UNIVERSITY OF NAIROBI

AN INVESTIGATION INTO DISASTER MITIGATION AND READINESS IN HOSPITALS WITH REFERENCE TO DESIGN AND FACILITIES

(CASE STUDY: NAIROBI AREA)

BY

NGURU E.M.

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DECLARATION

I, NGURU ERIC MUNENE, hereby declare that this project is my original work and has not been presented for a degree in any other University.

Signed: ..... Date: 4/7/2008.

NGURU E.M

DECLARATION OF THE SUPERVISOR

This research has been submitted for examination with my approval as a University Supervisor.

Signed: ..... Date: 4/7/2008

DR. MASU S.M.

B.A. (Bldg. Econ.) Hons; M.A. (Bldg. Mngt), Ph.D. (University of Nairobi)
M.A.A.K. (Q.S); A.C.I. Arb; F.I.Q.S.K; R. Q.S

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DEDICATION

This work is dedicated to my parents Josphat and Juliet Nguru; Members of my sib; Tony, Davie, Joyce, Bancie, Jose and Brian. My fountains of joy and pillars of love, whose dedication and commitment have inspired me throughout my life.

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LIST OF ABBREVIATIONS AND ACRONYMS

1. ADA	Americans with Disabilities Act
2. ADAAG	Americans with Disabilities Act Accessibility Guidelines
3. ASET	Available Safe Egress Time
4. BORAQS	Board of Registration of Architects and Quantity Surveyors
5. BS	British Standards
6. CBD	Central Business District.
7. CCTV	Closed Circuit Television.
8. CO_2	Carbon Dioxide
9. EMCA	Environmental Management and Coordination Act.
10. EOC	Emergency Operations Centre
11. HERDS	Hospital Emergency Data System
12. ICS	Incident Command System
13. ICTA	International Commission on Technology and Accessibility
14. ISA	International Symbol of Access
15. ISO	International Organization for Standardization
16. KBS	Kenya Bureau of Standards
17. KICC	Kenyatta International Conference Centre
18. LB	Libra Balances
19. MOH	Ministry of Health
20. NCC	Nairobi City Council.
21. NCPD	National Council for Persons with Disabilities
22. NEMA	National Environmental Management Authority
23. NFPA	National Fluid Power Association
24. NGO	Non Governmental Organizations
25. RSET	Required Safe Egress Time
26. SPSS	Statistical Package for Social Sciences
27. UN	United Nations
28. US	United States

OPERATIONAL DEFINITION OF TERMS

Disaster – disaster is an extreme disruption of the functioning of society that causes widespread human, material or environmental losses that exceed the ability of the affected societies to cope only using their own resources without outside intervention. (International Federation of the Red Cross Society)

Egress: this is the simple, direct escape from the building when the alarm is sounded. (Stollard and Abrahams, 1999)

Disaster Management: is an organized analysis planning, decision making and assignment of available resources to mitigate, prepare, respond to and recover from the effects of disasters.

Mitigation: is the discipline of attempting to reduce the effects of disasters when they occur.

Occupational Load: refers to the probable number of occupants in a building

ABSTRACT

The prime aim of this study was to evaluate the extent to which emergency planning is incorporated in the design of hospitals and also to examine the stock of emergency equipments all with reference to safe evacuation of patients from hospital wards, protection of expensive equipments and medicine if and when an internal disaster occurs. This included examining the adequacy of these facilities in the buildings as well as how the planning and building regulations provide for disaster preparedness on patient safety during evacuation.

Basically, the study relied on responses from questionnaires and interviews with architects, the hospital management personnel and members of the NCC fire brigade. Surveys of sampled hospitals were also conducted.

Research findings indicated that the aspect of safety in evacuation of patients is not put into ample consideration during design of emergency planning. This is mainly due to lack of awareness by the planning authorities, of this special group as well as inadequate building regulations and legislations. This may be due to lack of a central enforcing authority to implement even the few existing legislations that consider the needs of the emergency measures in buildings.

The study concludes that a great deal needs to be done to improve the emergency planning facilities required for safe evacuation of patients from hospital wards since only little attention is given to them during design of hospitals. The scant planning and building regulations do not compel architects planning authorities and the hospital personnel to consider emergency planning needs for patients.

The study recommends that creation of a central enforcing authority to ensure that the patients' needs are considered in building design will be a milestone towards achieving objectives of disaster preparedness in hospitals. For future developments, emergency planning requirements for safe evacuation of patients should be considered in the planning stages of building design.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

1.1.1 Background of the study

Kenya has faced many disasters since independence, 1963. The 'May 2008' fire that gutted a section of the Garissa provincial hospital, the 'January 2006' collapse of a building under construction at Nyamakima, the '2004' fire at Pumwani Hospital, the '2004' arson fire at City Hall, the 'August 1998' bombing of the Co-operative House in Nairobi and the 'May 1996' Sunbeam Supermarket tragedy just to mention a few, come to mind.

Internationally, we recognize such events as the September 11, 2001 massive tragedy of terrorist attack of the world trade centre, in America and the subsequent events which claimed over 3000 lives lost and property worth billions of dollars destroyed.

This demonstrates vivid evidence that no single premise is exempt from the devastation of a tragedy and that most tragedies are unpredictable. Disasters have negative aftermaths; whatever the reason for disasters the impact is always painful, tragic and devastating. Therefore, this calls for a need to adequately prepare for, if and when a disaster strikes. The paradox of planning and regulation bodies is that, those who spearhead or those bestowed with the mandate to formulate, implement and oversee relevant emergency measures, only come to board when a major disaster occurs.

According to Westgate (1976), a disastrous event is the manifestation of an interaction between extreme physical or a natural phenomena and a vulnerable human group. The international federation of the red cross and the Kenya draft paper policy (2004), defines a disaster as 'an extreme disruption of the functioning of the society that causes widespread human, material or environmental losses that exceed the ability of the affected societies to cope only using their own resources without outside intervention.

Events such as earthquakes, floods and cyclones by themselves are not considered disasters. Rather they become disasters when they adversely and seriously affect human life, livelihoods and property.

Disasters may come within days of prior warning or can happen without any warning at all.

Ordinarily, disasters can be categorized into two broad classifications.

(i) Natural disasters e.g. earthquakes, tornadoes, hurricanes, tsunamis et al.

(ii) Man made disasters e.g. bomb explosions, nuclear explosions, terrorist attacks, fire outbreaks, chemical spills, collapse of buildings and air contamination among others.

1.1.2 Disaster Management Policy (Emergency Management Policy)

Emergency Management is the discipline of dealing with and avoiding risks e.g. (Emergency evacuation, quarantine, mass decontamination et al.)

According to the international federation of the Red Cross society, disaster management is defined as an organized analysis, planning, decision making and assignment of available resources to mitigate, prepare, respond to, and recover from the effects of disasters. It involves preparing, supporting and rebuilding the society if and when natural or man made disasters occur.

In general, any disaster management policy is the continuous process where all the individuals, groups and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from the hazards. Effective emergency management relies on thorough integration of emergency plans at all levels of governmental and non governmental involvement. Activities at each level (individual, group, community) affect the other levels.

The academic trend is towards using the more comprehensive term 'disaster risk reduction', particularly for emergency management in a development management context.

1.1.3 Phases and professional activities

The nature of emergency management is highly dependent on economic and social conditions local to the emergency or disaster. This is true to the extent that disaster relief experts such as Fred Cuny have long noted that; in a sense, the only real disasters are economic and that the cycle of emergency management must include long term work on infrastructure public awareness, and even human justice issues. This is particularly important in developing nations like Kenya.

The process of emergency management involve to a large extent, but not always, of four phases.

Mitigation, preparedness, response and recovery

Fig.1.1: A diagrammatic representation of the four phases in emergency management

Source: <Wikipedia <em cycle.jpg>. Internet link

- **Mitigation**

According to (Ndua 2006), Disaster preparedness assumes that a disaster will encroach and focuses on laying down strategies for response and structuring a recovery framework. Mitigation efforts attempt to prevent hazards from developing into disasters altogether or to reduce the effects of disasters when they occur.

The mitigation phase differs from the other phases because it focuses on long term measures for reducing or eliminating risk. The implementation of mitigation strategies can be considered as a part of the recovery process if applied after a disaster occurs. However, even if applied as part of recovery efforts, actions that reduce or eliminate risk overtime are still considered mitigation efforts. A precursor activity to the mitigation is the identification of risks. Physical risk assessment refers to the process of identifying and evaluating hazards.

In risk assessment, various hazards [earth quakes floods, riots] within a certain area are identified. Each hazard poses a risk to the population within the area so assessed.

The hazard specific risk [Rh] combines both the probability and the level of impact of Specific hazard. However if there is no vulnerability, then there will be no risk.

e.g.: an earthquake in a desert where no one lives.

Risk assessment equation

$Rh = H * Vh$

Where,

Rh = the hazard specific risk

H= the hazard

Vh = populations vulnerability to the hazard

Source: [Wikipedia <ra equation>] Internet link.

- **Preparedness**

In the preparedness phase, emergency managers develop plans of action if the disaster strikes.

Common preparedness measures include:

a) Communication plans with easily understood terminology and chain of command.
b) Development and practice of multi-agency co-ordination and incident command.
c) Proper maintenance and training of emergency services.
d) Stockpiling, inventory, and maintenance of supplies and equipment.
e) Development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans.

Source: <Wikipedia em phases > internet link

An efficient preparedness measure is an emergency operations centre (EOC) combined with a practiced region-wide doctrine for managing emergencies. Another preparedness measure is to develop a volunteer response capability among civilian populations. Since volunteer response is not as predictable and easy to plan as professional response, volunteers are most effectively deployed on the periphery of an emergency.

- **Response**

The response phase includes the mobilization of the necessary emergency services and first respondents in the disaster area. This is likely to include a first wave of core emergency services such as firefighters, police and ambulance crews. They may be supported by a number of secondary emergency services, such as specialist rescue teams.

In addition, volunteers and non-governmental organizations (NGO_S), such as the local Red Cross branch or St. Johns Ambulance, may provide immediate practical assistance such first aid provision. A well rehearsed emergency plan developed as part of the preparedness phase enables efficient coordination of rescue efforts. Emergency plan rehearsal is essential to achieve optimal output with limited resources.

