AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA

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DECLARATION

I, **Joseph Kalanzi Kajubi**, formally declare that the research work on which this dissertation is founded is my original work (excluding where acknowledgements indicate otherwise) and that neither the full work nor any part of it has been, is being, or is to be submitted for another degree in this University or any other.

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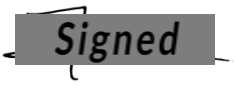
Signature: 

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Abstract

Background & Objectives: Major incidents occur commonly in Uganda, but little is known about either local hazards which risk causing major incidents, or health system preparedness for such events. Understanding risk and current preparedness is the first step in improving response.

Methods: We undertook a cross-sectional study across four teaching hospitals in Kampala (Mulago National Referral Hospital, Nsambya Hospital, Mengo Hospital and Lubaga Hospital). A local geographic area Hazard Vulnerability Analysis (HVA) for each site was combined with a key informant questionnaire and standardized facility checklist within the hospitals. Data collected included status of major incident committees, operational major incident plans and facility major incident operation centres, bed capacity, equipment and supplies and staffing. The HVA assessed the human impact, impact on property and on business of the hazards as well as measures for mitigation (preparedness, internal response and external response) in place at the hospitals.

Results: Only one of the four hospitals was found to have had an operational major incident plan. The designated coordinator for major incidents across all facilities was mostly a general surgeon; no funds were specifically allocated for planning .All hospitals have procedures for triage, resuscitation, stabilization and treatment. None of the facilities had officially designated a major incident committee. All the facilities had sufficient supplies for daily use but none had specifically stock piled any reserves for major incidents. All hospitals were staffed by at least a medical officer, clinical officers, nurses and a specialist with procedures for mobilizing extra staffs for major incidents. Some staffs had received some emergency care training in courses namely basic life support, advanced trauma life support, primary trauma care and emergency triage and treatment but no team had received training in major

incident response. Only one hospital carried out annual simulation exercises. Incidents involving human hazards specifically bomb threats, road crash mass casualty incidents, civil disorder and epidemics posed the highest risk to all four hospitals and yet preparation and response measures were inadequate.

Conclusion: Hospitals in Kampala face a wide range of hazards and frequent major incidents but despite this they remain under-prepared to respond. Large gaps were identified in as far as staffing, equipment and infrastructure.

Abbreviations

A&E: Accidents & Emergency

GoU: Government of Uganda

HVA: Hazard Vulnerability Analysis

MOH: Ministry Of Health

NHS: National Health System

NRH: National Referral Hospital

MIMMS: Major Incident Medical Management and Support

RRH: Regional Referral Hospital

UNAS: Uganda National Ambulance Service

UNISDR: United Nations International Strategy for Disaster Reduction

WHO: World Health Organization

Definition of Key Terms

Disaster: An interruption in the functions of a community or society that results in extensive human loss, physical damages, or disruption of the environment that exceeds the ability of the affected group to cope using its resources exclusively.[1]

Emergency: An unpredicted combination of circumstances or the resulting state of the unforeseen, that calls for instant action.[2]

Emergency management: The organization of resources for managing all phases of emergencies principally regarding preparedness, the response and the recovery phases.[1]

Hazard: A dangerous phenomenon, substance, human activity or condition that may cause death or injury, property destruction, economic and social disruption, loss of livelihoods or environmental harm.[1]

Major Incidents: Events that owing to the number, severity, type or location of live casualties requires special arrangements to be made by health services. [3]

Preparedness: The resources and capacity established by organizations, governments or communities to expect respond to effectively and recover from the effects of probable, impending or existing hazards.

Risk assessment: The process of determining the characteristics and degree of risk by evaluating the possible hazards and the vulnerably that could possibly affect people, and disrupt services and destroy property or the surrounding area.

Vulnerability: The characteristics of a group or society that affect their capacity to anticipate, cope with, resist and recover from the impact of hazards.

Chapter 1: INTRODUCTION

Healthcare facilities have a critical role to play during major incidents.[4] Major incidents often require multi-sectorial responses that include medical care. Major incidents are events that owing to the number, severity type or location of live casualties require special arrangements to be made by the health services.[3] Incidents occur when the resources and expertise in place are incapable of coping with the workload. Without appropriate planning and preparedness, health services are at risk of being overwhelmed by the magnitude of the incident and sudden surge in demand for acute care. Globally, there have been increased occurrences of disasters ranging from tsunamis, earthquakes, transport accidents, building collapses and epidemics.

The United Nations International Strategy for Disaster Reduction (UNISDR) defines a disaster as an interruption in the functions of a community or society that results in extensive human loss, physical damages, or disruption of the environment that exceeds the ability of the affected group to cope using its resources exclusively.[1] Without the appropriate response, these disasters can escalate into major incidents.

The WHO has acknowledged the necessity for countries to develop laws, protocols and structures that would facilitate the institutionalization of disaster risk management in their health sectors.[5] Hospitals are considered critical facilities which, according to the United Nations are defined as structures, systems and services that are economically or socially vital for the functioning of a community, during day to day situations and in the exceptional situations of emergencies. The WHO Regional strategy goes on to advise that the member countries should strengthen disaster risk management by developing adequate capacities in their departments of Health .The member states are further advised to assess and map possible risks from disasters through a health viewpoint; evaluate the safety situation of health facilities; create national standards for disaster response; and strengthen health information knowledge management. With such a mandate in place, countries owe it to their people to facilitate the necessary processes that will create enabling environments in their health care systems to respond to these challenges.

Research and development are essential components of health service delivery. Unfortunately, little data are available defining the characteristics and effectiveness of the health system response to major incidents because these data are rarely recorded, though

there is evidence to suggest that care given to patients in these situations is below the standard care given during regular day-day practice.[3,6]

Emergency care in lower- and middle income countries has been long neglected on the global health research agenda.[7] A study conducted in Iran investigated the effects of major incident experience on preparedness of health organizations on future disasters, revealed that there was a positive effect on policy making and resource distribution and an increase in overall preparedness activities.[8] Research is fundamental for policy making as it provides essential information to facilitate planning allocation of resources for potential incidents. A study carried out in Kenya to assess the emergent and urgent capacity of health facilities, revealed that limited communication, hospital infrastructure, supplies and properly trained health workers affected management of emergencies.[9] Data specific to capacity for major incident response is sparse but would be valuable for health authorities to plan for, as well as mitigate major incidents appropriately as they occur. Capacity indicators include infrastructural assets and physical resources, institutions; staff knowledge, skills, and management.[1] The data can be used to illustrate the impact emergency care can have on community care and hospital care of patients within the health delivery system to planners as they determine the key priorities. Efforts to develop emergency care in Uganda are already underway at various levels of the health system. Kampala has been faced with large scale major incidents ranging from terrorist attacks, mass casualty road traffic crashes, building collapses in the past decade. There have been no documented initiatives by health facilities targeting preparedness for these major incidents. Preparedness involves the education and training of intervention teams, and the creation of legislation, standards, organizational policies, plans and actions to be undertaken following an incident.[10] Strides are being taken in Uganda through the establishment of the Uganda National Ambulance Service, which is establishing pre-hospital care through a public ambulance service. Even well prepared health facilities face challenges in coping with the complex after- effects of disasters. Major incidents can result in interruption of communication systems and interference in access to external support. They can upset essential hospital services and even small but sudden increase in-patient admissions can push a hospital beyond its routine functional capability.

Health worker shortages and shortages in equipment, medicines and materials can negatively impact on access to acute and emergency care. Despite these challenges, efficient application of priority strategies and institutional policies can ensure an effective and timely facility

based response to major incidents. One such action that hospitals can undertake is risk and hazard identification and perceived vulnerability that could in turn advise the establishment of plans to mitigate such risks. Uganda, like Kenya, has standards of care in place for vertical programs like for HIV/AIDS, and malaria, but has no national guidelines for emergency care delivery at health facilities.[9]

Facility based care capacity initiatives are also underway for the different cadres of health workers in Uganda notably the Master in Emergency Medicine course under development at Makerere University College of Health Sciences and already in place at Nsambya Hospital. Major incident preparedness and response is an essential, crosscutting component for this process of emergency care development in Uganda. Kampala, being the capital city, hosts numerous mass gatherings ranging from religious gatherings to entertainment meetings which can result in major incidents as previous studies in the setting of mass gatherings and special events have shown.[11]

Ugandan health facilities differ widely as regards equipment, supplies and staffs, and hence possess varying capacities to provide emergency care, though each facility should have some capacity for acute care.[12] In order to improve emergency care within health services, it is essential to develop management systems that can use lessons from previous incidents to better prepare health facilities for future events.[8] Since hospitals have such a vital role to play during major incidents and yet remain at risk of being overwhelmed; there is a need to assess their response capacity.

Our study therefore assessed the hazards and vulnerabilities of four major hospitals in Kampala. Using a checklist, we conducted key informant interviews with key staffs at the hospitals to assess their knowledge, attitudes and skills about major incidents. We used a checklist to assess the hospital bed capacity, human resources; medication, equipment and supplies and management plans for major incidents.

Aim

The aim of this study was to describe health facility preparedness for major incidents in Kampala.

Objectives

1) To establish the need for hospital preparedness for major incidents in Kampala
2) To describe the state of hospital preparedness for major incidents in Kampala.
3) To describe the level of preparedness of hospital staffs and involvement in major incident response in hospitals in Kampala.

Chapter 2 - LITERATURE REVIEW

The terms major incident, disaster and mass casualty incidents are commonly used interchangeably, and many definitions exist of these terms. For the purpose of our study, we have adopted the MIMMS definitions of Major Incidents and Disasters. Major incidents are defined as events, that owing to the number, severity, type or location of live casualties, require special arrangements to be made by health services.[3] Major incidents can be categorised as simple/ compound or compensated/uncompensated. The infrastructure in simple incidents is not disrupted while there is destruction in critical components such as transport and communication in compound events. In compensated major incidents, the damage from the impact can be managed adequately using the community resources. In uncompensated incidents, the impact of the event overwhelms the community`s capacity to respond and this uncompensated Major Incident is then defined as a Disaster.

There are four stages of a major incident: Pre-hospital, reception phase, definitive care recovery and recovery phases.[3] The pre-hospital phase involves all activities that take place from the scene of the incident until the hospital. The hospitals provide personnel to give medical care to the victims at the scene and during transportation to the health facilities. The reception phase involves arrival of casualties to the hospitals and is very chaotic, lasting hours or up to days during prolonged incidents. The definitive phase entails delivery of medical, surgical and intensive care to the admitted patients. The recovery phase involves restoring the hospital back to normal activities; reflection, debriefing and post-traumatic support; and an audit of the incident.

Hospital Accident and Emergency (A&E) units are faced with high numbers of casualties during their day-day operations. The situation is further compounded when they have to deal with multiple casualties as well as direct infrastructural damage to the facilities from a major incident, as is evident during earthquakes and landslides or tornadoes.[13]

Major incidents, if uncontrolled, have the propensity of evolving into disasters. Hazards are classified as either natural, man-made or mixed (combination of natural and manmade).These hazards can potentially result in major incidents if not mitigated appropriately. Recent literature has shown different levels of preparedness of health facilities to various forms of major incidents across the world. Areas assessed include response planning and resources

availed such as medical supplies and equipment. [14] Hospitals plan for their emergency response to major incidents by focusing on the various forms of major incidents that are man-made or resulting from natural disasters. An understanding of the threat posed to the facility by the type of incident guides in appropriate resource allocation to enable effective response.

Man Made Incidents

Man-made incidents can be broadly subdivided into civil disorder, terrorist incidents, industrial incidents, transportation incidents, technological incidents, sports stadium incidents and a variety of other miscellaneous types.[3]

Civil disorder Incidents

Emergency care is crucial during major incidents that may occur during public events which gather a significant number of people in one place. These events can include sporting activities, entertainment events like concerts, religious meetings as well as public rallies. Possible negative outcomes of these events include stampedes, fire outbreaks, structural collapse, crowd panic, aggression (armed or unarmed), and terrorist attacks.[15]

In the United Kingdom, a study carried out on major incident occurrence revealed that out of the average three to four incidents that occurred annually, civil disorder accounted for 20.3%.[16]

In Africa, an example of a protracted event that involved large numbers of casualties and deaths was the 1994 Rwanda genocide that involved ethnic violence between the Hutu and the Tutsi resulted in displacement of over 1.3 million and over 500,000 people massacred.[17] In Uganda, Kampala is plagued by many incidents involving riots and demonstrations .These incidents result in many casualties that get injured during the confrontation with the police. The September 2009 clashes between the Uganda police forces and supporters of the leader of an ethnic group, left scores injured and approximately 15 people dead .[18]

Terrorist Incidents

Terrorists are ever more skilful and technically shrewd in their ability to cause mass casualties and deaths. The European Union Framework decision issued in 2002 on combating terrorism defines terrorism as intentionally committed serious offences such as; attacks upon a people's lives, kidnapping or taking hostage, capture of aircrafts or release of dangerous

substances, which may seriously harm a country or an international group. The main types of possible terrorist attacks include; bomb attacks, gun incidents, plane hijackings, biological terrorism, chemical attacks and radiological attacks. Terrorists aim their attacks at vulnerable targets to ensure they leave mass casualties. They do this by using advanced devices like improvised explosive devices and carrying out simultaneous attacks, which wound or kill many people .[19] Terrorist attacks pose a very high risk for mass casualties that need special attention due to the severity of their injuries and the numbers.

Recent examples of major terrorist attacks include the December 2014 Peshawar school massacre in which nine gunmen attacked an army school in Pakistan, killing 145 people (132 were children).[20] In January 2015, 12 people were killed when gunmen attacked the office of a magazine in Paris-France. [21]

In 2009 in Nigeria, the Boko Haram, a militant Islamist group, had a conflict with the security forces across many states in North Eastern region that left above 1,000 dead and with an estimated 700 fatalities in Maiduguru city.[22] Kenya has also been faced with an escalation in terrorist attacks with multiple casualties such as the September 2013 West Gate shootings that left 67 dead and 175 injured.[23]

In Uganda, the worst terrorist incident was the July 11th 2010 twin bomb attacks by the Somalia's al-Shabab group that left at least 74 dead and 70 critically injured.[24] The terrorists attacked an Ethiopian restaurant in the south of the city as well a rugby sports ground at another location as revellers watched the football World Cup final.

Technological incidents

Technology is also contributing tremendously to the list of disaster agents.[25] Technological hazards are those emerging from industrial conditions such as factory accidents, hazardous procedures, and structural accidents or as a result of human errors. Major incidents result from events involving these hazards include fires, explosions and system failures in communication, transport and electricity.

A nuclear major incident occurred on 11 March 2011 in Japan, following a major earthquake that affected three Fukushima reactors, resulting in evacuation of over 100,000 people and death of 1000.[26] The April 2010 Gulf of Mexico incident is regarded as the worst accidental

oil spill accident recorded in the history of the petrol industry.[27] These oil spills lead to extensive damage to the environment and disrupt critical services such as access to clean water.

Africa has also had major oil industry incidents in the recent past. An oil pipeline exploded in December 2006 killing at least 260 people in the Abule Egba region of Nigeria .[28]These incidents result in destruction of infrastructure, numerous casualties and multiple deaths. The injuries sustained are severe, requiring critical care provisions by hospitals located in and around the site of the accidents.

Kampala is a densely populated city with many people involved in commercial activities. Owino market is the biggest in Uganda having more than 500,000 vendors. These markets often are prone to fires with the worst incidents recorded in 2009 and 2011, with no reported fatalities and only minor smoke inhalation injuries .[29] School fires, on the other hand, have resulted in death.19 school children were killed in April 2008 at Budo Junior School, when their dormitory caught fire.[30] These incidents have led to increased vigilance in preparedness for fires such as installation of fire extinguishers in schools and public buildings.
Industrial accidents may happen as a consequence of human mistake, or as a side-effect of natural disaster. Industrial accidents can result in the release of toxic substances especially when they occur at chemical or nuclear plants. The 1997 European Commission defined an industrial major accident as an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by this directive, and leading to serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.[15]

Incidents of collapsed buildings cause significant morbidity and mortality. The International Red Cross report of 2010 documented that worldwide between 2006 -2008 alone, nine major building collapses resulted in over 100 deaths globally.[31]

There have been many incidents of industrial accidents in Africa. In May 1995; more than 100 miners lost their lives in a mineshaft accident in Orkney, in the Northwest Province of South Africa.[32] The 2014 church collapse, in Lagos Nigeria led to a death toll of 115 people, 85 of whom were South African nationals.[33]

In Uganda, collapsed buildings are a major problem in Kampala, as the city experiences major developments with a rapid property boom with recent history showing increasing occurrence of such events.

Table 1: Major incidents that involved collapsed buildings in Uganda (2004-2014)

Date	Description of event
July 22, 2013	7 injured : Magoba Plaza building collapse
July 2012	2 dead : Lugogo Bypass building collapse
July 2011	7 injured :Ntinda building collapse
October 2008	7 dead : Wall collapse at National Social Security Fund (NSSF) construction site
February 2008	10 dead: St. Peter's Secondary School building collapse
January 2008	3 dead : Mini Price Bata- building collapse
January 2008	10 dead, 8 injured, 30 trapped: Five-storey building collapse outside Kampala
September 02 2004	10 dead: Bwebajja 3 storey hotel building collapse containing 80 people

Source: HighBeam Research - Newspaper archives and journal article[34]

Transportation Incidents

Transport accidents contribute significantly to the morbidity and mortality resulting from major incidents globally. These include road, railway, air and maritime incidents.[3] The 2013 WHO Global Status Report on Road Safety indicates that worldwide, the total road traffic deaths is 1.24 million per year.[35] Many other people sustain injuries from road accidents and some continue to suffer from permanent disability the rest of their lives. These incidents have been reported to particularly affect the young.[36]Although air-transport is statistically the safest way of travelling, plane accidents continue to happen and the fatality rates among those involved in each incident are high. Reports indicate that in 2014 there were 111 aircraft accidents resulting in 1,212 fatalities.[37] Trains are convenient means of transport, for both passenger travel and cargo and yet they are becoming more dangerous over the years due to their increasing speed .Rail accidents are caused by factors such as human error, derailment, bridge collapses and explosions on board the trains. There is a difference in accident rates between passenger transport and cargo transport, with the majority of accidents occurring in cargo transport.[15]

The 2003 World report on road traffic injury prevention reported that Vietnam had 20,774 road accidents, with 12,864 deaths; Brazil reported 30 000 deaths, 44% within the (20 -39) age group and 82% being male.[36] The findings attributed most of these incidents particularly to the ever increasing number of motor cycles. With reference to train accidents, Europe is faced with rising numbers of fatal incidents, such as the July 2013 Northwest Spain event; in when a passenger train derailed killing at least 78 people .[38]

Africa has also experienced major transport related incidents such as when 850 people were injured in a train accident in Soweto South Africa in May 2011.[39] The September 2002 maritime accident off the Coast of Gambia involving the MV Le Joola that capsized off the coast of the Gambia killing 1,863 deaths and injuring 64, is said to be the second-worst non-military disaster in maritime history.[40] In Kenya alone, it is reported that 3000 people, between the (15-44) age group, lose their lives following road accidents annually.[36]
The 2013 WHO Global Status Report on Road Safety listed Uganda among the countries with worryingly high road accident rates, with an accident death rate of 10.1 per 100,000 people.[41] The 2011 Uganda Police Force Report indicated that the bulk of the accidents that occurred in the Kampala Metropolitan area were due to the rapid growth in traffic, presence of motor vehicles and especially the use of commercial motorcycles. A recent major transport incident was in June 2013 along the Northern Bypass highway.[42] The incident involved a fuel tanker explosion that left 39 people dead and several admitted at Mulago hospital with severe burns.

Table 2: Worst road traffic accidents involving multiple casualties in Uganda (2001-2014)

Date	Type of event (dead, casualties)
October 22, 2003	(7 dead , 17 injured) bus collision with stationary trailer -Busia
September 2003	(50 dead) UN trailer collision with bus from Kigali -Katuna, Uganda-Rwanda border.
July 30, 2003	(20 dead) lorry plunged into the River Nile - Pakwach town
February14, 2004	(42 dead) three vehicle collision - Lwankima, Mabira Forest Kampala-Jinja road.
February 2005	(45 dead) minibus- fuel tanker -Suzuki car collision -Lwankima, Mabira Forest.
June 7, 2005	(30 dead) bus-truck collision - Kabale-Katuna road.
July 30, 2006	(30 dead) fuel tanker-minibus collision - Kitega hill, Kampala-Jinja Road.
August 2006	(27 dead) minibus-fuel tanker collision – Kampala, Jinja Road
January 21, 2007	(8 dead) bus overturn- Pakwach, Nebbi road
January 2007	(33 dead, 70 injured) three separate bus accidents - Pakwach-Nebbi Road, Jinja-Iganga and Bugiri-Busia Highways.
February 7, 2007	(18 dead) taxi-trailer collision -Kampala-Masaka road
July 21, 2007	(16 dead) lorry overturn -Mityana
August 26 2007	(75 dead) UPDF truck crash - Kapchorwa
October, 2008	(27 dead) bus- trailer -pick-up collision -Mukono.
March, 2012	(23 dead) truck plunge into River Ala
September18,2012	(14 dead , 44 injured) crash -Malongo on Masaka-Mbarara Highway
September 2014	(5 dead, 15 injured) : 3 car crash - Kampala-Masaka highway

Source: Daily Monitor July 01 2013[43]

Table 3: Casualties and deaths that resulted from road accidents in Uganda (2007-2011)

Year	Mid Year Human Population	Vehicles involved	Road Accidents	Road Deaths	Road Casualties	Deaths per 10,000 vehicles Population
2007	28,581,300	28,517	19,867	2,597	13,576	71.4
2008	29,592,600	31065	20,729	2,488	13,753	52.9
2009	30,661,300	33931	22,699	2,734	15,829	52.3
2010	31,784,000	34412	22461	2954	15,854	46.5
2011	32,939,800	35716	22272	3343	16,619	

Source: Uganda Annual Road Traffic Accidents report 2012[44]

Sports Stadium incidents

Incidents at sports grounds usually result in mass casualties and therefore require planning for multi-hospital responses that can accommodate the high numbers. In the UK, it is recommended that hospitals located in close proximity to sports stadia should make provisions for receiving up to 200 casualties from possible incidents.[3] The 1989 Hillsborough disaster that led to the death of 96 and injury of up to 766 was the worst sports stadium incident in the UK history.[45]

The 2001 Accra Sports Stadium disaster took the lives of 127 football fans; making it the worst stadium disaster to have ever taken place in Africa.[46] Injuries are sustained during the stampedes were victims are crashed as people rush out or as a result of fans fighting each other.

