ADDIS ABABA UNIVERSITY

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DEPARTMENT OF EMERGENCY MEDICINE

Availability of Emergency Drugs and Essential Resuscitation Equipment and Barriers to Availability at the Emergency Room of Health centers in Addis Ababa, Ethiopia- Explanatory Sequential mixed method design

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A Research thesis submitted to Addis Ababa University College of Health sciences, School of Medicine Department of Emergency Medicine, in partial fulfillment of the requirements for post-graduate specialty certificate in Emergency and Critical care Medicine

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Abbreviations

AA- Addis Ababa

CHUK ED- University teaching hospital of Kigali

ECCD- Emergency and Critical care Directorate

ED- Emergency department

ER- Emergency Room

EHCRIG- Ethiopian health center reform implementation guideline

EMSSA- Emergency Medical Services of South Africa

IV- Intravenous

LMA- Laryngeal mask airway

LMICs- Lower and middle income countries

MOH- Ministry of Health

MgSo4- Magnesium sulfate

NPA- Nasopharyngeal airway

OPA- Oropharyngeal airway

ORS- oral rehydration salt

PFSA- Pharmaceutical fund and supply agency

PHC- Primary health care center

SDG- Sustainable Development Goal

UNICEF- United Nations children's funds

WHO- World Health Organization

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Abstract

Background- Essential medications, supplies, and functional equipment are needed for emergency care. But in lower middle-income countries (LMICs), there are major obstacles that prevent the provision of safe emergency care, such as a shortage of physical resources (supply and equipment) or medications. Several studies have suggested that the PHC level should establish and implement emergency services in order to reduce the burden on hospital emergency departments. Even though research regarding emergency capacity analysis has been done at hospital level, data are lacking at the health center level. Therefore, it's important to assess these facilities.

Objective- The main aim is to assess the availability of emergency equipment and drugs and barriers to availability in health centers in Addis Ababa, Ethiopia.

Methods- An explanatory sequential mixed method design study was conducted. A total of 6 health centers were included in the quantitative study where convenience sampling was used to select 3 from the 11 sub cities in Addis Ababa followed by simple random sampling to choose 2 health centers from each sub city. Data was inserted and analyzed by using SPSS version 27. Non-probability purposive sampling was used to choose samples for the qualitative data. Thematic content analysis was done to develop items that emerged from transcribed qualitative information.

Results- This study involved 6 health centers in Addis Ababa, Ethiopia. The survey revealed that there is a significant gap in terms of readiness of these facilities in handling emergency cases especially in terms of availability of emergency equipment and drugs. Equipments for infection prevention and control were available in all health centers. The interviews identified the barriers for availability of essential emergency equipment and drugs as: management, logistics and health system, human resource and patient related factors. The frequently raised management related issues include: Lack of priority and focus on ED, absence of electronic system and poor forecasting of equipment and drug needs. Logistic and health system related barriers include Budget constraints, long Procurement time issue, limited local market availability, guidelines and policies not aligned with health center needs. The absence of emergency-focused training and the

scarcity of qualified emergency health care providers were raised as human resource-related barriers. Patient related issues were secondary to patients' financial constraint.

Conclusion and recommendation- The study identifies emergency equipment and drugs at health centers were not maintained as per protocol of the health centers' emergency service leveling guideline. Lack of attention from health center leadership, budget constraints and long procurement process were identified as significant challenges. Based on this finding, there is an urgent need to increase attention to these facilities and provide a designated crash cart with the required emergency drugs and equipments.

1 Introduction

1.1 Background

World Health Assembly 72 resolution 12.9 defines emergency care as “an integrated platform for delivering accessible, quality, time-sensitive health care services for acute illness and injury across the life course”. Medical emergencies are defined as acute injuries or illnesses that pose an urgent risk to a person's life or long-term health(1).

The IFEM Delphi project defines an Emergency Department(ED) as: “The area of a medical facility devoted to provision of an organized system of emergency medical care that is staffed by Emergency Medicine Specialist Physicians and/or Emergency Physicians and has the basic resources to resuscitate, diagnose and treat patients with medical emergencies”(2)

Since 1978, the idea of primary health care (PHC) has undergone numerous interpretations and redefining, which has caused uncertainty over the word and its application."PHC is a whole-of-society approach to health that aims at ensuring the highest possible level of health and well-being and their equitable distribution by focusing on people’s needs and as early as possible along the continuum from health promotion and disease prevention to treatment, rehabilitation and palliative care, and as close as feasible to people’s everyday environment." World health organization (WHO) and United Nations children’s fund (UNICEF). In order to achieve universal health coverage, the health-related Sustainable Development Goals (SDGs), and health security, Member States have pledged to renew and implement primary health care(3). Emergency care must be given careful consideration at all health service levels, including PHCs and hospitals, as emergencies can immediately endanger lives or inflict permanent physical impairment(4).

Essential medications, supplies, and functional equipment are needed for emergency care. But in lower middle-income countries (LMICs), there are major obstacles that prevent the provision of safe emergency care, such as a shortage of physical resources (supply and equipment) or medications(5).

Establishing and utilizing emergency services at the PHC level has been recommended by numerous studies as a means of reducing the workload for hospital ED. Whether PHC centers offer efficient emergency services is the matter at hand. Numerous studies conducted worldwide have regularly documented PHC's emergency room's inadequate readiness with regard to emergency medications, supplies, and facilities(6).

1.2 Statement of the problem

Because medical, surgical, and traumatic emergencies are becoming more common, emergency care is becoming an even more vital component of health systems(7). Unfortunately, low- and middle-income countries (LMICs) bear the majority of this burden because of their inability to adequately plan, assemble a workforce with the requisite skills, and provide the physical resources needed to evaluate and handle emergency situations(8) (9).

One of the countries with the highest emergency-related death rates is Ethiopia. It accounts for 1154 deaths per 100,000 individuals and 47,728 years of disability adjusted life years. The nation's national emergency usage rate, which is 8 per 1000 inhabitants, is among the lowest in the world. There isn't enough information to support the theory that this lowest emergency utilization rates are the result of several obstacles. The organization of the health care system and sustainable support has an impact on the status and demand of emergency care. Additionally, the status may have been impacted by ongoing conflicts, pandemics and epidemic diseases(10).

In Ethiopia, emergency medicine is a still developing area of study. Emergency medicine has become a top priority for policymakers in recent years as a way to improve public health. Currently, residency and certification programs are used to educate emergency medical providers. (11). However, there are still big problems, one of them being physical resources specifically emergency equipment and medications.

A cross- sectional multi-centered emergency capacity analysis has been done and published in 2022 GC which has revealed significant deficiencies in hospital emergency medicine practices, facilities, and resources(11).