In the response phase, medical assets will be used in accordance with the appropriate triage of the affected victims. Individuals are often compelled to volunteer directly after a disaster.

Volunteers can be both a help and a hindrance to emergency management and other relief agencies. Volunteers under the direction of an organizing agency can provide solutions to the long term effects of a disaster.

- **Recovery**

The aim of the recovery phase is to restore the affected area to its previous state. It differs from the response phase in its focus; recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. Recovery efforts are primarily concerned with actions that involve rebuilding destroyed property, re employment and the repair of other essential infrastructure.

An important aspect of effective recovery efforts is taking advantage of a 'window of opportunity' for the implementation of mitigative measures that might otherwise be unpopular. Citizens of the affected area are more likely to accept more mitigative changes when a recent disaster is in fresh memory.

Disaster preparedness measures should be taken in advance to ensure that people and institutions are able to respond and cope with the effects of a given disaster. Effective disaster management should be based upon a comprehensive and continuous assessment of vulnerabilities and risks.

This will ensure reduced loss of lifes and little or no destruction of property if and when a disaster strikes.

For the purposes of this research study, disaster management was limited to mitigation and preparedness phases of emergency management policy.

1.2 Problem statement

Recent world events have demonstrated that healthcare facilities are not exempt from the devastation of a disaster.

For instance, according to the England journal of medicine:-

- 'At least thirty psychiatrist patients, some of whom were sedated, were burnt alive at a hospital in western Belarus in October 2006, after a patient set fire to the building', the emergencies ministry said.
  Hospital staff and the medical personnel had attempted to fight the blaze on their own, delaying the deployment of emergency services. By the time the fire brigade arrived, one of the hospital buildings was completely ablaze.
- An employee accidentally started the blaze while conducting a test in a hospital's microbiology laboratory in March 2007, in Helen Ellis memorial hospital, Canada destroying property and drugs worth millions of dollars.

In the Kenyan context, we recognize events such as the May 2008 fire that gutted a section of the Garissa provincial hospital. A nurse and a dentist were injured. The two medics were evacuated by the colleagues and the pubic who were assisted by the military personnel based in the area. US marines who were drilling boreholes in the towns' suburbs later joined in fighting the fire, which destroyed drugs worth millions of shillings and other equipments at the hospitals pharmacy department.

Source: Daily nation 6th may 2008 (Reference)

Events such as the 2008 invasion of Moi referral hospital in Eldoret, the 2004 fire in Pumwani hospital, maternity wards, also come to light.

Disasters such as fire, bomb explosions, earthquakes, gas leakage and even chemical spills are likely to happen at any point in time and without warning.

The main factor which differentiates healthcare buildings from other occupancies is that, no other building type presents such a wide spectrum of occupants with such varying physical capabilities or has such a need for the main operational functions of the building to remain active during a disaster.

In health care buildings, patients have differing physical abilities and a range of psychological characteristics which all impact on the degree of assistance that they will require to evacuate from a building safely.

In the case of fire for instance, a bed-ridden patient though noticing fire would not be in a position to escape unless otherwise assisted. So is the case with a mentally challenged individual who might in fact start the fire in a hospital. Heath care premises also involve use of extremely expensive equipments such as the magnetic resonance plant, X ray machine, oxygen generating plant, incubators et al. and the laboratory chemicals which if destroyed by fire may render the hospital non-operational overtime.

Adequate facilities for safe evacuation of patients and even for combating the hazard should therefore be in place. Proper disaster response requires proper preparedness. Each disaster is unique and each hospital is peculiar and exists within a unique community environment.

Warranted appreciation is given to the fact that under normal hospital operations, it's not possible to carry out fire drill unless if it is conducted under controlled environment. The use water as an extinguishing agent for fire suppression also is almost an impossibility due to varying conditions of patients and the sensitivity of hospital equipments.

However, certain elements are universal and should be considered in any hospital internal disaster preparedness plan e.g. fire suppression services, [co_2 and other relevant agents], rescue alarms, communication channels, signage, exit routes, safe rooms, fire education programs, installation of med sled and or evacuation chair, chutes, extrication kit, spinal board, vacuum splints, helipad, design parameters for stairs (risers and treads) and handrails, ramps, training of personnel, documented emergency policies et al.

Health premises thus present a unique problem in terms of evacuation in a disastrous situation. This hence requires adequate facilities as well as services of specially trained personnel. The method of escape or evacuation will depend on the particular disaster its magnitude at the time and the physical ability of the individual among other factors. This hence calls for highly organized degree of co-ordination for which manpower capacity and personnel are critical ingredients.

Emergency evacuation remains unattended in the sense that it does not receive adequate attention. In the words of Mahatma Gandhi (1887), a society that fails to protect and care for the weak and the powerless has no claim for being a civilized nation. Disaster mitigation and readiness in hospitals with reference to design and facilities is an issue that has not been adequately addressed by the planning, and regulatory authorities, design professionals, contractors and the society at large.

According to Dawson (1999), without a planned egress procedure, many people face the risk of being trapped in the same buildings that were designed to accommodate them. Various factors have contributed to this inadequate attention.

The building regulations as annotated in the building code do not draw a clear cut distinction between an office block building and a hospital building. According to Nduli (1998), the building code has been found to be outdated and inconsistent with the current needs of Kenyan construction industry.

its regulations also are found to have been based on preambles of a British document of 1948.

In 1998, a presidential commission charged with a mandate of reviewing the Kenyan building code, found out that not only was it inconsistent but also outdated in comparison to its counterpart the 'the British Building Code' which since its formulation has undergone series of reviews to make it user friendly (Ibid).

Though such a building code cannot be deemed obsolete, sufficient modifications need to be incorporated in it to make it adaptable for current user needs.

The National Environmental Management Authority [NEMA] which is a regulatory body, through the Environmental Management and Co ordination Act, has made it mandatory for all public buildings to have ramps for the physically challenged.

However, on the basis of research questions, one would ask,

- Would someone categorize patients in terms of physical disabilities?
- Who is responsible for ensuring that assented legislations and regulations are implemented?
- Are the hospital management personnel involved by the design professionals in design of hospitals during preliminary stages?
- Of the many existing and upcoming hospitals, how many incorporate patients based emergency planning techniques both in terms of tools and manpower and if any, are they adequate?
- Is the hospital personnel trained to respond to disasters among other duties?
- What is the future of patient safety during disastrous occurrences in the wake of a society where disasters are likely to subsist more often than not?

1.3 Objectives of the study

1.3.1 To evaluate the adequacy of facilities that have been incorporated in hospitals to aid evacuation of patients in the event of a disastrous occurrence.

1.3.2 To find out whether the basic design criterion by architects factors-in 'safe evacuation of patients' without compromising space requirements and the overall planning standards.

1.3.3 To find out whether the hospital personnel (attending nurses, doctors and rescue team) are trained to respond to disasters among other duties.

1.3.4 To recommend on the special measures that should be taken to aid safe evacuation of patients from hospital wards as well as protection of equipments during internal disasters; both in terms of design, human resource and facilities

1.4 Research hypotheses

H01 Most of the hospitals in Kenya are not equipped and furnished with relevant facilities and services [tools and human resource] that would aid efficient evacuation of patients from hospital wards in the event of an internal disaster.

HA1 Most of the hospitals in Kenya are equipped and furnished with relevant facilities and services [tools and human resource] that would aid efficient evacuation of patients from hospital wards in the event of an internal disaster.

H02 Most of the hospitals in Kenya are not designed in the basic design criterion such as to aid safe evacuation of patients from the wards in the event of an internal disastrous occurrence.

HA2 Most of the hospitals in Kenya are designed in the basic design criterion such as to aid safe evacuation of patients from the wards in the event of an internal disastrous occurrence.

1.5 Justification and significance of the study

More often than not, when a disaster strikes, many lifes are lost because; either help does not reach victims of disasters in good time or due to inadequate or poorly planned safety and emergency measures and facilities as well.

Factors affecting safe evacuation of patients are substantial, including the level and competence of staff present in an evacuation situation, patient distribution and the hospital management provisions in place. There are two critical time periods during evacuation [ASET] Available Safe Egress Time and [RSET] Required Safe Egress Time.

This research project primarily aimed to analyze requirements of safety during evacuation of patients, then introduce the relationship between ASET and RSET for patients in the event of an internal disaster in acute healthcare premises and weigh this against the available resources. The research further, aimed then to narrow down into issues concerned with the facility requirements and their availability, as well as design considerations in relation to disaster preparedness in hospitals.

The outcome would contribute to the development of a revised internal disaster risk assessment method for hospitals by determining the benefits or otherwise, of using the condition of each patient to predict their evacuation capabilities and the associated implications, and focus on policies relating to the issue as well; and then come up with recommendations to help ameliorate the possible aftermaths of internal disastrous occurrences.

This would hence create an insight of the need for optimizing preparedness for safe evacuation patients if, and when an internal disaster strikes.

1.6 Research methodology

1.6.1 Data collection

The research adopted both primary and secondary methods of data collection. Primary data was collected through conducting direct interviews; questionnaires were administered to the City Council of Nairobi (Fire Brigade personnel), the hospital management personnel and architectural firms in Nairobi.

A retrospective direct observational investigation (surveys) was also incorporated.

The data so collected was used to examine the views of different groups of people about the concerned topic as well as their recommendations.

Secondary data was sourced from the various published and unpublished journals relating to disaster management, textbooks, workshops and reports as well as accessing the internet. Other unpublished work and thesis on the subject were also studied to give view of the topic.

Articles on construction review and other scholarly works touching on the topic were used to achieve a contemporary edge to the research.

1.6.2 Data analysis

First, data mining, the process of sorting through large amounts of data and picking out relevant information was done so as to obtain relevant categories of qualitative and quantitative data sets.

Data mining is also described as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data and "the science of extracting useful information from data sets or databases.

For the purposes of analysis, a Statistical Package for the Social Sciences) (SPSS), a computer program used for statistical analysis, was used. Data analysis is the process of examining and summarizing data with the intent to extract useful information and develop conclusions.