Uganda has been fortunate not to have experienced a major sports stadium incident but it is becoming vulnerable due to the increasing popularity of sports and growing crowds that attend the events .The biggest sports facilities in Kampala include: Mandela National Stadium, Uganda`s biggest stadium, lies 12km East of the central business district with a capacity of 45,202; Nakivubo Stadium with capacity of 15,000 people and Lugogo cricket stadium with a capacity 10,000; and Kyadondo Rugby Club and Kampala Rugby Club for rugby. These stadia are multipurpose and also host entertainment events with huge crowds.

Natural Disasters

The Hyogo Framework for Action, proposed the use of the phrase "disasters associated with natural hazards" which included ; infestations, volcanoes, earthquakes ,tsunamis, landslides, tornadoes, severe storms, tornadoes ,floods, wildfires and droughts.[2] The event may cause either numerous serious injuries ill health or death, or serious disturbance or destruction of property. These natural disasters include earthquakes, floods, pandemics, wild fires, famine and drought. The United Nation Development Program 2004 annual report 2004 emphasized the strong link between risks of natural disasters and the progress of human development.[47]The report highlighted that human development activities like urbanisation in hazard-prone areas coupled with rapid construction of unsafe buildings are linked with an increased risk of natural disasters.

The United Nations International Strategy for Disaster Reduction report categorized natural events likely to result into major incidents as hydro-meteorological, geological and biological.[1]

Hydro, meteorological and drought incidents

These include floods, windstorms, extreme temperatures, drought, vegetative fires, landslides and avalanches. These incidents result in death, spread of disease and displacement of people. Globally, there has been increasing occurrence of major hydro-meteorological incidents. Prolonged droughts continue to affect many areas with resultant food shortages, displacement of people, deaths and loss of livestock. Flooding has also affected many parts of the world such as those that affected Malaysia in 2014 displacing 118,000 people, and the 2013 floods in North India that left 5,700 dead .[48, 49]

Africa as well is affected by hydro-meteorological incidents. It was estimated that 431 people died and over 1.3 million were displaced during flooding that affected Nigeria in 2012.[50] Drought is one of the main natural disasters in Africa, significantly impacting populations, economies, agriculture and animal husbandry of the countries affected. A previous study revealed that during 1960-2006, drought was responsible for 25% of the burden of natural disasters that occurred in Africa, especially West Africa, and the Horn of Africa; for which Ethiopia accounted for 39%.[51] Pastoral communities depend predominantly on their livestock for subsistence and are hard hit by food shortage that results from the losses in livestock experienced during prolonged droughts. From the past events ,such as reported above in

Ethiopia and Somalia, there are tremendous food shortage crises following drought, that involve coordinated international response towards provision of food relief support.
Uganda is often affected by flooding resulting from the torrential heavy rains. Areas worst affected include: Bwaise, Kalerwe, Kireka, Katwe and Ndeeba. Uganda has one of the highest rates of lightning strike deaths in the world according to the World Meteorological Organization; and Kampala has more days of lightning per year than any other city.[52] In June 2011, lightning struck a school killing 23 students.[53]

Geological incidents

These include earthquakes, tsunami, and volcanic eruptions. These incidents have continued to claim more lives and cause a lot of destruction globally. The 2004 Indian Ocean tsunami resulted in a death toll of approximately 230,000 people, affecting Indonesia, Sri Lanka, India and Thailand and is regarded as one of the deadliest natural disasters of all time .[54] The Haiti 2010 earthquake, that occurred in Port-au-Prince, left an estimated 222,570 people dead and 1.3 million displaced .[55]

In Africa, at least 500 people were reported to have been killed along the Mediterranean coast off Morocco when they were struck by a massive earthquake in February 2004.[56]
There have been reported major geological incidents in Uganda as well. In March 1966, it is estimated that an earthquake occurred in South West Uganda killing more than 100 people. [57]

Biological incidents

Epidemics continue to be a global threat and pose a danger to everyone, irrespective of age, lifestyle, ethnicity, or socio-economic status, compounded by increasing international travel and trade. All the above factors have a role in the spread of these diseases. Past events have clearly revealed that epidemics, pandemics and infectious disease outbreaks can potentially affect vast multitudes of people. In 2009, the USA was hit by an outbreak of H1N1Influenza that resulted in 13,217 human cases and 1082 hospitalizations .[58]

In October 2014, the W.H.O Ebola Response Roadmap Situation report cited that the total number of cases in the Ebola Virus epidemic in West Africa was reported as 8033 with 3865 fatalities.[59] The epidemic affected Guinea, Nigeria, Senegal, Liberia and Sierra Leone.
A previous study identified priority epidemic-prone diseases in Uganda as Cholera, Meningitis, Hepatitis E, Typhoid, Ebola, Marburg and the Plague, all of which have potential

of evolving into disasters if not planned for adequately.[7]The majority of the cases are sent to the Isolation Centre at Mulago National Referral Hospital. The CDC reported multiple outbreaks of Ebola in Uganda, with the two worst incidents being 2012 (seven cumulative cases, four deaths) and 2007 (total number of suspected cases was 149, with 37 deaths).[60] The Epidemiology of Cholera Outbreak in Kampala -Report revealed that between December 1997 and March 1998, 6228 cases of cholera were recorded in Kampala; with slum areas frequently affected by the outbreaks.[61] The prevalence of these water borne diseases has been shown to be high especially in areas affected by torrential floods.[62]

Impact of Major Incidents on Cities

Response to major incidents involves many players acting across borders. Under the International Health Regulations procedure, countries are expected to disclose health threats that might potentially have worldwide implications.[63]A review of incidents occurring globally shows that many major incidents occur more commonly in large cities.[31] Development of large cities results in increase in populations, construction, industry and increased activity. The resultant growth in numbers of people, trade, transport and housing predisposes the cities to disasters.[64] As cities increasingly become more populated along with this development, there will be more inhabitants at risk of being affected when a major incident or disaster strikes. Developed countries currently have numerous heavily populated cities and trends predict that forthcoming development in urban areas is mostly going to take place in the developing world.[19]There have been numerous global initiatives aimed towards mitigating disasters such as the 2011 World Health Assembly resolution 64.10 that endorsed risk management as the method to reducing the impact of disasters. However, many low and middle income countries still lack emergency medical systems.

Health Facilities and Major Incidents

Health facilities offer care for individuals, groups of patients (such as motor accidents) and to larger communities during catastrophes .[65]When incidents occur, they affect many people, resulting in high numbers of people requiring urgent medical care. Some reports estimate that up to 80% of deaths from injuries in these areas occur in the out-of-hospital setting.[66]This sudden surge in demand for care overwhelms the hospitals which are expected to deliver health services amidst the circumstances. Hospitals thus play a critical role in the event of major incidents. Improving their capacity to manage these incidents is very important. These

events result in damage that overwhelms the regular capacity of the health facilities necessitating extra resources.

Previous reports have documented preparedness of health facilities for major incidents. Preparedness includes development of plans, practicing of the responses through drills. A study carried out in North America found out that 94 % of hospitals held annual mass casualty drills.[67] An evaluation survey carried out in 2013 across tertiary health facilities in China, aimed at assessing health facility resilience highlighted ; disaster plan , staffs, command, security, communication, stockpile and drills as some of the fundamental components.[68]

Major Incident Planning

The presence of a major incident plan is a good indicator of the level of preparedness of a health facility. A study carried out in Beijing on preparedness of hospitals for infectious disease outbreaks, identified and assessed availability of an emergency plan as one of the indicators of response capacity.[69]

Developing an incident plan should consider the all-hazard approach which ensures that a single plan can cope with all types of incidents. This means that one plan can cater for all the potential incidents that the hospital is exposed to such as burns, mass casualty road accident victims or infectious diseases.[3]The plans should include procedures to be implemented when the facility is faced by overwhelming demand. The plans should cater for internal events arising from within the facility, such as structural damage, water and electricity failure as well as for those events external to the hospital like road terrorist attacks with multiple casualties. Some hospitals have developed plans with the all- hazard approach. A study on response planning to emergencies in the United States post the 2001 terror attacks revealed that up to 63% had plans that addressed various forms of terrorism as well as natural disasters.[14]

Regarding predicting how many patients should be planned for; there is still no standard consensus. One such way is to use previous incidents as a guide to planning for future occurrences. A core function of major incident response planning is preparation of health facilities to mobilize appropriate resources to mitigate the impact of the events on the

population. With the plans developed, it is crucial to ensure that all the staff involved in the response are well coordinated and communication lines are in place.[70]

Central coordination is ensured through a designated committee .The presence of hospital major incident committees is a vital component of response capacity though very few facilities have established them in their structures. An analysis of hospital emergency care capacity in Beijing, found out that only (15–45%) had a committee.[71]

Hazard Vulnerability Analysis (HVA)

HVAs are defined as the identification of hazards and the direct and indirect effects these hazards may have on the hospitals. Through the process of conducting the analysis, the risks linked to each hazard are investigated in order to appropriately plan for mitigation, response and recovery to major incidents.[72]There are tools that have been developed to guide health facilities in conducting these analyses. One such tool is the Kaiser Permanente modified hazard vulnerability and assessment tool for health facilities which was used in this study.[73] This tool assesses risk in terms of business impact, human impact and property impact on the health facility. Mitigation is measured in terms of preparedness, internal response and external response.[74]The CHAOS HVA is a similar tool which includes the assessment of the community`s ability to support a health facility during an incident.[75]

Mitigation refers to all measures undertaken before an incident to reduce the severity of its impact on the facility. Preparedness measures are the arrangements and activities adapted by the facility before an incident to improve the reaction to the event. Response measures are the activities undertaken by the facility address the immediate effects of an incident and recovery measures are those that should be undertaken to restore the status before the incident. After conducting the assessment, there is a need to compare the probability of the events occurring with the preparedness. Results from HVAs can be used to develop health facility capacity and improve the incident management plan.

Vulnerability Assessment

Physical vulnerability refers to the physical proximity to the hazard or inadequate physical and structural resistance to hazards. Vulnerability assessment is a continuing, dynamic process of people and organizations assessing the hazards and risks they face and determining what they wish to do about them.[10]This process includes a means of structured data collection

geared towards understanding the levels of potential threats, needs and immediately available resources. Data collected includes static infrastructure information of the facility, mapping out all structures that that might be useful in times of emergencies and major incidents. The other category of data gathered targets relatively dynamic socioeconomic data indicating causes of and levels of vulnerability, demographic changes and types of economic activity of the facility and the surrounding geographic area. Vulnerability assessments are hence valuable tools for establishing a major incident response plan. As regards planning, health facility vulnerability assessments inform authorities and decision-makers about the national and hospital-level approaches to major incident preparedness. These plans serve as the starting point for determining the types of plans that should be developed for health facilities to form part of the national disaster preparedness strategy. Vulnerability has been categorized as physical, political, economic, psychological, social and physical dimensions .[76]Of specific interest to this study is physical vulnerability which denotes the proximity to the hazard or the insufficiency in infrastructural resistance to hazards .[77]

Risk Assessment

Risk Assessment is the evaluation of hazards regarding specifics like location, strength, occurrence and likelihood of taking place. This involves analysis of vulnerability with respect to the social, economic and environmental factors; together with the efficiency of the existing and alternative coping capacities with respect to likely risk scenarios.[1] The WHO Hospital Emergency Check list describes this process as a procedure for defining the type and degree of risk, which involves examining possible hazards while calculating their impact on the health facility. The check list considers the existing conditions of weakness that could affect exposed organization, the property and infrastructure, social services and the surroundings. Response to major incidents involves both actions implemented after the incident as well as mitigation endeavours through risk reduction. Risk arises when hazards interact with the existing physical, social, economic and environmental vulnerabilities of an organization. Risk reduction involves reducing risks through strategies that evaluate and contain the contributing factors. This process involves minimizing contact to hazards, developing measures that reduce vulnerability of people and infrastructure as well as intelligent management the surroundings all towards improved preparedness and response to incidents. Risk reduction is combined with incident prevention which is the evasion of impacts of hazards and associated disasters in advance. Recovery is the refurbishment and improvement of facilities, infrastructure, livelihoods and living conditions of affected communities. Rehabilitation and

recovery starts immediately after the emergency phase and is based on previously determined strategies that designate definite roles to be carried out during the recovery phase.[1]

Surge

Research has shown that limited resources have been allocated for emergencies and when the incidents occur, they result in hurried and costly resource deployment.[77]Without adequate planning, health facilities can easily be overwhelmed in provision of health care during a major incident. The number of casualties and deaths during major incidents exceeds the level the emergency health care services can accommodate. The ability of health facilities to handle a rapid increase in demand for medical care resulting from disasters or major incidents is referred to as medical surge capacity. A system able to respond appropriately requires the appropriate mix of management; personnel; equipment, medication and supplies and infrastructure (structure, staff, stuff).[78]The WHO Global Health Report 2005 advised countries to adapt the following capacities for medical surge capacity.[79]

a. Development of public health institutions.
b. Adapting the national surveillance systems to international standards.
c. Development of capacity of human resources for health through training.
d. Regular assessments of core capacities using the WHO indicators.

Emergency Response to Major Incidents

Health facilities stage drills for response to the various biological, chemical, radiologic incidents. These drills are often in collaboration with key stakeholders in emergency response such as fire services and the police.[80]Worldwide, emergency medical staffs that include emergency medical technicians, paramedics and emergency physicians and nurses respond to emergencies every day. Emergency medical technicians and paramedics are responsible for the provision of medical care at the scene of the incident while emergency physicians provide definitive emergency care in the hospital.[15]When a major incident occurs, it can be called a crisis, an emergency or a disaster depending on who is involved, how many people are affected, its magnitude, and the current phase of the incident.

There are various players, agencies and groups involved that have different roles. Organizations that may be involved include health care agencies, Police, Fire, Emergency Medical Services, Ambulance services, Non-Government Organizations like the International

Red Cross, Faith-Based groups and private companies. Government agencies play a key role through their departments of health and security.[15]

Ambulance Services

Ambulance services provide treatment, stabilization and care of casualties at the incident scene followed by transportation to the health facilities for definitive care. Ambulances also transport medical staffs and resources to and from the incident site including standby emergency medical cover throughout the event.

Police

According to the International Labour Organization 2009, the main tasks of the Police are ensuring civil order and law enforcement. During major incidents, the role of the police include provision of help for injured victims, transportation to hospitals, notification of families of deaths and admissions to hospital, and protecting the site of the incident, regulation of traffic, investigation of the incident and management of information of the victims.

Fire Fighters

Fire-fighters routinely play the role of combating fire, assisting during major transport accidents, industrial accidents, natural disasters, terrorist attacks or during civil disorder.[81]These play these roles through conducting search and rescue; offering humanitarian services; management of hazardous materials; salvage of property and damage control.

Military

Military forces play a critical role in major incidents particularly in developing countries where relief organisations are not well-equipped.[82] Their tasks include evacuation of the injured from the site and transportation to hospitals as well as movement of medical personnel to offer care at the incident site. The advantage of working with the military is that they are trained for teamwork and are quickly available even on short notice.

There are variations in the capacities of different types of health facilities to respond to major incidents. Facilities can be categorised as public or private and teaching or non-teaching. Comparing the capacities of these different types of facilities at a national level guides

appropriate resource allocation and referral of patients during incidents. A study carried out in China showed that teaching hospitals were better prepared for infectious disease outbreaks than non-teaching hospitals.[69]

Coordination both within the health facility and between facilities is essential. Inter-facility coordination involves various staff ranging from the administrators, radiology, pharmacy, security and public relations to support services.[83]The capacity of these staffs is developed through training and coordination ensuring they are familiar with their roles and the process of plan activation.

Inter-facility coordination is an important component of response due the unique situations of major incidents that either have very many casualties or few severely injured patients that require critical care spread out across hospitals. To ensure that this process is carried out effectively in the event of an incident, health facilities must develop links and plans for coordination of medical services. In regions of Asia, studies have shown areas with hospitals with up to 75.9% involved in inter-facility collaboration for major incidents.[84]

Given the urgency, hospitals need to be prepared and equipped to handle major incidents. There have been several initiatives globally, across Africa and in Uganda targeted at improving preparedness and response capacity to major incidents.

Developments towards major incident response

Developments by World Health Organization

The WHO developed a Hospital Emergency Response Checklist tool to guide the processes of improvement of health facility response to disasters .[85]The tool which is based on an all-hazard approach, guides on current best practices on facility based emergency care principles and integrates priority actions required for effective response. The nine key components are highlighted below.

i. Command and Control**:** Command control is critical for hospital emergency response. This involves personnel, infrastructure, equipment, protocols, and communication services, working within a common structural framework created to help in the supervision of resources in place for response to emergency incidents. A core element of this system is the incident command group which is a multidisciplinary group that

is responsible for the control and oversight for all phases of the incident management, directs implementation of the plan, and is the overall authority for all decisions made and activities carried out.

ii. Communication: Efficient communication is essential in hospital major incident response. Clear, timely and precise communication is essential for making decisions, effective collaboration with stakeholders and partnerships.

iii. Safety and Security: Hospitals need safety and security protocols to ensure maintenance of smooth hospital operations and functioning during major incidents.

iv. Triage: This is the process of sorting patients based on their need for immediate medical treatment. Maintaining the patient triage processes during major incidents is crucial for continuous appropriate patient care.

v. Surge Capacity: This is the capability of an institution to increase above its regular capacity in order to manage the increased in demand for services.

vi. Continuity of Essential Services: The essential medical services of a hospital are supposed to continue even during a major incident. Activation of the major incident plan should not interfere with these services.

vii. Human Resources: Efficient human resource management is critical in ensuring appropriate staffing during major incidents which result in an increase staff demands on the hospital.

viii. Logistics and supply management: Logistics and supply management involves the effective forward and back flow and storage of goods and services between the source and the point of consumption. Hospitals need an efficient logistics and supply management process especially during major incidents.

ix. Post- Incident Recovery: Hospitals need strategies for recovery of operations aimed at mitigating the major incident`s long term impact on the hospital.

The WHO has also developed an Essential Resources of Emergency Care in Hospitals Tool to guide development of health facility capacity for emergencies has been tested and utilized in some countries in Africa such as Ghana.[86](**APPENDIX 1**)

The 2009 UNISDR Terminology on Disaster Risk Reduction was published in an effort to encourage mutual understanding of disaster risk reduction concepts.[1] It defines hazards as extreme events in the natural or man-made environment that adversely affect human life, infrastructure, services or actions to the extent of causing a disaster. Once hazards are

identified, risk reduction measures are developed to minimize the adverse effects of the hazards by eliminating the vulnerabilities which the events would have otherwise exposed.[10]These measures are hence aimed at reducing the potential impact of the hazards before they strike. Response to these hazards involves delivery of acute care and aid during or soon after the event in to ensure that people`s lives are saved, reduction of health impacts, maintenance of safety and security, and provision of the essential needs of the people affected. To this effect, hospitals are advised to carry out systematic assessments aimed at identifying hazards and vulnerabilities.

The Advanced Life Support Group in the UK developed the Major Incident Medical Management and Support (MIMMS) -the practical approach in the hospital .[3]It provides a guide to hospitals to develop major incident response capacity.

Developments in Africa

There have been some strategic steps towards mitigating these incidents in Africa. A study published in 2011 described the state of disaster readiness in hospitals in the public sector in the Western Cape of South Africa.[87]In this study, the data, which were collected, using a self-reported hospital assessment questionnaire, recognised best practices and made recommendations for improving disaster readiness at health facilities. Ethiopia has engaged partners in collaborations aimed at enhancing major incident preparedness.[88] Kenya has been faced with incidents involving droughts and collapsed structures.[23] As a step towards addressing the burden of major incidents, the Ministry of Health Kenya, in conjunction with the Massachusetts General Hospital carried out an assessment of the emergency and urgent healthcare capabilities of selected health facilities in the country.[9]

Developments in Uganda

Uganda is no different as regards major incidents and developments towards improvement of major incident preparedness. Uganda has had several incidents in the past involving displacement of persons due to civil conflict and unrest.[89]The country is faced with increasing susceptibilities related to the ever fluctuating demographics, technological advancements and socio-economic developments in most areas. There is unplanned urbanization which results in more high-risk zones such as towns along highways or around industrial zones. Environmental dilapidation, climate change, geological hazards are responsible for the increasing landslides, famines and droughts and epidemics. Majority of these incidents have

direct impact on health facilities located in Kampala which handle medical service provision for most of the affected people in these situations. A review of literature from police reports, media and publications revealed some past events that show a need for preparedness of hospitals to handle future incidents due to the high probability of their occurrence and potential impact they can cause. North to South and South to South partnerships are also being developed between institutions in Uganda with International experts in emergency care. Core to these collaborations is research capacity building. There have been some studies that have documented a gap in emergency medical care services for critically injured patients in Kampala-Uganda`s capital city. A study conducted in Kampala in 1998, described the patterns of injuries managed and the emergency care given to patients at five health facilities in Kampala.[90]Mulago Hospital manages many more injured patients than any other hospital in Uganda. This study revealed that an estimated 6,000 injured patients are treated at the facility every year. Data indicating the outcomes in hospital emergency care are still very scanty.

Chapter 4: METHODOLOGY

We carried out convenient sampling of all four teaching hospitals located within Kampala city. These hospitals were;

- Mulago National Referral Hospital
- Mengo Hospital
- St. Francis Hospital Nsambya
- Uganda Martyrs Hospital Lubaga

For the purpose of our study; we considered preparedness under two broad categories namely Health Facility Capacity and Hazard & Vulnerabilities Analysis.

Health Facility Capacity assessment

The capacity indicators for preparedness for major incidents we focused on were:

- Physical resources (bed capacity, occupancy, additional areas)
- Human resources (staffs numbers, training, skills, knowledge)
- Equipment, medication and supplies (reserves)
- Management processes (incident plans, disaster committees, communication, and drills) for major incidents.

