

Disaster response readiness assessment of Public Hospitals in Addis Ababa City, Addis Ababa, Ethiopia

Yared Boru Firissa:

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**KIT (Royal Tropical Institute)
Vrije Universiteit Amsterdam (VU)**

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Master of Science in Public Health

By:

Yared Boru Firissa

Declaration: Where other people's work has been used (from either a printed or virtual source, or any other source), this has been carefully acknowledged and referenced in accordance with academic requirements. The thesis "**Disaster response readiness assessment of Public Hospitals in Addis Ababa City, Addis Ababa, Ethiopia**" is my own work.



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Abstract:

Background:

The ability to anticipate, minimize the impact of, respond to, and recover from a disaster is called disaster response readiness. Several natural and manmade disasters occur frequently in poor nations like Ethiopia, and this study evaluates emergency preparedness among public hospitals in Addis Ababa, the capital city of Ethiopia.

Objective:

The primary objective of this study is to assess the disaster response readiness of Public Hospitals in Addis Ababa City.

Methodology:

A cross-sectional study design was utilized with a mix of quantitative and qualitative methods.

Results:

Ten hospitals in total were assessed; all but one hospital experienced a disaster in the previous two years, with road traffic accidents accounting for 50% of total disasters. Almost all hospitals have disaster plans, and five of them have trauma-specific plans (50%). A total of 16 (88.8%) of the hospitals' emergency and disaster representatives (n=18), two from each site as one doesn't have disaster experience, said that their facility's emergency care area is not enough to accommodate patients during disasters. Separate disaster medication/equipment stores are found in 7 (70%, n=10) hospitals, but only 3 (43%, n=7) of them are restocked regularly. Eight (44%, n=18) respondents stated that their hospital doesn't have a functioning disaster management team, and 11 (61%, n=18) of the respondents felt that their hospital is not well prepared to handle a disaster. Some of the respondents 6 (33%, n=18) said that commitment from Ministry of health and hospitals is among the enabling factor to improve disaster response readiness in the future.

Conclusion:

The findings show that most hospitals are inadequately prepared for disaster management, and the causes range from simple to complex. So, the Ministry of Health, the hospitals, and the non-governmental stakeholders need to work closely to improve disaster response readiness using the evidence provided in this study, while also suggesting the need for more studies.

Key words: Disaster, Emergency, Readiness, Trauma, Ethiopia

Word Count: 11,005

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Abbreviations

ALERT: All Africa Tuberculosis and Leprosy Rehabilitation Center

AaBET: Addis Ababa Burn Emergency and Trauma Hospital

ICU: Intensive Care Unit

NGO: Non-Governmental Organization

RTA: Road Traffic Accident

TBGH: Tirunesh Beijing General Hospital

WHO: World Health Organization

Key terms

Alarm procedure: “A means of alerting concerned parties to a disaster; various optical and acoustical means of alarm are possible including flags, lights, sirens, radio, and telephone.”

Assessment: “The evaluation and interpretation of short- and long-term measurements to provide a basis for decision making and to enhance public health officials’ ability to monitor disaster situations.”

Casualty: “Any person suffering physical and/or psychological damage that leads to death, injury, or material loss.”

Community emergency response team: “The CERT program supports local response capability by training volunteers to organize themselves and spontaneous volunteers at the disaster site, to provide immediate assistance to victims.”

Disaster case management: “The formal process of organizing and providing a timely, coordinated approach to assess disaster-related needs including healthcare, mental health, and human services needs that were caused or exacerbated by the event and may adversely impact an individual’s recovery if not addressed.”

Dispatch centers: “A system used to assign ambulance personnel and other first responders.”

Disaster management team: “A group of health professionals from different department who respond to the disaster.”

Emergency department: “The department of a hospital responsible for the provision of medical and surgical care to patients arriving at the hospital in need of immediate care.”

Incident command system: “The model for the command, control, and coordination of a response to an emergency; provides the means to coordinate the efforts of individual agencies.”

Isolation room: “Isolation rooms are special hospital rooms that keep patients with certain medical conditions separate from other people while they receive medical care.”

Poly trauma: “is a medical term describing the condition of a person who has been subjected to multiple traumatic injuries.”

Chapter 1: Background

Ethiopia is one of the developing countries found in East Africa with a population size of nearly 115 million and a population density of 115/km². With the current birth rate of 36 per 1000 and fertility rate of 4.1 per woman, the population size is expected to surpass a 200million in the coming 30 years (1). Addis Ababa is the capital of Ethiopia which is a highly developed and important political and trade center of the country. The area of the city is rapidly expanding, and in the last 30 years, it attained 530.21 square kilometers of surface area from the previous 222.04 square kilometers, with a Total population size of 3.3mil and population density of 5,165.1/km². It has 10 sub-cities and about 116 woredas which are small administrative units (2).

The health system setup of the country has 3 tires: Tertiary level which includes referral, teaching, and specialized hospitals, a secondary level which include general hospitals also serve as referral site, and the primary level which includes health centers. The classification is based on the type of service and the proportion of population served (3). The capital city has got all spans of services ranging from the health center to specialized hospitals, and, the country's biggest and most specialized hospital is found in the Addis Ababa, capital city. Most of the hospitals found in the capital city, participate in academic activities for specializing doctors, medical schools, nursing schools, and other paramedics. There are a total of 11 hospitals and 98 health centers in the city and one of the hospitals is exempted for only Covid-19 care; 4 of them are General hospitals and the rest are Specialized Referral hospitals with 2 of them Specialized in Trauma care.

All of them give comprehensive services and accept referrals from any corner of the country during disasters and are also kept responsible to manage any disaster happening in the city and outside. During the time of Covid-19, large treatment Center with more than 1000 beds was established which later shifted to deliver service to injured soldiers after Covid-19 cases started decreasing (3) (4). The referral system among health centers and hospitals is established in such a way that assigning a certain number of health centers to each hospital so that, a given health center can only refer to its assigned Hospital, except for some specialized care. During the time of disaster or any emergency condition, this path can be violated therefore, patients can directly go to hospitals and referral is not mandatory (5). The highest mortality in Addis Ababa is attributed to Non-communicable diseases followed by communicable diseases and injury of any causes (6).

Injuries from Road Traffic Accident (RTA), flooding, and disease outbreak like diarrhea is becoming common hazards resulting in disaster; Trauma is causing significant social and economic crisis contributing 10 % to all disease case visiting hospitals (7) (8), a recent study done in Addis Ababa also shows injury has contributed 7% in total death counted over consecutive 8years. In addition, the proportion of injury and death is higher among people aged 15-34, which is the productive age group (9). Moreover, when we look at economic consequences the country lost around 7.3bil USD only in the year 2014/15 from 15,086 road crashes (10). The city is also sustaining frequent flash flooding during the rainy season from June to August, due to the rapid increase in urbanization and impermeable surface; this has been another type of disaster overwhelming hospitals moreover, causing social and economic crisis (11). Infectious causes of disaster like Acute Watery Diarrhea outbreak has also been seen infrequently in most cities of the

country including the capital city, the rapid urbanization, poverty, and frequent cultural and religious gatherings in the capital city are among the contributing factors to the rapid dissemination of pathogen resulting in disaster (12). COVID-19 pandemic is one of the recent disasters the city suffered, Addis Ababa is still the leading city in recording the largest number of cases (71.6%) and deaths. (13). Therefore, Ethiopia, especially Addis Ababa city possesses a wealth of experience in disaster.

Chapter 2: Problem statement

Disaster and emergency health conditions are one of the main health concerns in Ethiopia. The country is situated in areas prone to both natural and manmade disasters. Therefore, it is a usual encounter to see natural disasters like drought, flooding, disease epidemic, and manmade disaster like injuries, especially road traffic accident casualties. Global Facility for Disaster Reduction and Recovery labeled Ethiopia as one of the top 20 countries with highly vulnerable to disaster and poor economic resilience (14) (15) (16) People around the globe have been experiencing a number of manmade and natural disasters. Climate change, trauma, epidemics, conflict, chemical and radiation injury, fire, and flooding are among them. The health and economic consequence of these hazards are maximum in the already fragile health care systems of developing countries (17).

Disasters in urban areas like disease outbreaks, fire, and flooding incidents are rising because of urbanization, also signs of earth quakes around rift valleys have been observed in Ethiopia. Conflicts that happen in the city like rallies, demonstrations, and oppositions due to political instability are also resulting in mass injuries. The above situations show that the country is continuously vulnerable to different kinds of hazards and associated disasters (18). The emerging common public health problem in Ethiopia is injury from RTA and, according to World Health Organization (WHO) report, Ethiopia is mentioned as one of the worst countries worldwide where RTA kills and injures a large number of road users (19).

Road traffic casualties disproportionately affect developing countries contributing to 90% of global road death reaching 34/100000. the number of people dying of RTA globally is surpassing the number of people dying of Tuberculosis, Human Immunodeficiency Virus, and diarrheal disease collectively (20). The world bank report showed that more than 1000 disasters happened in the last 40years in sub-Saharan Africa affecting over 330mil (21). Drought and its related medical consequences are another devastating public health problem in Ethiopia, causing the disaster by overwhelming cases of malnutrition, diarrheal disease, and respiratory infections. Since last 2020 Ethiopia experienced consecutive failed rainy seasons resulting in drought, especially in the south and southeastern part of the country; still there are more than 8 million people affected by the drought and its consequences (22).