In describing the type of data collected, frequency of emergency drills and checks, a histogram was used; histogram is a graphical display of tabulated frequencies .

It shows what proportion of cases fall into each of several categories. Multivariate data on priority levels of various facilities requirements with reference to the different patient categories was analyzed by use of frequency distribution tables and percentages.

Inferential statistics (drawing inferences from research findings) was used, to test the significance level of disaster mitigation and readiness in hospitals with reference to design and facilities.

The underlying principles in inferential statistics were that, the sample was representative of the population for the inference prediction; the dependent variable was subject to error, this error is assumed to be a random variable, with a mean of zero; the independent variable is error-free and that the errors follow a normal distribution.

1.6.3 Data Presentation

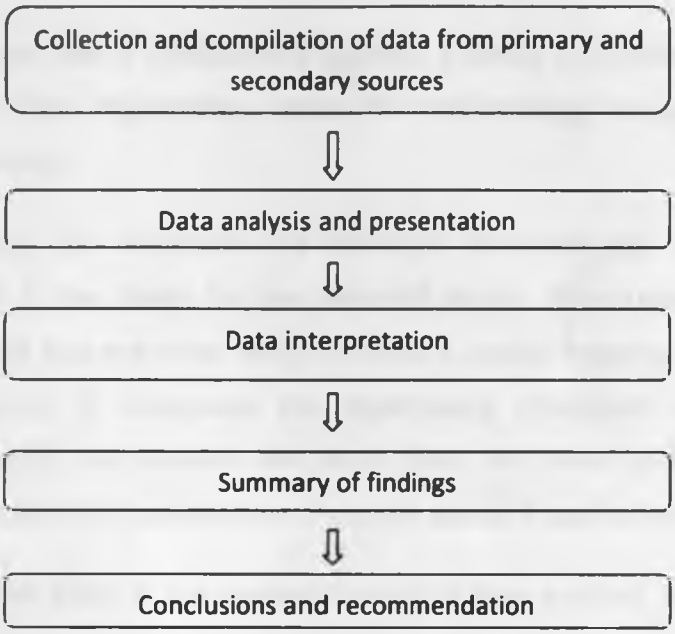
The data so analyzed was presented in forms of tables, bar charts and pie charts.

1.6.4 Assumptions of the study

Certain elements of the data could not be accurately given due to the sensitivity of organizations' ethics.

Therefore, for the purposes of this study, the hospitals are assumed to have been designed by a qualified design consortium.

Fig 1.2: Methodology flow chart



Source: Cooper, D.R, Schindler, P.S (2003) Business Research Methods, 8th ed., Irwin, McGraw-hill

1.7 Scope and limitations of the study

Due to time and financial constraints, the research was limited to a manageable geographical and elemental scope.

Nairobi area was chosen due to its geographical location and the high population both in persons and number of hospitals. Nairobi area has a total of seventy three hospitals and health centres hence a study of the area would give a representative sample of other hospitals in Kenya.

For the purposes of this study, research was limited to elements of rapid onset emergencies [fire and bioterrorism attacks, which include bomb explosions].

1.8 Organization of the Study

The research is organized in five sections as follows:

Chapter one is introductory section. It briefly introduces the problem statement, objectives, hypotheses, research methodology, scope and the justification of the study.

Chapter two discusses the literature reviewed and the theoretical framework, which is the basis for the research study. It includes the emergencies to be studied that are most likely to befall a typical hospital; these include: - fire, and terrorism. It discusses the emergency mitigation measures, preparedness strategies and facilities that have been, and need to be put in place for the safe evacuation of patients from hospital wards if and when a disaster occurs.

Chapter three is the research methodology section. It lays down a background of the research, the population being studied and clearly shows how the sample sizes are systematically arrived at. It also shows the sampling techniques used in this particular study. The data collection instruments and procedures are also discussed.

Chapter Four is the data presentation and analysis section. In this section, the information that is collected from the field is organized, analyzed using a computer program (SPSS) and presented in the form of tables bar charts and pie charts. The responses of various groups of people to whom questionnaires were administered as well as oral interviews conducted are tabulated, analyzed and presented. A summary of the findings is given and the problems encountered in the field are also annotated.

Chapter Five gives the conclusions and recommendations made based on the results of the findings. Suggested areas of further research are also mentioned.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

According to Cordeiro and Deshpande (2005), the general observations, studies, research, review and reports clearly point out that some sections of people are most affected by disasters. People belonging to certain vulnerable and disadvantaged sections such as invalids, women, children and persons with disabilities are badly affected due to various reasons. Sheer ignorance, apathy, inadequate regulations, discrimination and negative attitudes towards these groups of people are some of the factors that play a vital role in inflating the vulnerability of these groups of people during disastrous occurrences.

Any building should be equipped with emergency planning facilities as an effective means of disaster preparedness. Healthcare buildings were chosen in particular because they host dense populations, store very expensive equipments (magnetic resonance plant, oxygen generating plant, x-ray machine et al.), store expensive drugs and present a unique problem in terms of evacuation in a disastrous situation.

The main factor which differentiates healthcare buildings from other occupancies is that no other building type presents such a wide spectrum of occupants with such varying physical capabilities or has such a need for the main operational functions of the building to remain active during a disaster.

In health care buildings, patients have differing physical abilities and a range of psychological characteristics which all impact on the degree of assistance that they will require to evacuate from a building safely. This hence requires adequate facilities and services of specially trained personnel. In the case of fire for instance, a bed-ridden patient though noticing fire would not be in a position to escape unless otherwise assisted. So is the case with a mentally challenged individual who might in fact start the fire in a hospital.

The method of escape or evacuation will depend on the particular disaster its magnitude at the time and the physical ability of the individual among other factors. This hence calls for highly organized degree of co ordination, for which manpower, capacity building and personnel are critical ingredients.

Waneno (2007), talks about disaster preparedness in high rise buildings with reference to the physically challenged. In his study, he found out that, the physically challenged persons are not considered during design of buildings. He does not mention about the hospital buildings and the patients in the wards who so in the case of internal disasters face the risk of being engulfed and trapped in the same buildings that were meant to accommodate them, if they don't receive adequate attention.

Ndua (2006) discusses to a great extent, disaster management in Kenya. He looks at preparedness and management at a general level. In his study, he found out that the special groups of people such as the persons with disabilities are not considered during design of buildings, who should rightly so, be given special consideration owing to their differing physical abilities and a range of psychological characteristics which all impact on the degree of assistance that they will require to evacuate from a building safely.

Disaster mitigation and readiness in hospitals is an issue that has not been adequately addressed by the design professionals, developers, the standards authorities, contractors and the society at large.

2.2 Disasters in heath care buildings

There are many disasters that have occurred in hospital buildings as mentioned in chapter one of this research work. For the purposes of this particular study, disasters were limited to rapid onset emergencies; that is fire and bioterrorism attacks. Preparedness is limited to safe evacuation of patients and protection of valuable hospital equipments.

2.2.1 Fire

Blaze, conflagration or inferno all refer to the same thing, fire. Fire, according to Waneno (2007), can be a good servant and a bad master. It can be useful but it is also very lethal. Fire in hospital buildings may be brought about by chemical reactions in the laboratories, electric system failures, malicious intentions of psychiatrist patients et al.

The fire risks inherent in different types of buildings are normally brought to board when serious fatal fires attract public attention such as great London fire in 1666 and 'the 2004' arson fire in City Hall, Nairobi.

According to Stollard and Abrahams (1999), the objectives of fire safety should be integrated with the more general objectives of the architectural designs. This is in a bid to ensure that a building fulfils the fire regulations as well as meeting the architectural design requirements such as the internal spatial arrangement of the building.

According to Scott (1976), what is alarming is the fact that when new fire regulations are introduced, they only apply to new buildings and many thousands of existing structures are ignored. This especially applies to Kenya. Many new buildings are forced to comply with new fire regulations, while the planning and regulatory bodies ignore the implementation of these new fire regulations to older buildings.

It is important to ensure that fire safety measures as well as their design in buildings are properly implemented to ensure that the spread of fire in buildings is minimized. Although there are legislations to enforce the existing fire regulations, particularly with regard to means of escape, it still becomes ludicrous to incorporate fire check doors and escape ladders if flames and fumes can travel through hollow partitions and roof voids engulfing the building in minutes. This is particularly the case, when the additional costs of incorporating adequate fire stops into a new structure from its inception are nominal. According to Stollard and Abrahams (1999), study of the injury statistics of fire; the patterns of fire in hospital buildings are quite different from that in other building types.

In hospital buildings ,nearly nine out of ten injuries are the result of causative fires with the most common cases being laboratory test failures and psychiatrist patients setting the building ablaze.

Objectives of fire safety

a) Life safety
b) Property protection

The following tactics can fulfill the objectives

a) Prevention -controlling ignition and fuel sources.
b) Communication-informing the occupants and triggering of active systems.
c) Escape -ensuring the occupants of the building and the surrounds are able to move to places of safety before they are threatened by heat and smoke.
d) Containment- ensuring that the fire is contained within the smallest possible area limiting the amount of property likely to be damaged and the threat to life safety.
e) Extinguishment-ensuring the fire can be extinguished quickly and with minimum consequential damage to the building.

Typical Fire suppression model

In case of fire the first person at the scene will

a) Alert staff patients and visitors.
b) Pull lever in the fire alarm box.
c) Call fire emergency department.
d) Evacuate everyone in immediate danger from the area.
e) If possible, confine the fire by using extinguisher and closing all doors and windows.

If trapped in a room during fire

a) Place cloth material under door to prevent smoke from entering.
b) Retreat and close as many doors as possible between you and the fire.
c) Be prepared to signal for help from a window.
d) If caught up in smoke, drop to your hands and knees and craw.
e) If clothes catch fire, stop drop and roll.

To use a fire extinguisher, remember, **[PASS].**

P- Pull the safety pin. Twist first to break plastic tie and then pull.

A- Aim at the base of the fire.

S- Squeeze the trigger hands together.

S-sweep water from side to side across the base of the fire.