This we assessed using a facility checklist and key informant questionnaires of staffs at the facilities. **(APPENDIX 2)**

Hazard Vulnerability analysis

We carried out a hazard vulnerability analysis of each of the four hospitals, using a modified Kaiser Permanente HVA tool which looked at possible events, the probability of occurrence, severity and risk to the facility **(APPENDIX 3).**

Study group and location

We carried out convenient sampling of 60 key informants who were staffs in the four hospitals that were selected because of their role in major incident management in their facilities. We interviewed hospital directors, clinical heads (clinicians in charge of medical and surgical services) of Accident and Emergency units and heads of support services

(laboratory, radiology, security) as well as clinicians, nursing and support staffs who did not hold any managerial roles.

Categorisation of Hospitals

Mulago National Referral Hospital is the biggest public tertiary hospital in Uganda and teaching hospital for Makerere University College of Health Sciences. It was selected to represent public tertiary teaching hospitals.

Mengo hospital is a private not for profit hospital, located in Lubaga division, approximately 2km Northwest part of the Kampala central business district. It was selected to represent private not for profit general teaching hospitals.

Uganda Martyrs Hospital Lubaga hospital is a private not for profit hospital, located in Lubaga Division, approximately 3km West from the central business district of Kampala. It was selected to represent faith based general teaching hospitals.

St. Francis Hospital Nsambya is a faith based not for profit hospital, located on Nsambya Hill in Makindye Division, approximately 5 km southeast of the central business district. It was selected to represent faith based, not for profit teaching hospitals.

Ethics approval and legal considerations

This study was approved by the ethics Committee University of Cape Town; Mulago National Referral Hospital Research/ Ethics board, Mengo Hospital Research/Ethics board, Lubaga Hospital Research/Ethics board and Nsambya Hospital Research/Ethics board **(APPENDIX 4).** The data were stored on a password protected computer, in secure data sheets, with restricted access to the database. No interview subject identifying details were kept. Written consent was provided through a consent form provided to and signed by each respondent before the start of the interview (**APPENDIX 5**).

Data collection

Data were collected from June 2014 –September 2014.Three sets of data were collected from each site which included: a Hazard Vulnerability Analysis (HVA), hospital survey, and key informant questionnaires.

HVA

The investigator conducted an HVA of each hospital using the Kaiser Permanente HVA tool currently in use in South Africa .Permission was given by the University of Cape Town Division of Emergency Medicine to use the tool in for the study in Uganda. The hazards were modified to fit in with those that occur in Uganda. No pretesting was done since the tool had already been tested and is in use in Cape Town. The tool assessed the impact of hazards on human factors, on the property and on business continuation as well as the measures for mitigation (preparedness, internal response and external response) in place at the hospitals. The tool was filled out during interviews with the; hospital directors, administrators and heads of the Accidents & Emergency units and data was entered by the investigator. The objective of the HVA was to assess the hazards faced by the hospitals, which we categorised under four themes: Natural Occurring events, Technological events, Human-Related events and events involving Hazardous Material. We identified all probable events and went ahead to estimate the Probability, Severity and Risk of each. We assessed probability as the likelihood of the event occurring reported as low, moderate or high. We assessed severity as the probable Magnitude the event would have minus the resources in place for Mitigation. Magnitude was measured as; human impact (the possibility of injury and death from the event); Property impact (physical damages and losses); and impact on business (interruption of hospital services).Mitigation was measured as; preparedness (evidence of preplanning activities); Internal response (resources available, time of response, effectiveness of response); External response (mutual aid, community support, human resources and supplies).These are also reported as low, moderate or high. For the purpose of this report, risk is as derived as the permutation of the probability of an event with its negative consequences**.** We derived the relative risk of the hazard to the facility as a function of probability and severity. This is reported on a scale (0-100%).

Facility check list

The investigator conducted direct inspection of facilities and equipment within the Accident and Emergency units. Data were collected using a structured check list that was developed with reference to sections from a recognised WHO Hospital Emergency Response Checklist. **(APPENDIX 2).**We used the checklist to assess the preparedness of the health facilities specifically looking at the organization of the disaster committee, operational disaster plans for internal and external emergencies and facility disaster operation centres.

Key informant questionnaires

The principal investigator administered questionnaires to 60 key staffs in the four hospitals that were selected because of their role in major incident response. These were either holding management roles or in direct service delivery (clinical care or support services). Key informant guide attached as **(APPENDIX 6).**Interviewed staffs included hospital directors, clinical heads (clinicians in charge of medical and surgical services) of A&E units and heads of support services (laboratory, radiology, security) also selection of clinicians, nursing and support staffs that had no leadership roles (these were selected randomly using their staff identification numbers). 60 participants were interviewed; 15 from each hospital, nine from the administrative structure of both the hospital and heads of clinical and support structures and six who were directly responsible for clinical duties. Questions concerned prior education and experience specific to disasters, general preparedness knowledge, perceived preparedness of themselves and their department, and willingness to respond to a disaster from a conventional and/or chemical, biological, or radiological incident.

Inclusion criteria

- Hospital staffs with a role in major incident response, working at teaching hospitals located within Kampala.

Exclusion criteria

- Hospital staffs that declined to participate were excluded from the study.
- Non-teaching hospitals located within Kampala were excluded from the study.
- Hospitals that are not located within Kampala were excluded from the study.

Data analysis

Data were entered into a purpose-designed Microsoft Access database and exported to Excel for cleaning. The cleaned data were exported stata-V12. Reporting of results was limited to simple descriptive statistics.

Chapter 5: RESULTS

Four teaching hospitals responded with a response rate of 100%. A facility checklist and Hazard Vulnerability Analysis was conducted for each of the four hospitals. The 60 key informant questionnaires were administered. None were excluded.

The results are summarised broadly under two categories:

I. Hazard & Vulnerability Analysis.
II. Health Facility Capacity

I. Health Facility Hazard Vulnerability Analyses

Mulago Hospital

Events involving natural hazards at Mulago hospital

Events**:** The events involving natural hazards that posed the highest relative risk (threat) to Mulago Hospital were; earthquakes (30%) and lightning strikes (22%).

Mitigation: There are generally low preparedness and response measures in place for natural hazards.

Events involving technologic hazards at Mulago hospital

Events: The events involving technologic hazards that posed the highest relative threat (risk) to Mulago hospital were; water failure (61%), structural damage (33%) and supply shortage (28%).

Mitigation: There was little preplanning for oil explosions, fire and sewage failure. There was timely response to electrical, medical gas and information system failure events.

Events involving human hazards at Mulago hospital

Events: The events that involved human hazards that posed the highest relative threat (risk) to Mulago hospital were; mass causality incidents- trauma related (67%), mass casualty incidents- medical/ infectious (37%) and civil disorder (24%).

Mitigation: The measures in place regarding preplanning and internal response were moderate, while external response in terms of mutual Aid for incidents involving infectious agents was high.

Events involving hazardous materials at Mulago hospital

Events: The events involving hazardous material that posed the highest relative threat (risk) to Mulago hospital were; terrorist attacks events involving chemical agents (67%).

Mitigation: Measures in place for response to hazardous material preplanning were low.

Hazard specific relative risk to Mulago Hospital

For Mulago hospital the hazard specific relative threats are; hazardous Material (0.40), human hazards (0.20), technologic hazards (0.10) and natural hazards (0.05).

Summary of Mulago hospital hazard vulnerability analysis

In Mulago hospital, there is a (0.49) probability of a hazard occurring, and a (0.31) severity expected, with (0.15) overall relative risk. However, the probability of an incident involving hazardous materials is highest (0.41); with those involving natural hazards having the lowest probability (0.15).

Mengo Hospital

Events involving natural hazards at Mengo hospital

Events: No specific event involving natural hazards posed a particular threat to the hospital.

Mitigation: There are generally low levels of preparedness and response in place for events involving natural hazards.

Events involving technologic hazards at Mengo hospital

Events: The events involving technologic hazards that posed the highest relative risk (threat) to Mengo hospital were; structural damage (50%), information systems failure (37%) and electrical failure (37%).

Mitigation: There was a low preparedness for fire alarm and communication failure while the rest of the events had measures in place to mitigate them.

Events involving human hazards at Mengo hospital

Events: The events involving human hazards that posed the highest relative threat (risk) to Mengo hospital were; entertainment events (100%), civil disorder (83%), sporting events (67%) and mass causality incidents - trauma related (67%).

Mitigation: The measures in place for mitigation were on average low with the exception of mass casualty incident preplanning and responses which were moderate.

Events involving hazardous materials at Mengo hospital

Events: The events involving hazardous materials that posed the highest relative risk (threat) to Mengo hospital were; small casualty hazardous material events (94%), terrorist attacks with chemical agents (83%), and internal radiologic exposure (78%).

Mitigation: There was low preparedness and response to incidents involving hazardous material.

Hazard specific relative risk to Mengo hospital

For Mengo hospital the hazard specific relative threats are; hazardous materials (0.45), human hazards (0.30), technologic hazards (0.10) and natural hazards (0.05).

Summary of Mengo hospital hazard vulnerability analysis

In Mengo hospital, there is a (0.36) probability of a hazard occurring is, with a (0.42) severity expected, and a (0.15) overall relative risk. However, the probability of a major incidents involving hazardous materials is highest (0.59); with those involving natural hazards, having the lowest probability at (0.15).

Lubaga Hospital

Events involving natural hazards at Lubaga hospital

Events: The events involving natural hazards that posed the highest relative threat (risk) to Lubaga Hospital were; lightning strikes (78%) and epidemics (67%).

Mitigation: There were generally low levels of preparedness and response in place for events involving natural hazards.

Events involving technologic hazards

Events: The events involving technologic hazards that posed the highest relative threat (risk) to Lubaga Hospital were; Medical gas failure (78%), sewage failure (78%) and fire alarm failure (78%).

Mitigation: There was low preparedness for fire alarm failure, air conditioning and sewerage failures.

Events involving human hazards at Lubaga hospital

Events: The events involving human hazards that posed the highest relative threat (risk) to Lubaga hospital were; entertainment events (100%), bomb threats (100%) and biological terrorism (89%).

Mitigation: The measures in place for mitigation were on average moderate.

Events involving hazardous materials at Lubaga hospital

Events: The event involving hazardous material that posed the highest threat (risk) to Lubaga hospital were; terrorism involving chemical agents (100%) and radiologic agents (56%) and small-medium sized internal spills(44%).

Mitigation: There was generally low preparedness and response to incidents involving hazardous material.

Hazard Specific Relative Risk to Lubaga Hospital

For Lubaga hospital the hazard specific relative threats were; hazardous materials (0.40), human hazards (0.45), technologic hazards (0.35) and natural hazards (0.1).

Summary of Lubaga hospital hazard vulnerability analysis

In Lubaga hospital, there is a (0.52) probability of a hazard occurring, with an expected severity of (0.54) and (0.28) overall relative Risk. However, the probability of an event involving human hazards is highest at (0.70) and one involving natural disasters having the

Nsambya Hospital

Events involving natural hazards at Nsambya hospital

Events: Events involving natural hazards that posed the highest threat (risk) to Nsambya hospital were epidemics at (41%).

Mitigation: There are generally low levels of preparedness and response in place for events involving natural hazards with the exception of high external resources for epidemics.

Events involving technologic hazards at Nsambya hospital

Events: The event involving technologic hazards that that posed the highest threat (risk) to Nsambya hospital was fire (41%).

Mitigation: On average, there was high preparedness, internal response and external response for technological events.

Events involving human hazards

Events: The events involving human hazards that posed the highest threat (risk) to Nsambya hospital were; civil disorder (89%), entertainment events (83%) and bomb threats (67%).
Mitigation: The measures in place for mitigation of the highest threats were moderate.

Events involving hazardous materials at Nsambya hospital

Events: Events involving hazardous material that posed the highest threat (risk) to Nsambya hospital were ; terrorism involving a chemical agent (67%) and small casualty hazardous material incidents with < 5 victims (78%).
Mitigation: There was low preparedness and response to incidents involving hazardous material.

Hazard Specific Relative Risk to Nsambya Hospital

For Nsambya hospital the hazard specific relative threats are; hazardous Materials (0.39), human hazards (0.29), technologic hazards (0.09) and natural hazards (0.05).

Summary of Nsambya Hospital hazard vulnerability analysis

In Nsambya hospital, there is a (0.32) probability of a hazard occurring, with (0.41) severity expected, and (0.13) overall relative risk. However, the probability of events involving hazardous materials disaster is highest at (0.52) and those involving natural hazards having the lowest probability of (0.17).

Comparative Analysis

The following section shows results from comparative assessment of the four facilities looking at events affecting each hospital.

Events involving natural hazards

The natural events listed were flooding, hail storm, epidemics, earthquakes, drought, landslides and lightning strikes. Epidemics were the commonest natural event across most facilities with the highest relative risk reported at Lubaga hospital (67%).From recent history; the commonest epidemics were from cholera, Ebola and Nodding disease. Mulago was affected by this since most cases are referred to it, being the national referral hospital and having an isolation centre. There was low probability of flooding, hail storms, drought or lands slides and a moderate probability of lightning strikes. The magnitude from these events

was generally low across the four facilities. There were few or no special arrangements in place at any of the facilities in place in terms of preplanning initiatives. The internal and external responses were general low none existent.

Table 4: Events involving natural hazards with the highest relative risk to Mulago, Lubaga, Mengo and Nsambya hospitals.

Hospital	Event	Risk (relative threat) (0-100%)	Probability (*likelihood this will occur*)	Preparedness
Mulago	Earthquake	30	Low	Low
Lubaga	Epidemic	67	High	High
Mengo	Epidemic	22	Low	Low
Nsambya	Epidemic	41	Moderate	Moderate

Events involving technologic hazards

The commonest events involving technologic hazards identified were: electrical failure, medical gas failure, generator failure, fuel shortage, water failure, sewerage failure, information systems failure, fire, internal supply shortage and structural damage. The probability of these events occurring was averagely moderate across the facilities with particular mention of supply shortage, fire, water, electrical and medical gas failure and structural damage. There was a low probability of injury or and low-moderate impact on hospital business and property specifically regarding electrical and water failure and supply shortages. Measures for mitigation were moderate at Mulago hospital compared to the other three facilities that were generally scored high in terms of preparedness and response to these events. The technological events with the highest impact on business and relative risk to the hospital are shown in the table below.

Table 5: Events involving technologic hazards with the highest impact on business to Mulago, Lubaga, Mengo and Nsambya hospitals.

Hospital	Event	Risk (relative threat) (0-100%)	Probability (*likelihood this will occur*)	Preparedness
Mulago	Water failure	61	High	Moderate
Lubaga	Medical gas failure	78	High	Moderate
Mengo	Structural damage	50	High	High
Nsambya	Fire	41	Moderate	High

Events involving human hazards

The main events involving human hazards were; mass casualty incidents (trauma, medical/ infectious), terrorism, biological, sporting, civil disorder, entertainment events and war. From the recent history, trauma mass casualty incidents, civil disorder and terrorism related events have the highest probability of occurring .Mass casualty incidents with trauma were road crashes, fires, building collapses and civil disorder are the most common. There magnitude was moderate- high while measures for mitigation were generally low-moderate. Human-related events posed the highest risk to all four hospitals and yet preparation and response measures were moderate. Bomb threats, mass casualty incidents, civil disorder and entertainment pose significant threat to the facilities as shown in the table below.

Table 6: Events involving human hazards with the highest risk to Mulago, Lubaga, Mengo and Nsambya hospitals

Hospital	Event	Risk (relative threat) (0-100%)	Probability (*likelihood this will occur*)	Preparedness
Mulago	Mass casualty incident-trauma related	67	High	Moderate
Lubaga	Bomb threat	100	High	Low or none
Mengo	Entertainment event	100	High	Low or none
Nsambya	Civil disorder	89	High	Moderate

Events involving Hazardous materials

We assessed the following events; Mass Casualty Hazardous material Incident (from past events with more than five victims); Small Casualty Hazmat Incident (from past events with less than five victims) ; Chemical Exposure (external) ;small-medium sized Internal material spill; large internal spill; terrorism (either radiologic material or chemical agent) and radiologic exposure (either external or internal).Generally events involving hazardous material were very rare , with a low probability of occurrence across the facilities based on history. The potential magnitude from such events was high while the mitigation measures were low.

Table 7: Events involving hazardous materials with the highest risk to Mulago, Lubaga, Mengo and Nsambya hospitals

Hospital	Event	Risk (relative threat) (0-100%)	Probability (*likelihood this will occur*)	Preparedness
Mulago	Terrorism – chemical agent	67	High	Moderate
Lubaga	Terrorism – chemical agent	100	High	Low or none
Mengo	Small casualty hazardous material incident (with < 5 victims)	94	High	Low or none
Nsambya	Small casualty hazardous material incident (with < 5 victims)	78	High	Low or none

I. Health Facility Capacity

For the purpose of this study, we assessed capacity using key informant interviews and a facility checklist. Therefore the results we present are broadly classified into data from the Key informant responses and the facility Checklist.

No participants were excluded.

Table 8: Key informant responses from Mengo, Mulago, Lubaga and Nsambya Hospitals

	MENGO	MULAGO	LUBAGA	NSAMBYA
	Key Informant Responses			
Component in Major incident response				
Hospital Major Incident Plan	**No (60%)**	**Yes (67%)**	**No (80%)**	**Yes (53%)**
Efforts to develop Major Incident Plan	**Yes (67%)**	**Yes (60%)**	**No (53%)**	**Yes (57%)**
Major incident committee	**Yes (60%)**	**Yes (67%)**	**No (93%)**	**No (53%)**
Multi-disciplinary representation on committee	**Yes (67%)**	**Yes (67%)**	**No (87%)**	**No (67%)**
Preparations for internal and external incidents	**No (67%)**	**Yes (60%)**	**No (93%)**	**No (53%)**
Major incident plan available throughout hospital	**No (87%)**	**No (93%)**	**No (100%)**	**No (87%)**
A designated hospital major incident coordinator	**Yes (73%)**	**No (60%)**	**No (60%)**	**Yes (60%)**
Key Positions during major incident response identified	**Yes (93%)**	**Yes (60%)**	**Yes (73%)**	**Yes (67%)**
Lines of authority, roles and responsibilities specified in major incident response	**No (87%)**	**No (53%)**	**No (80%)**	**No (53%)**
Staffs familiar with major incident plan	**No (87%)**	**No (53%)**	**No (60%)**	**Yes (53%)**
On-going mandatory major incident training programs at the hospital	**No (80%)**	**No (73%)**	**No (60%)**	**Yes (53%)**
Annual hospital major incident drill	**No (87%)**	**No (73%)**	**No (66%)**	**Yes (60%)**
Plan of action specific for care of multiple casualties	**No (67%)**	**Yes (80%)**	**No (80%)**	**No (60%)**
Sufficient equipment for major incidents	**No (87%)**	**No (60%)**	**Yes (60%)**	**Yes (80%)**
Sufficient supplies, pharmaceuticals and extra staff and beds for major incidents	**No (53%)**	**Yes (80%)**	**No (67%)**	**Yes (100%)**
Provisions for external support (volunteers, relief supplies and equipment) during major incidents	**No (67%)**	**Yes (80%)**	**No (53%)**	**No (60%)**
Designated hospital major incident Operating Centre	**No (93%)**	**No (60%)**	**No (80%)**	**Yes (73%)**
Procedures for responding to the media during major incidents	**Yes (73%)**	**Yes (87%)**	**Yes (87%)**	**Yes (80%)**

Facility Checklist Results

We assessed the capacity of the hospitals by looking at the total beds, occupancy, and extra capacity for major incident response and specialist department bed capacity. All the facilities had identified areas that could be used as extra space for patient care in the event that they were overwhelmed by numbers. These areas included the surgical, medical wards, outpatient areas, and corridors.

Table 9: Hospital bed capacity of Mengo, Mulago, Lubaga and Nsambya Hospitals

	MENGO	MULAGO	LUBAGA	NSAMBYA
Hospital Bed Capacity				
Total Beds	350	3000	289	360
Bed occupancy (%)	40	140	70	61.7
Extra space to increase Hospital capacity in case of major incident	-General surgery ward -Outpatient department	-Surgical wards -Medical wards	-Medical wards -Surgical wards -Junior Dining Room -Corridors	-General wards

Human Resources

All facilities were staffed by at least a specialist, medical officers, clinical officers and nurses. Some staffs had received some emergency care training in courses namely (Basic Life Support, Advanced Trauma Life Support, Primary Trauma Care and Emergency Triage and Treatment.)

Table 10: Human resources (staffs cadres and in-service training in emergency skills and training for major incidents) at A&E Units of Mengo, Mulago, Lubaga and Nsambya Hospitals

	MENGO	MULAGO	LUBAGA	NSAMBYA
Human Resources at Accidents & Emergency Units				
Staffs cadres				
-Specialists	0	7	10	2
-Medical Officers	2	12	7	8
-Clinical officers	4	11	7	3
-Nurses	15	66	75	23
-Others	9	15	-	4
Training (%)				
Basic Life Support	-	-	10	-
Advanced Trauma Life Support	3.3	-	-	2.5
Advanced Cardiac Life Support	-	-	-	-
Primary Trauma Care	-	100	10	-
Other		3		
Staffing and Training for Major Incidents				
Staffing during major incidents	Procedures in place, staffs aware	Procedures in place, staffs aware	Procedures in place, staffs aware	Procedures in place, staffs aware.
Staffs training program in major incident situations	No	Yes	No	No
Simulation exercises and drills in past year	None	Simulations are carried out but not annually	None	None

Command and Control

The designated coordinator for major incidents was a general surgeon in 75% of the facilities, with other key positions being nurses and medical officers across all facilities. Plans mostly catered for internal emergencies with little consideration for incidents occurring outside the facility. Though there was a designated person to give over-sight and coordinate the response at all facilities. The representation on these teams included personnel from administration, clinical services (surgeons, physicians, and medical officers) and nurses. There is a clear gap in representation of staff from security, human resources, laboratory, pharmacy, engineering/ maintenance, radiology or nutrition/kitchen on these ad hoc committees.