1.3 significance of the study

The goal of Ethiopia's health sector strategic plan (2015–2020) is to guarantee equitable access to high-quality primary healthcare services. Ethiopia's Ministry of Health released the Ethiopian Health Center Reform Implementation Guideline(EHCRIG) in 2021 in an effort to raise the standard of treatment provided in these establishments(12).

Though the EHRIG has been in place for more than seven years, not much data has been acquired on the availability of emergency equipment and drugs that has been listed as requirement on the guideline. Moreover, there are no published evidences on the barriers to availability of these resources in these facilities.

Most patients arrive to referral hospitals without getting the appropriate care that should have been provided in health centers leading to patient suffering accounting for causing preventable deaths. Moreover, it creates overburdened ED in tertiary hospitals for cases that could be handled adequately in those setups. In order to address this problem identifying the barriers and limiting factors for adequate care is important. This research aims to assess the availability of emergency resuscitation equipment and medications and to identify barriers for shortage of these resources

at health centers in Addis Ababa which is one step forward in solving the problem and makes this research a benchmark for comparison for future researches that will be done in this area. In addition, it helps in strengthening the health policy concerning these facilities.

2 Literature review

2.1 Theoretical literature

2.1.1 Definitions

Essential drugs

World Health Organization (WHO) defines essential drugs as “the medicines that satisfy the priority health care needs of the population.” In other words, these medications need to be available to everyone, without respect to time or cost, and without regard to one's nationality or financial situation(13).

Essential equipment and supplies

Medical equipments are made of durable materials that are utilized in healthcare settings over a prolonged period of time and are mostly reusable. On the other hand, essential medical supplies, also known as consumables, are non-durable disposable materials used in healthcare(14).

In Ethiopia since the establishment of Emergency and Critical care Directorate(ECCD) in 2016, the Federal Ministry of Health (MOH) developed a guideline for quality emergency service delivery at different levels of facilities along national referral tier system with delineated scope of services which includes the essential emergency equipments and drugs required to be fulfilled at health centers (table 1).

2.2 Empirical literature

2.2.1 Availability of emergency equipment and drugs

In LMICs, the mortality rate at ED is significant, occurring in 1.8% of all cases (IQR 0.2%-5.1%) and 4.8% of pediatric cases (IQR 2.3%-8.4%)which was relatively high in sub-Saharan countries 3.4% (IQR 0.5-6.3%).Injuries and infectious diseases are the main contributors to morbidity. Access to quality emergency treatment might prevent more than half of deaths each year(15).

Emergency care in LMICs suffers a number of difficulties, including poor infrastructure, scarce resources, a lack of qualified medical personnel, and a lack of finance. Furthermore, political unrest and natural calamities can make these problems worse. To address these issues, several initiatives have been taken by international organizations, governments, and non-governmental organizations. These include improving the availability and accessibility of emergency medical services, providing specialized training to healthcare professionals, implementing standardized guidelines for emergency care, and strengthening healthcare systems through increased funding and public-private partnerships. However, despite these efforts, significant gaps remain in emergency care provision in many LMICs, highlighting the need for continued investment and innovation in this field(16).

A study done in Saudi Arabia on emergency services delivery in PHCs was published in 2007. The study included all 30 PHC's in Abha health district and showed that, of the surgical supplies, dressing drums, forceps, scissors, suture material, and intravenous stands were available in every PHC. On the other hand, the three items least readily available for emergency services were nasogastric tubes (30.0%), cannulas (43.3%), and urinary catheters (56.0%). None of the PHCs had any tracheostomy setups. Activated charcoal (3.3%), naloxone injections (6.7%), and antihistamine injections (33.3%) were the three least readily available emergency medications, while all PHCs had dextrose, normal saline, adrenaline, anti-scorpion venom, and tetanus toxoid on hand. The study proposed using emergency care at the level of PHCs as a way to lessen the strain of hospital EDs and urged that it be mandatory to routinely check PHCs for the availability of critical medications and equipment for emergencies(4).

A study on infrastructure and labor availability for PHCs in India was published in 2018 on 15 randomly selected PHC'S and revealed many deficiencies in infrastructure and manpower in the centers studied. Emergency medications made up fewer than 50% of the drugs that were on hand and concluded that PHCs lack the infrastructure required to deliver primary healthcare to the population(17).

Since studies of emergency care capacity at second-level hospitals were underrepresented, a qualitative and quantitative assessment of capacity for care of emergency patients was performed in Ghana in 2014. A number of physical resources were consistently available for resuscitation, such as the following: a stethoscope, blood pressure cuff, IV catheter and infusion set, urine catheter, Magill forceps, on the other hand, basic airway adjuncts, oxygen supply, pulse oximetry, and cervical collars were less readily available. The majority of other things, especially medical technology (such as defibrillators, ventilators, and heart monitors), were not available. No drug was consistently available, despite the fact that about 60% of necessary medications were kept in stock. There were several WHO medicine classes missing: blood products, muscle relaxants, tetanus immunoglobulin, tocolytics, and anticonvulsants (apart from diazepam). Naloxone and glucagon, two medications used to treat iatrogenic overdose adverse effects, were not available. This analysis found glaring shortcomings in a number of necessary services and

supplies. It was noted by both clinical (77%) and non-clinical professionals (79%) that improving treatment required making sure that appropriate emergency supplies and equipment were available (18).

A checklist adapted from the Emergency Medical Services of South Africa (EMSSA) guidelines and contextualized to Botswana was used in a cross-sectional study to audit the contents of resuscitation trolleys and the operational status of CPR equipment in four district hospitals. 40 wards were sampled, including pediatric wards, obstetrics and gynecology wards, male and female orthopedic wards, accident and emergency departments, intensive care units, and male and female medical wards. Between 19% and 31.1% of medications and equipment were available overall. The percentage of available equipment for sustaining fluids and circulation ranged from 27% to 49%, whereas the percentage of items for breathing and airway maintenance ranged from 9.2% to 24.1%. The general accessibility of vital medications for resuscitation was 20.4%. The research concluded that standard maintenance was not performed on the resuscitation trolleys(19).

In Ethiopia, twenty-two hospitals were chosen by convenience sampling for a cross-sectional study that was published in 2022. The most common equipment used for triage in 82% of the hospitals was blood pressure cuffs and stethoscopes; in comparison, thermometers, pulse oximeters, and glucometers were accessible in 64%, 55%, and 45% of the hospitals, respectively. All hospitals possessed bag-valve masks and nasal cannulas, but fewer than 10% had functional intraosseous kits and continuous positive airway pressure (CPAP) machines. The lack of hypertonic saline, thrombolytic, and transfusion supplies like FFP in most hospitals raises questions about how they should handle basic emergent conditions including shock, myocardial infarctions, strokes, and injuries. In most district and regional hospitals, there were neither emergency medicine-trained nurses nor physicians on staff, nor were there written standard protocols for emergency care(11).