2.2.2 Bomb explosions, terrorist attacks and contaminations

Terrorism is the unlawful use or threatened use of force or violence by a person or an organized group against people or property with the intention of intimidating or coercing societies or governments, often for ideological or political reasons.

Hospital facilities may be potential targets for threats because they may:-

a) Provide essential functions within a free society.
b) Command stature as prestigious institutions.
c) Serve as historic or local landmarks and community icons.
d) Have owners, operators, high profile patients, physicians, or other associated international and corporate ties or affiliations with certain nationalities, ethnic backgrounds, or religions.

Safety and design considerations against terrorism include but not limited to; Communal space within buildings, entry phones, closed circuit television,(CCTV) Integrated receptionist, searches and evacuations, proper designing of the structural elements, high performance glazing systems and 'Keep out of zone principle'.

Typical Response Guidelines for Bioterrorism Attack

a) Know that terrorists seek visible targets where they can avoid detection before or after an attack.
b) Learn about the different types of terrorist weapons including explosives, kidnappings, hijackings, arson, shootings, and chemical and biological substances.
c) Prepare to deal with terrorist incident by adapting many of the same disaster response techniques used to prepare for other crisis and emergencies.
d) Be alert and aware of the surrounding area. The nature of terrorism suggests there may be little or no warning.
e) Learn where emergency exits and stairs are located. Think ahead about evacuating a building, subway or a congested public area.
f) Notice immediate surroundings. Be aware of heavy or breakable objects that could move, fall, or break in an explosion.

2.3 Risk analysis of escape time from buildings

Emergency evacuation is the primary fire safety concern for safe building designs and a responsive evacuation system is one of the most important fire safety measures. Apart from the building layout, directional signage and exit locations. the total width of exits is the essence of an efficient building evacuation system. The imposed exit width for buildings in the prescriptive building codes, acts as a practical criterion of exit door designs in evacuating building occupants within an "explicit" evacuation time.

Current exit designs appear to be satisfactory with respect to the statutory requirement of carrying capacity. Occupant load refers to the probable number of occupants in a building space. The probable maximum value of the occupant load is an essential parameter for building egress designs.

In the event of a fire in a building compartment, the time available for occupants to safely evacuate the compartment, the Available Safe Egress Time (ASET), depends on the time of fire detection and on the time of the onset of hazardous conditions. In order to estimate these two times a dynamic simulation of the developing fire environment in the compartment is required. Also required are specific criteria for the simulation of detection and onset of hazard.

A user oriented computer program which carries out the required simulations and provides estimates for the ASET was developed by L.T. Wong; N.K. Fong Department of Building Services Engineering, the Hong Kong Polytechnic University; Hong Kong, China.

Theme of the model

To model the evacuation time from buildings in the event of emergencies based on occupant load, looking specifically at the exit width as a design parameter. The results showed that the building occupant load, occupant-load ratio, total exit width and specific flow rate at the exit significantly affect the risk to evacuees.

For fire growth in a particular fuel assembly, a single program run can be used to evaluate the ASET from enclosures (which are assumed to contain the fuel assembly) of different heights and areas, and under a variety of different detection and hazard criteria. The program can be used in either an interactive or batch mode. A safe egress system should be designed so that the required safe egress time (RSET) of the building occupants is shorter than the available safe egress time (ASET) (Cooper and Stroup, (1985); Nelson and Mowrer, (2002).

In a fire emergency, the occupants who are unable to evacuate sufficiently fast would be exposed to fire hazards (Hong Kong Buildings Department, (1996); NFPA 101, 2000; Wong, 2005; Cheung and Wong, 2004). However, many designs do not consider properly the uncertainties of transient building occupant loads and probable flow rate at exits or the risk of evacuees.

2.4 Patients and Safe-Evacuation Considerations

This is discussed in five major categories which include; the Facility mission, Planning and Design, Architectural Design Considerations, Emergency Services and the Emergency Systems Perspective.

2.4.1 The Facility Mission

Ordinarily, safety of patients on transit during and after a disaster partially depends on the availability and condition, but mostly on the adequacy of facilities of such transport and the personnel available in a typical evacuation situation. The various equipments and facilities required to safely evacuate patients from hospital wards are discussed below.

- **The Med Sled**

Safe for patient and staff with strong wrap and release over-sized braking carabineer. No lift required, simply roll and drag to load. It does not require one staff member to evacuate each patient less than one minute to load the same. It has a rigid sled for ease of transfer.

Med Sled in Use

For instance, evacuating a building with 400 beds, 6 floors and 175 non-ambulates 2-3 clinicals per floor for loading are required, 18 staff members, one (1) staff per landing, 11 staff members in all landings. Thus a total of 29 staff members are required to safely evacuate patients from this hospital.

Source :< http://www.design.ncsu.edu/cud> **Internet Link**

Fig. 2.1 and Fig. 2.2 Medical personnel loading a patient on a med sled for evacuation

Source: Internet link < ADA Standards for Accessible Design (ADASAD) and the Title II and Title III Technical Assistance Manuals> Website http://www.design.ncsu.edu/cud

Fig. 2.3 Med sled

Source: Internet link < ADA Standards for Accessible Design (ADASAD) and the Title II and Title III Technical Assistance Manuals> Website http://www.design.ncsu.edu/cud

- **Evacuation Chairs**

Designed to quickly and easily assist in the evacuation of the mobility impaired both up and down the stairs of multi-floor buildings. This chair is created primarily for use in stairwells and paved surfaces. Its hard wheels are puncture proof and shorter legs make it ideal for use in stairwells.

Features

It changes directions quickly and easily. It has heavy duty aircraft aluminum frame and a weight capacity of 650 + pounds. The chair only, ordinarily weighs 19 pounds. It can be harnessed for secure transportation and has built in leg straps to avoid injury. It also has multiple points of lift Folds for ease of storage.

Fig 2.4 Evacuation Chair.

Source: Internet link < ADA Standards for Accessible Design (ADASAD) and the Title II and Title III Technical Assistance Manuals> Website http://www.design.ncsu.edu/cud

Other necessary facilities s not discussed here include: - extrication kit, chutes, hip and pelvic splint, spinal board, vacuum splint and the head immobilizer all used to prevent aggravating the injuries while patients are on transit.

2.4.2 Planning and Design

Balancing the need for security and openness is an ongoing challenge for all public building. Health care facility design has a responsibility for creating an environment of care to enhance a positive experience within the facility, and protecting patients, staff, and visitors from violence, disaster and crime.

These concerns are not mutually exclusive. Health care facilities focus on treatment and healing; a bunker mentality or aesthetic can be perceived as counterproductive. Security measures should be "transparent" where possible, not visible to the public eye, to promote the image of health care facilities as welcoming, healing institutions.

- **Design considerations for medical buildings**

Any building design process falls under five main stages; Inception, Feasibility studies, Sketch design, Detailed Design and Working drawings. It's all too easy in the individual situation to lose sight of the broader context within which any new building project should be seen, the immediate and often urgent requirements tending to overshadow the wider perspective.

- **Parameters**

Before any thought is given to the design and construction of buildings to house medical services, two basic questions should be answered.

i. What are the health needs of the population to be served?
ii. Into what type of health delivery system does the project have to fit?

- **Building design**

The design of individual building is determined to a large extent by their internal functional requirements which in turn tend to be common to medical facilities generally.

- **Design method**

The first step in making a design for either a building or each room within a building is to establish the design criteria. These are the functional requirements which a building must satisfy in order to operate smoothly. To transform the functional requirements into a hospital building design, there are two particularly useful design 'tools' that can be useful.

- Need for adequate nursing space around each bed.
- Natural tendency to accommodate as many beds in a ward as possible.

Need for evacuation in the case of a disaster is never factored in and the fact is that maximizing beds definitely cuts on the evacuation space.

2.4.3 Architectural Design Emergency Considerations

- **The Helipad**

A helipad is a typical designated helicopter landing and take-off area. Its useful for highrise buildings and it forms a good area for attending evacuees before they are flown to the respective destinations.

Fig 2.5: Helipad at K.I.C.C

Source: Internet link <www.pbase.com> **Internet Link**

They range from simple unprepared fields and parking lots to locations that support scheduled air services complete with hangars and fuelling facilities (Syms, 2006). These helipads may also be constructed on rooftops of various multi-storey buildings. Examples of such buildings with helipads include: Kenyatta National Hospital, Times Towers and Kenyatta International Conference Center (KICC).

The standards for touchdown area sizes (the pad itself) are generally predicated on the size of the aircraft landing gear footprint or the rotor diameter. A multiplier of the aircraft's overall length or rotor system size generally determines the obstacle-clear areas surrounding the touchdown area. They can vary from an open area of 64' x 64' for a small two-seat helicopter to 109' x 109' for a medium twin-engine helicopter and up to several acres for facilities serving multiple aircraft (Ibid). Patients with disabilities and other injured victims in emergency situations use them. The victims are airlifted from the site enabling quick evacuation. Helipads are suitable for very tall buildings and may be used to evacuate people trapped on the upper floors of these buildings during disasters such as fire.

It is important that multi-storey hospital buildings have designated helipad spots, be it on the rooftop or on the parking lot. Most of the hospitals in Nairobi have areas that can be used as helipads but the problem is that the space is usually not enough since much of it is usually occupied by parking lot. The concept of helipads on rooftops may apply only to a few high-rise hospital buildings within Nairobi. Helipads facilitate quick evacuation of victims in critical condition.

- **The International Symbol of Access (ISA)**

Also known as 'the International Wheelchair Symbol', it consists of a blue square overlaid in white with a stylized image of a person using a wheelchair. It is maintained as an international standard, ISO 7001, and a copyrighted image of the International Commission on Technology and Accessibility (ICTA), a committee of rehabilitation international. It was designed by Susanne Koefoed in 1968.

The symbol is often seen where access has been improved, particularly in hospitals or for wheelchair users, but also for other mobility issues. Frequently, the symbol denotes the removal of environmental barriers, such as steps, to help also older people, parents with baby carriages and travelers. Universal design aims to obviate the need for such symbols by creating products and facilities that are accessible to nearly all users from the start. The wheelchair symbol is "International" and therefore not accompanied by Braille in any particular language.