Table 11: Major incident systems at Mulago, Nsambya, Lubaga and Mengo Hospitals

	MENGO	MULAGO	LUBAGA	NSAMBYA
Major Incident Systems				
Major incident plan	No plan	Plan exists, operational, updated, distributed ,used in simulation exercises	No plan	No plan
Special administrative procedures	No documentation	Procedures included in the plan but staff not been trained	-No documentation	No documentation
Funds allocated for major incident plan	None	None	None	None
Action cards	No cards	No cards	No cards	No cards
Triage , resuscitation, stabilization, treatment procedures	Procedures defined, staff trained. -Resources in place to implement procedures	-Procedures defined, staff trained. -No resources to implement procedures	-Procedures defined, staff trained. -Resources in place to implement procedures	Procedures defined, staff trained. -No resources to implement procedures
Patient transport and logistical support services in place for major incidents	Yes	No	Yes	No
Inter-hospital coordination and referral protocols for major incidents	No documentation demonstrating coordination	Communication in the network but no established procedures or protocols	Communication in the network but no established procedures or protocols	No documentation demonstrating coordination
Major Incident Warning systems				
MI warning system	No system	No system	No system	No system
Alarm system and staff trained to respond to it	None	None	None	-None
Major Incident Coordination area				
Hospital Emergency Operation Centre, SOPs**	-No designated area -No SOPs	-No designated area -No SOPs	-Area has been designated. -No SOPs	-Area has been designated, but non-functional. -No SOPs

Communication

The role of communication with the public, media was designated to the Executive Director or the Public Relations Officer at all the hospitals. There are clear processes of information transfer between hospital management, with the heads of department and the staffs .The communication systems mostly rely on landline, intercom and mobile phones. The facilities

had contact numbers of the staffs. There was no specifically designated area for addressing the press and there were no documented draft messages for targeted audiences. Individual departments conduct briefings of their staffs on their roles in response to major incidents but there was no over-all coordinated debrief for all hospital staff on their coordinated responsibilities since there were no functional incident plans inter-linking all departments. The hospitals have process for reporting information regarding incidents especially epidemic outbreaks to the MOH which then reports to the entire health system and international stakeholders and general public. Decisions regarding patient prioritization during major incidents like adapted admission and discharge criteria, triage protocols and infection prevention are communicated throughout the facilities though there were no documented triage protocols for mass causality incidents at the facilities.

Table 12: Communication Systems of Mulago, Nsambya, Lubaga and Mengo Hospitals

	MENGO	MULAGO	LUBAGA	NSAMBYA
Communication System				
Telephone directory of authorities with contact details	Directory exists, containing contact information for hospital staffs	Directory exists, containing contact information for hospital staffs	Directory exists, containing contact information for hospital staffs	Directory exists, with contacts for internal and external authorities.
Communication with the public and media	-Through Public Relations Officer or Executive Director -No documented procedures	-Through PRO/ED. -No documented procedures	-Through Public Relations Officer or Executive Director -No documented procedures	-Through Public Relations Officer or Executive Director -No documented procedures

Logistics and supplies

All the facilities had sufficient supplies for daily use but none had specifically stock pilled any reserves for major incidents. They all rely on the daily stock to be utilised in the event of a major incident. 50% of the facilities had sufficient medication reserves; one facility had sufficient supplies and materials; one had no reserves of instruments; 50% had life support equipment only enough for daily use and one facility had sufficient personal protective equipment for a major incident. There is no designated physical space in any of the hospitals for storage of additional supplies.

Safety and Security

Security was contracted out to private firms in the private hospitals and they managed all security and safety issues independently while the security at Mulago was integrated with the Uganda Police. There were no documented hospital evacuation plans, visitor's identification modes like tags, no designated decontamination areas for radiological, biological or chemical agents.

Triage

Nurses play the role of triage officer at the hospitals. Regarding mass casualty situations, there were no separate triage protocols or contingency areas for reception and care of patients or patient triage tags.

Continuity of Essential Services

All the facilities had arrangements to ensure the continuity of essential services which included designating wards that would be evacuated to create extra space for the critically ill in the event of a surge in patient numbers. There was no documented evacuation plan at any of the facilities.

Chapter 6: DISCUSSION

The Ministry of Health Uganda, through its Health Sector Strategic Plan III (2010/11-2014/15), established mechanisms for disaster preparedness and response at all the district levels across the country.[91] Unfortunately this study as well as other reports have highlighted that there are still inadequate resources, insufficient attention to planning for emergencies, under staffing and inadequate skills in emergency care.[77, 89] Coupled with the low prioritization of epidemic and disaster preparedness at District level, all the above factors have greatly hindered the realization of a national medical major incident response system. Major incident response requires planning and resources due of the large scale of the impact that can result. The perceived rarity in occurrence of these incidents unfortunately results in limited planning, resource allocation and prioritization. Although developing countries have efficient vertical programs addressing priority conditions like HIV/AIDS and malaria, there is still a weakness regarding focused efforts by governments geared towards medical response to major incidents.[12]

HVA

We analysed natural hazards, human hazards, technologic hazards and hazardous material as the potential threats to the four facilities in the study. Some hospitals have incorporated hazard analysis within their quality assurance processes through annual risk assessments that identify which hazards are expected to have the highest impact on the facility. Systematic hazard vulnerability analysis is not applied in hospitals in Uganda .This is the first attempt to towards a formal HVA in health facilities in Kampala. There is therefore a need to identify the necessary resources required to mitigate these incidents, which are usually associated with high risk of death and injury.

Major incidents involving human hazards pose a significant risk to hospitals within in close proximity to major cities in Uganda. These facilities handle many patients from incidents especially major car accidents along highways and trade routes leading to the cities. In Kampala, increased cars and motor cycles crashes contribute tremendously to trauma related mass casualty incidents.[90] Kampala, being the central business hub of Uganda, attracts many people involved in commercial activities. This results in a rise in crime, with increased incidents involving casualties from civil disorder such as riots and confrontation with security forces. Our literature review has shown an increased incidence in industrial accidents in

Uganda, specifically collapsed buildings within Kampala city. Hospitals therefore need to plan appropriately for management of conditions such as crush syndrome that result from major incidents involving collapsed buildings. With such a clear risk of mass casualty incidents, plans have to be developed to increase preparedness of health facilities for this calibre of patients. Advancements in management of events related to human hazards have been proven in South Africa were a Medical Resource Model has been developed that predicts the medical resources vital for mass crowds founded on the profile of the events.[92] Kampala is frequently on high terror alert and occurrence of a terrorist attack has the potential to result in multiple casualties and overwhelm the hospitals in and around the city. Due to the severity of injuries from these events, most of the patients from across the country are referred to these tertiary facilities with more resources. Tertiary facilities are therefore inevitably bound to handle large numbers of critically ill patients from all over the country and not necessarily limited to their geographical catchment area. With an understanding of the nature of injuries that result from these incidents, health facilities can immediately engage in preplanning for resources required for these kinds of patients. In our study, trauma from road traffic accidents, fires and terror attacks is the highest burden. Therefore hospitals should plan for trauma care resources such as surgical, burns, orthopaedic and neurosurgical services. The staffs should receive targeted in service trauma training to better equip them to handle the patients.

Cities are also vulnerable to the high threats of industrial incidents resulting from fires that could break out from explosions from the multiple fuel stations in urban areas like Kampala. Fires pose a threat to all four hospitals in this study, both occurring internally and externally. All of the hospitals are at increased risk since they do not have fire alarm systems and are ill equipped with fire extinguishers. The threat of extensive damage to property and disruption of hospital services is very high. Burn injuries from fires can be very severe requiring specialist attention and facilities. Currently, only Mulago Hospital has a burns unit among the four hospitals assessed. This is very alarming, considering the high probability of fires throughout the city. There is therefore needed to scale up capacity of all major health facilities to respond to burns victims from fires.

Major incidents involving technologic hazards have a high likelihood of occurrence at health facilities in Kampala. The biggest threats are failures in communication, information systems and electricity. They potentially have impact mainly on facility property and interruption of

hospital operations and therefore require more planning for effective mitigation. Kampala was affected by electricity shortages which impacted health facilities forcing them to resort to generator sources. These failures are easily exposed during major incidents when communication and information systems are overwhelmed. Essential services like intensive care and operation theatre equipment are stretched during multiple casualty incidents and can result in death if failures are not planned for appropriately. Most of these services, in hospitals in Kampala, are out sourced to private providers; therefore arrangements must be made to ensure continuous provision of these essential services and resources. In this regard service level agreements should be considered with all the relevant private providers.
From history, the potential threat from events related to hazardous materials to the hospitals in Kampala low. Uganda has rarely had any major incidents involving hazardous materials. This has resulted in neglect by authorities due to the preserved rarity of occurrence. This puts the hospitals in a very vulnerable position in the unfortunate event that a major incident occurs since experiences in other countries have shown that these events result in significant injury and death. There is therefore a significant need for development of measures for health facilities to mitigate man- made hazards in cities. Incidents involving hazardous materials require extensive resources due to the contamination associated with the agents. Resources include decontamination facilities, personal protective gear as well as isolation areas. The staffs expected to look after these patients need specialized training in management of complications resulting from exposure to hazardous materials. All hospitals in this study had no policies in place to respond in such an incident.

There is a need for preplanning for epidemics which pose the greatest possibility of human impact through deaths and interruption of services at hospitals in Kampala. These incidents require timely response either with internal resources or from mutual Aid. This lack of timely response was very apparent in the 2014 catastrophic Ebola outbreak in West Africa.[59]The incident illustrated how the international community can mobilize support to tackle a condition of global threat, however such mobilization needs to be done quickly. Our study identified that the probability of events involving natural hazards occurring at facilities in Kampala was low. However the level of preparedness was also noted to be low. This general lack of preparedness is of concern as any such incident could have a massive effect on the community.

Health facility capacity for major incidents

The capacity of a health facility to deliver a service is assessed by staffing and infrastructural components. Health facilities differ widely as far as equipment, supplies and staff, resulting in variations in capacities to provide emergency care across different centres. All these factors affect the efficiency and effectiveness of basic hospital operations; which are stretched further during major incidents. The Mumbai study on preparedness of health facilities during the 2008 terrorist attacks in India, illustrated the need for developing coordinated medical response and the impact of strengthening capacity of public hospitals.[93]All facilities should have some resources dedicated to major incidents. Studies recommend that effective hospital emergency response requires hospital incident command structures, staffs training and emergency medical caches.[94]

We assessed staffing and infrastructural capacities of the four hospitals in Kampala as regards their preparedness to respond to a major incident.

Staffs knowledge and perceptions

Staffs knowledge about major incidents is essential for provision of quality care but unfortunately health workers often lack training in emergency medicine making it difficult to efficiently respond to the events when they occur.[95] According to an Australian study looking at staffs knowledge about major incidents, majority of respondents rated themselves as "not really" prepared and were "unsure" of their respective departments' level of preparedness.[96] A similar study in the US assessing hospital preparedness for incidents involving fire arms revealed significant gaps among the hospital emergency personnel in as far as awareness about mass incidents, knowledge and skills, communication systems and security.[97]

Our study revealed that the staffs in health facilities in Kampala had limited knowledge about major incidents. There were varied responses regarding knowledge of existence of a major incident plan. We found that 45% reported that their facility had a plan, the majority of which were those in top management and a few clinical staffs. This showed that planning processes mostly existed among the heads of the units that develop plans without actively involving the rest of the staffs. Thus many staffs were not informed of the existence of these crucial hospital documents which affects the effectiveness of the response when the plans are activated. An assessment of Hospital Emergency Management in the Beijing Area revealed that only 15–45% of the hospitals had established a hospital emergency management

committee, performed a vulnerability analysis, or evaluated emergency management regularly. [12] Interestingly this figure is very similar to what we found in in our study, where 41 % reported that their facilities had major incident committees. Furthermore our study highlighted the limited access to major incident plans by the very staffs that need to implement said plans. The majority reported that ad hoc committees were assembled to address specific incidents, especially epidemics, due to their more frequent occurrence. Most staffs felt that the committees that existed were multidisciplinary, and had representation from all the key departments. Surgeons took the lead as coordinators in many of these committees which comprised mostly of general doctors and nurses. Executive directors, hospital administrators and public relations officers also participated. There was very little representation from departments like the laboratory, pharmacy, radiology as well as security personnel. There was a communication gap between the top management, responsible for planning, and the rest of the management who implement the activities. Majority of the staffs reported that the plans did not have clear lines of authority, roles and responsibilities. This affects response activities since some incidents occur when the designated staffs might not be available at the facility. Having lines of authority ensures that at any single time, the staffs at hand can carry out the activities based on the roles that are stipulated in the plan, allowing for hand over to more senior staffs as the incident evolves.

Due to the lack of involvement of all key personnel during the planning process, some staffs (48%) reported that they were not familiar with the plans and did not know the tasks they were to carry out during the response activities. This has a direct impact on the coordination and effectiveness of clinical care during the hectic situations of major incidents that require changes from the routine protocols. The majority of responders stated that their plans mostly prepared for incidents happening within the facilities and did not cater for those that occur externally. They reported that they were ill prepared to effectively respond to both internal and external incidents and needed to consider developing measures that were all encompassing. Staffs, particularly at top level of management, had the attitude that major incidents were very rare and therefore did not deserve to be given priority due to the already existent resource limitation. This lack of prioritization by the management is bound to affect the allocation of resources required for effective planning and response to incidents.

Staffs skills

In Uganda, there are currently no arrangements for continuous professional development in major incident management for hospital staffs. Our study revealed that the staffs in hospitals in Kampala were not adequately prepared to respond to major incidents at their facilities. In service training of staffs was carried out mostly at individual level, but there was no specific training in major incident management. Only 35% reported having received any training in incident response. There is a need for training of trauma teams through exercises and drills to ensure multidisciplinary involvement of staffs for efficient response. Staffs skills are tested through multidisciplinary activities such as drills, table top exercises or simulations. Our study revealed that the exercises that the staff mostly participated in were a plane crash simulation conducted by the Civil Aviation Authority and fire drills in conjunction with the Fire Brigade.

The clinical staffs, however, were more receptive of the need to prioritise development of clinical skills in emergency care and major incident management. There is a need for training in emergency care for personnel in hospitals. The already existent training initiatives in emergency care such as Emergency Triage And Treatment, Basic Life Support, Advanced Trauma Life Support ,Advanced Cardiac Life Support and Primary Trauma Care need to be scaled up to involve more health workers. Specialist training in Emergency and Disaster medicine should be developed at medical training institutions as has been done in some countries in Africa like South Africa, Ghana, Egypt, Tanzania, Ethiopia and Sudan. These emergency specialists play a central role in planning and coordination of care during major incidents. There is a need for training of trauma teams through exercises and drills to ensure multidisciplinary involvement of staff for efficient response. Staffs skills are harnessed through multidisciplinary activities such as drills, table top exercises or simulations. These plans ensure that the facilities secure resources, stockpile supplies and earmark funds for timely and effective response. Health facilities in Kampala do not plan for major incident drills and therefore are not able to routinely test their response as well as improve the skills of the staffs.

Supplies and equipment

Supplies and equipment assets must match the skills of the personnel responsible for providing care. Kobusingye et al recommended the use of personal protective wear (gloves and aprons), a stretcher, pressure dressings, splints and a mode of communication (telephone)

as the minimum equipment and supplies for emergency care at health facilities.[77]We assessed both public and private facilities and observed that even though they were all tertiary level hospitals, they had differences in their capacities for major incident response. Mulago (public hospital) was more resourced in as far as physical space and essential equipment while the private facilities had more supplies. 63% of the staffs interviewed, reported that their facilities had sufficient medical supplies and medicines for routine day-day services but had no measures in place for the extra requirements that follow major incidents.47% reported that they lacked adequate equipment. None of the hospitals in the study had defined strategies to cater for this extra demand. Hospitals with established major incident plans have inventory lists of equipment, medical supplies and drugs at all times. There should be a mechanism in place of estimating the consumption of supplies and drugs for anticipated major incident events. Managers should plan with suppliers, to ensure continuous supply of the essential supplies and drugs during major incidents. Physical space within the hospital should be designated for storage and stockpiling of emergency medical caches. The essential supplies, drugs and equipment should be stored in accordance with national guidelines to avoid losses from expiration. The role of the pharmacy in provision of drugs to patients at alternative treatment sites during major incidents should be defined beforehand. There should be processes for quick repair and maintenance of equipment needed for continued provision of essential hospital services. Hospitals in Kampala fall short of this recommendation as our study has revealed that most of them do not keep an emergency drugs cache and commonly use drugs from the daily stock.

Hospitals should also develop a contingency transportation plan for patient referral during major incidents. This was also noted to be essentially lacking in terms of the four hospitals that were surveyed as part of the study.

Health facility capacity

Factors that influence the capacity of a health facility to provide services include; policies, guidelines and standards; assessment of services; and institutional memory.[62]Coordination during major incidents is ideally conducted from a central area within the facility. We assessed for the presence of an incident operating centre at all the facilities in the study and found out that only 38% of the responders were aware of the existence of one. Without central coordination areas, the operations from the different key staffs are disjointed resulting in segmented activities, reducing the efficiency of the response.

The hospitals in our study did not have standard operating procedures that would enable emergency service providers to alert them of major incidents and therefore are at risk of not detecting events in time and hence getting overwhelmed by casualties. Response to major incidents requires quick detection and communication of incidents that enables timely activation of the response plans. Handling the media is another critical function of the plans. The role of managing requests from the media, at hospitals in Kampala is played by the hospital Public Relations Officer and the Executive Director. We discovered that during the response phase, information on the situation was collected from the clinical areas and reported by the head clinicians to the hospital administration. The report was then disseminated by either the hospital executive director of the Public Relations Officer to the media. Although this process of information flow exists, there are still areas for improvement. The Public Relations Officers should be included in the major incident committees through which they will be more acquainted with the rest of the key staffs. There is a need to develop systematic protocols of recording and disseminating major incident reports to the media. Hospitals should also designate media assembly areas to ease access to the press.

Security in hospitals in Kampala is managed primarily by private firms with their own protocols. Hospitals need to designate security teams to manage all safety and security activities during major incidents. Security priority needs should be identified based on likely vulnerabilities such as the hospital entry and exit points, water points, and kitchen and pharmacy areas. Control of admission points, triage points and other patient care areas should be maintained and visitor access must be suitably controlled. There is a need to integrate the security providers with the hospital major incident committees to develop more succinct safety plans for major incidents. Coordination with the police during major incidents, such as terrorist attacks, is necessary due to the complexities of the security processes involved.

Hospitals in Kampala do not have any strategy as regards surge capacity. We were able to collect data on the annual bed capacity and occupancy for the four hospitals though there were no estimates for surge. Hospitals should be able to assess their maximum capacity for patient admission and care based on: total number of beds, human resources, essential resources and the adjustability of physical space for acute care. The statistics recorded regarding bed capacity should be able to give a dynamic update of occupancy to guide calculation of surge capacity and identification of other possible spaces. There should be clear estimates of the anticipated increase in demand for services during a major incident and

processes of expanding inpatient capacity to accommodate the increase in demand. Extra areas such as corridors, parking space and tents should be identified for use in case of patient over flow beyond regular numbers.

Hospitals in Kampala can also increase their emergency care capacity by outsourcing the care of non-critical patients to appropriate alternative treatment facilities or designating additional adjacent sites that can be converted to patient care areas. Mulago Hospital created an isolation area adjacent to it for management of suspected cases of infectious agents like Ebola. There are plans in place for satellite public hospitals around Kampala to accommodate the extra patients that cannot be admitted in Mulago hospital. These are arrangements for day to day influx of patients but not necessary for those involved in major incidents. There is therefore a need for hospitals in Kampala to make arrangements for inter-facility patient transfer and referral as a means of accommodating the surge during major incidents. Cancellation of non-essential services like elective surgery also free up theatre space for the emergency procedures. Hospitals should be able to modify their policies on admission, discharge, and priority clinical interventions to accommodate the increase in demand. Being tertiary facilities, Mulago, Mengo, Nsambya and Lubaga hospitals should be reserved only for management of the most severe cases and the rest of the less critical patients should be referred to lower level facilities. All these are possible measures that can be adopted to increase the capacity of key health facilities to manage the sudden influx in patient numbers during major incidents.

Hospitals in Kampala have limited numbers of ambulances dedicated to referral. These are bound to be overwhelmed by a major incident. Major incidents involving many casualties require robust transport arrangements to ensure the right patient is taken to the right hospital. Hospitals need to plan for patient transportation resources like vehicles and drivers as well as develop protocols for transfer of patients between hospitals in the event that the regular processes are overwhelmed during the major incident. The Uganda National Ambulance service will be able to play this role in Kampala.

Ambulance services, through their communication systems are also able to give advice on which hospitals have space to accommodate patients in the event of a protracted incident. The skilled ambulance personnel offer an extra hand at the health facilities which are usually overwhelmed. This has been seen to work at Mulago hospital which often utilizes the help of

the Uganda Red Cross Society first aiders during major incidents. Aside from transferring casualties to the hospital in ambulances, these first aiders play the key role of receiving and transporting patients within the hospital. Therefore, there is a need to further develop ambulance services in Uganda, as they will play a vital role in major incidents.

Major incidents may disrupt essential services in hospitals, and therefore measures have to be put in place to ensure their continuity .To this effect hospital in Kampala should develop lists of all their services, ranked according to priority, defining the essential services and ensuring that they are maintained at all times. The resources required to ensure continuous functioning of these services must be availed. There must be evacuation plans in place to ensure the continuity of critical care. There are no formal operational plans at the four hospitals towards maintenance of essential services during major incidents. These plans are the task of a committee that should routinely meet and adapt them based on the circumstances. Plans should be in place to ensure back-up for essential resources like electricity, water and oxygen. To ensure prioritization of these services, there is a need for dedicated measures by the hospitals. None of the hospitals in our study have put into consideration the need to plan for these services in the context of major incidents.

There is no system in place for coordination between hospitals, the Ministry of Health and key stakeholders during major incidents in Kampala. Defining the roles and responsibilities of each hospital, depending on its capacity, ensures that there is continuous provision of health services at all facilities throughout the incident. This calls for centralized coordination of all key hospitals within the city. This has been demonstrated especially during coordination of disease outbreaks in Kampala. The Ministry of Health Uganda endeavours to coordinate inter-hospital transfer of patients to more well suited levels of care. This process should be scaled up to accommodate all possible major incidents.

Major incident planning at health facility level

Planning for major incidents at health facilities in Kampala is still under-developed. Planning is a critical function of the major incident management process and yet is only undertaken during the incidents at of the hospitals in our study. Preparedness measures involve stages of institutional planning, identification of essential resources, training of personnel and implementation. Most facilities in Kampala implement some type of plan as and when the incident strikes. Our study highlights that the important concept of pre-planning has not yet

been fully supported by the relevant hospital authorities. The ultimate goal is not to merely write a plan but to promote continuous interactions between staff. Isolated plans are in place for epidemics and mass casualty incidents at some hospitals.