The ongoing war in different areas of the country is resulting in overcrowding of hospitals as a result of widespread consequences like poly traumas, malnutrition, and destruction of health care services (23). In addition, the pandemic has put significant pressure on the already exhausted health care system from multiple disasters. Even though the case burden was not as large as that happened in developed countries, it has significantly affected the poor health care system the country has (24). The two major Covid-19 treatment centers found in Ethiopia are established in Addis Ababa the city with a high number of cases of Covid-19 and the most populated city in Ethiopia. All the COVID-19 treatment centers were newly established and there was no hospital in the city that was ready enough to accommodate such a flow of cases. This may indicate that hospitals found in the city were not ready enough to provide care for such ever-whelming disasters (25).

Disaster readiness is an important measure undertaken in advance to respond to the unexpected occurrences of any disaster, the disaster readiness plan ranges from pre-disaster preparation to the resilience of the system during post-disaster (26). Most study shows due to the predictability of

some of the disasters that the developing country was facing so far, the major focus was on dealing with disaster event than preparing for disaster and managing risks. The study done in the eastern part of Ethiopia in four public hospitals showed that despite the frequent occurrence of disasters, selected areas are ill-prepared for potential disaster strikes (27) (28).

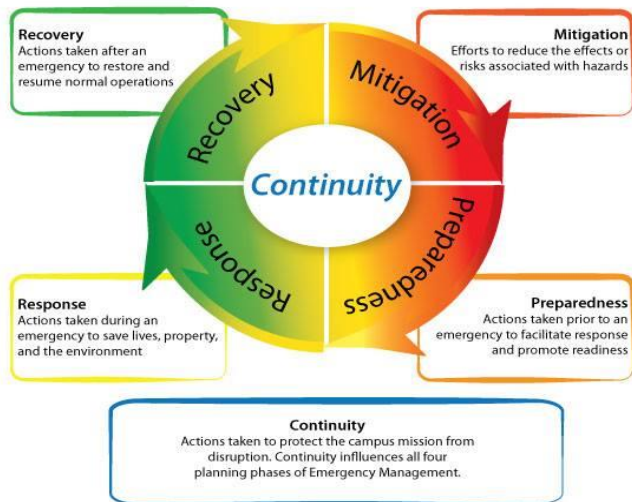


FIG 2.1 Disaster preparedness continuity: Canada Emergency Management Planning Guide 2010–2011 (29, p-7)

The scope of disaster management involves multi-sectorial from Government to the health care system and down to the community level, to keep the continuity of disaster preparedness. It involves pre-disaster readiness, mitigation strategies, disaster response, and post-disaster recovery and rehabilitation; During the pre-disaster phase hospitals are supposed to prepare plan documents, training of staff, restocking of disaster stores, and practice drills; during the phase of disaster the central command activates the disaster management team and supportive staff; then the team carry out the clinical and other supportive activities like patient care, organizing logistics and security; finally during recovery phase the team come up together and evaluate their performance and learn from and plan for the next time (29).

The immense loss of lives and resources happened in Ethiopia so far, is due to countries main focus being mainly on post-disaster response instead of planning ahead of time (9). Developing nations in particular experience significant human and resource loss from manmade and natural disasters. These are mainly attributable to a lack of disaster readiness in terms of a trained workforce, infrastructure, resources, risk assessment, inter sector collaboration, and strategies to manage a large number of patients at the hospital level (30). Hospitals should be functional during and after a disaster; however, this potential is achieved only if hospitals are ready to respond to unexpected hazards. In developing countries, the critical role of hospitals is known among the society that it serves the community by managing disasters, however, attention is not given to their preparedness level.

There are improvements seen across the world in disaster readiness after the resolution made by the World Health Assembly to make hospitals functional during times of disaster, however, in the developing country many hospitals are less prepared with limited capacity as a result one episode of mass casualty can disrupt the whole structure and service capacity of a given hospital (31) (32).

Preventing disaster and Minimizing the effect of disaster can be ensured by building a resilient system to withstand the consequences of disaster and by providing an immediate and appropriate response to a disaster. However, when we look at the experience of the country in disaster management the development in readiness is not as satisfactory compared to the ample experience the country has so far (28). Our hospitals mainly focus on taking care of the daily usual patient flow and there is not much effort seen until recently for disaster which happens once in a while. Now a day's ministry of health took the disaster as one of its major initiatives and working to improve Emergency and disaster management, especially in major cities of Ethiopia by designing a platform called Major Cities Emergency and Critical Care Improvement Program (MECIP) in Addis Ababa and other five regional cities (33).

Chapter 3: Justification

The frameworks and initiatives of Emergency preparedness have been addressed by several global organizations working on health-related emergencies and disasters. And it is evident that mainly in low-middle income countries the implementation of Sustainable Development Goal (SDG) will be strengthened by strong emergency and disaster readiness (34). Disaster readiness has to be integrated at various levels of disaster management as part of policy and administrative regulations. The stakeholders are vast and not limited to the National Government, Private sectors, Regional cooperation, Non-Governmental Organizations (NGO), Community and, Health care systems. From listed major stakeholder hospitals play a crucial role by shouldering the primary responsibility of providing emergency care services therefore, hospitals are supposed to be always on hand in order to accommodate unforeseen disasters (35).

Addis Ababa, the capital of Ethiopia, is the largest city and accommodates a large number of hospitals and the two trauma centers in the country. From the recent pandemic, the highest number of cases and deaths were recorded in this city as a result most public hospitals service collapsed fast (13). Since there was no plan for such disaster before, the city administration and Ministry of Health in collaboration established two new treatment centers after the case started to overwhelm (4). The study on the vulnerability of cities to natural disasters showed that Addis Ababa is prone to riverine and flash floods due to extreme climatic events, rapid urbanization, and population size. This is a wake-up call for hospitals and other stakeholders to have strong disaster response readiness plan (11) (36).

The study from different African countries showed that disaster preparedness is in its early stage, they picked challenges related to human resources, knowledge gaps, economic constraints, lack of awareness of disaster, and less support from hospital administration and other stakeholders as a barrier to effective readiness to respond to disaster (37) (38). So far there was no adequate assessment study done collectively on all public hospitals in Addis Ababa on disaster readiness, especially based on the components listed and suggested by WHO, which include, a well-organized disaster plan, standard infrastructure, trained human resources, and adequate equipment used to provide health care in emergency condition (37) (39).

There was one study underwent seven years back in the same area which showed of 8 hospitals studied 6 of them had a low level of preparedness in terms of Human resources and essential Emergency health services plans. This study has not explained well what tools and framework used for assessing hospitals and also important parameters like infrastructure, communication system, availability of drugs and medical equipment, and also disaster experiences were missing in the report (40). It is important to evaluate the status of hospitals from different aspects to know their preparedness level and provide recommendations. Disaster response involves multiple sectors like community, healthcare, fire brigade, police force, lawmakers, and city administrations, however, still, the burden is higher on the healthcare system since every disaster ends up in hospitals for care. Therefore, this study intends to assess the status of Addis Ababa hospitals in terms of all necessary inputs required for effective disaster response (41).

This study has compared several conceptual frameworks and chose the most appropriate one for the study setting. The Nonagon for Disaster Preparedness in Hospitals, which is a conceptual framework applied in Prehospital and Disaster Medicine, was used to design study objectives and data collection tools. By applying the tool, the study has assessed hospital readiness in terms of Disaster plan, Infrastructure, Human resources, Emergency equipment, Drugs used during a disaster, and the last two years of disaster experiences in all public hospitals found in Addis Ababa.

Chapter 4: Objective

4.1 General objective

Disaster response readiness assessment of public hospitals in Addis Ababa, to recommend policy makers actions to improve disaster response.

4.2 Specific objectives

- To assess plan and protocol of hospitals on disaster response.
- To assess hospital infra structure and logistics capacity readiness for disaster response.
- To assess hospital Human resource capacity readiness for disaster response.
- To evaluate disaster response experience of hospitals in the last two years.
- To recommend policy makers actions to improve disaster response.

Chapter 5: Methodology

5.1 Study type and study method

This is a mixed quantitative and qualitative cross-sectional study to assess hospitals' readiness status to respond to a disaster, in all public hospitals found in Addis Ababa. The study has both quantitative and qualitative parts which is aligned with objectives and data collection tool. The objectives and data collection tool were designed based on a conceptual framework “Nonagon for Disaster Preparedness in Hospitals” which defines and operationalize disaster preparedness in hospitals (26). Several possible frameworks, like Singapore Emergency department design in a pandemic, WHO disaster preparedness conceptual framework, Guidelines for hospital emergency preparedness planning goi-undp drm program (2002-2008), WHO, Global Assessment of National Health Sector Emergency Preparedness and Response, and Disaster readiness of medical facilities in AICHI prefecture, has been referred and, the final appropriate framework has been selected.

