was prepared, and the director of the drugstore was asked to fill out the second section questionnaire.

Section 3: The questionnaire's final section comprised questions about which antidotes they

needed to have on hand in hospitals. The WHO and published documents (34, 29 & 30) were utilized to build a list of commonly required antidotes and critical tablets used for treating poisoning problems. This phase was done by a professional designated by the ED's directors.

Data processing & analysis

The data was cleaned, coded, and validated for normality and completeness before being entered into SPSS version 20.0 for analysis. To assess the supply of remedial aid for the management of acute toxic exposures, descriptive statistics were computed. Finally, statistics were presented in the form of frequency tables, graphs, and charts.

Ethics approval and consent to take part

The research office at Wollo University's Emergency & Ophthalmic Nursing provided ethical clearance. After receiving authorization from the hospital administration, respondents signed a formal consent form that specified the purpose, method, duration, and other details of the study. All the collected data were kept confidential and no one except the members of the research team had access to the collected information.

3. Results

In the ED of the reviewed hospital, 520 toxic cases were treated. Organophosphate poisoning accounted for 140 (26.9%) of the 520 toxin cases (169 from Boru Meda Hospital and 351 from Dessie Referral Hospital), Bleach (sodium hypochlorite) poison 116 (22.3%), Rodenticide (rat poison) 114 (21.9%), Food poisoning 40 (7.7%), Snake Bite 26 (5%), Carbon monoxide poison 26 (5%), Alcohol poison 18 (3.5%), Tricyclic antidepressants (Table 1).

Table 1: The Top Ten Causes of Poisoning in Dessie Town's Government Hospitals, January 2020.

Rank	Toxic Agent	Dessie Ref.Hospital	Boru Meda Hospital	Total (%)	Rank
1	Organophosphate poison	98	42	140 (26.9%)	1st
2	Bleach (sodium hypochlorite) poison	81	35	116 (22.3%)	2nd
3	Rodenticide (rat poison)	64	50	114 (21.9%)	3rd
4	Food poisoning	30	10	40 (7.7%)	4th
5	Snake Bite	18	8	26 (5%)	5th
6	Carbon monoxide poison	20	6	26 (5%)	6th
7	Alcohol poison	14	4	18 (3.5%)	7th
8	Tricyclic antidepressants (TCA) poison	8	8	16 (3%)	8th
9	Kerosene poison	6	6	12 (2.3%)	9th
10	Chlorpmazine (CPZ) poison	5	0	5 (0.96%)	10th
11	unspecified drug poisoning	4	0	4 (0.77%)	11th
12	Other detergent (Detol) poisoning	2	0	2 (0.4%)	12th
13	Plant (endode) poisoning	1	0	1 (0.2%)	13th
Total		351	169	520	

Availability of decontamination useful resources

For the evaluation of the accessibility of techniques used to sterilize harmful materials, Nasogastric tube, and orogastric tube was included in materials, and all types of charcoal, Magnesium Sulfate, Sodium Sulfate, Ipecac Syrup, and Polyethylene Glycol were remembered in Medication. Charcoal pills, charcoal syrup, sodium sulfate sorbitol, ipecac syrup, and polyethylene were not available in any of the emergency rooms.

Orogastric tube (nearly half the time), magnesium sulfate, charcoal powder (37.5% most effective in Boru Meda Hospital), and Nasogastric tube and magnesium sulfate were all accessible in both emergency departments (Figure 1).