Fig. 2.6: Symbol of Access

Source: Wikipedia commons

Proper use of this symbol enables the patients with various disabilities in identifying and being able to use accessible facilities. It also helps in creating general awareness; this is mainly with respect to accessibility problems faced by the persons with disabilities. This can help to stimulate actions geared to eliminate architectural design barriers (Mukai, 2006).

The use of this symbol is governed by the following policies:

i. The international assembly shall always use the symbol in the design and proportions.
ii. Colors used shall always be in sharp contrast and, unless there are compelling reasons to use different colors, the symbol and its background shall be produced either in black and white or dark blue and white.
iii. No change in or addition to the design of the symbol shall be permitted.
iv. The symbol should not be used for purposes other than to identify, mark or show the way to facilities that are accessible to persons whose mobility is restricted by disability.

The use of such symbols is quite helpful especially in emergency situations. They help the persons with disabilities to identify the escape routes or facilities that are designed for them hence enabling quick evacuation.

- **Ramps**

Unlike staircases, ramps are used for ease of movement for the mobility impaired, where ease of maneuver is required. Ramps may be of different types depending on design considerations.

Threshold Ramps

These are available for 0.75-inch to 1.5-inch thresholds, while aluminum type rages from 1-6 inch thresholds. They are very easy to install since they accommodate most doorway entrances including sliding doors.

Made of non-slip surface and offers an effective way to make doorways more accessible. Normally has 300 lb. weight capacity.

Fig.2.7 Threshold Ramps

Source: Internet link < ADA Standards for Accessible Design (ADASAD) and the Title II and Title III Technical Assistance Manuals> Website
http://www.design.ncsu.edu/cud

Thresholds should be omitted wherever possible. These thresholds are usually great obstacles to the wheelchair bound and cause great problems to them when entering or exiting buildings. Weather stripping at the bottom of the door is preferred to thresholds to ensure a level floor surface that allows for easy accessibility by the wheelchair bound patients.
Lacey (2004) also suggests that kick plates be placed between 0.30 m and 0.40 m in height for easy reach by the ambulant and the wheelchair bound.

Portable Ramps

The use of a portable ramp calls for installation of a doorbell (with an appropriate sign) to summon an employee to bring the ramp to the door, if readily achievable. If the accessible entrance is one other than the main entrance, a sign at the main entrance should indicate where the accessible entrance is located.

Figure 2.8: Portable ramp

Source: Internet Link <www.dynamic-living.com>

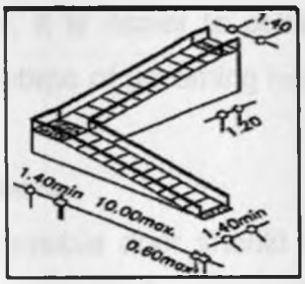
Installation of entrance and exit Ramps

An exterior location is preferred for ramps. Indoors ramps are usually not recommended because they take up a great deal of space. Ramps are especially useful for the ambulant; the wheelchair bound persons and those with visual disabilities (Woodson, 1981).

Their minimum width may vary according to the configuration and slope but the minimum width should be 36 inches (915 mm). Their extensive width allows for free flow of traffic to and fro. The maximum slope of a ramp in new constructions should be 1:12 and the maximum rise for any run shall be 30 inches (760 mm) (Ibid). They should be constructed of non-slip material.
The ramps should be provided with landings for resting every 10m. The ramps should be used in conjunction with elevators.
The entrance and exit ramps are ideal for accessibility as well as egress from buildings for the wheelchair users.

The Environmental Management and Coordination Act (EMCA) require all public buildings in Kenya to install ramps to enable accessibility by those confined to wheelchairs.

Fig 2.9: Entrance ramps

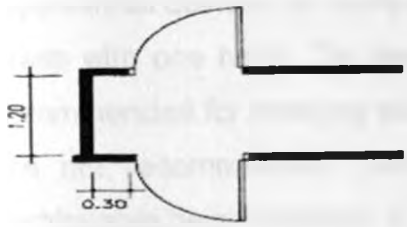


Source: Adler (1999)

- **Widening of Doorways and Corridors**

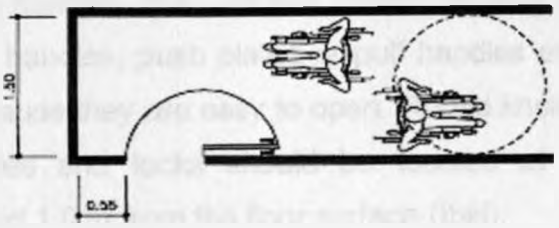
This is done to accommodate wheelchair users. Doorways and corridors must have adequate clearance and be wide enough (1.50m) to allow room for maneuvering, passage by the mobility impaired (Neufert, 2003). Clearance in corridors can be achieved by careful design without unnecessary addition of space to the conventional floor plan.

Fig 2.10: Accessible corridor



Source: United Nations (2003)

Fig 2.11: Accessible corridor enabling rotation



Source: United Nations (2003)

The unobstructed width of a public building corridor should not be less than 1.50m.The recommended width is 1.80m (Ibid). The flooring material should be able to accommodate artificial limbs or canes and should be non slip.

Widening of corridors and doorways is very difficult in already existing hospitals that were designed without taking into consideration the mobility impairments of patients. It is easier to achieve such facilities if they are incorporated at the design stage of upcoming hospital buildings.

- **Doors**

An accessible door should have the following features: a sign, door handle, glazing and a kicking plate. These make the building more accessible to wheel chair confined persons (Lacey, 2004). Revolving doors are not suitable for use by patients and people with prams. The emergency doors should be fire resistant and are normally located in stairwells, corridors, and other areas required by Fire Codes.

The door leaf, doorframe, locking mechanism and closure are rated between 20 minutes and 3 hours. The rating indicates how long the door can withstand the fire. For exterior doors, the minimum opening is 0.90 m when the door is open and for interior doors, the minimum opening is 0.80 m.

Swinging doors are recommended for use in hospitals since access can be achieved from either side.

Operational devices on doors such as handles, pulls, latches should be easy to grasp with one hand. The lever type handles, push plates or pull handles are recommended for swinging doors because they are easy to open. Round knobs are not recommended. Door handles and locks should be located at a comfortable height between 0.90 m and 1.0 m from the floor surface (Ibid).

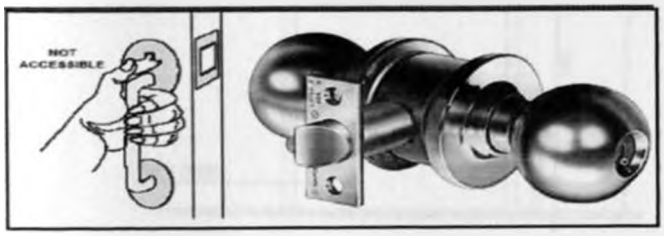
- **Hardware: Door Knobs**

Inaccessible door hardware can prevent access to the medical offices. For example, the handle shown requires the user to tightly grasp the handle to open the door. People with limitations in grasping, such as arthritis, find this type of handle difficult or impossible to use.

Non-accessible door handles

- A thumb latch is not accessible because one must grasp the handle and pinch down on the thumb latch at the same time.
- A round door knob which requires tight grasping and twisting to operate or a handle with a thumb latch are inaccessible and should be modified or replaced

Fig2.12 Non Accessible Door Knobs

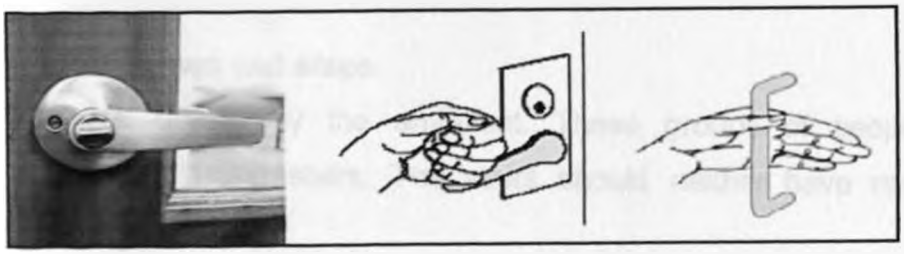


Source: Internet Link <www.dynamic-living.com>

Accessible door handles

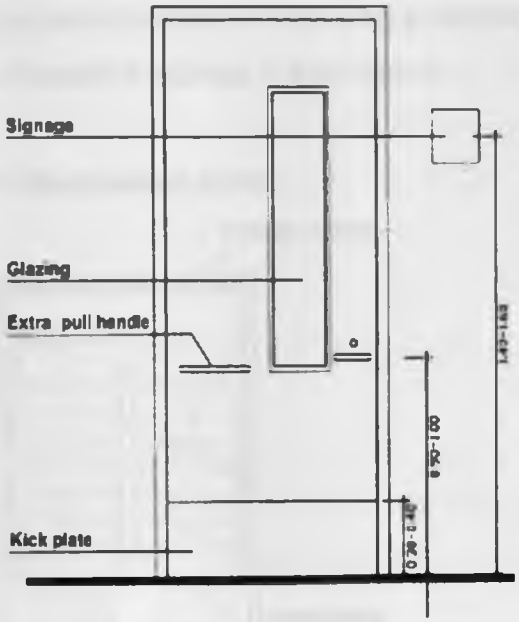
- A loop-type handle is accessible because it can be used without grasping, pinching or twisting.
- A lever handle is also accessible because it can be operated without a tight grasp, pinching or twisting.

Fig.2.13 Accessible door handles



Source: Internet Link <www.dynamic-living.com>

Fig 2.14: Accessible door



Source: United Nations (2003)

- **Smoke alarms**

Smoke alarms should be installed, as a measure against fire spread. Smoke alarms can make a vital difference in the event of a fire and may reduce the risk of dying in a fire by as much as 60 per cent (TriData Corporation, 1999). The smoke alarms should be properly functioning and should be cleaned by regular vacuuming and monthly testing of batteries and replacing them annually.