5.2 Conceptual framework

The Nonagon for Disaster Preparedness in Hospitals is a hospital disaster assessment framework. It incorporates multi-sectorial like in-hospital and community emergency response team readiness for disaster readiness and response. It has nine components which include: (Disaster Plans or Protocols), (Available Equipment), (Education, Training, and Exercises), (Command, Control, and Coordination), (Crisis Communication Strategies), (Available Staff), (Public Engagement Models), (Safety and Security) and (Continuity Strategies). This model is selected because it gives relatively more emphasis to hospital Emergency department level readiness when compared to other frameworks.

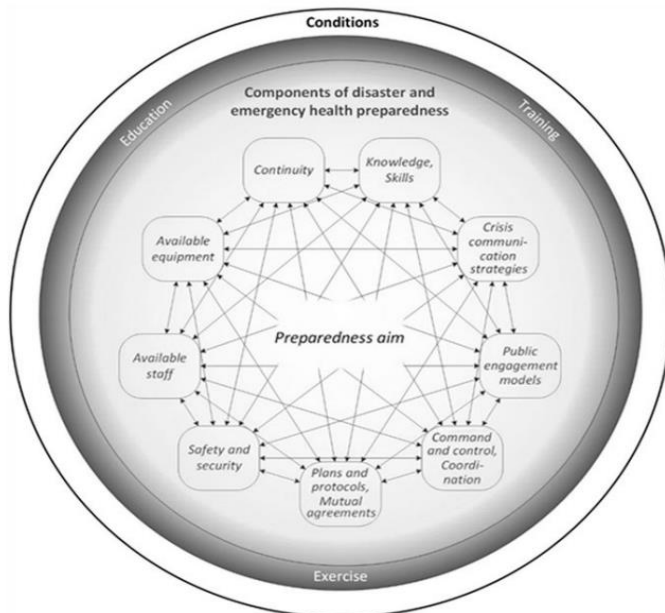


Fig 5.1. Nonagon for Disaster Preparedness in Hospitals. Verheul © 2020 Prehospital and Disaster Medicine (26. P-14)

Three main components of The conceptual framework have been extracted, which are mainly focusing on hospital level readiness. Furthermore, hospitals infrastructure and specific hospital disaster experiences have been included in addition to the available information on the framework. Disaster experience is included to reason out the strength and weaknesses of the facilities during their real-life experience. The rest of the components of the framework is beyond the scope of this study and it rather completely fits into a national level of disaster readiness. Therefore, for the sake of customizing this study, the followings are part of the framework used in this study.

1. System: workflow, protocols, communications
2. Staff: Human resources
3. Supply: logistics

Based on this, the data collection tool which was used in this study has 6 sections in addition to general information on facilities. The sections are separated based on the objectives, which assess the disaster readiness plan and protocols; human resource readiness; infrastructure readiness; logistics, and the interview questions on the last two years of disaster experience for key informants. The tool was pretested in the same setting prior to the start of data collection.

5.3 Sampling and recruitment:

All hospitals in Addis Ababa city have Emergency departments and are supposed to give emergency services and accept patients from every corner of the city during a disaster. Therefore, all 11 hospitals found in the city were included. The individuals recruited to answer the questions are based on the position they hold in the hospital. The emergency department is responsible for the disaster plan as per the national regulation, therefore, all available information regarding disaster readiness will be provided by the people who lead the Emergency department and also the disaster response representatives of the hospitals.

5.4 Data collection method

Data collectors filled the required information based on the data collection tool, using electronic data collection by web-based google form, and taking notes for the key informant interview. English was the medium of communication during data collection and the tool was not translated into the local language. The tool has three main parts, the questionnaire, checklist, and key informant interviews. The rationale for using the combined tool was not to miss any of the parameters which measure the status of facilities for disaster management, interview questions were added because it covers important points difficult to explore with the questionnaire only, like the experience of disaster management. Their assessment of disaster response experience was limited to two years only, for the sake of making easy to remember the event. A total of 3 trained Emergency master nurses were deployed to each hospital for data collection. They are not from the same hospital where they collect the data. Data collectors were oriented about data collection and data collection tools via zoom by the principal investigator.

5.4.1 Questionnaire:

The questionnaire part assesses the readiness in terms of the general information about the hospital, human resource status, and infrastructure design of the hospital. The respondents were the emergency head nurse which is believed to be knowledgeable about the required information.

5.4.2 checklists:

The checklist part includes the Human resource, equipment, medication used during the disaster. The head nurse guided the data collectors to observe what is available and also during desk review of important data.

5.4.3 key informant interview:

The respondents were selected from people who are directly involved in disaster management both in administration and clinical role. Based on this, Emergency head department and hospitals' disaster representatives were selected from each hospital, and interviewed accordingly. Therefore, there were total of 22 respondents from all hospitals. Two respondents were chosen for the sake of validity and they were asked about disaster experience in the last two years and opinion about preparedness level of their hospitals in the future.

5.5 Data processing and analysis:

Data were entered into an excel sheet and analyzed for quantitative data analysis and were checked for possible data entry errors. It was rearranged and summarized using descriptive approaches including graphs, tables, and statistical methods. Descriptive statistics were used to analyze the data, which include frequency, percentage, mean, and range. Data visualization techniques and statistical summary measures were used to display the findings.

The qualitative part was analyzed separately based qualitative data analysis method. Data content was reviewed and explored, gathering of notes and documents was done. The transcript was read, relevant pieces were coded, related codes were categorized, deductive thematic analysis approach was used. Four broad themes were finally abstracted, based on the objectives in a deductive way these are; disaster plan and protocol, logistics, infrastructure and human resource.

5.6 Quality Assurance:

A questionnaire pretest was done at a similar hospital setting which is found at 45km from Capital city before actual data collection. There was regular discussion among the principal investigator, local tutor, and data collectors on daily data collection reports and any encounters. Data was reviewed for clarity and missing content was checked to correct the next day of data collection. Data collectors were trained Emergency nurses who have an interest in doing research; so that it was easier for them to understand and use the content of the questionnaire for data collection. The nurses who collect the data are not from the same hospital where they are going to collect the information.

5.5 Ethical consideration:

Before the start of the research ethical approval was obtained from the Ethical review board of KIT, the local IRB from Debre Brehan University, and a Support letter from the Ethiopian Ministry of Health. The ministry of health has sent a support letter to each hospital to collect the data. The hospital leadership has involved the emergency department and medical director's office in the decision-making process with a formal written letter. Data collectors were trained on the data collection process and confidentiality. Dealing with issues related to disaster may also discomfoting for data collectors and respondents so there were support meetings with the principal investigators before and during data collection to discuss their encounters. Data collectors have signed an agreement with the hospital that the hospital's data will be kept secret. But due to the nature of the key informants, it will be known which group of people said what, this was put as a limitation.

5.7 Limitations

The schedule was tight due to time constraints for primary data collection. Since there is no research grant available the financial constraints were a burden to the researcher. There is no adequate literature done based on the city's context; the only available study lacks essential information like research framework, limited parameters, and a limited number of hospitals studied. Most of the information was asked from key informants (e.g. Head departments, disaster representatives) and some of them were not readily available and reluctant to give this information out. However, all precautions were taken, such as getting a letter of support from the Ministry of Health, visiting offices frequently to find the respondents, giving full disclosure about the purpose of the study, and obtaining appropriate consent from the respondents.

5.8 Dissemination of result

The study result will be presented for advisors at KIT during the final submission. The findings will also be reported to each hospital and Ministry of health Emergency and critical care directorate. Finally, the recommendation will be given for policy makers, hospitals, Ministry of Health, Health Workers, Addis Ababa city health bureau, and effort will be made to publish the finding to journal.

Chapter 6: Results

6.1 Quantitative result

6.1.1 Hospitals Characteristics

There are total of 11 hospitals in the city of Addis Ababa, the hospitals are not evenly distributed across the city; as we can see from the map they are condensed at some area in the city and the rest are distributed along the exit of the city; (fig 6.1). The figure is designed with my request by Network for Perioperative and Critical Care (N4PCc) in which I am a member.



Figure 6.1. Location of Public Hospitals in Addis Ababa.

All public hospitals except 1, found in Addis Ababa are included in the study; Out of 11 hospitals, 1 General hospital was not included because the respondents didn't respond to a call and were not available in the office multiple times. With a response rate of 91%, the 10 included hospitals were Tikur Anbesa Hospital, St. Paul Millennium Medical Collage Hospital, Addis Ababa Burn Emergency and Trauma (AaBET) Hospital, All Africa Leprosy and Tuberculosis Rehabilitation Center (ALERT) Hospital, Yekatit-12 Hospital, Ras Desta Hospital, Tirunesh Beijing General Hospital (TBGH), Minilik Hospital, Yeka Kotebe Hospital, and St. Peter Hospital. Of the 10 hospitals, 5 of them are General Hospitals, 4 are Tertiary Hospitals, and 1 Trauma center. One tertiary hospital also gives specialized trauma care, so the city has 2 trauma center. One General hospital is exempted mainly for COVID-19 care (Table 6.1).