2.2.2 Barriers to availability

Multiple researches have been done to identify the challenges and causes of essential drugs and equipment shortage.

The research carried out in Europe in 2015 divided difficulties into three groups: Manufacturing problems stem from a variety of factors, including raw material shortages, globalization-related concerns like international decision-making processes, and standardization-related concerns like loss of conformance. Problems with distribution and supply arise mostly from quotas allotted to other nations, their distribution, transportation, and stocking once within the nation, not from the long procurement procedure. Economic issues include reference pricing, multiple tenders, stock discontinuation but not a lack of funding(20).

A cross sectional descriptive study was done in Nigeria in 2016 to assess the barriers to availability and accessibility of essential drugs at both public and private healthcare establishments which identified multiple factors for unavailability of these essential drugs. These include insufficient funding for purchasing the necessary drug quantity, improper distribution and supply of important medications to their places of consumption, and the inability to pay suppliers in a way that prevents them from extending credit facilities to the healthcare institutions. Additionally, medications are wasted because of expiries brought on by inaccurate measuring(21).

Another mixed method study was done in Rwanda in 2021 to evaluate the issues and solutions related to the shortage of necessary medications, supplies, and equipment at the ED of the university teaching hospital of Kigali. The research revealed that main reason for stock outs and low availability is the procurement process which always takes longer than expected. It associated this problem to the local market which is in over capacity and doesn’t cover all the

requests of the hospital. Other challenges include no precise planning of restocking policies, poor communication between ED and pharmacy and budget shortage. The use of emergency procurement process regulations, better stock management with careful planning, collaboration with other health facilities, improved staff communication, increasing the capacity of local supplies, and budget increases are some of the suggested interventions and solutions to increase the accessibility of necessary medications, supplies, and equipment(22).

In our setup, a 2019 study that evaluated the availability of necessary medications and inventory control procedures at health centers in Adama town, Ethiopia revealed that the main difficulties encountered throughout the purchase procedure were transportation and the stock position of the pharmaceutical fund and supply agency (PFSA) which led to increased stock out days. Poor inventory management practice was also another challenge and the authors recommended improvement of inventory management by providing computers and training(23).

The above studies are done in diverse population and various socio economic conditions. Challenges in Africa are mostly related to the procurement process and budget issues unlike the ones in Europe which is mostly related to manufacturing.

Currently there is no study done on availability of emergency equipment and drugs and the barriers for availability in health centers located in Addis Ababa (AA).

3

3. Objective

3.1 General objective

To assess the availability and assess barriers for availability of adult essential resuscitation equipment and medications in Emergency Room's (ER) of health centers in AA, Ethiopia

3.2 Specific objective

- To determine the availability of adult emergency resuscitation equipment at health centers ER in AA, Ethiopia
- To determine the availability of essential emergency drugs at health centers ER in AA, Ethiopia
- To identify barriers for availability of emergency equipment and drugs at health centers ER in AA, Ethiopia

4 Research methodology

4.1 study site

Ethiopia's approximate land size is 1.1 million square kilometers, and it is situated in the Horn of Africa. A 20-year health sector development strategy, carried out by a number of five-year health sector development programs (HSDP), serves as the framework for the Federal Democratic Republic of Ethiopia's healthcare system. A three-tiered health-delivery service structure has been implemented by HSDP IV. The primary level consists of primary healthcare units (health

posts and health centers) and primary hospitals; secondary level services are provided by general hospitals; and tertiary services by specialized hospitals(24).

Over the past ten years, there has been a significant growth in the number of primary healthcare units due to both new facility building and the renovation and modernization of existing facilities. In the urban area health centers are built to serve around 40,000 people(24).

Ethiopia's capital city is Addis Ababa with area of 572 km² with 2,739,551 inhabitants based on the 2007 census. In AA, the number of health centers was 24 in the year 2000 EC which increased to reach 106 located in 11 sub-cities and 116 woreda's in 2016(25).

4.2 Population

4.2.1 Source population

Quantitative data- All health centers located in AA

Qualitative data- Emergency department leadership of the health centers

4.2.2 Study population

Quantitative data- Three out of the eleven sub cities are selected by convenience sampling followed by selection of two health centers form each sub city by using simple random sampling making a total of six health centers,

Qualitative data- Emergency department heads and team leaders of the health centers

4.3 Study design

A health center based descriptive, cross sectional and explanatory sequential mixed method design

4.4 Eligibility criteria

Quantitative data-

Inclusion criteria

All health centers providing emergency care in AA from September 1 to September 30, 2023

Exclusion criteria

Health centers that do not agree to participate in the study

Health centers not currently providing emergency care

Qualitative data-

Inclusion criteria

Emergency department leaders with an experience of greater or equal to 1 year

Exclusion criteria

Emergency department leaders with experience less than 1 year

Emergency department leaders not willing participate in the study

4.5 sample size determination and sampling technique

4.5.1 Sampling method

Quantitative data- Convenience sampling from the sub cities in AA

Qualitative data- non probability purposive sampling method was applied. Key informants with expertise and experience in chain supply or emergency department operations were selected.

4.5.2 Sample size determination

Quantitative data- out of the 11 sub cities, 3 sub cities are chosen using convenience sampling then 2 health centers are selected from each sub-city using simple random sampling (lottery method).