Previous experience of major incidents has been shown to result in better performance and coordination for future incidents. History shows that hospitals in Kampala have dealt with many major incidents. Data from past incidents can give you an estimate of the number and severity of casualties which guides planners to ensure that their plans have the capacity to handle these numbers. The WHO essential resources for emergencies in hospitals are an excellent reference material to guide development of health facility lists. Hospitals in Kampala should utilise these resources from the WHO alongside their past experience to enrich future responses. A study carried out in Kenya showed that none of the lower level facilities and 30% of higher level health facilities had a defined approach to trauma.[9] Without these policies in place to handle the daily emergency cases, hospitals are bound to be overwhelmed during major incidents that present the hospitals with either multiple patients or few but critically ill patients.

Hospitals in Kampala should improve data collection specific to emergencies and major incidents through the national health management information systems. Surveillance and early warning systems need to be developed by health services at national level and at facility level to detect potential incidents. This will require the inclusion of hazard and vulnerability assessment as a tool for quality assurance in health facilities. Infrastructural measures include designation of disaster operation centres at health facilities and identification of additional functional space and beds. While there are efforts to establish well equipped A&E units at Regional Referral Hospitals, these vital facilities are still lacking at the majority of district hospitals and lower level health facilities. The few facilities with A&E units lack appropriately trained staffs, supplies and equipment.

National coordination for major incidents

There is global acknowledgement that measures to respond to major incidents must be incorporated into national policies, legislation and programmes for development.[5] It is hoped that the findings of this study may play some role in informing such policies and legislation. These efforts should also be supported through collaboration bilaterally, regionally and internationally. Inter-facility referral systems during major incidents is a challenge even in

the developed world, were coordination among hospitals that are not linked by a common system is still under-developed.[81]The situation in Uganda is further complicated by weak referral systems for patients from lower facilities to higher levels. There is a need for the development of national essential standards of emergency care, level appropriate standardized training packages for health workers as well as essential equipment lists for hospitals. The development of the national emergency services in Uganda should prioritise response to major incidents that involves coordination of the pre-hospital personnel and hospital staffs.[98]

The African Federation for Emergency Medicine has taken the lead in creating networks of people and organizations working in the field of emergency medicine.[99]As a result of these interactions, policies and other resources are developed that guide the creation of emergency care structures in Africa. Conferences and forums of these experts have generated important guides towards all levels of emergency care human resource development and health systems. A strategic move towards translating these international standards into national guidelines that can be applied to hospitals, involves instituting contingency planning for major incidents within the essential hospital processes for quality improvement. Some of these international best practise guides include the AFEM Handbook of Acute and Emergency Care[99], the W.H.O Hospital Emergency Response Checklist and Major Incident Medical Management and Support (MIMMS)[3] .The Ministry of Health Uganda has identified key strategies for strengthening the capacity of hospitals to provide emergency care.[91] These strategies include; training of key hospital staffs , allocation of financial resources, support supervision, provisions of ambulances and information communication technology for patient referrals, enhancement of A&E units at all regional referral hospitals and development of national standards of best practice for all hospitals. A study carried out in rural Uganda, assessed emergency response in a resource limited setting and showed that emergency medical systems in rural Africa can be inexpensive.[100] There is currently political will towards development of emergency services in Uganda, which should be backed by evidence that coordinated systems can play a key role in major incident response.[101] Unfortunately, there are limited data defining the characteristics of health systems that handle major incidents.[102]

Limitations

The study was conducted at only four hospitals. We ensured that they were selected from both the public and private sector considering that they jointly received the highest combined

number of patients in the country. A larger study using a statistically valid sample representative of the National Health Service is recommended.

The Kaiser Permanente HVA tool does add a certain amount of subjectivity so we combined this with opinions from the key informants that were objective. The tool was completed by one personnel from each facility and therefore the data captured were subjective to the individual. This accounted for the discrepancies in results as seen between the hospitals which are within the same geographical area and yet reported different threats posed by natural hazards. Further HVA assessments should be completed by a group of respondents as opposed to a single individual to give more objective data.

A further study with a larger sample size involving more health facilities is recommended to give a better description of perceptions of different staffs towards preparedness for major incidents.

Conclusions

Hospital staffs at health facilities in Kampala are under-prepared to respond to major incidents. Large gaps were identified as far as basic emergency care capacity, major incident planning, human resource emergency care skills training, equipment, medications and supplies and logistics for major incidents. There is a need for development of national standards for hospital medical major incident planning and response, continuous health facility hazard vulnerability assessment and coordinated inter-agency response strategies in low- income countries.

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TABLES OF RESULTS

Hazard Vulnerability Analyses of Mulago, Mengo, Lubaga and Nsambya Hospitals

1. MULAGO HOSPITAL

Table 1.1: Relative comparative risk of events involving natural hazards to Mulago Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood	1	1	1	1	3	3	3	22%
Hail Storm	1	1	1	1	3	3	3	22%
Epidemic	1	1	2	2	2	2	1	19%
Earthquake	1	1	3	3	3	3	3	30%
Drought	1	1	1	1	3	3	3	22%
Landslide	1	1	1	1	3	3	3	22%
Lightning strick	1	1	1	1	3	3	3	22%
AVERAGE SCORE	0.44	0.44	0.63	0.63	1.25	1.25	1.19	4%

RISK = PROBABILITY * SEVERITY		
0.04	0.15	0.30

Table 1.2: Relative comparative risk of events involving technologic hazards to Mulago Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure	1	1	1	1	2	1	0	11%
Generator Failure	1	2	2	3	2	2	2	24%
Transportation Failure	2	2	0	2	2	2	0	30%
Fuel Shortage	2	2	0	2	2	2	0	30%
Water Failure	3	2	0	3	2	2	2	61%
Sewerage Failure	1	0	0	0	3	3	1	13%
Fire Alarm Failure	0	0	0	0	0	0	0	0%
Communications Failure	1	0	0	0	3	3	0	11%
Medical Gas Failure	1	1	0	0	1	1	0	6%
Air Conditioning Failure	0	0	0	0	0	0	0	0%
Information Systems Failure	1	0	0	0	1	1	0	4%
Fire	1	1	2	3	3	3	2	26%
Oil explosion	1	3	2	3	3	3	3	31%
Hazmat Exposure, Internal	1	1	1	1	3	3	3	22%
Supply Shortage	3	1	0	0	2	2	0	28%
Structural Damage	2	1	2	2	2	2	0	33%
AVERAGE SCORE	1.11	0.89	0.53	1.05	1.63	1.58	0.68	13%

RISK = PROBABILITY * SEVERITY		
0.13	0.37	0.35

Table 1.3: Comparative relative risk of events involving human hazards to Mulago Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)	3	3	1	2	2	2	2	**67%**
Mass Casualty Incident (medical/infectious)	2	2	1	2	2	2	1	**37%**
Terrorism, Biological	1	3	3	3	3	3	1	**30%**
Sporting event	1	3	1	3	3	2	2	**26%**
Civil Disorder	1	3	1	2	3	2	2	**24%**
Entertainment event	1	2	1	2	3	3	2	**24%**
War	1	3	3	3	3	3	1	**30%**
Bomb Threat	1	3	3	3	3	3	1	**30%**
AVERAGE	**1.10**	**2.20**	**1.40**	**2.00**	**2.20**	**2.00**	**1.20**	**22%**

RISK = PROBABILITY * SEVERITY		
0.22	0.37	0.61

Table 1.4: Comparative relative risk of events involving hazardous materials to Mulago Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*	1	3	3	3	3	3	3	**33%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*	1	3	3	3	3	3	3	**33%**
Chemical Exposure, External	1	3	3	3	3	3	3	**33%**
Small-Medium Sized Internal Spill	1	3	3	3	3	3	3	**33%**
Large Internal Spill	1	3	3	3	3	3	3	**33%**
Terrorism, Chemical	3	3	0	3	2	2	2	**67%**
Radiologic Exposure, Internal	1	3	3	3	3	3	3	**33%**
Radiologic Exposure, External	1	3	3	3	3	3	3	**33%**
Terrorism, Radiologic	1	3	3	3	3	3	3	**33%**
AVERAGE	**1.22**	**3.00**	**2.67**	**3.00**	**2.89**	**2.89**	**2.89**	**39%**

RISK = PROBABILITY * SEVERITY		
0.39	0.41	0.96

2. MENGO HOSPITAL

Table 2.1: Comparative relative risk of events involving natural hazards to Mengo Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood	1	1	1	1	3	3	3	22%
Hail Storm	1	1	1	1	3	3	3	22%
Epidemic	1	1	1	1	3	3	3	22%
Earthquake	1	1	1	1	3	3	3	22%
Drought	1	1	1	1	3	3	3	22%
Landslide	1	1	1	1	3	3	3	22%
Lightning strick	1	1	1	1	3	3	3	22%
AVERAGE SCORE	**0.44**	**0.44**	**0.44**	**0.44**	**1.31**	**1.31**	**1.31**	**4%**

RISK = PROBABILITY * SEVERITY		
0.04	0.15	0.29

Table 2.2: Comparative relative risk of events involving technologic hazards to Mengo Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure	2	2	2	2	1	1	2	37%
Generator Failure	1	1	1	1	1	1	1	11%
Transportation Failure	1	1	1	1	1	1	1	11%
Fuel Shortage	2	1	0	1	1	1	1	19%
Water Failure	1	1	1	1	1	1	1	11%
Sewerage Failure	1	0	0	1	1	1	1	7%
Fire Alarm Failure	1	0	0	0	3	3	3	17%
Communications Failure	1	1	0	3	2	2	2	19%
Medical Gas Failure	1	2	0	0	2	1	1	11%
Air Conditioning Failure	0	0	0	0	0	0	0	0%
Information Systems Failure	2	1	1	3	1	1	3	37%
Fire	1	1	1	1	1	1	2	13%
Oil explosion	0	0	0	0	0	0	0	0%
Hazmat Exposure, Internal	0	0	0	0	0	0	0	0%
Supply Shortage	1	1	0	2	1	1	1	11%
Structural Damage	3	1	1	3	1	1	2	50%

RISK = PROBABILITY * SEVERITY		
0.09	0.32	0.27

Table 2.3: Comparative relative risk of events involving human hazards to Mengo Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)	3	2	2	2	2	2	2	**67%**
Mass Casualty Incident (medical/infectious)	3	2	0	2	2	1	2	**50%**
Terrorism, Biological	1	3	0	3	3	3	3	**28%**
Sporting event	2	3	3	3	3	3	3	**67%**
Civil Disorder	3	3	3	3	2	2	2	**83%**
Entertainment event	3	3	3	3	3	3	3	**100%**
War	1	2	2	3	3	3	3	**30%**
Bomb Threat	1	1	1	1	2	2	2	**17%**
AVERAGE	**1.70**	**1.90**	**1.40**	**2.00**	**2.00**	**1.90**	**2.00**	**35%**

RISK = PROBABILITY * SEVERITY		
0.35	0.57	0.62

Table 2.4: Comparative relative risk of events involving hazardous materials to Mengo Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*	2	3	3	2	3	3	3	**63%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*	3	3	3	2	3	3	3	**94%**
Chemical Exposure, External	1	1	1	1	3	3	3	**22%**
Small-Medium Sized Internal Spill	1	1	1	1	3	3	3	**22%**
Large Internal Spill	1	1	1	1	3	3	3	**22%**
Terrorism, Chemical	3	2	2	2	3	3	3	**83%**
Radiologic Exposure, Internal	3	3	1	1	3	3	3	**78%**
Radiologic Exposure, External	1	1	1	1	3	3	3	**22%**
Terrorism, Radiologic	1	1	1	1	3	3	3	**22%**
AVERAGE	**1.78**	**1.78**	**1.56**	**1.33**	**3.00**	**3.00**	**3.00**	**45%**

RISK = PROBABILITY * SEVERITY		
0.45	0.59	0.76

3. LUBAGA HOSPITAL

Table 3.1: Comparative relative risk of events involving natural hazards to Lubaga Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood	1	1	1	3	3	3	3	**26%**
Hail Storm	2	1	1	3	3	3	3	**52%**
Epidemic	3	3	2	3	1	1	2	**67%**
Earthquake	1	2	3	3	3	3	3	**31%**
Drought	2	3	1	2	3	3	2	**52%**
Landslide	1	1	1	1	3	3	3	**22%**
Lightning strick	3	3	1	3	1	3	3	**78%**
AVERAGE SCORE	**0.81**	**0.88**	**0.63**	**1.13**	**1.06**	**1.19**	**1.19**	**9%**

RISK = PROBABILITY * SEVERITY		
0.09	0.27	0.34

Table 3.2: Comparative relative risk of events involving technologic hazards to Lubaga Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure	3	2	2	3	1	1	2	**61%**
Generator Failure	3	2	2	3	1	1	2	**61%**
Transportation Failure	2	2	3	3	1	1	2	**44%**
Fuel Shortage	2	2	2	3	2	3	2	**52%**
Water Failure	3	2	3	3	1	1	2	**67%**
Sewerage Failure	3	2	2	3	3	2	2	**78%**
Fire Alarm Failure	3	2	3	1	3	3	2	**78%**
Communications Failure	2	3	3	2	1	1	2	**44%**
Medical Gas Failure	3	3	2	3	2	2	2	**78%**
Air Conditioning Failure	1	1	1	1	3	3	2	**20%**
Information Systems Failure	3	1	1	3	1	2	2	**56%**
Fire	2	3	3	3	1	2	3	**56%**
Oil explosion	2	3	2	3	1	3	3	**56%**
Hazmat Exposure, Internal								**0%**
Supply Shortage	2	2	3	3	2	1	3	**52%**
Structural Damage	2	2	2	3	2	3	3	**56%**
AVERAGE SCORE	**1.89**	**1.68**	**1.79**	**2.11**	**1.32**	**1.53**	**1.79**	**36%**

RISK = PROBABILITY * SEVERITY		
0.36	0.63	0.57

Table 3.3: Comparative relative risk of events involving human hazards to Lubaga Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)	3	2	2	3	2	2	3	**78%**
Mass Casualty Incident (medical/infectious)	3	3	1	3	2	2	3	**78%**
Terrorism, Biological	3	3	3	3	2	3	2	**89%**
Sporting event	1	1	1	1	3	3	3	**22%**
Civil Disorder	3	3	3	3	2	2	2	**83%**
Entertainment event	3	3	3	3	3	3	3	**100%**
War	2	2	2	2	2	2	2	**44%**
Bomb Threat	3	3	3	3	3	3	3	**100%**
AVERAGE	**2.10**	**2.00**	**1.80**	**2.10**	**1.90**	**2.00**	**2.10**	**46%**

RISK = PROBABILITY * SEVERITY		
0.46	0.70	0.66

Table 3.4: Comparative relative risk of events involving hazardous materials to Lubaga Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*	1	1	1	1	3	3	3	**22%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*	1	1	1	1	3	3	3	**22%**
Chemical Exposure, External	2	2	2	2	2	2	2	**44%**
Small-Medium Sized Internal Spill	2	2	2	2	2	2	2	**44%**
Large Internal Spill	2	2	2	2	2	2	2	**44%**
Terrorism, Chemical	3	3	3	3	3	3	3	**100%**
Radiologic Exposure, Internal	1	1	1	1	3	3	3	**22%**
Radiologic Exposure, External	1	1	1	1	3	3	3	**22%**
Terrorism, Radiologic	2	2	2	2	3	3	3	**56%**
AVERAGE	**1.67**	**1.67**	**1.67**	**1.67**	**2.67**	**2.67**	**2.67**	**40%**

RISK = PROBABILITY * SEVERITY		
0.40	0.56	0.72

4. NSAMBYA HOSPITAL

Table 4.1: Comparative relative risk of events involving natural hazards to Nsambya Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood	1	1	1	1	3	3	3	22%
Hail Storm	1	1	1	1	3	3	3	22%
Epidemic	2	2	0	3	2	3	1	41%
Earthquake	1	1	1	1	3	3	3	22%
Drought	1	1	0	1	3	3	3	20%
Landslide	1	1	1	1	3	3	3	22%
Lightning strick	1	1	1	1	3	3	3	22%
AVERAGE SCORE	0.50	0.50	0.31	0.56	1.25	1.31	1.19	5%

RISK = PROBABILITY * SEVERITY		
0.05	0.17	0.28

Table 4.2: Comparative relative risk of events involving technologic hazards to Nsambya Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure	1	1	1	1	1	1	0	9%
Generator Failure	1	1	1	1	1	1	0	9%
Transportation Failure	1	0	0	1	1	1	0	6%
Fuel Shortage	1	0	0	1	1	1	0	6%
Water Failure	1	1	0	1	1	1	1	9%
Sewerage Failure	1	1	0	0	1	1	1	7%
Fire Alarm Failure	0	0	0	0	0	0	0	0%
Communications Failure	1	0	0	1	1	1	1	7%
Medical Gas Failure	1	1	0	1	1	1	1	9%
Air Conditioning Failure	0	0	0	0	0	0	0	0%
Information Systems Failure	1	0	0	1	1	1	1	7%
Fire	2	2	3	3	1	1	1	41%
Oil explosion	1	3	3	3	3	3	3	33%
Hazmat Exposure, Internal	1	3	3	3	3	3	3	33%
Supply Shortage	1	1	0	1	1	1	1	9%
Structural Damage	1	2	2	2	2	1	1	19%
AVERAGE SCORE	0.79	0.84	0.68	1.05	1.00	0.95	0.74	8%

RISK = PROBABILITY * SEVERITY		
0.08	0.26	0.29

Table 4.3: Comparative relative risk of events involving human hazards to Nsambya Hospital

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)	1	3	1	1	1	1	1	**15%**
Mass Casualty Incident (medical/infectious)	1	2	0	1	1	1	1	**11%**
Terrorism, Biological	1	2	0	1	3	3	3	**22%**
Sporting event	2	2	1	2	3	2	3	**48%**
Civil Disorder	3	3	3	3	2	2	3	**89%**
Entertainment event	3	3	3	3	2	2	2	**83%**
War	1	3	3	3	3	2	3	**31%**
Bomb Threat	3	3	3	3	1	1	1	**67%**
AVERAGE	**1.50**	**2.10**	**1.40**	**1.70**	**1.60**	**1.40**	**1.70**	**28%**

RISK = PROBABILITY * SEVERITY		
0.28	0.50	0.55

Table 4.4: Comparative relative risk of events involving hazardous material to Nsambya Hospital

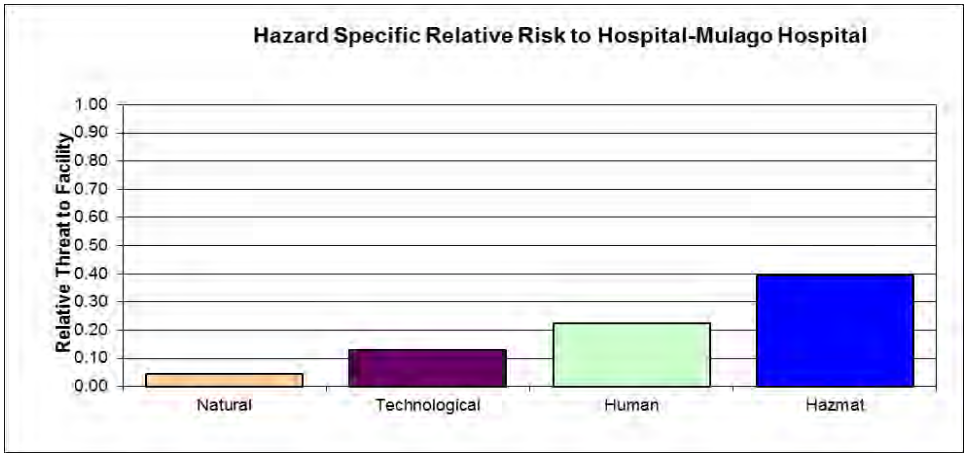
EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*	2	2	2	2	3	3	3	**56%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*	3	2	2	1	3	3	3	**78%**
Chemical Exposure, External	1	1	1	1	3	3	3	**22%**
Small-Medium Sized Internal Spill	1	1	1	1	3	3	3	**22%**
Large Internal Spill	1	1	1	1	3	3	3	**22%**
Terrorism, Chemical	3	3	0	3	2	2	2	**67%**
Radiologic Exposure, Internal	1	1	1	1	3	3	3	**22%**
Radiologic Exposure, External	1	1	1	1	3	3	3	**22%**
Terrorism, Radiologic	1	3	3	3	3	3	3	**33%**
AVERAGE	**1.56**	**1.67**	**1.33**	**1.56**	**2.89**	**2.89**	**2.89**	**38%**

RISK = PROBABILITY * SEVERITY		
0.38	0.52	0.73

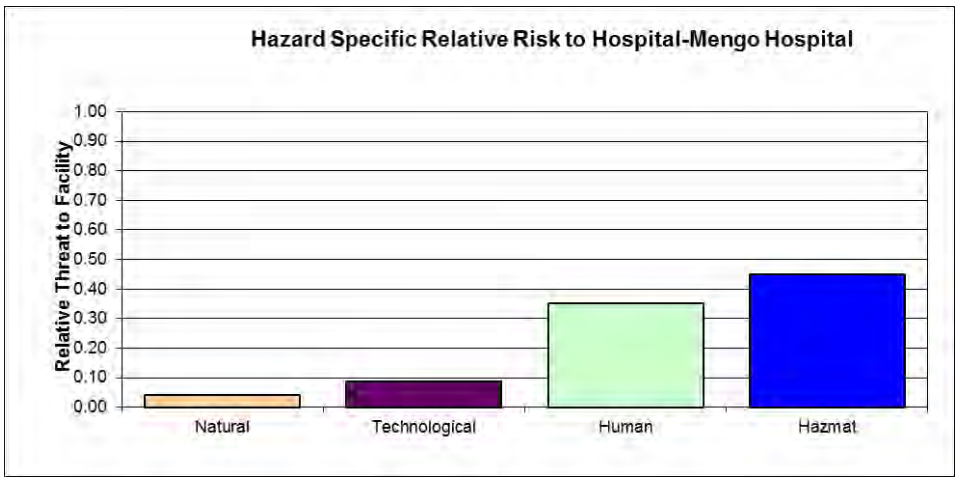
GRAPHS

Graphs of Hazard Specific Relative Risks to Mulago, Mengo, Lubaga and Nsambya Hospitals