Table 6.1 Characteristics of Public Hospitals in Addis Ababa.

No	Hospitals	Level of Hospital	Total Emergency bed	Total Hospital bed	Annual emergency visit
1	Yekatit 12 Hospital Hospital	General Hospital	18	475	12560
2	AaBET hospital	Trauma Center	49	180	15000
3	ALERT Hospital	Tertiary Hospital/Trauma Center	47	451	15,052
4	St.paul Hospital	Tertiary Hospital	28	550	7200
5	Ras dasta hospital	General Hospital	21	169	10000
6	Tikur ambessa Hospital	Tertiary Hospital	67	700	20000
7	Eka Kotobe Hospital	General Hospital/Covid-19 center	31	335	2600
8	St.peter hospital	General Hospital	11	262	5600
9	Tirunesh Beinjing Hospital	General Hospital	21	157	9899
10	Minilik hospital	Tertiary Hospital	25	334	12619

The annual average Emergency patient flow to each Hospital during the usual days varies depending on the capacity of the Hospitals (Table 6.1). General hospitals have assigned lower number beds to Emergency Departments and Tertiary hospitals have higher number of emergency beds and total hospital beds as well. The number of assigned Emergency beds, the level of hospitals, and emergency patient flow all goes together; Tertiary hospitals have a higher number of patient flow and assigned emergency beds. The two trauma centers have the largest number of Emergency beds and are on the second and third in a number of annual patient flow next to Tikur Anbessa hospital.

6.1.2 Disaster plan and protocol

All studied hospitals have a disaster plan and disaster management team; and, only 5 (50%, n=10) hospitals have a disaster-specific guideline, however, trauma is the only disaster for which a specific guideline was prepared. There is no specific plan for other disasters like fire, flooding, earthquakes and pandemics in all hospitals. From the assessment, all hospital except one has encountered disaster in the last two years, which is disaster from RTA in 5 (n=10, 50%) hospitals, 1 hospitals experienced a disaster from conflict; Covid-19 in 2 hospitals, other infectious diseases (mass poisoning at school) in 1 hospital and the remaining one has never had disaster experience in the last two years.

Two hospitals which are both referral hospitals have no emergency activation system. There is a unified incident command system in 8 (80%. N=10) hospitals, however, the names, designation, and phone numbers of members of incident command are not known in 4 (40%, N=10) of the hospitals. There are also no shared responsibilities among departments and disaster management teams in 5 (50%, n=10) hospitals. There is no disaster alert code in 6 (60%, n=10) hospitals.

Maximum disaster drill frequency is 1/year in 5 (50%, n=10) of the hospitals, and the rest, 4 general hospitals and 1 Tertiary Hospital haven't performed a disaster drill in the last year. Half of the hospitals (50%, n=10) has an emergency management network with other non-medical sectors which are involved in disaster management.

6.1.3 Infrastructure and logistics

All the hospitals have got their own ambulances, and have designated ambulance parking areas with accommodation capacities ranging from 1 to 6. In addition, the Addis Ababa health bureau has also its own ambulances which are parked at the city dispatch center. All hospitals have designated areas for emergency care and separate triage area where patients are sorted and allocated to their level of care. We had also able to see that the emergency care area is labeled as red, green, and orange according to the level of care based on the severity of the cases in all surveyed hospitals.

The accessibility of the emergency care area to the client at arrival is assessed and, all are found in close proximity to the main gate of the hospital. On the regard of space capacity, 7 (n=10, 70%) hospitals reported that the emergency care area is not enough to accommodate patients during a disaster and no reserved space to expand. Availability of continuous power supply and data management system shows that, 8 (80%, n=10) hospitals have got backup generators, and only 2 (20%, n=10) hospitals use electronic medical records. Separate pharmacy laboratory and isolation areas are lacking in most Hospitals, and only 4 (40%, n=10) hospitals have isolation areas in their emergency care area.

There are only 3 (30%, n=10) Emergency department which has reserved ICU beds during the time of the disaster, 2 of these Hospitals are trauma centers and one of them is COVID -19 care center. Means of disaster team activation was assessed and only 2 hospitals have loudspeakers in the Emergency departments to mobilize their team and 2 General hospitals have no telephone in emergency department. None of the hospitals has wireless set of communication both for security and ambulances. There are only 2 hospitals that are able to provide continuous food and water supply for health care workers during times of disaster.

6.1.4 Human resource

The nurse and doctor number and level of training were assessed and the result has been described based on the proportion of trained professionals according to the following table (Table 2). Nurse to patient ratio in the Emergency department shows, 1:3 in 7 (70%, n=10) hospitals and 1:4 in 2 hospitals, one of which is a COVID -19 Center and the other is Tertiary hospital; In addition, 1 Trauma center has a nurse to patient ratio of >1:5. Back up nurses and doctors during time of disaster are assigned in 6 (60%, n=10) of the hospitals. In Tertiary hospitals proportion of trained nurses and doctors are less in number compared to general hospitals (Table 6.2). Most hospitals lack specialist doctors, like Emergency medicine physician, Neurosurgeons, Plastic surgeons, Orthopedic surgeon, Trauma surgeon, and, Infectious Disease Specialists. And almost all hospitals have General surgeon assigned to Emergency departments.

Table 6.2: proportion of trained nurses and doctors on disaster management.

Number	Hospital Name	Number of Nurses (% trained on disaster)	Number of General practitioners (% trained on disaster)
1	Yekatit 12 Hospital Medical College	24 (20.8%)	5 (0)
2	AaBET hospital	380 (28.9%)	N/A
3	ALERT Specialised Hospital	44 (95.5%)	19 (52.6%)
4	St.paul hospital	66 (3%)	N/A
5	Ras dasta hospital	20 (0)	8 (0)
6	Tikur anbesa specialized hospital	58 (0)	N/A
7	Eka Kotobe General Hospital	31 (0)	7 (0)
8	St.peter specialized hospital	22 (100%)	11 (100%)
9	TBGH	21 (47.6%)	4 (0)
10	Minilik comprehensive specialized Hospital	21 (61.9%)	4 (50%)

During times of disaster whether health care workers can easily avail at hospitals on time was, assessed; the finding shows none of the nurses and doctors working in the Emergency department live in the hospital compound. The prehospital team which will be deployed to the scene during the time of disaster is found only in 3 (30%, n=10) hospitals, 2 of which are trauma centers, while 7 (70%, n=10) hospitals don't have a prehospital team. The triage area is covered only by nurses in 5 (50%, n=10) hospitals and doctors are assigned in the rest of the hospitals. The security service assessment for the Emergency department showed that in 7 (70%, n=10) hospitals there are no separate security guards for Emergency department. It is only available at 1 Trauma center and 2 General hospitals.

6.1.5 Drugs and equipment

Medication and materials used during a disaster are assessed in each hospital's Emergency department and showed that 7 (70%, n=10) of ten hospitals have a separate store that is utilized during a disaster; however, only 3 disaster stores are regularly checked and restocked. Basic medication used in most disasters is lacking in most hospitals. All except 1 hospital has continued oxygen supply without interruption; the availability of blood for the injured patients during the time of disaster has been assessed and 5 (50%, n=10) of hospitals said that blood product is not available in their Hospital. The availability of selected non-consumable emergency equipment used during a disaster is also described according to the following graph, it shows that most hospitals have non-consumable equipment, especially for management and follow-up of airway and breathing.

Available equipment in the disaster management store

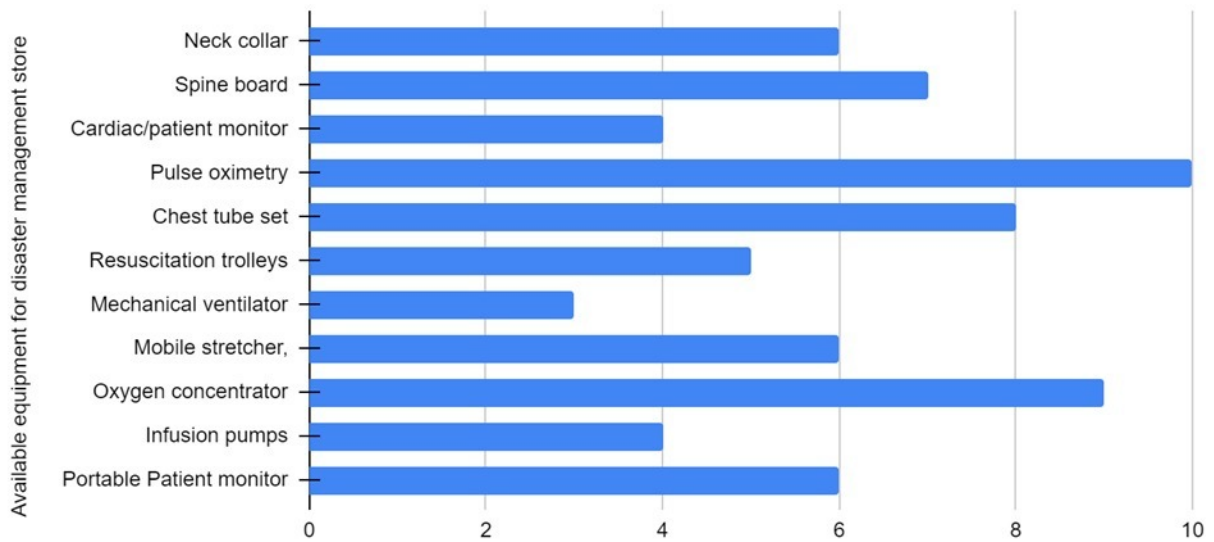


Fig. 6.2. Available equipment in the disaster management store.