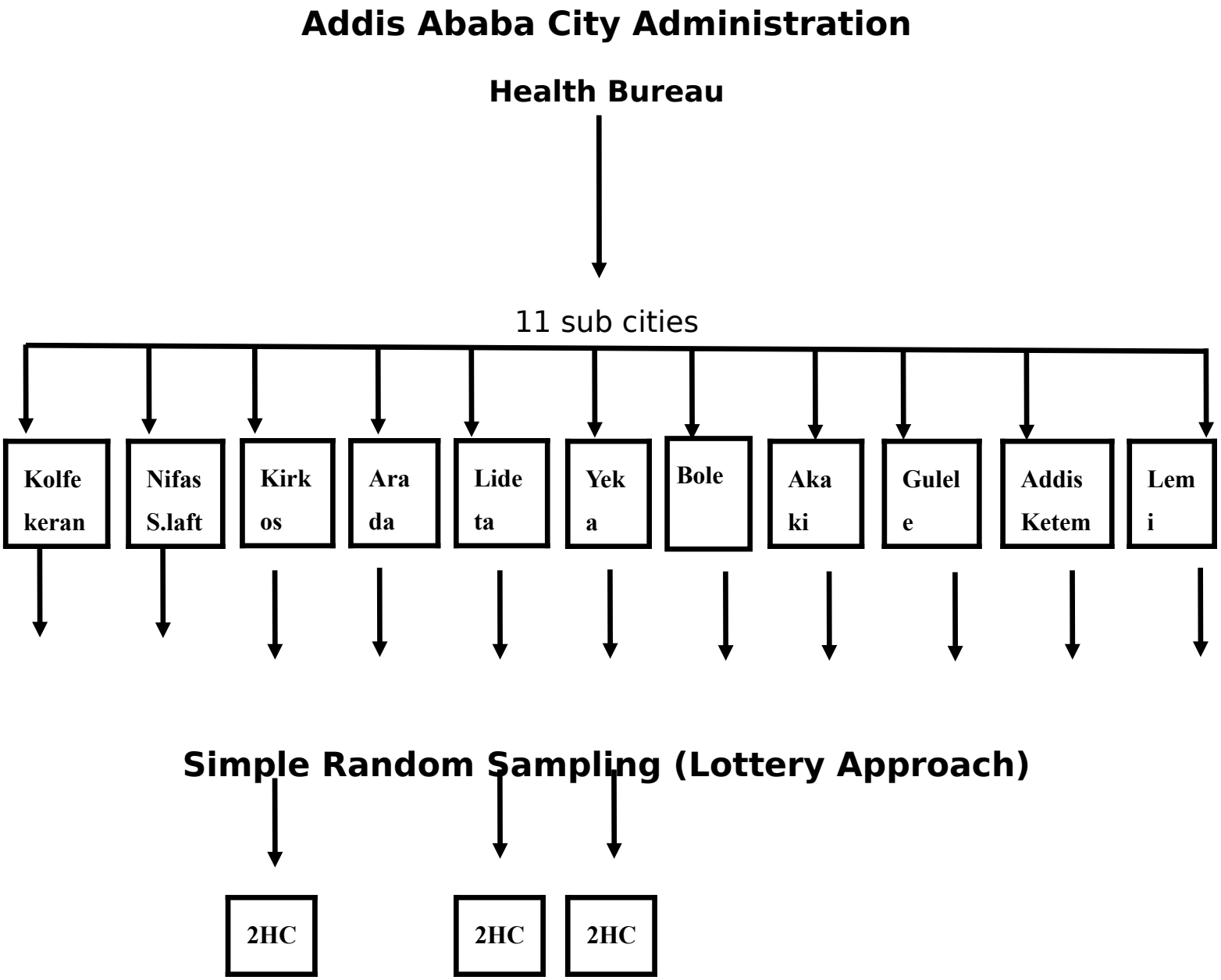

Figure 1 Sampling method for the quantitative study

Qualitative data- Emergency department head and team leaders had an in depth interview until data saturation is reached which was reached at 9 interviewee's in this study.

4.6 Data collection

Quantitative data –A checklist for basic emergency service for health centers adopted in 2021 by Ethiopian MOH was adopted. This tool was updated to reflect the Ethiopian context in collaboration with Ethiopian policymakers and professionals. The checklist consists of three main parts for both materials and drugs: Mandatory, desirable and optional materials and mandatory crash cart medications, mandatory and medicine for poisoning and overdose, respectively.

Qualitative data- Following discussions and clarifications regarding the study, the objectives of the investigation were outlined, and informed consent was signed. An in depth face to face semi structured interview was done for 15 to 20 minutes.

4.7 Data analysis

Quantitative data- After manually verifying that the data was complete, it was coded and added to the statistical package for social sciences (SPSS) version 27 computer program for analysis. The data were shown in tables, and the frequencies were summarized using descriptive statistics.

Qualitative data- The interview audio recordings were translated and transcribed verbatim. The transcripts were analyzed using inductive and deductive principle of thematic analysis. Using an initial set of broad codes drawn from the interview areas, a thematic coding framework was developed. Additional codes were added and modified until no new codes can be identified. The findings resulted in patterns within and across interviews that were interpreted as themes.

4.8 Data quality control and assurance

To assure the quality of data, structured data collection was used. The checklist was tested for validity on 15% of the study population before the start of data collection by the primary

investigator. Each facility data collection was done during day of first visit. Each visit took 1-2 hour to check all the equipment and medications in each health center against the checklist. All audio recordings were kept safe in a locked computer file. The primary investigator was the data collector of both quantitative and qualitative data. The completeness of the data was reviewed and verified every day.

4.9 Ethical consideration

Formal permission written letter was obtained from department of Emergency medicine, Addis Ababa University. This Ethical clearance letter and research proposal was submitted to Addis Ababa regional health bureau where they gave feedback and obtained ethical clearance to be submitted to sub cities of the health centers selected. Letter of support was received from the sub cities health bureau. The letter of support and purpose of the study was clearly communicated with medical director of the health centers. Informed consent was obtained from participants before the interview. Participants were also assigned a unique identifier number in order to keep participants participation confidential.

4.10 Plan of data dissemination

Finding of the study will be disseminated to Addis Ababa University/TASH, School of Medicine; Emergency and Critical care Department, to Addis Ababa Health Bureau and to Federal Ministry of Health.

5 Results

5.1 Quantitative data results

5.1.1 The availability of Emergency Equipment

- **Devices for oxygenation and ventilation**

Bag mask ventilation devices, oxygen cylinder, portable oxygen, flow meter, oxygen concentrator, nasal prong and face mask were available in all study sites. Oropharyngeal airway (OPA) was present in only 2/6 (33.3%) of the health centers. Suction machine was available in all the health centers but suction tip was found in only half of them. Nasopharyngeal airway (NPA), nebulizer and laryngeal mask airway (LMA) were not available in all of the health centers.

- **Devices for monitoring breathing and circulation and treat cardiac arrhythmia**

Cardiac monitor was present in 3/6 (50%) of the health centers. Sphygmomanometer, stethoscope pulse oximeter, glucometer and thermometer were all found. Defibrillator was absent in all health centers during the study period.

- **Equipments for infection prevention and control**

Hand antiseptics, PPE (N 95, apron, goggle and facemask) and safety box were found in all health centers.

- **Devices to gain vascular access**

Sets for intravenous administration including syringes with different sizes and IV cannula with different size gauges were all present. Although equipments mentioned as desirable/optional on the guideline, fluid warmer and infusion pump, were not found in any of the health centers.

- **Devices for cardiac and trauma life support protocol**

None of the health centers had crash cart. Neck collar was found in all the health centers unlike pelvic binder and lumbar brace which were absent in all. NG tube was found in 5/6 (83.3%) health centers and urinary catheters with different sizes were available in all the study areas.

Minor set and suturing set was available in all health centers and dressing set was present in 5/6 (83.3%) of the health centers.

- **Emergency infrastructure and supporting materials**

Even though the total number of beds required is 12 on the guideline all health centers in the study area have 3 beds and 1 couch. Generator and water reserve tank was present in all health centers.