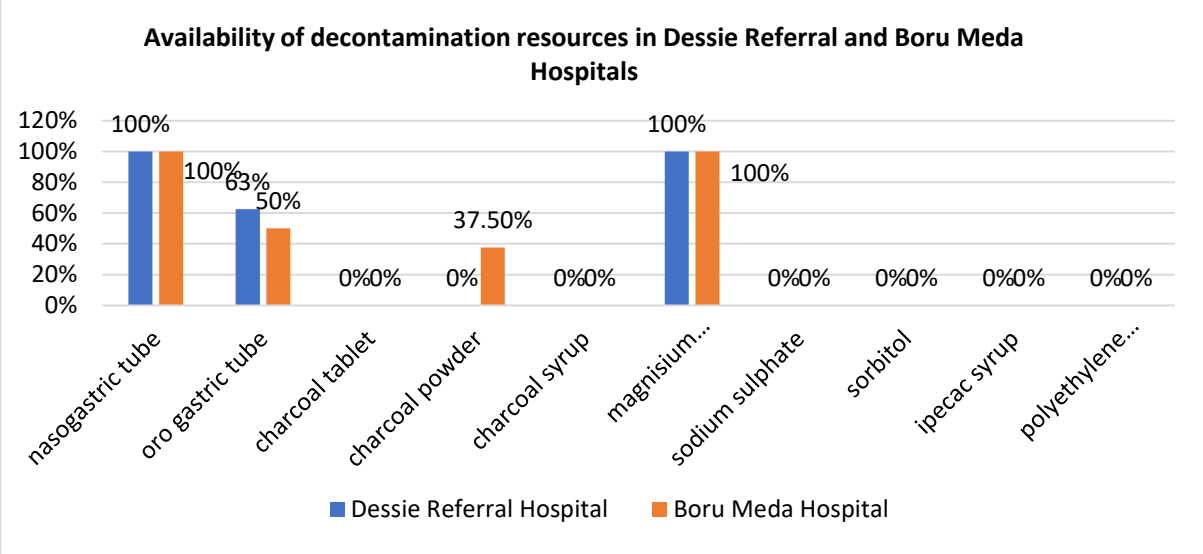

Figure 1. Accessibility of decontamination resources in Dessie Referral and Boru Meda Hospitals, Dessie, Ethiopia

Availability of stabilization resources in the hospitals

Ten of the fifteen stabilizing materials were 100% accessible in both hospitals at the time of data collection, while the remaining four materials were unavailable in both hospitals. Circulatory strain devices, Hydroxyethyl starch, Gelofusine, Pacemaker, and Electrical Defibrillation were among the materials used. A mechanical ventilator was not accessible at Boru Meda Hospital, although it is available at Dessie Referral Hospital (Table 2).

Table 2. Accessibility of adjustment assets for stabilization in governmental Hospitals of Dessie town, January, 2020.

S.N	For stabilization resources	Dessie Hospital	Boru Hospital
1.	Blood pressure device	100%	100%
2.	IV line tube	100%	100%
3.	Nasal prong	100%	100%
4.	Laryngeal mask airway	100%	100%
5.	Oxygen mask device	100%	100%
6.	Endotracheal tube	100%	100%
7.	Mechanical ventilator machine	100%	0%
8.	Colloid		
	Hydroxyethyl starch	0%	0%
	Gelofusine	0%	0%
9.	Crystalloid		
	N/S	100%	100%
	LR	100%	100%
	Glucose	100%	100%
10.	Pacemaker	0%	0%
11.	Electrical defibrillation	0%	0%

Availability of removal enhancement sources

Haemodialysis, Haemoperfusion, Haemofiltration, Alkaline diuresis, Acid diuresis, peritoneal dialysis, and Exchange transfusion have been safeguarded for this study due to the accessibility of techniques utilized to remove augmentation of dangerous components. All emergency departments did not have all enhancement resources at the time of data collection. (Table 3)

Table 3. Accessibility of disposal improvement assets Dessie Referral and Boru Meda Hospital, Dessie, Ethiopia, 2020.

S.N	Elimination Enhancements	Dessie Referral Hospital	Boru Meda Hospital	Essential lists in WHO/Ethiopia
1.	Haemodialysis	0 %	0 %	EW
2.	Haemoperfusion	0 %	0 %	EW
3.	Haemofiltration	0 %	0 %	EW
4.	Alkaline diuresis	0 %	0 %	EW
5.	Acid diuresis	0 %	0 %	EW
6.	Peritoneal dialysis matchine	0 %	0 %	EW
7.	Exchange transfusion device	0 %	0 %	EW