6.2 Qualitative results

6.2.1 hospital Disaster experience

Experiences of hospitals on disaster response and challenges in the last two years was assessed by key informant interviews to triangulate the result with the questionnaire and checklist. A total of 20 key informants were interviewed from 22 with a response rate of 91%; due to the difficulty of reaching the disaster coordinator and Emergency head department of one of the hospitals.

Challenges that hospitals encountered during their last time in disaster were assessed by interviewing 18 key informants from 9 hospitals; because 1 of the hospitals has not experienced disaster in the last 2 years.

6.2.1.1 Infrastructure

The majority of the respondents 16 (89%, n=18) mentioned that, lack of resources in general was the main challenge they have experienced during last time disaster response. From 18 respondents, 16 (88.9%) of them reported that they have infrastructure problem and difficulty of accommodating the patient flow. Therefore, patients sleep on the floor and are sometimes referred down to Health centers from hospitals, merely due to a lack of space. Only One respondent from the trauma center and one respondent from the newly constructed General hospital reported that they have enough space to manage any level of patient flow. They said that the Department was renovated recently considering the high patient flow to the hospital.

6.2.2.2 Medication and equipment

All respondents except 1 from the Trauma center mentioned that, there were no adequate medications and consumable equipment to manage the victims. There are medications and equipment kept in disaster stores but they are not stored based on the expected amount of patient flow that could happen. Therefore, they said that they usually run out of medications after managing only a few patients. Most critically ill patients especially poly trauma victims usually need blood products to replace the loss, however, most of them said that “there are patients who die due to lack of blood and also lifesaving surgeries are being canceled due to lack of blood”. One respondent said that risk assessment of disaster is not being done by the hospitals. That could have helped in anticipating the level of disaster so that, involving other stakeholders to be ready for a specific type of disaster in making available important medications and medical equipment.

6.2.2.3 Response plan and protocol

Eight (44%, n=18) respondents said that lack of a disaster team in their hospitals is another challenge they are having. Health workers call each other and ask for help by their own initiative when case flow overwhelms, otherwise there is no established team to mobilize when disaster happens. One of the reason is lack of interest and awareness about disaster readiness by hospital management, which was mentioned by 4 (22%, n=18) respondents. One respondent said that “management team sometimes consider as a playing child while we discuss issues of readiness and disaster drill” furthermore, problems related to staff orientation and knowledge gap among health workers were reported by 4 (22%, n=18) respondents. Specifically, knowledge about components of disaster readiness, risk assessment, the flow of activities, and other skills of case management is lacking among some health care professionals and hospital administration.

Improper task sharing and lack of interest to take responsibility have resulted in a lack of organized disaster management team, as reported by 6 (33%, n=18) of respondents. People are not willing when they are given specific responsibility to carry out, and also the disaster team lead usually doesn't share responsibility among its members. Moreover, regarding the hierarchy of command flow, a disorganized chain of command has been witnessed by 10 (55%, n=18) respondents and it was another contributing factor to the poor response. Some respondent said that “we do not know sometimes whom we should hear to perform tasks or ask for support” due to an unknown share of responsibilities. Overall only 7 (39%, n=18) respondents think that their hospital is ready to manage disaster, and the rest of the respondents 11 (61%, n=18) said that their hospital is not ready enough for any level of disaster.

6.2.2.4 Human Resource

Human resource scarcity is reported by 6(33%, n=18) respondent and, 4 (22%, n=18) respondents mentioned there is knowledge gap among health professionals about how to approach a high number of cases at a time and organize large teams. Shifting of human resources and other logistics from routine care to disaster response is another problem reported by one respondent; it significantly compromises the care of other non-disaster cases in hospitals. All the respondents have raised that the absence of separate security for the Emergency department as one of the major problems, as a result they had fighting incidents and were threatened with violent attendants during disaster.

6.2.2.5 Post disaster recap and monitoring

Post-disaster recap is the feedback and discussion session daily during a disaster, or after the end of disaster to evaluate what is done right and wrong. Based on the assessment of 18 respondents, 6 (33%, n=18) of them neither had a daily nor at the end of disaster recap. Eight (44.4%, n=18) of respondents said they had recap daily during a disaster and the remaining 4 (22%, n=18) respondents reported that the recap was after the last day of disaster management. The reasons they put were, it was difficult to collect together the disaster team after the event; lack of designated individuals to run the recap session and, lack of commitment to discuss the strength and failures of the disaster management. One respondent said, “we don’t know where about of the disaster team members right after disaster time passes.” The monitoring and evaluation status was also assessed, half of 10 (55%, n=18) of the respondents said that there is no monitoring and evaluation activity going on at any level of disaster preparedness in their hospital, the reasons they mentioned were in appropriate documentation and lack of assigned responsible person.

6.3 Enabling factors for disaster readiness

Although there are several barriers mentioned there are also enabling factors respondents have mentioned for disaster response readiness. Almost all except one respondent believe that there are also facilitating factors as opposed to the barrier in order to be ready for disaster response. Most 10 (50%, n=20) respondents mentioned, the previous encounters they had on disaster are important input to learn from and, use the experiences to be ready for the coming one. One respondent said that “we do not even need drills because we are having enough of a real disaster.” In addition, the availability of human resources and trained professionals are reported as facilitating factor by 8 (39%, n=18) respondents. The majority of respondents have also mentioned that they have ample knowledge about processes and components of disaster readiness which must be included in the disaster plans.

Six respondents (33%, n=18) said that the commitment of hospital administration and the staff on improving emergency care and disaster response at the hospital level is a good enabling factor to advance disaster response. Some of the respondents said that there is strong guidance and coordination from the Ministry of health, and also have a clear vision and plans in their hospitals. Majority of them said the two big Trauma centers in the country have also contributed a lot by accommodating a large number of patients and delivering specialty level care, furthermore patient transfer and referral system are easy due to these centers. They also serve other hospitals by sharing knowledge, Onsite training, and exchange of health professionals. Most respondents have appreciated the commitment of the ministry of health to organizing disaster management across the country especially after the ministry has established DMAT (Disaster Medical Assistant Team) at a national level as part of disaster countermeasures.

Chapter 7: Discussion

This study evaluates the readiness status and disaster experience of public hospitals found in Addis Ababa. The level of these hospitals ranges from General hospitals to Tertiary hospitals and Specialized centers therefore, all level of care is included in this research considering the variation in readiness status based on the type and level of service. These hospitals have an Emergency department with bed capacity proportional to the level of the hospitals and patient flow, from the result the two Trauma centers have higher emergency bed capacity and also highest emergency patient flow preceded by one Tertiary hospital.

All hospitals have disaster experience in the last two years which shows how common disaster is in the city, there is variation in experience of disaster among hospitals, where RTA is by far the commonest type of disaster followed by infectious diseases like COVID -19 and other injuries. This epidemiology goes with the dramatic increase in RTA and other injuries in Ethiopia (4)(5). Similarly study from Amhara region of Ethiopia showed that, RTA is the usual cause of disaster encountered in their Emergency department (42). COVID -19 is a worldwide problem including Ethiopia and it is a common occurrence in every hospital but, there are separate treatment centers established in the city which pool the burden from other hospitals so that, it is not the frequent disaster experience for all hospitals. There is a recent increase in conflict related to political instability in the country resulting in bullet injury and related casualties as another common problem reported from two hospitals.

All hospitals reported that their Emergency department is labeled as red, green, and orange which facilitates care by assigning patients to each area according to their critical status. This designation is independent of the level of the hospital and the size of the Emergency department, it is a standard to have such labeling (28) (43). However, when we look at the accommodation capacity of the emergency department, only 3 (30%, n=10) hospitals said the corridors, waiting area, and reserved beds are enough to be used during overwhelming of cases. Which is the same with response from interview in which 89% of them said emergency care area was not enough during their last time disaster. The rest of the hospitals are unable to do that despite having a similar risk of disaster. The key informants have also reported space problems as one of the main barriers to disaster response. A similar study in developing countries like Kampala and Tehran hospitals shows that space problem is one of the challenges in disaster management (44) (45). Not only in developing countries even developed countries face challenges when there is a huge number of cases presented to hospitals at times, like the case of covid-19 (46).

Isolation area for any case suspected to be risky for other patients like COVID-19 is an important component of the Emergency Department (47) and, according to this result, only 4 (40%, n=10) hospitals are designated areas for patient isolation. This could be due to already limited space, which makes difficult reserving extra space. There are patients who need ICU services during a disaster so the Emergency department reserves beds to use during time of the disaster, from the assessment only 3 hospitals have reserved ICU beds, these are Trauma centers and COVID-19 treatment center which is usually expected to have such service due to high flow of patient and also they are supposed to accept referral from other hospitals. The national review of ICU service

results in Ethiopia shows that it is one of the compromised health care services across the country therefore, it may not be expected to be provided to this level (48).