Wheelchairs, stretchers, instrument trolley, weight scale and intravenous stand (IV) stands were available in all health centers. Only 50% of the studied health centers had hard board and none of them had refrigerator. Siren was available in only 2/6 (33.3%) of the health centers.

- **Optional/ desirable equipments**

Venturi airway mask, suprapubic catheter set, traction kit were all absent. Splint, even though handmade, was available in 5/6 (83.3%) of the health centers.

Table 1 Availability of mandatory crash cart Equipments in ER's of the selected Health centers

Mandatory crash cart equipment	HC1	HC2	HC3	HC4	HC5	HC6
Neck collar	1	1	1	1	1	1
Lumbar brace	0	0	0	0	0	0
Pelvic binder	0	0	0	0	0	0
Iv cannula with different size	1	1	1	1	1	1
Syringes with different size	1	1	1	1	1	1
NPA	0	0	0	0	0	0
OPA	1	0	0	0	1	0
NG tube	1	1	0	1	1	1
Urinary catheter	1	1	1	1	1	1
Tongue depressor	1	1	1	1	1	1
Torch light	1	1	1	0	1	0

Present- 1 Absent-0

5.1.2 The availability of Emergency Medications

- **Mandatory crash cart medications**

Digoxin and sodium bicarbonate were not available in any of the health centers. Magnesium sulphate(Mgso4) and dexamethasone were available in only half of the health centers. Atropine sulphate, aspirin, adrenaline, furosemide, salbutamol puff and Oral hydration salt(ORS) were present in all health centers.

The best stocked ER had 22/27 (81.5%) pieces of these medications, while the worst had 12/27 (44.4%).

- **Anti epileptics**

Diazepam was available in 5/6 (83.3%) of the health centers while phenytoin was available in only 1/6 (16.7 %) of the study sites. Phenobaritone was absent in all health centers.

- **Drugs for poisoning**

Atropine sulphate was available in all health centers. Vitamin k and rabies antiserum were present in 2/6 (33.3%) of the studied health centers, Otherwise antidotes including TAT, protamine sulphate,physiostigmine and activated charcoal weren't available in all health centers.

- **Intravenous solutions**

0.9% normal saline, ringers lactate, 5% dextrose with water injection and 40% in 20 ml dextrose injection were found in all health centers.

- **Infectious agents**

Antibiotics except ceftriaxone were consistently lacking in all of the health centers.

Table 2 Availability of mandatory crash cart medications in ER's of the selected Health centers

Present-1 Absent-0

Mandatory crash cart medications	HC1	HC2	HC3	HC4	HC5	HC6
Digoxin	0	0	0	0	0	0
Mgso4	1	0	0	0	1	1
Atropine	1	1	1	1	1	1
Hydralazine	1	1	1	0	1	1
Nifedipine	1	1	1	1	1	1
Adrenaline	1	1	1	1	1	1
Furosemide	1	1	1	1	1	1
Asprin	1	1	1	1	0	1
Diclofenac	1	1	1	1	1	0
Tramadol	1	1	1	0	1	0
Pethidine	0	0	0	0	0	1
Diazepam	1	1	1	1	0	1
Haloperidol	1	0	0	0	0	0
Cimetidiene	1	1	1	1	1	0
Dexamthasone	1	1	0	0	1	0
Hydrocortisone	1	1	1	0	1	1
Ca gluconate	1	0	1	0	0	0
0.9% NS	1	1	1	1	1	1
5% dextrose	1	1	1	0	1	1
Ringers lactate	1	1	1	1	1	0
Dextrose 40%	1	1	1	0	1	1
ORS	1	1	1	1	1	1
Aminophylline	0	1	0	0	0	0
Salbutamol	1	1	1	1	1	1
Nacho3	0	0	0	0	0	0
Chlorpromazine	0	0	1	0	0	0
Hyocine	1	1	1	0	1	1

5.2 Qualitative data results

The aim of the qualitative component of this study is to supplement the quantitative data, to identify the challenges affecting availability of emergency resuscitation equipments and medications in ER's of health center.

5.2.1 Profile of participants

In total, 9 participants were interviewed, emergency unit leadership, who are responsible for managing and overseeing essential drugs and equipments and who have more than and equal to one year experience. Table 3 depicts the average profile of the key informants.

Table 3 Profile of participants

Participant	Sex	Education level	Experience	Position
Key info1	Male	BSC Nurse	2 years	ED head
Key info2	Female	General practitioner	1 year	ED head
Key info3	Female	BSC Nurse	2 years	ED team leader
Key info4	Female	BSC Nurse	2 years	ED team leader
Key info5	Female	BSC Nurse	2 years	ED head
Key info6	Female	BSC Nurse	3 years	ED head
Key info7	Mal e	BSC Nurse	2 years	ED head
Key info8	Female	BSC Nurse	5 years	ED team leader
Key info9	Female	BSC Nurse	2 years	ED team leader

5.2.2 Themes and codes

Respondents openly shared their thoughts about the difficulties and factors pertaining to the availability of emergency equipment and drugs. Overall, four themes were identified. A summary of the themes and the codes is presented in table 4.

Even though most of them agree that there is improvement from previous time there is still a huge gap in terms of this essential items availability.

Table 4 Themes and codes for the qualitative data

Themes	Codes
Health system and supply chain (logistic) barriers	Budget constraints
	Long Procurement process issue
	Limited local market availability
	Guidelines and policies not aligned with health center needs
Human resource barriers	Shortage of trained emergency health care workers
	Lack of emergency focused training
Patient barriers	Financial barriers
Oversight and management barriers	Lack of priority and focus on ED
	Absence of electronic system
	Poor forecasting of equipment and drug needs

Theme 1- Health system and logistics (supply chain) barriers

Key informants linked the limited local market availability of essential drugs to be one issue. The long time it takes to acquire the requested items is also another problem.

> "If the provisons are unavailable nationwide or are very difficult to acquire it may take long. But if they are available in the country the deciding factor would be the providers logistics as there may be differences in the logistics it may take a week, a month or more" k3

> "Sometimes there might be shortages of drugs like Diazepam, when there is a critical shortage all over the country. There are even times when we struggled to get the drug from other health facilities."k6

> "Local supplier (PFSA) may not have the requested items. And after we requested it takes time to receive the items. The tender process takes almost a month" k7

Key informants also have raised issues regarding budget constraints.

“Budget shortage is an important factor. We always ask for fridge and defibrillator but since there is no budget these items are even not put on items listed on the tender“K7

Additional factor was discordance between the health center treatment guideline and the drugs and equipments listed as a requirement to be fulfilled. Most items on the checklist are not utilized based on the guideline.