***EW- WHO Essential**

Availability of recommended antidotes

The normal accessibility of vital antidotes is listed and examined by the WHO and Ethiopian critical antidotes list. Medicines are available in tiers ranging from 0 (deferoxamine digoxin immune Fab, Dimercaprol, Fomepizole, Glucagon, Pralidoxime, Cyanide Kit, N-acetylcystine, Naloxone, methylene blue) to 100% (Ethanol (a hundred percent) - 62.75%, and Pyridoxine-93.75%) (Atropine sulfate, Calcium gluconate, and Sodium bicarbonate). Despite this, none of the clinics tested possessed all of the antidotes recommended by the WHO or the Ethiopian basic medicine list (table 4).

Table 4 accessibility of fundamental cures at Dessie Referral and Boru Meda hospitals in Dessie, Ethiopia, 2020

S.N	Essential Antidotes	Dessie Referral Hospital	Boru Meda Hospital	Average	Essential list in WHO/Ethiopia
1	Atropine	100%	100%	100%	EE
2	Calcium gluconate	100%	100%	100%	EE
3	Deferoxamine	0%	0%	0%	EW
4	Digoxin immune Fab	0%	0%	0%	EW
5	Dimercaprol	0%	0%	0%	EW
6	Ethanol (100%)	62.50%	63%	62.75%	EW
7	Fomepizole	0%	0%	0%	EW
8	Glucagon	0%	0%	0%	EW
9	Methylene blue	0%	0%	0%	EW
10	N-acetyl cysteine	0%	0%	0%	EW/EE
11	Naloxone	0%	0%	0%	EW
12	Polyvalent anti-venom	100%	100%	100%	EE
13	Pralidoxime	0%	0%	0%	EW/EE
14	Pyridoxine	87.50%	100%	93.75%	EW/EE
15	Sodium bicarbonate	100%	100%	100%	EW
16	Cyanide Kit	0%	0%	0%	EE

***EE-Ethiopian Essential** ***EW-WHO Essential**

Availability of essential emergency medication/drugs

Dopamine, Bronchodilators, Corticosteroids, Antihistamines, Dextrose, Diazepam, Phenytoin, Morphine, Epinephrine, and non-steroidal anti-inflammatory drugs (NSAIDs) were found in more than half of the critical medicines (10 out of 18) in every emergency room. Nonetheless, medications such as calcium disodium edetate, flumazenil, and isoproterenol were no longer available in each emergency room during the study period. In addition, Leucovorrin (13%), Vitamin K (88%), and Physostigmine salicylate (13%) were all approved for use in emergency rooms (Table 5).

Table 5: Essential medicine availability in Dessie Referral and Boru Meda hospitals in Dessie, Ethiopia, in 2020.

S.N	Drug	Dessie Referral Hospital	Boru Meda Hospital	Average	WHO recommendation
	Other antidotes				
1.	Calcium disodium edetate	0%	0%	0%	EE
2.	Epinephrine	100%	100%	100%	EE
3.	Flumazenil	0%	0%	0%	EW
4.	Isoproterenol	0%	0%	0%	EE
5.	Leucovorrin	13%	13%	13%	EW
6.	Protamine sulphate	0%	0%	0%	EE
7.	Vitamin K	88%	88%	88%	EE
8.	Physostigmine salicylate	13%	13%	13%	EE
	Availability of essential capsules/treatments				
9.	Dopamine	100%	100%	100%	EW
10.	Bronchodilators	100%	100%	100%	EE
11.	Corticosteroid	100%	100%	100%	EW
12.	Antihistamine	100%	100%	100%	EW
13.	Thiamine	0%	0%	0%	EW
14.	Dextrose	100%	100%	100%	EW
15.	Diazepam	100%	100%	100%	EE
16.	Phenytoin	100%	100%	100%	EE
17.	Morphine	100%	100%	100%	EE
18.	NSAIDs	100%	100%	100%	EE