- **Staircases and steps**

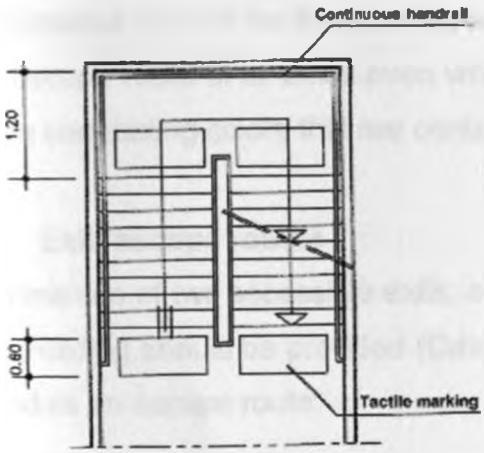
They are usable by the ambulant. These groups of people experience difficulties in using stairs. The stairs should neither have open risers nor protruding nosing.

Not only are these features dangerous for use by patients, but also to the able bodied since people may catch their toes on them as they climb (up) the stairs.

Mechanical stairs may be provided with an adaptable tread of at least 1.2m long to be used by persons confined to wheelchairs.

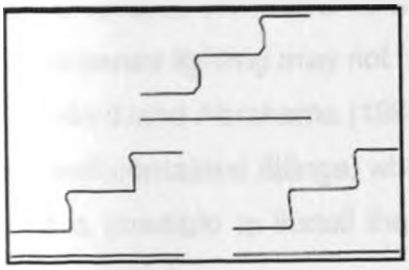
This design consideration of removing protruding nosing can easily be achieved in various hospital buildings in the country.

Fig 2.15: Mechanical stairs



Source: Adler (1999).

Fig 2.16: Recommended steps



Source: United Nations (2003)

- **Protective devices**

It is appropriate that the all wards be fitted with automatic fire sprinklers, fire blankets, hydrants, hose reels, dry risers, drenchers and water spray projectors as indicated in the Kenyan building code for public buildings or domestic buildings over 20 feet.

Exit signs

Exit signs should be provided and set to flash (less than 5 hertz) when a fire alarm sounds. These signs should be connected to the emergency power systems. The color of the exit door should contrast with the surrounding surface so as to make it distinguishable by the people with sight problems (Neufert, 2003). These exit signs should be visible and should be placed on the doorframes and not on the door leaves. This will enable an individual to identify an escape route at all times even when the door is open. The exit signs should have contrasting colors that are conspicuous to the visually impaired.

- **Exit/ escape routes**

A minimum of two accessible exits, or horizontal exits for all accessible areas of the building should be provided (Dawson, 1999). Incase of fire, one exit can be used as an escape route.

- **Emergency and escape lighting**

It is necessary to light escape routes such that they can be used during a fire when the failure of a local electrical circuit is possible. Emergency lighting might be provided, on failure of a mains supply, or by a standby generator. Such emergency lighting may not function in a fire due to local circuit failure.

Stollard and Abrahams (1999) suggest that escape lighting should be provided by self-contained fittings, which are capable of running for a set period of time. If it is possible to install the escape lighting at low levels, then this becomes more useful.

Corridors and rooms usually fill with smoke from the ceiling downward and lights below this smoke level are more necessary.

The current recommendations in British standards, BS 5266 (emergency lighting) require a provision of 0.2 to 0.5 lux on the center of the escape route. In addition, for escape routes of up to 2m wide, 50 per cent of the route width should be lit to a minimum of 0.1 lux. This may not be suitable to fully sighted people.

Fig 2.17: Typical emergency lighting

Source: Mersey World (2007).

- **Positioning of equipment**

Manual alarm pull stations should be mounted no higher than 48 inches (1.2m) from the floor level. If manual alarms are mounted higher than 48 inches, these devices should be retrofitted with attachments that make them accessible to the wheel chair users (TriData Corporation, 1999). This will enable the wheelchair users to access emergency controls with little difficulty.

Retrofitting of these devices should be done in all buildings with the supervision of the fire department personnel. A good example of a Kenyan building, which has fire controls, positioned at appropriate heights for the wheelchair bound is the Nairobi Women's' Hospital.

Retrofitting of the alarm triggers is not expensive and should be done in all buildings.

- **Portable fire extinguisher**

If one is confined to a wheel chair, consider mounting (or having someone mount) a small "personal use" fire extinguisher in an accessible place on his or her wheelchair, and make the person familiar with its use

- **Areas of Refuge**

Where there is only one accessible exit, provide a minimum of one fireproof refuge area (fire rated enclosed elevator lobby preferred).

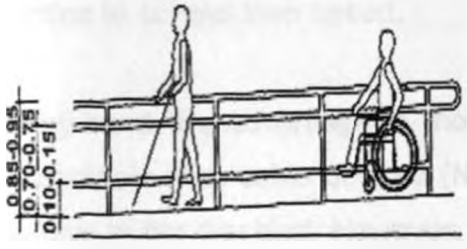
These are fire safe areas that should be on each floor of a multi-story building. The fire refuge area should be a minimum of 16 square feet (1.5 square meters) outside of the exit circulation path. They should have fire-safe compartmentalization walls.

They provide an area free from fire and toxic smoke until fire fighting rescue personnel arrive. TriData Corporation (1999) suggests that each compartment should, of course, have a way-out stairs or an elevator with an independent and protected power source. An occupancy or call system from refuge areas to fire department or entrance vestibules should be provided. These refuge areas enable the patients to be evacuated from the building to seek refuge while waiting for rescue personnel.

- **Guard rails and Handrails**

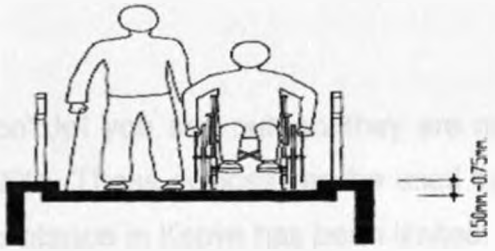
They should be installed around hazardous areas, stairs, ramps, accessible roofs, and galleries to mention a few. They should be mounted between 0.85m and 0.95m above the finished floor level for the ambulant and the elderly.
For the benefit of wheelchair users, a second handrail can be mounted between 0.70m and 0.75m from the floor level (Woodson, 1981). Guard and handrails should be between 34 to 38 inches wide. The guard and handrails are important in emergency situations as they provide support to both the able bodied and the disabled.

Fig 2.18: Recommended handrail heights



Source: Adler (1999)

Fig 2.19: (Front elevation)



Source: Adler (1999)

However, it should be noted that at greater heights in high-rise buildings, the height of the hand and guardrails should be more than that recommended for patients who are wheelchair bound. This is to prevent these groups of persons from easily toppling over hence improving safety.

- **Fire alarms**

Audible fire alarms that exceed the average ambient sound level by a minimum of 15 decibels should be provided. These alarms should exceed a noise of 30 seconds or less duration by a minimum of 5 decibels (Ibid).

The fire alarm should be audible enough but should not be too loud as this may be destructive making some patients loose their mobility. Sorenson (1979) says that the maximum audible emergency signal should not exceed 120 decibels.

- **Miscellaneous Devices**

These include controlled descent devices using cables and chutes of various types. The cable devices usually use a strap or chair secured to the cable by a device that is squeezed to allow descent. The more you squeeze, the faster you go. Letting go stops your descent. This method of escape is rarely used in Kenya. Although it is cheap, most people are reluctant to evacuate down the outside of a building.

The chutes may be of solid or flexible fabric tubes that generally rely on friction to control their speed.

They have the advantage in that they don't let you see out, so they are more acceptable than cable devices (NEMA, 1999). These devices can be used by all groups of the disabled. However, their acceptance in Kenya has been limited.

- **Site and Perimeter Security**

Site security in and around the facility is important before, during, and after an incident. Public road ways and access points should be secured for control and traffic segregation.

Planning issues include:-

a. Monitor vehicular and public access to mission-critical areas, such as the central power plant, emergency department, and surgical suites, through visual and electronic surveillance.

b. Design and route access roadways away from main hospital emergency areas.

c. Isolate critical areas by bollards, berms and physical barriers

d. Ensure that site access and control allows emergency vehicles, facility support, and medical staff to be quickly screened and admitted to the facility.

e. Provide treatment space and facilities for walk-ins and other casualties to be screened and admitted in a timely manner.

f. Accommodate concerned family members looking for information about a loved one. Provide a waiting area with a room or area for private consultations.

g. Determine extent and access of press and media representatives. Security planning should consider how the facility will handle media relations in an emergency, and designate an area to handle media personnel and vehicles.

h. Ensuring that parking areas and pedestrian circulation paths are well lit and under visual surveillance by the public and facility staff.

- **Location and Circulation**

Minimizing exits and entries limits unauthorized access and allows the option of a lock-down in an emergency. Providing adequate security and staff supervision reduces opportunities for crime and terrorism directed at and within the facility. Other considerations include:-

a) Clearly delineate public and patient care areas, for easy access.

b) Provide good sight lines and observation

c) Encourage staff to monitor the care environment and ensure that visitors are authorized.

d) Utilize way-finding strategies and signage to enable patients and visitors to understand where they are and how to locate other areas within the facility.

2.4.4 Emergency Services

- **Emergency kits (Safety kits)**

These are services that patients may require if for instance, they were trapped in the hospital in case of fire or any other emergency; examples include; medicines, diabetes supplies (such as extra syringe needles, test devices and supplies, insulin and a way to keep it cold), personal hygiene items, food and water for an assistance animal, super-bright wide beam flashlight, batteries for medical and other devices.

The emergency kit should be able to sustain the individual for 72 hours. Emergency kits should be positioned at conspicuous points and clearly marked to enable easy identification intended users. They should have the necessary medical essentials.

However, most hospitals have safety kits that are not well maintained.

- **Public Fire education**

Although fire or other emergencies affects all people, certain groups are more vulnerable and subsequently, at a higher risk to fire related injuries and death than others. The patients in hospital wards receive little or no consideration in this case. It is therefore difficult to assess the degree to which their states play in making them vulnerable. They should be considered in public fire education programs.