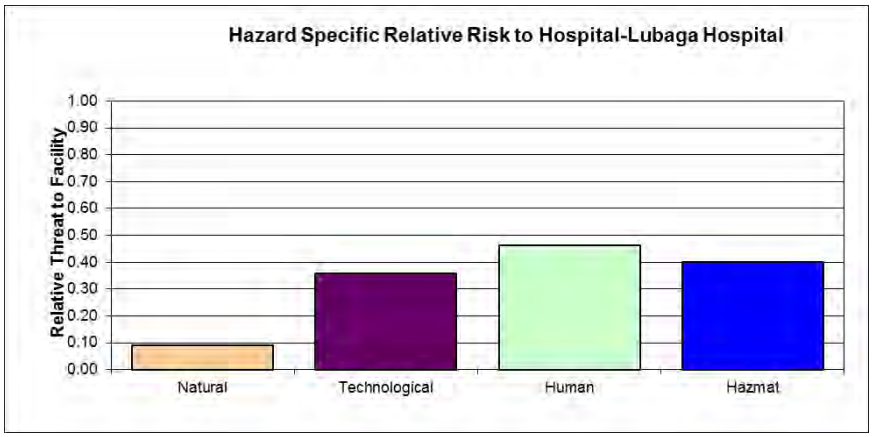
Graph 1: Hazard specific relative risk at Mulago Hospital



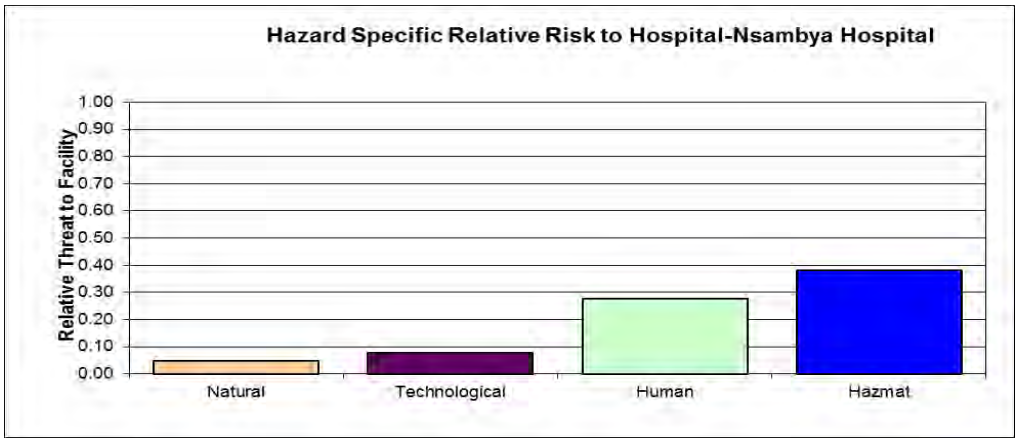
Graph 2: Hazard specific relative risks to Mengo Hospital



Graph 3: Hazard specific relative risks to Lubaga Hospital



Graph 4: Hazard specific relative risks to Nsambya Hospital



APPENDIXES

APPENDIX 1: ESSENTIAL RESOURCES FOR THE DELIVERY OF EMERGENCY CARE IN HOSPITALS

Resources	Major emergency care centre	Regional emergency care centre	District emergency care centre	Primary emergency care centre
Organization and administration				
Multidisciplinary emergency care team	✓	✓		
Maintenance of statistical data	✓	✓	✓	
Resources				
Immediate access to radiology or CT and ultrasound scan facility on site	✓	✓		
Blood bank on site	✓			
Access to blood bank		✓	✓	
Radiological technician on site 24 hours a day	✓	✓		
Radiological services available promptly			✓	
Clinical laboratory services				

Laboratory services on site available 24 hours a day (including, but not limited to, the following tests) Haemoglobin, glucose, gram stain, blood slide test Bacterial cultures	✓ ✓ ✓	✓ ✓ ✓	✓	
Quality improvement				
Evidence of quality improvement program in accident and emergency unit	✓	✓	✓	
Monthly morbidity and mortality review	✓	✓		
Medical nursing audit and utilization review	✓	✓		
Personnel				
Designated doctor in charge, member of the emergency care team, with special competence in care of critically ill and injured	✓	✓		

patients, present in the emergency care unit 24 hours a day				
Designated doctor in charge, member of the emergency care team, with special competence in care of critically ill and injured patients, available on call			✓	
Nursing personnel with special competence in the care of the critically ill and injured patients, designated member of the emergency care team, present in the Accidents and Emergency unit 24 hours a day	✓	✓	✓	
All personnel trained in airway, breathing, and circulatory support techniques	✓	✓	✓	✓
Equipment required for resuscitation per station shall include but not be limited to				

Bag valve resuscitator with reservoir	✓	✓	✓	
Sphygmomanometer (blood pressure cuff)	✓	✓	✓	
Cervical collars	✓	✓	✓	✓
Chest decompression set	✓	✓	✓	
Cut down set	✓	✓	✓	
Delivery pack	✓	✓	✓	✓
Diagnostic peritoneal lavage set open (1)	✓	✓		
Dressing trolley	✓	✓	✓	✓
Drip stand	✓	✓	✓	
Laryngoscope and blades (adult)	✓	✓	✓	
Laryngoscope and blades (paediatric)	✓	✓	✓	
McGill's forceps (adult and paediatric)	✓	✓	✓	
Ophthalmoscope	✓	✓	✓	
Overhead x-ray gantry (full access to all beds)	✓			
Portable ventilator capable of paediatric vent	✓			
Resuscitation patient trolley	✓	✓	✓	

Scissors to cut clothing	✓	✓	✓	✓
Scoop stretcher (1)	✓	✓	✓	✓
Spine board (1)	✓	✓	✓	✓
Spot lamp (1)	✓	✓		
Sterile basic packs (2 per station)	✓	✓	✓	
Stethoscope	✓	✓	✓	✓
Suction apparatus	✓	✓	✓	✓
Wheelchair (1)	✓	✓	✓	✓
X-ray gowns (staff)	✓	✓		
X-ray viewing box	✓	✓	✓	
Consumables (adult and paediatric)				
Catheters (all sizes)	✓	✓	✓	
Central lines	✓	✓		
Chest drains	✓	✓	✓	
Diathermy	✓			
Endotracheal tubes	✓	✓	✓	
Eye protection for staff	✓	✓	✓	✓
Gloves	✓	✓	✓	✓
Humidification filters	✓	✓	✓	
Intraosseous needles	✓	✓		

Intravenous cannulas, fluids, lines	✓	✓	✓	
Introducers and endotracheal tubes (all sizes)	✓	✓		
Lumbar puncture set	✓	✓	✓	
Malaria test kits	✓	✓	✓	✓
Masks	✓	✓	✓	✓
Medical waste disposal systems	✓	✓	✓	✓
Nasal cannula	✓	✓	✓	✓
Nasogastric tubes (all sizes)	✓	✓	✓	✓
Nebulization masks	✓	✓	✓	
Oropharyngeal airways	✓	✓	✓	
Oxygen mask	✓	✓	✓	✓
Suction catheters	✓	✓	✓	✓
Syringes (assorted)	✓	✓	✓	✓
Tracheotomy tubes	✓	✓		
Urine dipstick				✓
Wound care products	✓	✓	✓	✓
Drugs shall include but not be limited to the following				
Activated charcoal	✓	✓	✓	✓
Adrenaline	✓	✓		

Flumazenil (or similar benzodiazepine)	✓	✓	✓	
Antihistamine (such as diphenhydramine)	✓	✓	✓	✓
Atropine	✓	✓	✓	✓
Ciprofloxacin or equivalent	✓	✓	✓	
Beta-2 antagonist (such as propranolol)	✓	✓	✓	✓
Calcium chloride	✓	✓	✓	✓
Calcium gluconate	✓	✓	✓	✓
Dextrose, 50%	✓	✓	✓	✓
Diazepam	✓	✓	✓	
Dopamine	✓	✓		
Emetic (ipecac)	✓	✓	✓	✓
Metronidazole IV	✓	✓	✓	
Furosemide or equivalent	✓	✓	✓	
Heparin, 1,000 g/ml	✓	✓	✓	
Hydrocortisone	✓	✓	✓	✓
Lidocaine IV	✓	✓	✓	✓
Magnesium sulphate IV	✓	✓	✓	
Midazolam	✓	✓	✓	
Morphine	✓	✓	✓	

Naloxone	✓	✓	✓	
Nitro-glycerine	✓	✓	✓	✓
Crystalloids (such as normal saline)	✓	✓	✓	✓
Phenytoin	✓	✓	✓	
Polyvalent snake venom	✓	✓		
Potassium chloride	✓	✓	✓	
Scoline (Suxamethonium chloride)	✓	✓		
Sodium bicarbonate	✓	✓	✓	✓
Streptokinase	✓	✓		
Tetanus toxoid	✓	✓	✓	✓
Vitamin K	✓	✓	✓	✓

APPENDIX 2: FACILITY CHECKLIST TOOL

A. GENERAL ASSESSMENT OF FACILITY

1. Facility Name: .....
2. Address: .....
3. Total number of beds: .....
4. Bed occupancy: .....
5. Description of the facility: …….

6. Capacity of the health facility: Health facility capacity: Indicate the total number of beds and the capacity to expand service in emergencies

Department	**Number of beds**	**Additional capacity**	**Remarks**
Medicine			
Surgery			
Paediatrics			
Obstetrics & Gynaecology			
Accidents & Emergency			
Others (specify)			
Total			

7. **Areas that can be used to increase functional capacity**: Indicate the features of areas and spaces that can be used to increase the facility's capacity in case of a major incident. Specify square meters, available services and any other information that can be used to evaluate its suitability for use during major incidents.

Location	**Area (m^2)**	**Water**		**Power**		**Remarks**
		Yes	**No**	**Yes**	**No**	

Note: Specify how each space can be adapted for different uses (for example, patient care, triage, outpatient care, observation)

B. HUMAN RESOURCES AT A&E

Staff	**Numbers (Full time / Part time)**
Specialists	
Medical Officers	
Clinical officers	
Nurses	
Others (volunteers)	
Training *Number of eligible staffs that have had training at the different levels within the last 3 years*	**Number (%)**
Basic life support	
Advanced Trauma Life Support	
Advanced Cardiac Life Support	
Primary Trauma Care	
Other	

C. MAJOR INCIDENT PREPAREDNESS

QUESTION	**SCORE**			**COMMENTS**
	Low	**Average**	**High**	
1.ORGANIZATION OF THE HEALTH FACILITY`S DISASTER COMMITTEE				
I. Does the facility have a disaster committee? *Low =Committee does not exist or there is no documentation*				

about the committee; Average = Committee exists with three or less disciplines represented, but it is not functioning; High = Committee exists with four or more disciplines represented, and it is functioning.				
II. Is each member of the disaster committee aware of his/her specific responsibilities? *Low = Responsibilities have not been assigned or these responsibilities are not documented; Average = Responsibilities have been officially assigned but members are not familiar with them and/or they have not been implemented; High = All members know and meet the terms of their assigned responsibilities.*				
III. Has a space been designated and equipped for the facility's Emergency Operations Centre (EOC)? *Low = A space has not been designated for the Emergency Operations Centre or it cannot be verified; Average = A space has been designated but it is not properly equipped, or important documentation is not available; High = A space has been designated, it is properly equipped, and important documentation is readily available.*				
IV. Is an updated telephone directory of authorities (internal and external) and other contacts available? *Low =Directory does not exist or is not available for inspection; Average = Directory exists but it is not updated, committee members are not aware of it, or it only contains contact information for facility staff; High = Directory of internal and external authorities exists, it is updated, and committee members are familiar with it.*				
V. Are action cards available for all facility personnel? *Low = Action cards do not exist or they are not available for inspection; Average = There are not enough cards, and/or personnel are not familiar with them; High = All staff members have cards and know their contents.*				
2. OPERATIONAL DISASTER PLANS FOR INTERNAL OR EXTERNAL EMERGENCIES				
I. Does the facility have a major incident plan? *Low = The plan does not exist or a document is not available; Average = The plan exists but it is not operational, and/or it is not updated, and/or it has not been distributed,*				

and/or it has not been used in simulation exercises. High = The plan exists, it is operational, it is updated, it has been distributed, and it has been used in simulation exercises.				
II. Does the major incident plan address both internal and external emergencies? *Low = The plan does not address either or there is no supporting documentation; Average = The plan addresses only internal or only external major incidents; High = The plan addresses both internal and external major incidents.*				
III. Does the plan identify specific actions that will strengthen critical care services in the facility? *Low = Actions are not included or are addressed only in document; Average = Actions are included but are only partially implemented; High = Actions are included and have been completely implemented.*				
IV. Are there procedures for activating and deactivating the plan and are personnel familiar with procedures? *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures are included in the plan, but personnel have not been trained; High = Procedures are included and personnel are familiar with them.*				
V. Does the plan address special administrative procedures for major incidents? *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures included in the plan, but administrative process is slow; High = Procedures included and personnel are familiar with how to implement them.*				
VI. Have funds been specifically allocated to carry out the major incident plan? *Low = Funds have not been allocated or there is no documentation showing budget; Average = Budget exists but it guarantees funds only for preparedness activities, or only for major incident response activities; High = Funds are allocated for both preparedness and response to major incidents*				
VII. Are procedures in place for expanding space when needed for major incident response and/or				

expanding space for critical care services? *Low =Space for expansion has not been identified or there is no documentation regarding expansion; Average = Space has been identified and personnel have been trained to carry out the expansion, but there are no resources for expansion; High = Procedures exist, personnel have been trained, and resources are in place to carry out expansion of space.*				
VIII. Does the plan include procedures for admitting patients in the event of a major incident, including forms and protocols for treating mass casualties? *Low = Procedures are not in place or there is no relevant documentation; Average = Procedures are in place but only forms are available or only protocol available; High = Procedures are in place and both forms and protocols are available.*				
IX. Are procedures in place for triage, resuscitation, stabilization, and treatment? *Low = Procedures have not been defined or there is no documentation on procedures; Average = Procedures are defined and personnel have been trained, but there are no resources to implement procedures; High = Procedures exist, personnel have been trained, and resources are in place to implement procedures.*				
X. Does the plan address transport of patients and logistical support? *Low = Vehicles for patient transport and logistical support are not available or there is no relevant documentation; Average = There are insufficient vehicles and/or insufficient logistical support; High = Sufficient vehicles and logistical support are available.*				
XI. Is coordination in place with other facilities in the local health services network and with entities providing Prehospital emergency care? *Low = Coordination plan is absent or there is no documentation that demonstrates coordination; Average = There is communication in the network, but there are no established procedures or protocols for major incident response; High = There is communication and coordination with other facilities in the health services network, and procedures and protocols are in place for major incident*				

response.				
XII. Is the health facility's major incident plan linked to the local emergency response plan? *Low = The plans are not linked or there is no documentation that demonstrates linkage; Average =Plans are linked but not operational; High = Plans are linked and operational.*				
XIII. Does the major incident plan address specific procedures for referral of patients? *Low = Procedures do not exist or there is no documentation on the procedures; Average = Procedures exist but only on paper; High = Procedures are documented and personnel have been trained in process.*				
XIV. Does the plan include procedures for communicating with the public and media? *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures exist but personnel have not been trained; High = Procedures exist and personnel have been trained.*				
XV. **What procedures are in place for staffing during major incidents?** *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures are in place but personnel have not been informed; High = Procedures are in place and personnel are aware of procedures.*				
XVI. Does the major incident plan address procedures for both internal and external evacuation of the facility? *Low = Procedures do not exist or there is no documentation for procedures; Average = Procedures are in place but personnel have not been trained, and/or evacuation routes are not adequate; High = Procedures are in place, personnel have been trained, and evacuation routes are clearly marked and unobstructed.*				
XVII. Are health personnel prepared to act in major incident situations? *Low = Personnel are not trained or there is no training program; Average = There is sporadic training but less than half of the staff is trained; High = There is an on-going*				

training program and more than 50% of personnel are trained.				
VIII. Does the facility have a major incident warning system and are personnel trained in the system? *Low = Warning system does not exist or there is no documentation for system; Average = Warning system is in place but personnel have not been trained in system; High = Warning system is in place and personnel have been trained in how to respond.*				
XIX. Does the facility have an alarm system and have staff been trained to respond? *Low = Alarm system does not exist or there is no documentation about system; Average = Alarm system is in place but personnel have not been trained in system; High = Alarm system is in place and personnel have been trained in how to respond.*				
XX. Has the facility carried out major incident simulation exercises and drills in the last year? *Low = Simulation exercises do not take place or there is no documentation about exercises; Average = Simulations are carried out but not each year; High = Simulations are carried out at least once each year and the plan is updated according to the outcome of the exercises.*				
1. HOSPITAL DISASTER OPERATION CENTER				
I. Does the plan indicate where the Hospital Disaster Operation Centre is to be located (with preference given to an area away from the A&E)? *Low=There is no designated area; Average=An area has been designated but is non-functional; High= An area has been designated, away from the A&E and is functional*				
II. Have standard operating procedures been developed for the Operation Centre? *Low=No standard operating procedures; Average= Standard operating procedures available, but not updated; High=Standard operating procedures available and updated*				
2. AVAILABILTY OF MEDICATIONS, SUPPLIES, INSTRUMENTS AND EQUIPMENT FOR MAJOR INCIDENTS.				
I. Are there reserves of medications available for				

emergency response? *Low= There is no reserve or there is no documentation demonstrating reserve; Average = Reserves of medications are sufficient only for daily, conventional use; High = There are sufficient reserves of medications for major incident response.*				
II. Does the facility have reserves of supplies and treatment materials for major incident response? *Low = There are no reserves or no documentation regarding supplies for major incidents; Average = Reserves are adequate only for regular, daily use; High =Sufficient reserves are in place for major incident response.*				
III. Does the facility have a reserve of instruments for major incident response? *Low = There are no reserves or there is no documentation regarding reserve instruments; Average = Reserves are adequate only for regular, daily use; High = Sufficient reserves are in place for major incident response.*				
IV. Does the facility have life support equipment? *Low = The facility does not have this equipment; Average = Equipment available but only enough for daily use; High = Facility has sufficient equipment for use during a major incident.*				
V. Does the facility have personal protection equipment for major incidents? *Low = The facility does not have this equipment or there is no relevant documentation; Average = Reserves of this equipment are only sufficient for regular, daily use; High = Facility has sufficient equipment for use in a major incident.*				

APPENDIX 3: MODIFIED KAISER PERMANENTE HAZARD VULNERABILITY ANALYSIS TOOL

Naturally Occurring Events

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood								0%
Hail Storm								0%
Epidemic								0%
Earthquake								0%
Drought								0%
Landslide								0%
Lightning strick								0%
AVERAGE SCORE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%

Technologic Events

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure								0%
Generator Failure								0%
Transportation Failure								0%
Fuel Shortage								0%
Water Failure								0%
Sewerage Failure								0%
Fire Alarm Failure								0%
Communications Failure								0%
Medical Gas Failure								0%
Air Conditioning Failure								0%
Information Systems Failure								0%
Fire								0%
Oil explosion								0%
Hazmat Exposure, Internal								0%
Supply Shortage								0%
Structural Damage								0%
AVERAGE SCORE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%

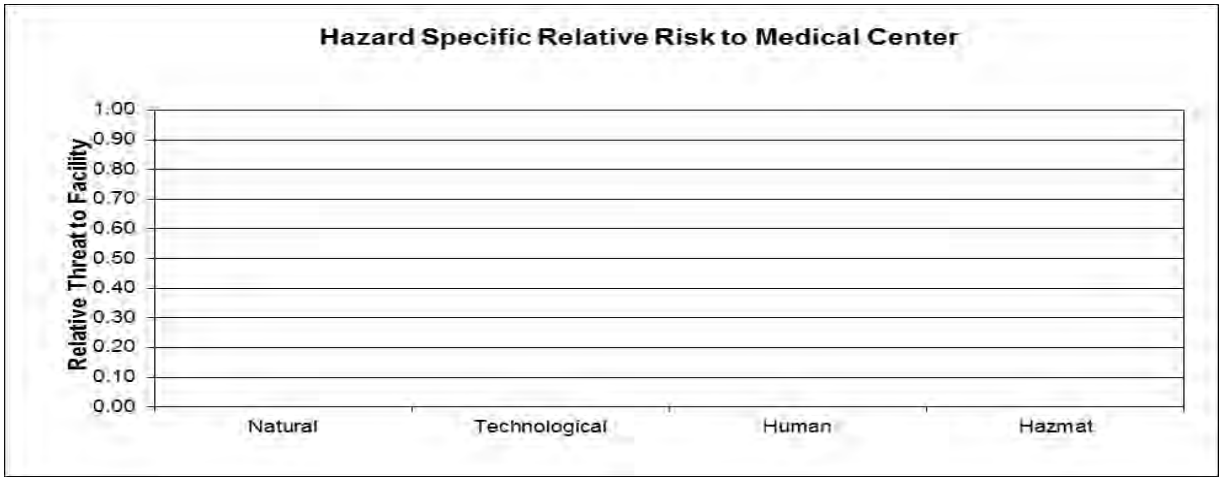
Human Related Events

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)								**0%**
Mass Casualty Incident (medical/infectious)								**0%**
Terrorism, Biological								**0%**
Sporting event								**0%**
Civil Disorder								**0%**
Entertainment event								**0%**
War								**0%**
Bomb Threat								**0%**
AVERAGE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

Events involving Hazardous Materials

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*								**0%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*								**0%**
Chemical Exposure, External								**0%**
Small-Medium Sized Internal Spill								**0%**
Large Internal Spill								**0%**
Terrorism, Chemical								**0%**
Radiologic Exposure, Internal								**0%**
Radiologic Exposure, External								**0%**
Terrorism, Radiologic								**0%**
AVERAGE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

Hazard Specific Relative Risk to Health Facility



APPENDIX 4: HUMAN RESEARCH ETHICS COMMITTEE APPROVAL

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492 • Facsimile [021] 406 6411
Email: Sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

24 June 2014

HREC/REF: 193/2014

Dr W Smith
Emergency Medicine
J-Floor
OMB

Dear Dr Smith

Project Title: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA (Masters – J Kalanzi)

Thank you your letter dated 23 June 2014, addressing the issues raised by the Human Research Ethics Committee.