A disaster plan has the standard of procedure by which a disaster is planned for and responded; every studied hospital has a disaster plan and there are also designated disaster teams that stand by for the time of disaster. Due to variation in approach to disaster depending on the type of disaster, a specific plan is required for each type like fire, trauma, earth quake, flooding and pandemics (49). However, what we have observed in these hospitals were, only 5 (50%, N=10) hospitals have disaster-specific plans which are only for trauma-related disasters, and the rest have a general guide to all types of disaster. This seems to result from their previous experience that trauma is the usual cause of disaster in their hospitals so they are more ready for that than other causes.

Although all hospitals reported that they have disaster team in their hospital, during interview there were reports of no disaster team in hospital, this may be due to in active team and lack of communication among members. It is not enough to have a disaster management team rather there should be a team activation system and a strong link of communication to act immediately. Even in some of referral Hospitals there is no emergency activation system; Most hospitals have no disaster alert code. Simple tools like a loudspeaker in the Emergency department are found only in two hospitals, in addition, there are also a few hospitals that have no telephone in the Emergency department. Communication during a disaster goes beyond the patient treatment area, therefore strong loop of communication should be maintained between the Emergency department, disaster management team lead, incident command lead, ambulances, and security.

From our finding none of the hospitals have wireless sets of communication for ambulances and security. Although facilitating tools like telephone and loudspeaker is easy to do, Problem-related with advanced communication system is not limited to developing country, a wide range of challenges has been reported in developed country as well (50). A study from Tanzania showed that their communication networks are overwhelmed within the facility and outside during disaster, this can be related to a lack of specific plans and resource constraints; however, developed country study showed during times of disaster their medium of communication was effective and stable which can be explained by adequate resources (11) (51). An organized chain of command based on the assigned hierarchy is important to keep the flow of order during times of disaster both by the administrative and clinical teams. majority of these hospitals have a unified incident command system, however, almost in half of the hospitals the designation of activity, phone number, and responsibility of the team are not known.

The same findings from the key informant interview showed that 33% of respondents mentioned disorganized teams and chain of command as a challenge during times of disaster. lack of concise information flow leads to Incorrect information which creates anxiety to the professional and harm to the patient, proper flow of information makes it easy for patient referral, interventions, appropriate use of resources and minimizes anxieties (52). Practicing drill is an important way of practicing response to the disaster in the real world, in order to identify gaps frequent drill is a better option than only sticking to experience and written documents. Drills and exercise boost the confidence of professionals and empower them to manage real disasters effectively.

Experience from Japan during the Great East Japan earthquake and tsunami showed that they are able to respond to the incident due to frequent drills and simulation exercises they had been practicing (53). From our assessment, only 50% of the hospitals have had disaster drills in the last 1 year, and key informants have also responded that experience from previous disaster management is one of the enabling factors to be prepared for disaster instead of drill. This can be interpreted as if hospitals encounter frequent disasters they may not be interested to do drills frequently.

Disaster management is not only the responsibility of one sector rather several stakeholders who are directly or indirectly involved in disaster management are supposed to be involved. To this study, only 50% of the hospitals have established networks to work with other sectors like security, city administration, and fire brigade. The recent COVID-19 pandemic demonstrated how individual sectors are unable to control disasters if they stand alone. The unexpected event of the terrorist attack on September 11 has exposed the weakness of the country in terms of multisector collaboration. Which led the government to establish a well-structured emergency management system through collaboration with other stakeholders (54). Therefore, multisector collaboration shares responsibility and vulnerability which facilitates proper readiness and response to a disaster (55).

Preparing an adequate and trained health workforce is an important component of disaster readiness, from this study the nurse-to-patient ratio is 1:3 in a majority of the Emergency departments which is similar to the recommendation of the American Academy of Emergency Medicine (56), one of the trauma centers has way more than this with a ratio of 1:5 which might be due to higher patient flow. However, it is difficult to keep this proportion during times of disaster. Some hospitals have a plan to mobilize the health workforce to a more hectic area and keep the proportion stable, however, with a high patient flow, it is difficult to maintain this number. Even though the workforce is to the standard there is a shortage of trained nurses and doctors and specialist physicians. The proportion of trained doctors and trained nurses are very small as it is described above. Furthermore, according to a key informant interview, 33% of the respondent mentioned that there is a lack of trained health professionals, and four respondents specified that there is a clear knowledge gap among health professionals about disaster management.

As we can see from the result the proportion of trained health care workers in General hospitals is higher than that of Tertiary hospitals, this may be due to the missed contribution of resident doctors (specializing doctors) in Emergency Department activity. The study only considered trained General practitioners, nurses, and Specialist doctors however, some Tertiary hospitals have specializing doctors covering the job of the department, this is why we found fewer trained professionals in tertiary hospitals. From this, we can only conclude that there is a shortage of trained General practitioners in hospitals where they are the main actor in Emergency department. Whereas in academic hospitals, specialist doctors and resident doctors are always available and General practitioners are not involved, it has been described in the table that the question is not applicable to these hospitals. This is the same for nurses where master student nurse in academic hospitals doing most of the activities.

There is a trend in public hospitals rotating trained health professionals from one department to the other therefore, disaster trained nurses and doctors may be assigned to totally unrelated departments, which is another possibility for shortage of trained professionals. Furthermore, in some hospitals, respondents said that hospital management showed no interest in supporting the

disaster team like budgeting for training, document preparation, drill and other capacity building programs for health workers. Experience from COVID-19 showed that the pandemic exacerbated the health care workforce challenges in developing country and also it challenged the stable staff number in developed country, one of the best example were, the Chinese health care workers were requesting international medical assistance to overcome the staff shortage (57).

The management of disaster starts from a prehospital level which is not the scope of objectives of this research, however presence of a disaster team responsible for prehospital care has been assessed and there are only 3(30%) hospitals that have pre-hospital care and two of them are trauma centers which are usually expected due to large flow of disaster cases to these hospitals. These are also hospitals with the highest number of trained nurses. This finding goes with the study done on prehospital care in Addis Ababa; which showed that of 238 trauma patients only for 19 (8%) patients prehospital care was provided by trained ambulance staff, which shows how inadequate the prehospital care is in this setting (58).

The security issue is always there during the time of the disaster, therefore, the safety of the health workforce and patients themselves are worth consideration during each step of disaster response; this can be insured by assigning separate security guards to the Emergency Department. From all the hospitals only 3 (30%) of them have separate security and the rest are vulnerable to violence. Health care facilities are in charge of facilitating a safe environment and providing the best possible protection for their employee and patients (59). Similarly, a study conducted in Egypt showed that work place violence against staff of Emergency department is reported by 59.7% of health care workers, which would get worse during times of disaster (60).

Shortage of medication and equipment is one of the main problems at every level of care in developing countries, due to the nature of emergency care some drugs are not even listed on the country's national drug list which creates shortage (61). During an interview, there was only one respondent from trauma center that reported as having adequate medication and equipment for disaster management. Almost all key informants reported lack of medications and equipment as the main challenge during their last time disaster response. Most of the scarce equipment is the consumable one, which need to be restocked frequently. Disaster management is costly by its nature and it needs enough resources to respond to the unexpected high flow of patients. Therefore, optimal allocation of scarce medical equipment and drugs needs the involvement of higher officials and institutional leaders to provide an adequate amount of resources based on hospital disaster plans (62).

Furthermore, another barrier the respondents mentioned are lack of risk assessment which should be done by hospitals and other stakeholders that helps to forecast what type and likelihood of disaster to happen. hospitals may use risk assessment results to plan on resource shifting, being ready for a specific types of disasters, and delivering organized responses (63). Identifying and prioritizing potential hazards is done by risk assessment that gives the insight to response and recovery strategies. hospitals and other stakeholders prioritize their intervention and make an informed decision to the limited resources they have to manage disasters, these all can be accomplished only if they work on risk assessment ahead of time (64).

Another problem discussed was whenever a disaster happens the usual activity of hospitals freezes and routine services are compromised. This idea is supported by a recent memory that most hospital service have deteriorated during fight against COVID-19. A study done in 31 countries from low, middle and high income countries in which Ethiopia was found showed that despite the

effort they made to maintain other health care services the COVID-19 pandemic caused significant disruption to the health care system (65).