- **Buddy system or cross training**

Buddies or monitors should be trained to take the responsibility of ensuring the safety of the ICU and the non ambulant patients in coma. It is important to have designated or back up buddies in the event that the designated buddy is absent. Proper emergency planning and routine training should be done in hospitals to ensure that this system is effective in Kenya.

- **Fire Safety Practices or Exit drills**

The ambulant patients should practice exit drills so that in the event of a disaster such as fire taking place, they are better equipped to deal with it. This should be done with members of the fire department as well the hospital staff and other employees. They should practice using evacuation chairs, med sled and other tools. Exit planning is a significant aspect.

However, safety practices are rarely carried out in Kenya due to sheer ignorance or lack of awareness.

Lack of awareness by the fire regulatory authorities in Kenya about the needs of patients and the difficulties they face or are likely to face may be a reason for overlooking them in the fire campaigns.

Exit drills should be practiced and the fire department should be involved in conducting them (Ibid). It is important that the fire service be involved in these drills to give advice on proper evacuation techniques.

2.4.5 Emergency Systems Perspective

- **Threat assessment and emergency evacuation policy**

Health care facility and institutional managers must assess potential threats and vulnerability before developing a security plan. Threat assessments should be completed by a multidisciplinary team of experts designated by the facility leadership or administration, and chaired by someone with time, ability, and skills to do the job.

The team should include administrators, facility managers, in-house and consulting security personnel, local law enforcement, business interests, and design professionals, both in-house and consultants as required.

This should guide them in drafting an emergency evacuation policy.

- **Hospital Emergency Response Data System (HERDS)**

A regional perspective and effective communication among health care institutions will encourage collaboration. T

he health department should also develop and implement the Hospital Emergency Response Data (HERDS), a computerized system combining geographic information systems and a comprehensive interactive database, linking all hospitals with principal planning and response agencies.

This statewide disaster planning database should be constantly updated.

The HERDS provides a real time inventory, by facility, of disaster response requirements, including:-Available beds, Emergency department activity, Life support equipment, Medical supplies, Pharmaceuticals Contact, list of those with designated roles in the event of a disaster, Means of reporting and tracking all types and levels of incidents.

- **Training Team**

All aspects of health care facility operations must be evaluated in accordance with the threat assessment. To address security design needs, the facility leadership should create a multidisciplinary planning team, including but not limited to the following:-

Hospital administration, medical and nursing staff, facility managers, in-house personnel involved with operations, security and finance, architects and engineers, in-house and outside consultants, security consultants as needed to advice on threats, technology and operational protocols et al.

Health care facility administrators should create a disaster response committee or team to develop policies and procedures to be followed by all personnel in the event of a disaster. A widely accepted protocol, known as the incident command system (ICS), is applicable to regional and facility planning. The ICS is based on five major activities and generally defines:

Staff roles, lines of authority, chain of command and communication, Operational responses to incidents or events, Communications, building services, electrical power and ventilation designed for 24/7 operations with emergency backup power in case of failure. Secure location, close to the emergency department, since that area will likely be the hub of the initial response to an incident.

Health care facilities and public agencies should utilize the ICS to create a common framework, including: Clarifying mutual understanding and common terminology, Delineating span of control, Defining organizational structure, identifying personnel accountability, Establishing unified command and Creating incident action plans.

In addition to designated health care facility staff, alternates must be designated to manage each component, should primary staff be unavailable or require relief.

Under the direction of command, authorized individuals and support staff should develop a detailed emergency response plan. The plan must be communicated and circulated among staff, and be subjected to routine training and drills to ensure effectiveness. Preparation and readiness are essential to response. Under this system, an event would immediately initiate a sequence of actions and communications, by those in designated roles.

- **Incident Command System (ICS) Elements**

Incident command centre, Staff education and training, Disaster planning protocols, Communication, Affiliations and partnerships, Record keeping, data collection and tracking patients

- **Compatible Communications Technology and Equipment**

After the co-operative house attacks, cellular communications and telephone lines in within CBD area were interrupted and unreliable for quite some time. The lack of communication and news on the rescue effort progress was equally distributing and counterproductive. Police and Fire Department radios were not compatible, preventing them from sharing information. The following tools are necessary:

a. Communications technology and equipment must be tested, reliable and compatible within and among public agencies, facilities, cities, areas and regions.

b. Communications among law enforcement personnel and health facilities must be maintained on reliable, secure equipment and lines, Satellite phones, Ham radio, Two-way radios – they must be compatible throughout a facility, area and region, Couriers and runners.

c. Communication between hospitals and the public, media, and local community is recommended

- **Managing Volunteers and Credentialed Professionals**

The number of volunteers coming forward to offer help after a major incident can be overwhelming. Without any way of verifying their credentials, volunteers require oversight by known and qualified medical and nursing staff, a database of credentialed staff should be maintained by public and private entities within a facility and health care system on a regional basis, and through professional organizations.

2.5 The Building Code

The earliest forms of building codes and standards date as far back as the Mesopotamians in 1800 BC. The code of Hammurabi, the earliest legal code known in its entirety, is a collection of laws and edicts developed by the Babylonian king Hammurabi. Since then standards have evolved for health, welfare and life safety in the workplace and for the general public.

The advent of the industrial revolution prompted development of new codes and standards. Tragic events connected with these new workplaces eventually led to reforms. During the later part of the 19th century, government, insurers, professional organizations and the ad hoc watch dog groups developed more statutory rules, regulations and performance standards addressing the hazards accompanying progress in economic development.

The present day Kenyan building code is an adoption of the by laws relating to buildings, which evolved over the centuries in the big cities of Britain. According to (Nduli 1998), the building code has been found to be outdated and inconsistent with the current needs of Kenyan construction industry. Its regulations also are found to have been based on preambles of a British document of 1948.

In 1998, a presidential commission charged with a mandate of reviewing the Kenyan building code, fund out that not only was it consistent but also outdated

in comparison to its counterpart the 'the British Building Code' which since its formulation has undergone series of reviews to make it user friendly (Ibid).

Though such a building code cannot be deemed obsolete, sufficient modifications need to be incorporated in it to make it adaptable for current user needs. The Kenyan building code does not have sections that entirely cover healthcare centers and disaster preparedness in hospitals.

The Kenyan building code has not undergone any major modifications since its adoption in1948. Existence of a draft [KS 02-1006-KBS] dated April 1997 did not make any significant changes. The recommendations annotated in the draft were not implemented; nor were they documented as policies. Thus provisions for people with physical and psychological challenges are still lacking in the current building code. This can be attributed to laxity in the authorities or lack of a central enforcing authority to implement the changes that have been recommended.

This would be true to the extent that the regulation and authoritative bodies, those who spearhead or those bestowed with such mandate to formulate, implement and oversee relevant emergency measures only come to board when a major emergency occurs.

2.6 The Building By-Laws

These are the various legislations that govern and control the building standards. These e regulations reflect the importance attached to buildings by various parties.

- Environmental Management and Coordination Act of 1999- This has laid down a regulation empowering the National Environmental Management Authority to ensure that all public buildings have ramps for accessibility by the physically challenged particularly the wheelchair bound.

- Factories Act cap 514-An Act of Parliament to make provision for the health, safety and welfare of persons employed in factories and other places, and for matters incidental thereto and connected therewith.
- Local Government Act cap 265- An Act of Parliament to provide for the establishment of authorities for local government; to define their functions and to provide for matters connected therewith and incidental thereto
- Public Health Act cap 242 -An Act of Parliament to make provision for securing and maintaining health. Cap 242 was first introduced in Kenya in 1931 several revisions have taken place over the years. The 1931 publication was replaced by The City Council of Nairobi by- laws of 1948, which deals with matters pertaining zoning and planning.

  According to Nduli 1998 buildings have a lot of effect on the general health of the public; hence this act should be strictly enforced.

2.7 The Context of Kenya Vision 2030 and the Flagships for Disaster Preparedness

The publication is a summary of Kenya's new long-term national planning strategy, officially known as Kenya Vision 2030. The vision is based on three "pillars" namely; the economic pillar, the social pillar and the political pillar that underpin the Vision 2030.

It also provides a run-down of major, (or flagship) projects to be embarked upon in the medium term period of the vision, i.e. from 2008-2012.

According to the vision; Kenya will enhance disaster preparedness in all disaster-prone areas and improve the capacity for adaptation to global climatic change. Revitalize Community Health Centers to promote preventive health care (as opposed to curative intervention) and by promoting health of individual lifestyles; Specific strategies will involve: provision of a robust health infrastructure network; improving the quality of health service delivery to the highest standards and promotion of partnerships

2.8 Conclusion

In the words of Eric Strife, British philosopher, "adversity is merely an obstacle; those who are wise simply walk through it"

According to Edmund Burke (1729 – 1797) British orator, philosopher and politician; "Better be despised for too anxious apprehensions, than ruined by too confident security".

From small rural community hospitals to large urban teaching medical centers, health care facilities are charged with providing medical treatment within safe environments for patients, staff, and visitors. Ongoing operations, peak performance, life safety and survival are among the primary security planning goals. Security and safety issues have always been a major concern in health care facilities.

The events of august 1998, Nairobi bombast, the fire at Pumwani hospital and the violence at Moi referral hospital, Eldoret, raised new issues relating to security and health care facilities with fire, terrorism, violence and biochemical warfare among the most pressing concerns.

As threats and risks continue, the intensity of response and treatment increase placing renewed emphasis on emergency preparation and facility planning.

Like other public and private institutions serving important community functions, health care facilities must develop security plans based on vulnerabilities, risks and threats. Integrating design, technology, and operational policies is the best way to achieve these goals. Each facility must address local, regional and statewide issues and site-specific criteria.

The events of august 1998 serve as a vivid reminder to health care providers about the urgent need for emergency preparedness, training, and drills.

According to the words of Edmund burke, (1729-1797) "all that is necessary for the triumph of evil, is that good men do nothing".

As the world learnt from the tragedy of august 1998 and the subsequent events, the human spirit and capacity of first responders to help those in need knows no bounds. The events of august 1998, added new dimensions and challenges for healthcare facilities serving communities of alls sizes, demographics and populations. The prospect of a terrorist act , natural disaster or biochemical attack upon a building city, region, or simultaneous sites within a country has forced the healthcare community and public policy makers to assess services, capabilities, preparedness and flexibility of operations as never before.