“Most crash cart medications aren’t available here at our health center level and we have asked why and the answer is that the health centers tier doesn’t meet the requirements to have access to the check listed provisions and the check list provided is done to make a standard for care and rescue referrals to hospitals but that’s is a plan and the infrastructures aren’t yet fully available to implement the checklist.” K3

“We use Ethiopian primary health care clinical Guideline (PHCG). We mostly don’t give the medications on the list at a health center level, for example it says give nifedipine after that it says refer not use labetolol. The PHCG mostly restricts us from using the advanced medications because we have to refer this patients” k8

Theme 2- Human resource barriers

The other barrier mentioned was concerning training of health professional working in the ER. There is a huge gap in emergency training and lack of emergency trained professionals, even when trained; since they don’t practice most of it, they will forget most the things form the trainings.

“When we get trainings we come and orient the rest of the staff. We get trained on how to do cardiopulmonary resuscitation but we might not know how to administer some of the medications listed. It’s only me that’s had training once over the past 5 year” k8

“So there are some medications you listed that we even have never heard of but if they were available we will know there us. The other thing is we need training, I have training 3 years ago

but after that there is no one who did. We know some medications during trainings but never seen them in practice." K9

"More trained personnel can be hired and more drugs and equipments that are up to the standard of the checklist can be provided so as to decrease referral to hospitals. There can also be more trainings not only to emergency personnel but all medical care givers in the facility should be given training as they can be on duty in the ER " k4

Theme 3- Patient barriers

Another noted challenge during the discussions was concerning patient financial status. There is a big problem while managing patients found from the streets since they can't deny care in emergency situations.

"I think patient financial status have an effect even though there are compensatory methods put in place as the number increases there would be an effect in the stock."k3

"We give them what is available but after the patient is relived we ask. The other problem is most people are from the street so we can't replace them." K9

Theme 4- Oversight and management barriers

The health centers emergency department leadership agreed that availability of emergency equipments benefit the patient and the health care workers, yet one of the barrier identified was lack of attention from the health centers leadership or attention to departments with outside funding. Participants stated that despite the health center's efforts to date to offer a variety of remedies to the challenges, the issue has continued for a number of reasons.

"There is negligence among the working staff starting from the director of the health center through every level of the departments including not assessing and notifying resources that need to be restocked." K2

"I personally don't think ED is getting the attention it deserves. More focus is being given to program areas, on basis of funding too. But the complaints and hardships are harsher at the ED.

We already notified the health center head about the various problems affecting the emergency department and things that need to improve and are awaiting feedback.” K2

One of the other factors cited as limiting the availability of these necessary medications and equipment was the absence of an electronic system for forecasting and monitoring them leading to increased workload since surveillance is done manually.

“We don’t have an electronic system to control and forecast sustainability of these essential items. It has been proposed but it’s not implemented yet since it needs system and I believe it is very helpful if it’s implemented.” K1

“It is difficult. We have a lot of work load because we do surveillance manually. We have to keep track of the drugs on the daily. There is no electronic system to control the sustainability of these resources. Whenever drugs are expired or unavailable, they prepare hard copy list and give them to the emergency staff. “ k2

6 Discussion

The survey revealed that there is a significant gap in terms of the readiness of these facilities to handle emergency cases specifically in terms of availability of resuscitation equipment and drugs. Devices to deliver oxygen were readily available in all health centers but devices to maintain airway patency are lacking.

Cardiac monitor was available in only 50 % of the health centers and Defibrillator was present in none of the facilities which make it difficult to diagnose and manage life threatening arrhythmias and cardiac arrest. Managing patients with status epilepticus and poisoning is also another challenge. Availability of materials and drugs for infection prevention and control seems to be adequate in all the facilities.

In depth interviews were used to identify barriers for availability of essential emergency equipment and drugs and it showed that there are management, logistics, human resource and patient related factors. The frequently raised management related issues include: Lack of priority and focus on ED, absence of electronic system and poor forecasting of equipment and drug needs. Logistic and health system related barriers include Budget constraints, long Procurement time issue, limited local market availability, guidelines and policies not aligned with health center needs. The absence of emergency-focused training and the scarcity of qualified emergency health care providers were human resource-related obstacles.. Patient related issues were secondary to patients' financial constraint.

A bias that needs to be taken into account is the one related to selection bias as the method used is purposive sampling because samples are chosen subjectively. In this study, another bias is related to the representativeness issue. Since the sampled health centers are located in AA it might not represent health centers located in the periphery. The other is response bias, where the participants respond inaccurately to questions in the interview.

After quantitative data collection and analysis was done explanatory sequential mixed method is used to identify the barriers associated with the gaps presented during the quantitative study.

The results indicated that no designated crash cart is available in all of the study sites and among the crash cart medications adrenaline, atropine, furosemide, ORS, NS and salbutamol are the ones found in all health centers. Digoxin and sodium bicarbonate were not found in any of the

health centers. According to a study conducted in Botswana, the overall availability of medications and equipment varied from 19.4% to 31.1%, and only 20.4% of the necessary medications were available on resuscitation trolleys, which is so much lower than the 100% that is expected which led to the conclusion that these trolleys are not maintained as per protocol which is the case in our study too(19).

In contrast to a study done in Saudi Arabia health centers published in 2007 which showed the 3 least available equipments were IV cannulas(43.3%), NG tube(30%) and urinary catheters(56%), all our study sites have the mentioned materials 100%. This research shows a huge gap in medications used to manage poisoning patients which is comparable with the mentioned study(4).

All in all, our findings suggest that emergency equipments and drugs are inadequate and there is lack of required resources for providing emergency care, which is in line with the study done in hospitals in Ghana which showed only 60% availability of essential medications(18).

Studies around the world have shown similar challenges to those highlighted in this study. According to interviewees, the main obstacle is the procurement procedure, which is regarded as lengthy and requires tenders that have already been set by the government, in a study done in Rwanda, university teaching hospital of Kigali (CHUK ED) which was also mentioned as one of the barriers in our set up(22).

In the developed world, the challenges identified in Europe were more related to manufacturing problems, including raw material shortages, rather than the lengthy procurement process and lack of funding, which are significant barriers in our set up(20).

As other developing and low-income nations allocation of budget is frequently inadequate to this sector which is revealed as part of the barrier in our study. Similar findings were seen in studies done in Tanzania and Nigeria(26) (21). However, few interviewees mentioned budget as a problem when discussing the lack of necessary medications, supplies, and equipment at the CHUK ED Rwanda(22).

One of the biggest issues raised in this study was that some of the listed required essential equipment and drugs on the checklist are not supposed to be utilized based on the treatment guideline of the health centers, which have an algorithm to refer patients. This shows that policy

and guideline makers are not aware of the dilemma presented here. The other is patient financial status. Both of these barriers don't seem to be identified as challenges in other researches.