Post-disaster recap is one part of monitoring and evaluation system which is a feedback session to learn from mistakes and strengthen the system for the future incident. The recap can be made daily or on the last day of the disaster, as we can see from the response of key informants 50% of them said that there is no monitoring and evaluation activity in their Emergency department and one-third of them mentioned that there was no post-disaster recap. There is no assigned person to control such activities and hospital management and other disaster management team are not interested in facilitating monitoring and evaluation activities. Monitoring and evaluation is an integral part of disaster response, it helps in identifying gaps and upgrading the plan. The effectiveness of preparing plan documents, training staff, making ready disaster store, response and recovery activities are determined by monitoring and evaluation results (66)

Some of the enabling factors to be prepared for disaster management listed by respondents are long time experience in managing disasters, the commitment of Ministry of health and hospitals to work on disasters, and the availability of a healthy workforce. They have also appreciated that having two trauma centers in one city is a promising resource for the future of disaster, however, they criticize that most hospitals' plans and activities are more inclined toward trauma, in fact, it is the prevalent disaster in the city, but they don't see while other causes of the disaster are discussed and planned for. Overall of the key informants, only 7 respondents said that their hospitals are ready to manage disasters and the rest 11 responded that their hospitals are incapable of managing disasters with their current status.

7.1 Limitation of the study

There are a few limitations this study has, which start from the topic selection; despite disaster being a common problem worldwide there is not enough literature from the same setting to compare with. Specially to know whether there is any improvement or deterioration as the change happens to the city like urbanization and also change in the pattern of the disaster like the existence of pandemic. When we look at the study area only hospitals found in the same city are included in the study it could have helped in generalizing the findings if Hospitals from regions have also been included. The conceptual framework used is not from a developing country it is taken from the systematic review done at Utrecht University, and it has been mentioned above the framework considers disaster readiness beyond the Hospital level.

Even though the approach of disaster readiness and management is the same worldwide, multisector disaster management is in the early stage in Ethiopia, so far Hospital level disaster readiness and management are rather the main areas of focus. I may consider designing a hospital-level conceptual framework that also includes disaster experiences of hospitals, that is my future plan. The key informants are the Emergency Head Department and Disaster representatives of Hospitals, even though these individuals also participate in clinical practice it would have been good to include other health care professionals working in the department and not in a managerial position, to avoid possible bias. Finally, when we try to assess the human resource status of Hospitals specializing doctors are not included in the questionnaire, only trained nurses, trained general practitioners, and specialists are considered, however specializing doctors (residents) are the main part of disaster management in some hospitals.

7.2 Analytical framework:

The analytical framework used is “Nonagon for Disaster Preparedness in Hospitals” which is a very vast framework that includes disaster management components with multi sectoral context which extends to communities’ contributions. In addition, the health care component of the framework is not limited to the Hospital level it goes beyond and includes prehospital care. In fact, most disasters end up in Hospitals, however, a disaster plan needs the involvement of different stakeholders. However, the scope of this study is only limited to the Hospital level as a result it is difficult to exactly fit into the framework. Moreover, the hospital disaster experience is an important part of planning for improvement and, learning from experience as well as understanding the problem and strength from individuals’ point of view, but this important point is missing from the framework so it was a must to include this in the framework. Therefore, I suggest this framework when a national disaster plan is considered, for a hospital-level study more customized framework is needed.

Chapter 8: Conclusion

In general, almost every hospital except one has experienced disaster in the last two years of which RTA is the most common disaster experienced. The level of hospital emergency bed number and patient flow goes together so that, tertiary hospitals have higher patient flow. Every hospital has a disaster policy and plan which is not disaster specific except 5 (50%) hospitals that have trauma-specific disaster plans. The disaster management team and incident command are established in all hospitals but most of them are not organized and there is no sharing of activities among members of the team. Medium of communication during a disaster like a wireless set of communication is absent in all hospitals. In addition, the majority of hospitals have no alert code for disaster. half of the hospitals haven't practiced drill in the last 1 year and the rest have had one time in the last year. There are only three hospitals that have a network to work with non-healthcare stakeholders.

Almost all hospitals have labeled emergency departments and separate triage areas. The shortage of space to accommodate patient over-flow; lack of separate pharmacies and laboratories are common problems in the majority of emergency departments. Most hospitals also report that there is a shortage of space for patient isolation and ICU service during disasters. Electronic data management is used only in two hospitals. The majority of the hospitals are unable to provide Food and water supply for workers during disasters. shortage of medications and consumable equipment used during disasters are common problems almost every hospital is encountering.

Even though the number of healthcare workers assigned is adequate according to the standard and the response from key informants, there is a shortage of trained healthcare workers. There is also a knowledge gap observed in the area of disaster among health care workers and Hospital management. The trauma centers have a relatively higher number of trained health care professionals and specialist doctors. Most respondents remember their experience as they have been managing disasters in a disorganized way due to poor planning and team organization, furthermore lack of risk assessment prior to disaster makes them confront unexpected types and a number of disasters. The routine service of hospitals is also affected during a disaster due to an unplanned shift of resources to cope with the disaster.

Most hospitals have no system for monitoring and evaluation and half of them do not practice post-disaster recap. Some of the respondents believe that they have opportunities to improve their readiness due to the strong commitment from hospital admin, Ministry of health, and their own disaster experience. Overall only 7 respondents believe that their hospital is ready to manage disaster and the rest reported that their hospitals are incapable to manage a disaster. The findings show that most hospitals are inadequately prepared for disaster management, and the causes range from simple to complex. So, the Ministry of Health, the hospitals, and the non-governmental stakeholders need to work closely to improve disaster response readiness using the evidence provided in this study, while also suggesting the need for more studies.

Chapter 9: Recommendation:

Disaster readiness goes beyond Hospitals; several actors are involved in disaster management although the scope of this research is mainly focused on hospitals level disaster readiness. Based on the identified gaps the improvement in disaster management needs multisector involvement. The recommendation goes to the Ministry of Health, Addis Ababa city Health bureau, Hospital management, Departments and Health care professionals. The aim of the collaboration is to have a strategy that contributes to a reduction in disaster risk through different approaches, minimizing the consequence of disaster through readiness and response, finally to establish a resilient community and health care system. This joint plan helps in strengthening the system for adequate preparation, timely, and effective response to the disaster.

9.1 Ministry of Health and Addis Ababa city health bureau

These two bodies have the mandate to support, facilitate and coach hospital activities. The infrastructure problem can be solved by the renovation of existing buildings or by increasing the number of specialized centers in disaster care. Ministry of health can also design standards of emergency department space size considering the disaster in addition to the daily patient care. It is good that a number of health care professionals are available in most hospitals but capacity building in the disaster workforce can be solved by designing curriculum and training and a policy which makes certificate of training mandatory to work in the Emergency Department. The hiring of specialist doctors can be difficult due to the small number of professionals but the ministry of health and the Addis Ababa health bureau in a collaboration with hospitals can facilitate professional exchange programs among hospitals, especially during times of disaster.

The distribution of consumable equipment can be evaluated whether there is an equity problem. Ministry should share drugs and equipment based on the need of hospitals by evaluating the burden of disaster. The ministry has prepared national disaster plan but there should customized disaster-specific plan at the hospital level, this document can be prepared by collaborating with multiple stakeholders. The disaster plan shouldn't only focus on trauma even though it is the commonest disaster, hospitals with support of ministry have to have a plan and readiness for other causes of disaster like a disease outbreak. Because the care and readiness plan is different based on the type of disaster.

9.2 Hospitals

Hospitals play important role in solving identified problems from this study, having plans to renovate the infrastructure, designing their emergency department based on their patient flow, and mobilizing other departments during times of disaster to accommodate the high flow are among the few. Professional exchange and experience sharing with other hospitals can also be made at the hospital level, the training budget can also be discussed with the ministry of health when there should be training. The usual trend in Addis Ababa hospitals is the rotation of professionals especially nurses and General practitioners after they serve for 6 months in a given department, therefore, they leave the department after they become experts in a specific area, so discouraging such practice is possible to have experienced professionals.

Improving communication problems by dividing tasks among disaster teams, creating a medium of communication, and practicing drills can be solved as a short-term plan by taking initiative. Restocking of disaster stores can also be integrated with other daily activities and audited accordingly.

To protect the safety of patients and health care professionals, hospitals have been mandated to assign guards to the emergency departments. Communication and drill may be within a hospital or outside the hospital so hospitals should create a strong platform to communicate with Neighboring hospitals, health authorities, staff, administrators, media, and the public as well; therefore, it makes it easy to handle disaster by mobilizing professionals like health care workers, police, fire bridge, defense force and volunteers.

9.3 Emergency Department and Health care professionals

Emergency Department can solve human resource problem by delivering trainings for new staff and refresher training for those who have been trained. The annual plan should include disasters readiness plan, and at the end of the year, it should be audited the same with other hospital activities. The monitoring and evaluation process should be followed by health care professionals and a post-disaster recap should also be handled possibly by the disaster management lead. The disaster audit should not only include how the disaster is managed but rather to what extent the routine service of the hospital is affected due to shifting of resources. Furthermore, at the end of the year revision of annual plan should be done based on the previous years' experience. Ministry of health and hospital management should involve departments and health professionals during regular meeting to plan together and audit their activity.

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Annex 1

Action plan

NO	Activities	milestone 1				milestone 2						Milestone 3						Responsible				
		February		march		April		May		June		July		August								
1	Thesis outline			X	X															PI		
1	Finalizing proposal					X	X	X	X												PI, Advisor	
2	Submission for ethical clearance					X	X	X	X												PI	
3	Submission of proposal first draft								X												PI	
4	Communicate with ministry of health and each hospitals								X	X	X	X									PI	
5	Pilot study										X	X									PI, Data collector	
6	Comment on the feedback											X									PI	
5	Train data collectors											X									PI	
6	Data collection												X	X	X						Data collectors	
7	Drafts and final Advanced draft of thesis completed															X	X	X	X	X	X	PI

Annex 2.