***EE-Ethiopian Essential** ***EW- WHO Essential**

4. Discussion

According to the findings of this study, the majority of Dessie town government hospital emergency departments have some key quick interventions, such as gastrointestinal disinfecting processes and assets to enhance poison end. There are currently no commonly acknowledged clear standards that represent an ED's readiness to administer extreme toxic introductions and poisonings. The items required for executing Gastric Lavage, such as nasogastric and orogastric tubes, were found to be more commonplace than different arrangements employed to reduce the assimilation of harmful experts, such as charcoal, diuretics, and a complete entrail water device. This finding is consistent with the findings of previous poisoning studies in Palestine, which looked at a variety of cases that had long since passed through a cleaning technique, with gastric lavage being the most commonly used (36), and other studies conducted in our kingdom's Gondar and Jimma emergency clinics revealed similar findings. (29) The results of the recent study also demonstrate that properties for apparent sterilization via stomach lavage, such as a nasogastric tube and magnesium sulfate, were readily available in all

EDs (100%) of each institution. A comparable investigation aimed towards Pakistani scientific clinics corroborates our findings. (31)

This study found that ipecac syrup is not available in all (100%) of a hospital's emergency rooms. These findings are consistent with a study conducted in a Pakistani emergency room, which found that ipecac syrup should no longer be used routinely in the presence of harmful introductions due to a lack of proof of progressed effects and dangers, such as dwindled availability of Activated Charcoal, delayed administration of oral remedies, prolonged pneumonitis, and various entanglement of not on time emesis. (27 & 35) Furthermore, both hospitals' emergency departments did not have charcoal tablets or charcoal syrup, according to the study. In Pakistan, a comparable report was completed. Over 83% of clinics did not have charcoal on hand, and additional research conducted in South Africa suggests that access to activated charcoal is only about 40%, owing to the government's inflexibility. This treatment is included in the WHO and Ethiopian essential medications/drugs lists as a primary medical drug for treating a poisoning case. (36)

Furthermore, the findings of this study show that the resources needed to complete sterilization by entire within water devices (for example, polyethylene glycol) are not readily available in any of the evaluated hospitals' EDs. In each of the hospitals investigated, there was no sorbitol at all. Sorbitol is now scarcely available in Pakistan's legislative emergency clinics. (36) The use of cathartics to hasten the release of toxins from the gastrointestinal system is still a point of contention.

Our findings on the accessibility of GI purification items are also consistent with the Malaysian study by Awang et al. (27) and the Pakistan study (36), both of which were recorded as basic medicine in Ethiopia. In this study, no charcoal of any kind was found in any of the hospitals' emergency rooms. The look that they controlled, and introduced in Pakistan the accessibility of charcoal pills changed superior to powdered form, and they were handy in more than 66 percent of Pakistan's EDs, but the drug is listed as an essential medicine in the WHO and Ethiopian simple medication list[28]. Apart from quantity expanders (colloids), wherein their accessibility became vastly improved and reached 100%, and evaluation directed in Pakistan[36], this research on the accessibility of adjustment belongings was also attainable using the results of Awang et al. (17) The results of this study showed that hemodialysis is no longer available in all emergency rooms, which could lead to a reduction in the use of this procedure to improve the disposal of certain hazardous professionals.

Surprisingly, corrosive diuresis is now available in 0 percent of the reviewed Hospital's emergency rooms. Corrosive diuresis, on the other hand, is no longer recommended or used in harming treatment. It is a treatment with a high risk of side effects and minimal benefit, and its use has been discontinued. (32) It's unclear why the respondents said that simple diuresis is currently unavailable (zero percent in each hospital's emergency departments), while sodium bicarbonate is always available (one hundred percent in both hospitals' emergency departments) in this study. This is most likely because the respondents are unfamiliar with the use of these professionals in the treatment of poisoning cases, or the treatment is unavailable for various reasons, such as a lack of ability to check blood gases due to the inaccessibility of a blood vessel blood gasoline analyzer or another circumstance. All government hospitals (for example, hemodialysis belongings 0 percent) carry out a few stop-improvement processes since they have the best possible work environments for it.