7 Limitations

Despite the fact that this study provides a very important input on the gaps health centers have in terms of the availability of essential equipment and drugs, it still has limitations. Firstly, it didn't include pharmacy head and health center leadership, which could have given us a better insight on the barriers, but because of time and financial restraints, this wasn't possible. Secondly, data collection was done at a single point in time and didn't consider other confounding variables like the usual stock-out time and other cyclical events that can't be quantified. Finally, when assessing availability, only presence is assessed, but whether more than one piece of equipment or medication is available within a given category is not studied, and the functionality of the equipment is not assessed.

8 Conclusion

The study identifies emergency equipment and drugs at health centers were not maintained as per protocol of the health centers' emergency service leveling guideline. The availability of emergency equipment and drugs was consistently inadequate in the studied health centers and these gaps should be addressed urgently. Lack of attention from health center leadership, budget constraint and long procurement process were identified as significant challenges. However, further research is required to explore the barriers and solutions to improve availability of this essential equipment and drugs which lead to better patient outcome.

9 Recommendations

Based on this study's result the recommendations are; a designated crash cart should be availed with all the necessary equipment and drugs in the ER, a system to forecast stock out and ensure

sustainability should be implemented by electronic system, increasing attention to ER in terms of training of staff and increasing emergency trained professional (Both basic and Advanced cardiac life Support) and update treatment guideline of these facilities to align with the updated emergency service requirement is recommended. Further research to pinpoint the approximate number of stock out days is also proposed.

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Annexes

Annex 1 information sheet and consent form for quantitative design

Title of study

Evaluation of availability of Emergency drugs and Essential resuscitation equipment in selected health centers in Addis Ababa, Ethiopia

Principal investigator

Dr. Lidia Dagne, Final year Emergency and Critical care resident

Introduction

It is requested of you to participate in a research project. It is crucial that you comprehend the purpose of the research and what it entails before choosing to take part in it. If anything unclear or if you require further information, please ask the researcher after carefully reading the accompanying material.

This form is prepared by the investigator whose main objective is to study availability of emergency equipment and drugs of health centers in Addis Ababa, Ethiopia.

Purpose of the study

The purpose of this study is to assess the availability of emergency equipment and resuscitation drugs at health centers in Addis Ababa in order to identify the gaps in delivering appropriate emergency care, which is currently unknown.

Study procedures

The checklist that is utilized is adopted from the basic emergency service leveling guideline for health centers adopted in 2021 by Ethiopian Ministry of health. The checklist consists of three main parts for both materials and drugs: Mandatory, desirable and optional materials and mandatory crash cart medications, mandatory medications and medicine for poisoning and overdose, respectively.

Risks

There are no risks involved in taking part in this research. You are free to refuse to respond to any or all of the questions, and you can stop participating whenever you'd like.

Benefits

You will not directly gain anything from taking part in this study. Nonetheless, we anticipate that the data gathered from this investigation may help identify the barriers for delivering quality emergency care specifically in terms of availability of emergency equipment and drugs.

Confidentiality

This study projects data will remain private. The information gathered from the survey regarding your health facility will be kept in a file without the health center's name on it. Only the primary investigator will have access to your health center information.

Contact information

You can get in touch with the study's primary investigator at the following address if you have any queries at all regarding it or if taking part in it has negative consequences on you.

Name- Dr Lidia Dagne

Tel. - +251923777821

Email – lidiadagne@yahoo.com

VOLUNTARY PARTICIPATION

It is voluntary for you to participate in this study. You are free to choose whether or not to participate in this study. Should you choose to participate in this research; a consent form will need to be signed. You are still able to withdraw your consent at any moment and for any reason once you sign the consent form. If you decide to withdraw from this study, it won't have an impact on your relationship—if any—with the researcher. Your data will be erased or returned to you if you leave the research before all data collection is finished.

CONSENT

I've had a chance to read the information supplied, comprehend it, and ask questions. I am aware that participation is completely voluntary and that I can end it whenever I want, for any reason, and without cost. I am aware that a copy of this permission form will be provided to me. I willingly consent to participate in this research.

Medical director's signature _____ Date _____

Investigator's signature _____ Date _____

Annex 2 Information sheet and consent form for the qualitative design

Title of study

Evaluation of availability of Emergency drugs and Essential resuscitation equipment and barriers for unavailability in health centers in Addis Ababa, Ethiopia

Principal investigator

Dr. Lidia Dagne, Final year Emergency and Critical care resident

Introduction

It is requested of you to participate in a research project. It is crucial that you comprehend the purpose of the research and what it entails before choosing to take part in it. If anything unclear or if you require further information, please ask the researcher after carefully reading the accompanying material.

This form is prepared by the investigator whose main objective is to study availability of emergency equipment and drugs and barriers for availabilty in health centers in Addis Ababa, Ethiopia.

Purpose of the study

The purpose of this study is to assess the barriers for availability of emergency equipment and drugs in health centers in Addis Ababa, Ethiopia in order to identify the gaps in delivering appropriate emergency care, which is currently unknown.

Study procedures

The checklist that is utilized is adopted from the basic emergency service leveling guideline for health centers adopted in 2021 by Ethiopian Ministry of health. The checklist consists of three main parts for both materials and drugs: Mandatory, desirable and optional materials and mandatory crash cart medications, mandatory medications and medicine for poisoning and overdose, respectively.

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Name- Dr Lidia Dagne

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CONSENT

I've had a chance to read the information supplied, comprehend it, and ask questions. I am aware that participation is completely voluntary and that I can end it whenever I want, for any reason, and without cost. I am aware that a copy of this permission form will be provided to me. I willingly consent to participate in this research.

Interview participant's signature _____ Date _____

Investigator's signature _____ Date _____

Annex 3 Checklist for Emergency Equipment and Drugs (Quantitative study)

MATERIAL RESOURCE REQUIREMENTS FOR HEALTH CENTER EMERGENCY SERVICE		
Measurement Criteria	*Yes*	*No*
Mandatory materials		
Total number of Beds		
Wheelchair		
Stretcher		
Crash cart		
Hand antiseptics		
PPE-N95, Boot, Apron, Goggle, Face mask		
Generator **(Solar)**		
Water reserve tank for the whole hospital		
AED		
Sphygmomanometer		
Cardiac monitor		
Suction machine		
Oxygen cylinder		

Portable oxygen cylinder			
Flow meter			
IV stand			
Thermo-meter			
Stethoscope			
Air way equipment for pediatric and adult	• Oral airway (small, medium & large)		
Breathing equipment	• Nasal prong, catheter and facemask		
	• BVM		
Nebulizer			
Crash cart	Syringe with different sizes		
	IV Cannula with different sizes		
	Neck collar		
	Lumbar brace		
	Pelvic binder		
	NS,RL & D5		
	NG tube and Urinary catheter and urine bag		