It is a pleasure to inform you that the HREC has **formally approved** the above mentioned study.

Approval is granted for one year until the 30 June 2015.

Please submit a progress form, using the standardised Annual Report Form, if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

We acknowledge that the following student:- Dr J Kalanzi are also involved in this project.

Please note that the on-going ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC REF in all your correspondence.

Yours sincerely

Signed

pp

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

Hrec/ref:193/2014

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Hrec/ref:193/2014

MR Medad. Ebyamuntu — Surgery
Please Guide

MENGO HOSPITAL RESEARCH REVIEW COMMITTEE
P.O.BOX 7161
KAMPALA

29/7/14

4th July, 2014

To: Dr. Kalanzi Joseph Kajubi
Principal investigator
University of Cape Town

Re: MHRRC approval of proposal titled: An Analysis of Health Facility Preparedness for Major Incidents in Kampala District.

This is to acknowledge receipt of your proposal, introduction letter and approval letter. Since this protocol has been approved by the Lubaga Hospital Research Review Committe (LHRRC), all that you require from the Mengo Hospital IRB is an administrative approval.
We hereby grant you the administrative approval.

Continued approval is conditional upon your compliance with the following requirements:

1) Significant changes to the study site and significant deviations from the research protocol and all unanticipated problems that may involve risks or affect the safety or welfare of subjects or others, or that may affect the integrity of the research must be promptly reported to the MHRRC.

2) Please send the report upon completion or termination of the study to the MHRRC. The study cannot continue after 25/05/2015 until re-approved by the LHRRC.

Please call me if you have any questions about the terms of this approval.

Yours Sincerely,

Signed

.....
Prof. M. Kawooya
Chairman (MHRRC)

cc. Deputy Medical Director

Signed

LUBAGA HOSPITAL

P.O. Box 14130, Kampala, Uganda
Tel: 256-414-270203/4, 0312-234800
Fax: 256-414-234226, E-mail:rubaga@ucmb.co.ug

Date 27 May 2014

REF: LHRRC/2014/62

Dr. Kalanzi Joseph Kajubi
University of Cape Town
Department of Disaster Medicine and Special Events

Dear Dr. Kalanzi,

Re: LHRRC Protocol 2014/62 An Analysis of Health Facility Preparedness for Major Incidents in Kampala
This is to inform you that the Lubaga Hospital Research Review Committee (LHRRC) has approved the above research study. The approval period is from 26 May 2014 to 25 May 2015. **Your study number is LHRRC/2014/62**
Please be sure to reference either this number in any correspondence with the LHRRC.

Continued approval is conditional upon your compliance with the following requirements:

1) A copy of the **Informed Consent Document**, approved as of **26/05/2014** is enclosed. No other consent form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.

2) All protocol amendments and changes to approved research must be submitted to the LHRRC and not be implemented until approved by the LHRRC except where necessary to eliminate apparent immediate hazards to the study subjects.

3) Significant changes to the study site and significant deviations from the research protocol and all unanticipated problems that may involve risks or affect the safety or welfare of subjects or others, or that may affect the integrity of the research must be promptly reported to the LHRRC.

Please complete and submit reports to the LHRRC as follows:

a) Renewal of the study - completes and returns the Continuing Review Report-Renewal Request (Form 404A) at least 8 weeks prior to the expiration of the approval period. The study cannot continue after **25 May 2015** until re-approved by the LHRRC.
b) Completion, termination, or if not renewing the project- send the report upon completion of the study.

Please call me if you have any questions about the terms of this approval.
Yours sincerely,

Signed

Dr. Kibuuka Peter
CHAIRMAN LHRRC

LUBAGA HOSPITAL RESEARCH REVIEW COMMITTEE
CHAIRMAN
Date:
Sign:

ST. RAPHAEL OF ST. FRANCIS HOSPITAL NSAMBYA
General and Maternity

Our Ref: IRC /PRJ/08/14/042

Mr. Kalanzi Joseph Kajubi
Master of Science Degree (Med) Emergency Medicine
UNIVERSITY OF CAPE TOWN
+256782430333

13rd August 2014

Dear **Mr. Kalanzi Joseph Kajubi** ,

RE: RESEARCH PROJECT, "AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS for MAJOR INCIDENTS IN KAMPALA"

I am pleased to inform you that the Nsambya Hospital Institutional Review Committee (IRC) approved the above research proposal on 8TH August 2014. The approval will expire on the 10th August 2015. If there is need to continue with the research beyond the expiry date, a request for continuation should be made in writing to the Executive Secretary of the Nsambya IRB.

Any problems of a serious nature related to the execution of your research project should be brought to the attention of the IRC, and any changes to the research protocol should not be implemented without IRC approval except when necessary to eliminate apparent immediate hazards to the research participant(s).

This letter also serves as proof of IRC approval and as a reminder for you to submit to IRB timely progress reports and a final report on completion of the research project.

Yours sincerely,

Signed

Prof. Ignatius Kakande
Chairman of the IRC

St. Raphael of St. Francis Hospital - Nsambya
P. O. Box 7146 Kampala - Uganda
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E-mail: admin@mulago.or.ug
Website: www.mulago.or.ug

IN ANY CORRESPONDENCE ON THIS SUBJECT PLEASE QUOTES NO…

THE REPUBLIC OF UGANDA

MULAGO NATIONAL REFERRAL

P.O. Box 7051
KAMPALA, UGANDA

26th June, 2014

Dr. Kalanzi Joseph Kajubi
University of Cape Town
Department of Disaster Medicine and Special Events.

Dear Kalanzi,

RE: APPROVAL OF PROTOCOL MREC: 606: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA.

The Mulago Hospital Research and Ethics Committee reviewed your proposal referenced above and hereby grant approval for the conduct of this study for a period of (1) year from 26th June, 2014 to 25th June, 2015.

This approval covers the protocol and the accompanying documents listed below;

- Hazard and vulnerability analysis tools.
- Summary of medical center hazards analysis.
- Facility assessment tool
- Human resources ATA&E
- Key informant interview guide
- Participant consent form.

This approval is subjected to the following conditions:

1. That the study site may be monitored by the Mulago research and ethics committee at any time.
2. That you will be abide by the regulations governing research in the country as set by the Ugandan National Council for Science and Technology including abiding to all reporting requirements for serious adverse events, unanticipated events and protocol violations.
3. That no changes to the protocol and study documents will be implemented until they are reviewed and approved by the Mulago Research and Ethics Committee.
4. That you provide annual progressive reports and request for renewal of approval at least 60 days before expiry of the current approval.
5. That you provide an end of study report upon completion of the study including a summary of the results and any publications.

I wish you the best in this Endeavour.

Signed

APPROVED
APPROVAL DATE 26 JUN 2014 EXPIRY DATE 25 JUN 2015
MULAGO RESEARCH ETHICS COMMITTEE
IRC

DR.NAKWAGALA FREDERICK NELSON
CHAIRMAN- MULAGO RESEARCH & ETHICS COMMITTEE

Vision: "To be the leading centre of Health Care Services"

APPENDIX 5: PARTICIPANT CONSENT FORM

TITLE OF THE RESEARCH PROJECT: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA

UNIVERSITY: University of Cape Town (UCT)

FACULTY: Health Sciences

DIVISION: Emergency Medicine

STUDENT: Dr. Joseph Kalanzi

STUDENT NUMBER: KLNJOS004

EMAIL ADDRESS: Kajubi.josef@gmail.com

CONTACT NUMBER: +256782430333

SUPERVISOR: Dr. Wayne Smith

Head: Disaster Medicine and Special Events

Tel: +27 (0)829910760

Email: Wayne.Smith@westerncape.gov.za

Dear participant,

You have been chosen to take part in this cross-sectional study that will describe the state of preparedness of health facilities for major incidents in Kampala through key informant interviews and a hospital Accident and Emergency checklist. Through a set of planned visits of hospitals and meetings with stake holders, the investigator will interview stakeholders and assess Accident and Emergency units at teaching hospitals in Kampala. The sample size is of four teaching hospitals namely Mulago National Referral Hospital, Mengo Hospital, Nsambya Hospital and Lubaga Hospital. The data collection tools will include; an interview guide, a Hazard Vulnerability Analysis tool and a standardized facility check list. Data collected will include: general information about the facilities (number of beds, bed occupancy and extra space that can be used during major incidents), human resources and major incidents preparedness.

We will conduct semi structured one-one interviews of key staff in hospitals that have been selected because of their role in major incident management in hospitals. These will be: These will be: hospital directors, clinical heads (clinicians in charge of medical and surgical services) of A&Es and heads of support services (laboratory, radiology, security) also selection of clinicians, nursing and support staff who are not in managerial roles (these will be selected randomly using their staff identification numbers).A total of 60 participants; 15 from each hospital, will be recruited based on their job descriptions that stipulate their management roles and the role they may need to be expected to play in a major incident response.9 personnel from management structure of the hospital will be approached for this study. This will include personnel from the management of both the hospital and managers of clinical and support structures. Furthermore, 6 personnel who are directly responsible for clinical duties will also be approached to form part of the study. The interviews will take place on the hospital premises, in a private place designated by the hospital administration and will last approximately thirty (30) minutes. The data will be stored on a password protected computer, in secure data sheets, with restricted access to the database. There is no possible risk of participation and the data collected will be handled by the researcher only. The interviews will be kept confidential, and once the information has been transcribed, no interview subject details will be kept.

Declaration by participant

By signing below, I *(name)* ……..……. agree to take part in a research study entitled: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA

I declare that:

- I have read or had read to me the participant information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.

- I understand that taking part in this study is voluntary and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.

Signed at (*place*) .....…..…… on (*date*)……...…….. 2014.

.....

Signature of participant

Declaration by investigator

I *(name)* ……..…… declare that:

- I made explained the study information to ……
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.

Signed at (*place*) .....…..…….. (*Date*) ……...…… 2014.

.....

Signature of investigator

APPENDIX 6: KEY INFORMANT INTERVIEW GUIDE

NO.	**Question**	**Yes**	**No**	**Comment**
1.	Does the hospital have a disaster plan?			
2.	Has the hospital considered developing a disaster plan?			
3.	Is there a disaster planning committee?			
4.	Is it multi-disciplinary and include administrative members?			
5.	Does the plan detail actions to be taken for both internal and external disasters?			
6.	Is the plan widely distributed and readily available throughout the hospital?			
7.	Is there an individual designated as a disaster coordinator?			
8.	Have other key position holders who have a role in disaster management been identified?			
9.	What are the key positions?			
10.	Does the plan include lines of authority, role responsibilities, and provide for succession?			
11.	Are those who are expected to implant and use the plan familiar with it?			
12.	Does the hospital have on going, mandatory disaster training programs?			
13.	Does the hospital conduct an annual exercise?			
14.	Does the exercise ensure all key participants are familiar with the contents of the plan?			
15.	Is there a precise plan of action whereby at short notice , multiple casualties can be received and: •Identified •Triaged •Registered			

	•Treated in designated treatment areas •Admitted or transferred •Transported as needed			
16.	Are sufficient equipment, supplies, and apparatus available, in an organized manner, to permit prompt and efficient casualty movement?			
17.	Has provision been made for a large influx of casualties to include such factors as (Bed arrangements, personnel requirements, and extra resources such as interpretive services, linen, pharmaceuticals, and dressings?			
18.	Has provision been designated (e.g. space, equipment) for extra people who may come to the hospital to provide services (e.g. volunteers, outside agencies)			
19.	Does the hospital have a Disaster Operation Centre?			
20.	Have provisions been made to identify the procedures for handling requests for information from the media?			

Appendix 7

PROPOSAL

AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA

NAME: KALANZI JOSEPH KAJUBI

STUDENT NUMBER: KLNJOS004

EMAIL: Kajubi.josef@gmail.com

CELL: +256782430333

SUBMITTED TO THE UNIVERSITY OF CAPE TOWN

In partial fulfilment of the requirements for the degree Master of Science Degree (Med) Emergency Medicine

SUPERVISOR

Dr Wayne Smith

Head: Disaster Medicine and Special Events

Tel: +27 (0)829910760

Email: Wayne.Smith@westerncape.gov.za

TABLE OF CONTENTS

Abbreviations

A&E= Accidents & Emergency

GoU =Government of Uganda

HVA= Hazard Vulnerability Analysis

MOH= Ministry Of Health

NHS= National Health System

NRH=National Referral Hospital

RRH=Regional Referral Hospital

UNAS= Uganda National Ambulance Service

USAID= United States Agency for International Development

WHO= World Health Organization

Introduction

1.1. LITERATURE REVIEW

Cities, with their large concentrations of people, buildings, infrastructure and economic activities, are the locus of both large and small-scale disasters. A review of urban disasters shows the wide range of disasters that occur in African cities, such as aircraft crashes, fires and explosions, illegal dumping of hazardous materials, shack fires and traffic accidents. Building collapses, documented from a 2010 International red Cross and Red Crescent report, show that in a two-year period (from 2006 to 2008); nine building collapses killed at least 100 people.[1] Cities are also the locus of social hazards such as violent crime, riots and terrorism, as well as public health hazards such as HIV / AIDS, which has a higher incidence in cities.

The WHO African Region continues to be challenged by frequent natural and man-made emergencies causing injury, death, population displacement, destruction of health facilities and disruption of services, often leading to disasters[2]. Several global initiatives, developed since 2005, including the World Health Assembly resolution WHA64.10 adopted in 2011, have focused on Disaster Risk Management as the approach to containing and minimizing the impact of emergencies.

However, many low and middle income countries do not have formal emergency medical systems in place; thus an estimated 80% of injury deaths in these countries occur in the pre-hospital setting.[3]

Some efforts are taking place in Sub-Saharan Africa never the less. The U.S. Government, through USAID, signed a partnership agreement on November 13 2013 [4] to improve urban emergency preparedness and response in Addis Ababa.

Uganda is no different. The lack of access to emergency medical care for seriously injured people in Uganda's capital city, Kampala, has been documented by others. A study conducted in Kampala in 1998, described injuries and their emergency care at five city hospitals in Kampala.[5]

UGANDA

The republic of Uganda is located in East Africa and lies astride the equator. It borders Kenya to the east, Tanzania to the south, Rwanda to the southwest, the Democratic Republic of

Congo to the west, and South Sudan to the north. The country has an area of 241,039 square kilometres and is administratively divided into 112 districts. The current population is 30 661 300 (Mid-year estimate (2009 - 2010)[6] .The country is administered by the Central Government based in Kampala using the presidential system. A decentralization system has resulted in power being devolved across four geographical regions, namely: Northern, Eastern, Central, and Western.

Health system situation analysis

The NHS in Uganda constitutes of all institutions, structures and actors whose actions have the primary purpose of achieving and sustaining good health. Both the public and private sectors play an important role in provision of health services. The public sector comprises of multiple players, namely the MOH; Ministry of Local Government ;Ministry of Defence ;Ministry of Internal Affairs ;and Ministry of Gender, Labour and Social Development which provide health services.[7]

The delivery of health services in Uganda is done by both the public and private sectors with Government of Uganda being the owner of most facilities.[8]The public Health delivery system consists of:

- District Health System (communities, Village Health Teams or Health Centre 1)
- Health Centres II, III and IV
- General hospitals
- Regional Referral Hospitals
- National Referral Hospitals

Currently, there are 56 public hospitals: 2 NRHs (Mulago and Butabika), 11 RRHs and 43 general hospitals. There are 42 Private Not for Profit (PNFP) and 4 Private Health Practitioners (PHP) hospitals.[8]

GoU is making strides towards development of Prehospital emergency care through the UNAS, an autonomous body under the MOH. Little attention has been given to development of capacity of receiving facilities to handle emergencies as well as well major incidents.

Facility based emergency care in Uganda

Within the capital city of Kampala, Uganda's national referral hospital, Mulago Hospital, handles many more injured patients than any other health facility in the country. Approximately 6,000 injured patients are treated there every year.[5] Data indicating the outcomes in hospital emergency care is still very limited.

While there are efforts to establish well equipped A&E units in RRHs, these vital facilities are lacking in the majority of district hospitals and lower level health facilities. Those in place lack dedicated trained personnel and equipment .There is however no formal in-service training for the staff, the majority of which are medical officers, clinical officers and nurses without specialists.

Major Incidents

Major incidents are defined as events that owing to the number, severity, type or location of live casualties require special arrangements to be made by health services[9].

Table 1

Size	**Total number of Casualties (alive or dead)**	**Casualties admitted to hospital**
Minor	**25-100**	**10-50**
Moderate	**100-1000**	**50-250**
Severe	**>1000**	**>250**

Source: Major Incident Medical Management and Support, the Practical Approach in the Hospital. First published 2005 [9]

Types of major incidents

Occasional incidents may result from deliberate terrorist attacks or from other forms of social disorder. Although a wide variety of incidents occur, they can be broadly subdivided into civil disorder (including terrorist incidents), industrial accidents, transportation accidents, sports stadium events and a variety of other miscellaneous types.

High profile major Incidents in Kampala history:

Kampala city has been faced with a couple of major incidents in the recent past; with some notable high profile ones being:

i. **Terrorist bombings**: The July 11th 2010 twin bomb attacks by the Somalia's al-Shabab terrorist group that killed at least 74 people and injured 70 in Kampala. One blast hit an Ethiopian restaurant in the south of the city on Sunday, while the other occurred at a rugby sports club as people watched the World Cup final.[10]

ii. **Fuel tanker explosion:** June 29th 2013, at least 39 people died after an accident involving a fuel tanker exploded along the Northern Bypass. An estimated 30 people, the majority of which were motor cycle riders, were admitted at Mulago Hospital with severe burns.[11]

iii. **Building collapse:** City of the Lord Church collapsed during heavy rainstorm on March 8th 2006 injuring more than 100 people and killing 26. It is estimated that there were about 300 people in the church at the time of the collapse.[12]

iv. **Bus crash:** The worst road accident in recent history occurred on August 26, 2007 when at least 70 people including 57 UPDF soldiers died on the Kapchorwa-Sironko Road.[13]

The availability of adequate emergency medical services is often considered a basic human right in high-income countries [14]. Given the urgency, hospitals need to be prepared and equipped to handle major incidents.

A study published in 2011 described the state of disaster preparedness in hospitals in the public sector in the Western Cape, South Africa [15].In this study, the data, which was collected using a self-reported hospital assessment questionnaire, identified best practices and made recommendations for improving disaster preparedness in the hospitals.

Hazard Vulnerability Analysis

A Hazard Vulnerability Analysis (HVA) is the process whereby a hospital can identify its most likely hazards, as well as to determine what the vulnerability of the hospital to each of the identified hazards may be. The risks associated with each hazard are analyzed to prioritize planning, mitigation, response and recovery activities [16]. The HVA identifies potential major incidents and disasters and other events from a technological, natural, man-made and hazardous material perspective which is most prevalent in the surrounding area and community that it serves. The tool widely used is the Kaiser Permanente model [17]. This tool takes inputs on the probability, impact of threats and mitigation and preparedness measures that have been taken to determine a level of risk for each hazard.

2.1.Motivation for study

WHO has recognized the need for Member States to formulate policies and legislation, and develop capacities in order to institutionalize Disaster Risk Management in the health sector [4] .The Regional strategy proposes that Member States strengthen disaster risk management by developing appropriate laws and policies; building adequate capacities in the MOH; assessing and mapping the risks from a health sector perspective; assessing the level of safety of, and

applying standards to, hospitals and other health facilities; developing national standards for response; and strengthening evidence and knowledge management.

Efforts to develop emergency care in Uganda are already underway at various levels of the health system. The UNAS is establishing Prehospital care through a national ambulance service. Facility based care capacity initiatives are being established for the different cadres of health workers in Uganda notably the Master in Emergency Medicine course being developed at Makerere University Kampala. Major incident preparedness and response is an essential, crosscutting component for this emergency care development process.

RESEARCH QUESTION

What is the state of preparedness of health facilities in Kampala to handle major incidents?

AIM

To describe health facility preparedness for major incidents in Kampala

2.2. OBJECTIVES:

I. To establish the need for hospital preparedness for major incidents in Kampala

II. To describe the state of hospital preparedness for major incidents in Kampala.

III. To describe perceptions of key hospital staff about preparedness for major incidents.

3. METHODOLOGY

3.1. Study design

This is a cross-sectional study that will describe the state of preparedness of health facilities for major incidents in Kampala through key informant interviews and a facility checklist. Through a set of planned visits of hospitals and meetings, the investigator will interview key staff and assess A&E units at teaching hospitals in Kampala. The data collection tools will be; an interview guide, a Hazard Vulnerability Analysis tool and a standard facility check list. Data collected will include: general information about the facilities, human resources and major incidents preparedness.

3.2. Sampling

3.2.1. Inclusion criteria

All teaching hospitals operating in Kampala will form part of the study.

3.2.2. Exclusion criteria

Teaching hospitals that do not agree to participate will be excluded from the study.

3.3. Data collection

Data will be collected in three parts:

I. Hazard Vulnerability Analysis (HVA):

The investigator will carry out a HVA of all four teaching hospitals using a modified version of the Kaiser Permanente HVA tool adapted for Uganda **(Appendix A).** This tool will identify the most likely hazards and vulnerability to each of them. It identifies potential major incidents and disasters and other events from a technological, natural, man-made and hazardous material which are most prevalent in the area around the hospital .The tool will assess the human impact, property impact and business impact of the hazards as well as measures for mitigation (preparedness, internal response and external response) in place at the hospitals.

II. **Hospital survey:**

The investigator will visit the A&E units of the four teaching hospitals and conduct direct inspection of facilities and equipment within the A&Es. The dates for each visit will be randomly assigned from within the 2 months data collection period. Data will be collected using a structured check list (**Appendix B**). This tool will assess preparedness in terms of; the organization of the health facility`s disaster committee, operational disaster plans for internal and external emergencies and facility disaster operation centres.