Data Collection tool

<https://forms.gle/Mzo6HRA2jxGrtrzN7>

Observation checklist tool & questionnaire to assess disaster readiness assessment of Public Hospitals in Addis Ababa,

1. Hospital demography

- A. Please indicate the type of medical facility.
General hospital __
Tertiary hospital __
Trauma Center __
- B. Total number of Hospital bed ____
- C. Total number of Emergency bed
- D. Total number of annual emergency patient flow
- E. Hospital phone no. _____ email. _____

2. Hospital Emergency department infrastructure

- A. Does your hospital have emergency department? Yes/no
- B. Is the emergency department close to the main gate? Yes/ no
- C. Is there ambulance parking area yes/no, if yes how many ambulances can be parked at a time...?
- D. Is your emergency department have separate triage area? Yes/no, if yes, is the space enough to accommodate patient during disaster Yes/no
- E. Is your emergency department having red/orange/green area? Yes/no, if yes how many beds are assigned at Red____ Orange_____ Green_____
- F. Is your emergency department have patient waiting area? Yes/no if yes, is it enough to accommodate patient during disaster Yes/no
- G. Is there continues power supply for emergency department yes/no, if no, is there backup generator yes/no
- H. Is there continues water supply for emergency department? Yes/no
- I. Do use electronic medical record, Yes/no?
- J. How many patients besides your present patients could your emergency facility accommodate in a disaster? e.g., using corridors, waiting rooms
- L. Is there dedicated ICU bed for the time of disaster, yes/no
- M. Is emergency OR performed in your Hospital, yes/no? if yes how many Emergency OR table do your hospital have ____?
- N. Does your emergency department has Isolation are, yes/no
- O. Is there separate emergency laboratory, yes/no?
- P. Is there separate emergency pharmacy, yes/no?

3. Disaster plan and protocol status

- A. Does your hospital have disaster plan?
- B. Is there disaster management team in the hospital yes/no, if yes who are included?
- C. Is there specific disaster manual to deal with; Fire: yes/no Flooding: yes/no earth quake: yes/no, conflict: yes/no, trauma: yes/no
- D. Do you have emergency activation system during disaster, yes/no?
- E. Is there telephone in emergency department, yes/no?
- F. Is there defined chain of command during disaster, yes/no?
 - F1. Who is the unified incident command of the hospital?
 - F2. Names and contact numbers of all members of the staff and their position according to the Incident Command Structure known, yes/no
 - F3. Is there Disaster Alert Codes, yes/no
 - F4. Responsibilities of individuals and other departments are defined, yes/no?
- G. Is there Loudspeaker in emergency department to mobilize disaster team, yes/no?
- H. Are there Wireless sets for security and ambulance personnel? Yes/no
- I. Is there separate store for disaster yes/no? for how many patient is the store enough?
- J. Does your hospital hold disaster-readiness drills on an annual basis, yes/no?
- K. Do you have emergency food and water supplies on hand for health workers during disaster, yes/no?
- L. Does your facility have an emergency network for use when a disaster occurs, Yes/No?

4. Human resource assessment

- A. What proportion of nurse to patient number are available at: Red ___ orange ___ green ___?
- B. Is there adequate number of physicians proportional to patient number, yes/no
- C. Is there adequate number of specialist doctors proportional to patient number, yes/no
- D. Which professionals are listed are available: Emergency physician ___ Anesthesiologist ___ Orthopedic surgeon ___ Neurosurgeon ___ General surgeon ___ Vascular surgeon ___
- E. Is there back up nurses who are stand by for the time of disaster, yes/no
- F. Is there backup physicians who are standby for the time of disaster
- G. How much percentage of nurses are trained on disaster?
- H. How much percentage of doctors are trained on disaster?
- I. How much percentage of professionals live in the hospital compound?
- J. How much percentage of professionals arrive within 1 hour if called during g emergency?
- K. Is there pre hospital team deployed during disaster, yes/no? if yes who are included? Pre hospital nurse specialist ___ Emergency nurse specialist ___ Trained doctors ___
- L. Who are triage team members? Number of nurses ___ and doctors ___
- M. Does the emergency department have separate security officer, yes/no?

5. Emergency drugs and equipment

- A. Is there crash cart in emergency department, yes/no?
- B. Are emergency drugs being available, yes/no?
- C. How frequent do you refill the emergency drugs?
- D. Is there continues blood product supply, yes/no?

- E. Does each bed have oxygen source yes/no?
- F. Is Oxygen being continuously available for the emergency department?
- G. Is there a difficult or specialized airway trolley available in unit? yes/no, if yes which one is available? Intubation set____ cricothrodotomy set ____tracheostomy set_____
- H. Is there the following equipment available?


- Cardiac/patient monitor (for reference 1/1bed)
- Suction machines, yes/no, if yes proportion to bed?
- Pulse oximetry, yes/no
- End Tidal carbon dioxide monitoring, yes/no?
- Defibrillator, yes/no
- Resuscitation trolleys, yes/no?
- Mechanical ventilator, yes/no?
- ECG machine, yes/no?
- Mobile stretcher, yes/no?
- Oxygen concentrator, yes/no?
- Mobile X-ray machine, yes/no?
- Infusion pumps with adequate IV sets, yes/no?
- Portable Patient monitor, yes/no?

6. Interview guide on disaster experience

- A. Has your hospital recently experienced a disaster (last two years)?
- B. What kind of disaster your hospital usually experiences?
- C. Did you manage your last disaster properly?
- D. Was there post disaster recap after disaster?
- E. What problem do you encounter to prepare for disaster?
- F. Please describe the hospital preparedness level to manage any type of disaster or emergency in which there is a large influx of patients
- G. Are you aware of the major components/issues that must be included in a hospital disaster plan?
- H. How do you describe the monitoring and evaluation of disaster response?
- I. What factors will facilitate disaster preparedness in your hospital
- J. What factors are barriers to disaster readiness in your hospitals?

Annex 3

KIT REC & Ethiopian Ministry of Health Letter

**KIT** Royal Tropical Institute

RESEARCH ETHICS COMMITTEE

Contact: Sandra Alba
s.alba@kit.nl

To: Yared B. Firssa
y.firssa@student.kit.nl

Amsterdam, 10 May 2022

Subject Decision Research Ethics Committee S-179

Dear Yared B. Firssa,

The Research Ethics Committee (REC) of the Royal Tropical Institute has reviewed your application for ethical clearance of the "Disaster readiness assessment of Public Hospitals in Addis Ababa City" (S-179) that was originally submitted on March 17, 2022 and resubmitted on May 6, 2022.


The Committee has reviewed the adapted protocol and has taken note of your amendments and clarifications and is pleased to see that you have addressed our concerns and questions to our satisfaction.

The Committee is of the opinion that the proposal meets the required ethical standards for research and herewith grants you ethical approval to implement the study as planned in the aforementioned protocol. This approval is granted considering that you will inform the GDPR project officer about your research project for GDPR monitoring purposes.

The Committee requests you to inform the Committee when substantive changes to the protocol are made, important changes to the research team take place or researchers are added to the research team.

Moreover, the Committee requests you to send the final report of the research containing a summary of the study's findings and conclusions to the Committee, for monitoring purposes by the REC.

Wishing you success with the implementation of the research,




Dr. Sandra Alba

Co-chair
KIT Research Ethics Committee


The Netherlands
Tel: +31 (0)20 528 9844

KIT
Amsterdam, 10 May 2022

Royal Tropical Institute



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Ministry of Health - Ethiopia
Healthier Citizens for Prosperous Nation!

Date: 10 MAY 2022
RefNo: 8/22/1/44/657


To Whom it May Concern

This is to certify that Dr. Yared Boru Firissa, is an Emergency physician currently studying MPH/Health systems policy and management at KIT Royal Tropical Institute, Amsterdam, Netherland. He is conducting a research entitled "Disaster readiness assessment of public Hospitals in Addis Ababa, Ethiopia" A cross sectional mixed quantitative and qualitative study under the supervision of Ministry of health and KIT Royal Tropical Institute. The research assesses disaster readiness in Addis Ababa which is one of Ministry's focus areas. The finding will be important input to our strategy. The proposal has been granted the required ethical clearance to be conducted based on the timeframe. Therefore, the investigator needs to access relevant data from your hospital; we kindly request your cooperation in providing required information.

Thank you in advance for your cooperation

Regards,

Alegntaw Feyesus (MD)
Emergency & Critical Care
Directorate Director



+251-115-517011
+251-115-518031
+251-115-159657
+251-115-524549
+251-115-516378
+251-115-513301

Fax +251-115-519366
1234
Addis Ababa, Ethiopia

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In Reply Please Refer to Our Ref.No.

E-mail : moh@moh.gov.et
Website : www.moh.gov.et
Ministry of Health, Ethiopia
@FMOHealth