Except for peritoneal dialysis, which became accessible in 51.4% of Malaysian clinics and became regarded as one of the most famous strategies used to improve the end of harmful substances[27], there were no obvious differences in the accessibility of disposal enhancement assets between this research and the research conducted in Palestine and Malaysia. These studies show that a large number of therapies aren't available in the emergency departments of the hospitals studied. Certain large pharmaceuticals, which are remembered for the FMOH's basic medicines list, aren't loaded by either institution. Pralidoxime, for organophosphate injury, and calcium disodium edetate, for heavy metal harm, are examples of such antitoxins. Organophosphate poisoning became the most commonly reported case 140 (26.9%) in emergency rooms, followed by way of liquor and unclear pharmaceutical introduction.

Surprisingly, no emergency rooms had the medication for organophosphate poisoning (pralidoxime) (zero percent) in stock. Furthermore, the availability of an antitoxin to treat each patient who had been affected by cyanide became limited, as the two emergency departments had no therapeutic medicine on hand. As Al-Sohaim et al. (33) and Sawalha et al. (34) have recently demonstrated, counteractants used to deal with conditions other than damaging and presenting hazardous drugs were more frequently loaded. In each hospital's emergency rooms, atropine sulfate, calcium gluconate, polyvalent anti-venom, and sodium bicarbonate were all available (100%). In Ethiopia, inadequate drug loading is anything from an average problem. This investigation is also consistent with concentrates from unusual international sites that exhibit varied and absent remedy loading levels. According to Al-Sohaim et al's report (33), no emergency departments possessed enough supplies of sixteen antitoxins. In South Africa, Wium and Hoffman (27) directed a study. The investigations' outcomes revealed that there was a problem with the accessibility and transportation of large counteracts, as none of the responding hospitals loaded the entire rundown with pharmacological treatments. A comparative study conducted in northern Palestine by Sawalha et al.[34] found that the number of antidotes provided in all emergency clinics ranged from 6 to 10, but that no emergency departments had all 37 of the medications listed. Examined Queensland scientific clinics to see how much stock of thirteen antitoxins they have. According to the findings, most clinics do not store a few large medications, and only about every health center emergency department has partially adequate supplies to deal with adult poisoning.

5. Conclusion

From decontamination resources, only nasogastric tube and magnesium sulfate were available in both hospitals. However, charcoal tablets, charcoal syrup, sodium sulfate sorbitol, ipecac syrup, and polyethylene were no longer available in either.

Apart from the defibrillator, the majority of them were available from sources employed for stabilization. In those hospitals, the majority of antidotes were unavailable. In both hospitals, only atropine sulfate, calcium gluconate, sodium bicarbonate, and polyvalent anti-venom were available. In each hospital, there was no deferoxamine, digoxin, immune fab, dimercaprol, fomepizole, glucagon, or pralidoxime and cyanide package.

For the length of the study, there were no removal augmentation sources in any of the hospitals. Finally, a number of the poisoning remedy supplies examined have been stocked out in maximum time at both hospitals.

The Federal Ministry of Health (FMOH) should establish and make available particular poisoning treatment resources, such as stocking

recommendations, and a toxicology center that may be used in Ethiopian hospitals. With the help of concerned bodies, hospital management, and department heads should create evaluation checklists and assign assessors to increase the availability and usage of poisoning treatment resources.

The pharmacy director, emergency department director, and other hospital leaders should make plans based on the top 10 causes of poisoning and the ease with which treatment resources are available. On registration books and patient history cards, all clinical staff should be required to record all necessary and mandatory information. The records should subsequently be archived in a secure and easily accessible location.

Abbreviation

ED: Emergency Department

FMOH: Federal Ministry of Health

GI: Gastro-Intestinal

HMIS: Health Management and Information Department

NSAIDs: Non-Steroidal Anti- Inflammatory Drugs

WHO: World Health Organization

Author Contributions

HA brought the original idea. DA, ES, LT & AF drafted and revised the work. HA, ES, DA and AF supervised data collection. DA, LT, & ES analyzed and interpreted the findings. Finally, Lt wrote the manuscript.

Conflict of Interest

The authors declare that they have no competing interest

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