III. **Key informant interviews:**

The investigator will carry out 60 semi structured one-one interviews of key staff in the four teaching hospitals that have been selected because of their role in major incident management in hospitals. These will be: hospital directors, clinical heads (clinicians in charge of medical and surgical services) of A&Es and heads of support services (laboratory, radiology, security) also selection of clinicians, nursing and support staff who are not in managerial roles (these will be selected randomly using their staff identification numbers).A total of 60 participants; 15 from each hospital, will be recruited based on their job descriptions that stipulate their management roles and the role they may need to be expected to play in a major incident response. 9 personnel from management structure of the hospital will be approached for this study. This will include personnel from the management of both the hospital and managers of clinical and support structures. Furthermore, 6 personnel who are directly responsible for clinical duties will also be approached to form part of the study. To ensure privacy, the interviews will take place in a private place on the hospital premises, allocated by the hospital administration and will last approximately thirty minutes. Attached is the key informant guide as (**Appendix C**).

Inclusion criteria:

All participants that accept to participate in the study

Exclusion criteria:

All participants who decline to participate.

2.4 STUDY TIMELINE

This study will take approximately six months.

TASK	**MONTH**
Ethics approval	March 2014
Collection of data	March-May 2014
Statistical Analysis	June 2014
Writing	August 2014
Submit for Publication	December 2014

3.0. Data analysis

Simple descriptive statistics will be used to analyse the data in terms of equipment, human resources and major incident plans.

4.0. Ethical and legal considerations

The data will be stored on a password protected computer, in secure data sheets, with restricted access to the database. No interview subject identifying details will be kept. The principal investigator will get permission from the Ministry of Health and ethics approval will be obtained from the research boards of each participating hospital prior to conducting the study. Written consent will be provided through a consent form provided to and signed by each respondent before the start of the interview. The from will be translated so as to be in the mother tongue of the respondent (**Appendix E**)

5.0 Study Limitations

Only teaching hospitals will be included in the study and will not reflect the resources in private hospitals in Kampala. The study also does not include smaller facilities which provide care for a significant number of patients. A broader study will be recommended that will include private hospitals and smaller facilities.

6.0. Budget

This study will cost approximately R 8,500 and will be self-funded. (**Appendix D)**

7.0. Reporting of results

A full report will be given to the all the hospitals involved in the study, the MOH and UNAS. The results will be submitted for publication in a peer-reviewed journal.

APPENDIXES

APPENDIX A: HAZARD AND VULNERABILITY ANALYSIS TOOL:

NATURALLY OCCURRING EVENTS

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Flood								0%
Hail Storm								0%
Epidemic								0%
Earthquake								0%
Drought								0%
Landslide								0%
Lightning strick								0%
AVERAGE SCORE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

TECHNOLOGIC EVENTS

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Electrical Failure								0%
Generator Failure								0%
Transportation Failure								0%
Fuel Shortage								0%
Water Failure								0%
Sewerage Failure								0%
Fire Alarm Failure								0%
Communications Failure								0%
Medical Gas Failure								0%
Air Conditioning Failure								0%
Information Systems Failure								0%
Fire								0%
Oil explosion								0%
Hazmat Exposure, Internal								0%
Supply Shortage								0%
Structural Damage								0%
AVERAGE SCORE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

Human Related Events

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Incident (trauma)								**0%**
Mass Casualty Incident (medical/infectious)								**0%**
Terrorism, Biological								**0%**
Sporting event								**0%**
Civil Disorder								**0%**
Entertainment event								**0%**
War								**0%**
Bomb Threat								**0%**
AVERAGE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

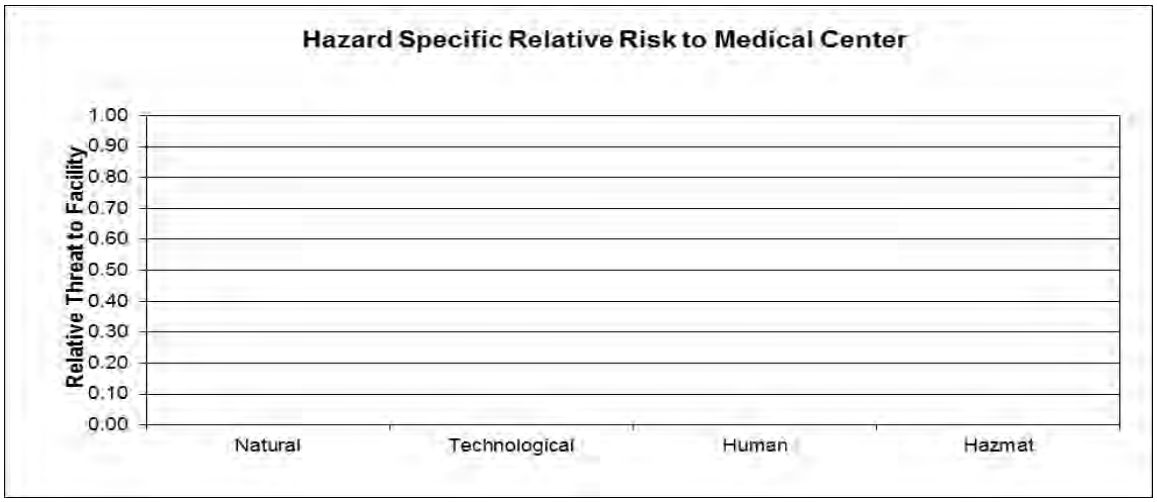
Events Involving Hazardous Material

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Time, effectivness, resouces*	*Community/ Mutual Aid staff and supplies*	*Relative threat**
SCORE	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= Low 2 = Moderate 3 = High*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 = N/A 1= High 2 = Moderate 3 = Low or none*	*0 - 100%*
Mass Casualty Hazmat Incident *(From historic events at your HC with >= 5 victims)*								**0%**
Small Casualty Hazmat Incident *(From historic events at your HC with < 5 victims)*								**0%**
Chemical Exposure, External								**0%**
Small-Medium Sized Internal Spill								**0%**
Large Internal Spill								**0%**
Terrorism, Chemical								**0%**
Radiologic Exposure, Internal								**0%**
Radiologic Exposure, External								**0%**
Terrorism, Radiologic								**0%**
AVERAGE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

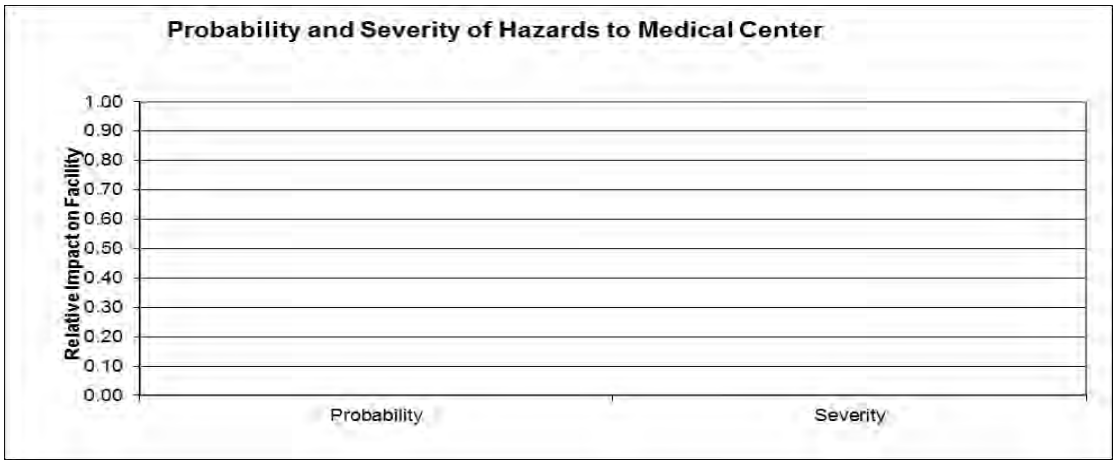
Summary of Health Facility Hazards Analysis

	Natural	Technological	Human	Hazmat	Total for Facility
Probability	0.00	0.00	0.00	0.00	0.00
Severity	0.00	0.00	0.00	0.00	0.00
Hazard Specific Relative Risk:	0.00	0.00	0.00	0.00	0.00

Hazard Specific Relative Risk to Health Facility



Probability and Severity of Hazards to Health Facility



Appendix B: HEALTH FACILITY CHECKLIST TOOL

D. GENERAL ASSESSMENT OF FACILITY

8. Facility Name: .....
9. Address: .....
10. Total number of beds: .....
11. Bed occupancy: .....
12. Description of the facility: …….

13. Capacity of the health facility: Health facility capacity: Indicate the total number of beds and the capacity to expand service in emergencies

Department	**Number of beds**	**Additional capacity**	**Remarks**
Medicine			
Surgery			
Paediatrics			
Obstetrics & Gynaecology			
Accidents & Emergency			
Others (specify)			
Total			

14. **Areas that can be used to increase functional capacity**: Indicate the features of areas and spaces that can be used to increase the facility's capacity in case of a major incident. Specify square meters, available services and any other information that can be used to evaluate its suitability for use during major incidents.

Location	**Area (m^2)**	**Water**		**Power**		**Remarks**
		Yes	**No**	**Yes**	**No**	

Note: Specify how each space can be adapted for different uses (for example, patient care, triage, outpatient care, observation)

E. HUMAN RESOURCES AT A&E

Staff	**Numbers (Full time / Part time)**
Specialists	
Medical Officers	
Clinical officers	
Nurses	
Others (volunteers)	
Training *Number of eligible staff that have had training at the different levels within the last 3 years*	**Number (%)**
Basic life support	
Advanced Trauma Life Support	
Advanced Cardiac Life Support	
Primary Trauma Care	
Other	

F. MAJOR INCIDENT PREPAREDNESS

QUESTION	**SCORE**			**COMMENTS**
	Low	**Average**	**High**	
1.ORGANIZATION OF THE HEALTH FACILITY`S DISASTER COMMITTEE				
VI. Does the facility have a disaster committee? *Low =Committee does not exist or there is no documentation*				

about the committee; Average = Committee exists with three or less disciplines represented, but it is not functioning; High = Committee exists with four or more disciplines represented, and it is functioning.				
VII. Is each member of the disaster committee aware of his/her specific responsibilities? *Low = Responsibilities have not been assigned or these responsibilities are not documented; Average = Responsibilities have been officially assigned but members are not familiar with them and/or they have not been implemented; High = All members know and meet the terms of their assigned responsibilities.*				
VIII. Has a space been designated and equipped for the facility's Emergency Operations Centre (EOC)? *Low = A space has not been designated for the Emergency Operations Centre or it cannot be verified; Average = A space has been designated but it is not properly equipped, or important documentation is not available; High = A space has been designated, it is properly equipped, and important documentation is readily available.*				
IX. Is an updated telephone directory of authorities (internal and external) and other contacts available? *Low =Directory does not exist or is not available for inspection; Average = Directory exists but it is not updated, committee members are not aware of it, or it only contains contact information for facility staff; High = Directory of internal and external authorities exists, it is updated, and committee members are familiar with it.*				
X. Are action cards available for all facility personnel? *Low = Action cards do not exist or they are not available for inspection; Average = There are not enough cards, and/or personnel are not familiar with them; High = All staff members have cards and know their contents.*				
2. OPERATIONAL DISASTER PLANS FOR INTERNAL OR EXTERNAL EMERGENCIES				
XXI. Does the facility have a major incident plan? *Low = The plan does not exist or a document is not available; Average = The plan exists but it is not operational, and/or it is not updated, and/or it has not been distributed,*				

and/or it has not been used in simulation exercises. High = The plan exists, it is operational, it is updated, it has been distributed, and it has been used in simulation exercises.				
XXII. Does the major incident plan address both internal and external emergencies? *Low = The plan does not address either or there is no supporting documentation; Average = The plan addresses only internal or only external major incidents; High = The plan addresses both internal and external major incidents.*				
XXIII. Does the plan identify specific actions that will strengthen critical care services in the facility? *Low = Actions are not included or are addressed only in document; Average = Actions are included but are only partially implemented; High = Actions are included and have been completely implemented.*				
XXIV. Are there procedures for activating and deactivating the plan and are personnel familiar with procedures? *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures are included in the plan, but personnel have not been trained; High = Procedures are included and personnel are familiar with them.*				
XXV. Does the plan address special administrative procedures for major incidents? *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures included in the plan, but administrative process is slow; High = Procedures included and personnel are familiar with how to implement them.*				
XXVI. Have funds been specifically allocated to carry out the major incident plan? *Low = Funds have not been allocated or there is no documentation showing budget; Average = Budget exists but it guarantees funds only for preparedness activities, or only for major incident response activities; High = Funds are allocated for both preparedness and response to major incidents*				
XXVII. Are procedures in place for expanding space when needed for major incident response and/or				

expanding space for critical care services? *Low =Space for expansion has not been identified or there is no documentation regarding expansion; Average = Space has been identified and personnel have been trained to carry out the expansion, but there are no resources for expansion; High = Procedures exist, personnel have been trained, and resources are in place to carry out expansion of space.*				
VIII. Does the plan include procedures for admitting patients in the event of a major incident, including forms and protocols for treating mass casualties? *Low = Procedures are not in place or there is no relevant documentation; Average = Procedures are in place but only forms are available or only protocol available; High = Procedures are in place and both forms and protocols are available.*				
XIX. Are procedures in place for triage, resuscitation, stabilization, and treatment? *Low = Procedures have not been defined or there is no documentation on procedures; Average = Procedures are defined and personnel have been trained, but there are no resources to implement procedures; High = Procedures exist, personnel have been trained, and resources are in place to implement procedures.*				
XXX. Does the plan address transport of patients and logistical support? *Low = Vehicles for patient transport and logistical support are not available or there is no relevant documentation; Average = There are insufficient vehicles and/or insufficient logistical support; High = Sufficient vehicles and logistical support are available.*				
XXI. Is coordination in place with other facilities in the local health services network and with entities providing Prehospital emergency care? *Low = Coordination plan is absent or there is no documentation that demonstrates coordination; Average = There is communication in the network, but there are no established procedures or protocols for major incident response; High = There is communication and coordination with other facilities in the health services network, and procedures and protocols are in place for major incident*				

response.				
XXII. Is the health facility's major incident plan linked to the local emergency response plan? *Low = The plans are not linked or there is no documentation that demonstrates linkage; Average =Plans are linked but not operational; High = Plans are linked and operational.*				
XIII. Does the major incident plan address specific procedures for referral of patients? *Low = Procedures do not exist or there is no documentation on the procedures; Average = Procedures exist but only on paper; High = Procedures are documented and personnel have been trained in process.*				
XIV. Does the plan include procedures for communicating with the public and media? *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures exist but personnel have not been trained; High = Procedures exist and personnel have been trained.*				
XXV. **What procedures are in place for staffing during major incidents?** *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures are in place but personnel have not been informed; High = Procedures are in place and personnel are aware of procedures.*				
XVI. Does the major incident plan address procedures for both internal and external evacuation of the facility? *Low = Procedures do not exist or there is no documentation for procedures; Average = Procedures are in place but personnel have not been trained, and/or evacuation routes are not adequate; High = Procedures are in place, personnel have been trained, and evacuation routes are clearly marked and unobstructed.*				
XVII. Are health personnel prepared to act in major incident situations? *Low = Personnel are not trained or there is no training program; Average = There is sporadic training but less than half of the staff is trained; High = There is an on-going*				

training program and more than 50% of personnel are trained.				
VIII. Does the facility have a major incident warning system and are personnel trained in the system? *Low = Warning system does not exist or there is no documentation for system; Average = Warning system is in place but personnel have not been trained in system; High = Warning system is in place and personnel have been trained in how to respond.*				
XIX. Does the facility have an alarm system and have staff been trained to respond? *Low = Alarm system does not exist or there is no documentation about system; Average = Alarm system is in place but personnel have not been trained in system; High = Alarm system is in place and personnel have been trained in how to respond.*				
XL. Has the facility carried out major incident simulation exercises and drills in the last year? *Low = Simulation exercises do not take place or there is no documentation about exercises; Average = Simulations are carried out but not each year; High = Simulations are carried out at least once each year and the plan is updated according to the outcome of the exercises.*				
4. HOSPITAL DISASTER OPERATION CENTER				
III. Does the plan indicate where the Hospital Disaster Operation Centre is to be located (with preference given to an area away from the A&E)? *Low=There is no designated area; Average=An area has been designated but is non-functional; High= An area has been designated, away from the A&E and is functional*				
IV. Have standard operating procedures been developed for the Operation Centre? *Low=No standard operating procedures; Average= Standard operating procedures available, but not updated; High=Standard operating procedures available and updated*				
5. AVAILABILTY OF MEDICATIONS, SUPPLIES, INSTRUMENTS AND EQUIPMENT FOR MAJOR INCIDENTS.				
VI. Are there reserves of medications available for				

emergency response? *Low= There is no reserve or there is no documentation demonstrating reserve; Average = Reserves of medications are sufficient only for daily, conventional use; High = There are sufficient reserves of medications for major incident response.*				
VII. Does the facility have reserves of supplies and treatment materials for major incident response? *Low = There are no reserves or no documentation regarding supplies for major incidents; Average = Reserves are adequate only for regular, daily use; High =Sufficient reserves are in place for major incident response.*				
VIII. Does the facility have a reserve of instruments for major incident response? *Low = There are no reserves or there is no documentation regarding reserve instruments; Average = Reserves are adequate only for regular, daily use; High = Sufficient reserves are in place for major incident response.*				
IX. Does the facility have life support equipment? *Low = The facility does not have this equipment; Average = Equipment available but only enough for daily use; High = Facility has sufficient equipment for use during a major incident.*				
X. Does the facility have personal protection equipment for major incidents? *Low = The facility does not have this equipment or there is no relevant documentation; Average = Reserves of this equipment are only sufficient for regular, daily use; High = Facility has sufficient equipment for use in a major incident.*				

APPENDIX C: KEY INFORMANT INTERVIEW GUIDE

NO.	**Question**	**Yes**	**No**	**Comment**
1.	Does the hospital have a disaster plan?			
2.	Has the hospital considered developing a disaster plan?			
3.	Is there a disaster planning committee?			
4.	Is it multi-disciplinary and include administrative members?			
5.	Does the plan detail actions to be taken for both internal and external disasters?			
6.	Is the plan widely distributed and readily available throughout the hospital?			
7.	Is there an individual designated as a disaster coordinator?			
8.	Have other key position holders who have a role in disaster management been identified?			
9.	What are the key positions?			
10	Does the plan include lines of authority, role responsibilities, and provide for succession?			
11	Are those who are expected to implant and use the plan familiar with it?			
12	Does the hospital have on going, mandatory disaster training programs?			
13	Does the hospital conduct an annual exercise?			
14	Does the exercise ensure all key participants are familiar with the contents of the plan?			
15	Is there a precise plan of action whereby at short notice , multiple casualties can be received and: •Identified			

	•Triaged •Registered •Treated in designated treatment areas •Admitted or transferred •Transported as needed			
16	Are sufficient equipment, supplies, and apparatus available, in an organized manner, to permit prompt and efficient casualty movement?			
17	Has provision been made for a large influx of casualties to include such factors as (Bed arrangements, personnel requirements, and extra resources such as interpretive services, linen, pharmaceuticals, and dressings?			
18	Has provision been designated (e.g. space, equipment) for extra people who may come to the hospital to provide services (e.g. volunteers, outside agencies)			
19	Does the hospital have a Disaster Operation Centre?			
20	Have provisions been made to identify the procedures for handling requests for information from the media?			

APPENDIX D: BUDGET

ITEM	**COST**
Printing	R 1000
Internet	R 500
Phone calls	R 1000
Transport	R 3000
Statistician	R 3000
TOTAL	**R 8,500**

APPENDIX E: PARTICIPANT CONSENT FORM

TITLE OF THE RESEARCH PROJECT: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA

UNIVERSITY: University of Cape Town (UCT)

FACULTY: Health Sciences

DIVISION: Emergency Medicine

STUDENT: Dr. Joseph Kalanzi

STUDENT NUMBER: KLNJOS004

EMAIL ADDRESS: Kajubi.josef@gmail.com

CONTACT NUMBER: +256782430333

SUPERVISOR: Dr. Wayne Smith

Head: Disaster Medicine and Special Events

Tel: +27 (0)829910760

Email: Wayne.Smith@westerncape.gov.za

Dear participant,

You have been chosen to take part in this cross-sectional study that will describe the state of preparedness of health facilities for major incidents in Kampala through key informant interviews and a hospital Accident and Emergency checklist. Through a set of planned visits of hospitals and meetings with stake holders, the investigator will interview stakeholders and assess Accident and Emergency units at teaching hospitals in Kampala. The sample size is of

four teaching hospitals namely Mulago National Referral Hospital, Mengo Hospital, Nsambya Hospital and Lubaga Hospital. The data collection tools will include; an interview guide, a Hazard Vulnerability Analysis tool and a standardized facility check list. Data collected will include: general information about the facilities (number of beds, bed occupancy and extra space that can be used during major incidents), human resources and major incidents preparedness.

We will conduct semi structured one-one interviews of key staff in hospitals that have been selected because of their role in major incident management in hospitals. These will be: These will be: hospital directors, clinical heads (clinicians in charge of medical and surgical services) of A&Es and heads of support services (laboratory, radiology, security) also selection of clinicians, nursing and support staff who are not in managerial roles (these will be selected randomly using their staff identification numbers).A total of 60 participants; 15 from each hospital, will be recruited based on their job descriptions that stipulate their management roles and the role they may need to be expected to play in a major incident response.9 personnel from management structure of the hospital will be approached for this study. This will include personnel from the management of both the hospital and managers of clinical and support structures. Furthermore, 6 personnel who are directly responsible for clinical duties will also be approached to form part of the study. The interviews will take place on the hospital premises, in a private place designated by the hospital administration and will last approximately thirty (30) minutes. The data will be stored on a password protected computer, in secure data sheets, with restricted access to the database. There is no possible risk of participation and the data collected will be handled by the researcher only. The interviews will be kept confidential, and once the information has been transcribed, no interview subject details will be kept.

Declaration by participant

By signing below, I *(name)* ……..……. agree to take part in a research study entitled: AN ANALYSIS OF HEALTH FACILITY PREPAREDNESS FOR MAJOR INCIDENTS IN KAMPALA.

I declare that:

- I have read or had read to me the participant information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.

Signed at (*place*) .....…..……. on (*date*)……...…….. 2014.

.....

Signature of participant

Declaration by investigator

I *(name)* ……..…… declare that:

- I made explained the study information to

  ……

- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.

Signed at (*place*) .....…..…….. (*Date*) ……...…… 2014.

.....

Signature of investigator