	Minor set		
	OPA, NPA		
	Tongue depressor		
	Torch light		
Minor wound care set	Suturing set		
	Dressing set		
	Minor surgical set		
Instrument tray (Troly)			
Suction tip			
Hard board			
POP			
Pulse Oximeter			
Glucometer			
Weight scale			
Safety box for sharp object disposal			
Refrigerator			
Siren			
Desirable materials/equipment			
Oxygen Concentrator			

Venturi airway mask		
Fluid warmer		
Supra pubic catheter set		
Optional materials/equipment		
AED		
Traction kit		
Splinting		

DRUGS AND SUPPLY (25%), CF (0.26)		
Mandatory crash cart medications	Yes	No
Digoxin Injection,0,1mg/ml, 0,25mg/ml		
Magnesium sulfate Injection,2%,5%,10%,20%,50% in 20ml		
Sodium Chloride 0.9% (Normal Saline),500ml,1000ml		
Atropine sulfate injection,1mg/ml in 1 ml ampoule		
Hydralazine Injection,20mg/ml in 1 ml ampoule		
Nimodipine		
Adrenaline injection,0.1mg/ml		
Furosemide injection10mg/ml		
Acetylsalicylic acid (ASA) Tablet, 71mg ,75mg & 81mg		

Diclofenac Injection,25mg/ml in 3 ml ampoule,75mg/ml		
Tramadol Injection,50mg/ml in 2 ml ampoule,100mg/ml		
Pethidine Injection,50mg/ml in 3 ml ampoule,100mg/ml		
Diazepam Injection,10mg/2ml		
Phenytoin Injection, (2) 50mg, po 100mg		
Haloperidol injection,5mg/ml in 1 ml ampoule		
CIMETIDINE Injection,200mg/ml		
Dexamethasone Injection,4mg/ml ,25mg/ml,50mg/ml		
Hydrocortisone Injection,50mg/ml		
Calcium Gluconate injection ,10mg in 10ml ampoule		
Dextrose with water Injection ,5% in 1000ml		
Ringer's Lactate (Hartmann's Normal) Injectable solution ,1000ml		
Dextrose injection, 5% in 1000ml, 40% in 20ml		
Oral rehydration salt powder (ORS)		
Magnesium sulfate Injection ,20% in 10ml		
Aminophylline Injection ,250mg/10ml in 10ml & 20ml		

Salbutamol puff		
Sodium bicarbonate Injection(concentrated),7.5%(40mEq/50ml)in ; 8.4%(50mEq/50ml)		
Dobutamine powder injection 250mg		
Haloperidol injection,5mg/ml in 1 ml ampoule		
Chlorpromazine hydrochloride Injection,25mg/ ,50mg/2ml		
Hyoscine (scopolamine) hydro bromide Injection,0.45mg/ml,0.6mg/ml in 1ml		
Mandatory		
Lidocaine hydrochloride Injection,5mg/ml,10mg/ml,20mg/ml		
Heparin (UFH) Injection,1000U/ml,5000U/ml		
Phenobarbitone		
Nimodipine injection,1mg/5ml		
Metoclopramide Drops,0.2mg/drop Injection,5mg/ ,50mg/2ml ampoule		
Medicine for Poisoning and Over Dose		
Activated Charcoal Tablet,125mg,250mg, powder for reconstitution 15mg/120ml,25mg		
Atropine Sulfate Injection,1mg/ml in 1 ml ampoule		

Physostigmine Salicylate Injection, 1mg/ml in 1 ml and 2ml ampoule		
Pralidoxime powder for injection, 1g/vial		
Protamine sulfate Injection,10mg/ml		
Rabies Antiserum Equine Injection,200units in 5 ml		
Vitamin K Injection,10mg/ml in 1 ml ampoule		
TAT Injection,1500IU/ml		

Annex 4 Interview Guide

1. What is your role in this health center and for how long?
2. How do you view the current status in terms of availability of this equipment and drugs?
3. Who are important stakeholders for providing and managing emergency equipment and drugs?
4. How frequently do you assess availability against the checklist and is there an electronic system to control the sustainability of these resources?
5. Do you have a system for notification and forecast of consumption rate to make availability sustainable or how do you assess need to ensure continuous availability?
6. What is the advantage of having accessible emergency equipment and drugs?
7. What are the barriers for the availability of emergency equipment and drugs?
8. Do you believe patient financial status has an effect on availability?
9. Do you believe that if this equipment and drugs are available the medical providers have the proper knowledge on how to utilize the equipment and when to administer the medications?
10. What measures are currently being taken to assure sustainable supply of these resources?
11. Do you believe that emergency department is getting the attention that it deserves from the hospital leaders or any of the governing bodies?

In Amharic

ለቃለ መጠይቅ የተዘጋጁ ጥያቄዎች

1. በዚህ የጤና ማዕከል የርስዎ የስራ ድርሻ ምንድን ነው?
2. አሁን ያሉትን የድንገተኛ መድሐኒቶች እና መሣሪያዎች አቅርቦት እንዴት ይመስከቱታል?
3. እነዚህን መድሐኒቶች እና መሣሪያዎች መከታተል እና ማቅረብ የማን ሀላፊነት ነው?

4. በየስንት ጊዜው የተዘጋጀውን ዝርዝር ከትትል ታደርጋላችሁ? የተሰራ የኮምፒውተር ሲስተም አለ ወይ?
5. የተለየ የምትጠቀሙት መንገድ አለ እነዚህን መድሐኒቶች እና መሣሪያዎች በዘላቂነት ለማቅረብ?
6. በነዚህ መሣሪያዎች እና መድሐኒቶች መሟላት ማን ነው የሚጠቀመው?
7. ምን ምን እንቅስቃሴዎች አሉ እነዚህ መሣሪያዎች እና መድሐኒቶች እንዲሟሉ?
8. የታካሚ የገቢ ሁኔታ እንደ እንድ እንቅፋት መታየት ይችላል ወይ?
9. እነዚህ መሣሪያዎች እና መድሐኒቶች ቢሟሉ መጠቀም የሚችል የሰለጠነ የሰው ኃይል አለ ብለው ያምናሉ?
10. በአሁኑ ሰአት እነዚህ መሣሪያዎች እና መድሐኒቶች ለማሟላት እየተደረገ ያለ ጥረት አለ ወይ?
11. ድንገተኛ ዲፖርትመንቱ በሆስፒታሉ አመራሮችም ሆነ በመንግስት አካላት ተገውን ትኩረት አግኝቷል ብለው ያምናሉ?

Declaration

I, Dr. Lidia Dagne Mario, declare that this dissertation entitled: “Availability of emergency drugs and essential resuscitation equipment and barriers to availability: Explanatory sequential mixed method design” is my own unique work, which I have never submitted to another university for consideration for a degree award of any kind, nor will I ever bring it to one. I have given due credit to every source I used.

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Signature- …….

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Place- Addis Ababa, Ethiopia