The aftermaths highlighted in the august 1998 bombing of the cooperative house in Nairobi and the subsequent events clearly illustrate that lessons previously unimaginable can be learned from even the most horrific events. These unique benchmark experiences have been shared to inform and illuminate healthcare planners, designers, administrators and the medical personnel as they develop and refine disaster planning policies and regulations.

Balancing public policy needs and limited resources against ongoing medical service delivery, and real potential threats, risks and case scenarios is the fundamental challenge facing the 21st century healthcare industry and the many owners, operators, facility managers and administrators.

The most vital information that healthcare facilities require for security design is based upon local, regional, and state level disaster planning efforts and threat assessments. Based on information available from law enforcement agencies , security personnel, industry organizations ,and other institutions, healthcare facilities of every size and location must develop disaster plans or more specifically an incident command system ICS, outlining necessary policies and procedures for emergency preparedness in the event of a major disaster or terrorist attack.

Richard Feynman, US educator and physicist said; "we are at the very beginning of time for the human race. It is not unreasonable that we grapple with problems. But there are tens of thousands of years in the future.

Our responsibility is to do what we can, learn what we can, improve the solutions and pass them on".

Comprehensive security planning integrates the best healthcare design practices, technology and carefully considered policies and emergency procedures. Many heath care facilities will be able to enhance existing disaster planning and preparedness options by revisiting the ways spaces are planned, programmed, designed, located, staffed and operated. Planning flexible use of space always a fundamental heath care design tenet, takes on a new meaning when the prospect of evacuating mass casualties in the event of a disastrous occurrence.

Within this context, the health care community must address the following.

- Provide healthcare services integral to a facility's primary mission, whether regional acute care, community health, nursing home care, or other specialized function.
- Provide all necessary facilities for safe evacuation of patients in case of an internal disaster.
- Prepare a flexible response to extreme conditions stemming from a disaster or terrorist attack.
- Outline options for providing services in the event of loss of power, services, utilities, or space due to terrorism, crime disaster or contamination.
- Protect the building systems, facility infrastructure and emergency backup supplies that maintain ongoing hospital operations.
- Minimize service disruption, potential loss of life and the inevitable chaos ensuing during and after a disaster.
- Increase the inherent ability to accept advances in healthcare equipment, technology, clinical programs, and patient acre initiatives.

- Communicate the facility's preparedness and value to the community, through being a good neighbor public outreach, and patient education services all year round, not only during disasters and times of need.

Current security threats and risks facing civilized society are daunting. The stakes are high and the challenges are great but they are by no means insurmountable. According to Jean Tetreau, Canadian author, the human capacity to fight back will always astonish doctors and philosophers. It seems that indeed there are no circumstances so big that man cannot conquer them.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1Introduction

Generally this chapter lays down the procedure adapted in this research. It discusses the study area, population, sampling techniques and data collection and analysis methods used by the researcher. The data so collected is used to test the hypotheses as well as to fulfill the objectives of the study.

3.2Research Design

According to Donald C. and Pamela S., (2003) there are various definitions of research design but no one definition imparts the full range of important aspects.

- Research design constitutes the blueprint for the collection measurement and analysis of data. It aids the researcher in the allocation of his limited resources by posing crucial choices. For instance,
  a) Is the blueprint to include experiments, interview observations, analysis of records simulation or some combination of these?
  b) Are the methods of data collection and the research situation to be highly structured?
  c) Is an intensive study of a small sample more effective than a less intensive study of a large sample?
  d) Should the analysis be primarily quantitative or qualitative?

- Research design is the conceptual structure in which research is conducted. It is the plan and structure of investigation so conceived as to obtain the answers to research questions. The plan is the overall scheme or program of the research.

It includes an outline of what the researcher will do from writing hypotheses and their operational implications to the final analysis of data.

A structure is the framework, organization or configuration of the relations among variables of a study.

A research design expresses both the structure of the research problem and the plan of investigation used to obtain the empirical evidence on relations of the problem.

3.3 Background of the Area of Study

Nairobi is the capital city of Kenya. It is located at an altitude of 1675m (above sea level), inland from the Indian Ocean coast of Mombasa and approximately 350km from Lake Victoria, shores of Kisumu on the further west. Moreover it is also situated on a well watered plain adjoining the highlands of central Kenya. The city is 140km south of the equator (Wikipedia, 2007). Geographically, Nairobi is positioned at $1^0$16'S $36^0$48'E. The British originally founded the city as a railway encampment as they pushed westwards building the Uganda railway in the last decade of the 19^{th} century; 1890s. In 1919, it was declared a municipal and granted city status in 1954. It occupies an area estimated to about 690km^2 (established in 1963) with a current population estimated at 4million persons.

Administratively, Nairobi is both a district and a province that hosts nearly all national government officers. It is subdivided into eight divisions, which are in turn made up of a total of twenty nine locations and sixty four sub locations.

Rampant growth and development of Nairobi due to its central location, need for industrial growth and the administrative functions has led to the demand for many health care centers so as to cater for the needs of the ever increasing population. The two major hospitals which developed/ have developed to cater for those needs and which host complicated patient populations include.

3.3.1 Kenyatta National Hospital (KNH)

Kenyatta National Hospital (KNH) is the oldest hospital in the country having been founded in 1901 as the Native Civil hospital and then King George VI in 1952. It is currently the largest National referral, teaching and research hospital.

Key Statistics: Staff Capacity: 6,000, Bed Capacity: 1,800 beds, Average Annual Outpatient attendance: 600,000 visits, Average Annual Inpatient attendance: 89,000 patients, Average length of Stay: 7 Days.

Source: sinistry of health, 2008 health report.

3.3.2 The Karen Hospital

Karen Hospital is a private hospital located in the serene suburbs of Karen, on Langata-Karen Road, 12 kilometers from the Nairobi City Center.

The hospital can be accessed from either the Ngong Road or Langata Road and is within close proximity of the Wilson Airport and the Jomo Kenyatta international Airport. Karen hospital is a fully fledged 102 bed hospital offering high quality healthcare services in response to the changing demands for efficient, effective and affordable treatment, rehabilitation and preventive healthcare programs.

Source: www.karenhosp.org. Internet link

3.4Investigation Methods

3.4.1. Research techniques and control of variables

For the purposes of this study both attributes from qualitative techniques and variables from quantitative techniques of investigation were incorporated

According to Cooper D.R. and Schindler P.S. (2003), Qualitative techniques are techniques that don't carry nominal variables but rather carry attributes or

character of something. An attribute is the essential character or nature of something. It denotes meaning, definition, analogy (model) or metaphor characterizing something.

Thus it involves in-depth conversational interviewing, participant observation, photographs, case studies, elite/ expert interviewing and document analysis.

On the other hand, quantitative techniques produce variables; measurable quantities. It answers the question how much? It assumes meaning and refers only to the measure of it.

For the purposes of this study, research deals with ex post facto design; this is where the investigator has no control over the variables in the sense of being able to manipulate them. The researcher can only report what happened or what is happening. The researcher is limited to holding factors constant by judicious selection of subjects according to strict sampling procedures and by statistical manipulation of findings.

3.4.2. Population parameters and sample statistics

Population parameters are summary descriptors (incidence proportion, mean, and variance) of variables of interest in the population. Sample statistics are descriptors of the relevant variables computed from sample data. Sample statistics are used as estimators of population parameters. The sample statistics are the basis of inferences about the population for this particular study.

3.4.3. Types of data used in the study

Type of data	example in questionnaire
▪ Nominal	{Yes} and {No}.
▪ Ordinal	High priority, little quarterly priority, Moderate priority
▪ Interval	Annually, half yearly, quarterly monthly.
▪ Ratio	Number of nurses required.

3.5 Population

According to Lapin Lawrence L. (1990), Population is the total collection of elements about which one would wish to make some inferences. Population element is the subject on which the measurement is being taken. It is the unit of study. Census is the count of all elements in a population.

The ministry of heath through the Public Health Act, cap 242, under the Central Board of Health requires all hospitals private and public to obtain operational license from the ministry's headquarters. The ministry of health thus was the best source for the most comprehensive list of hospitals in Nairobi area.

A list of operational hospitals obtained from the ministry dated April 2008, and a similar schedule from National Hospital Insurance Fund [NHIF], indicated that there were 40 operational Hospitals, 27 heath centres and 6 nursing homes. Further the hospitals were categorized into major and minor hospitals with the major hospitals (13no.) having a bed capacity of greater 100 beds and the minor hospitals (27 no.) having a bed capacity of less than 100 beds.

3.6 The sample

Most people intuitively understand the idea of sampling. The basic idea of sampling is that by selecting some of the elements in a population, we may draw conclusions about the entire population. A sample is a collection of observations representing only a portion of the population. There are several compelling reasons for sampling, including; economy, greater accuracy of results, and greater speed of data collection/timeliness and inaccessibility of some population elements. The ultimate test of a sample design is how well it represents the population it purports to represent. Validity of a sample depends on two considerations: accuracy and precision.

Accuracy is the degree to which bias is absent from the sample. An accurate (unbiased) sample is the one in which the underestimates and overestimates are balanced within the members of the sample.

Precision: No sample will fully represent its population in all aspects. The numerical descriptors that samples may be expected to differ from those that describe populations because of random fluctuations inherent in the sampling process. This is called the sampling error and reflects the influences of chance in drawing the sample members.

Precision is measured by the standard error of estimate, a type of standard deviation measurement; the smaller the standard error of the estimate, the higher is the precision of the sample. The ideal sample design produces a small standard error of estimate.

3.6.1 Sampling size and technique for the hospitals in Nairobi

A list of operational hospitals obtained from the ministry dated April 2008, and a similar schedule from National Hospital Insurance Fund. [NHIF], indicated that there were 40 operational Hospitals, 27 heath centres and 6 nursing homes.

For the purposes of this study, only hospitals were considered and from the list there are 27 hospitals with a bed capacity of 1-100 beds and 13 hospitals with a bed capacity of more than 100 beds making a total of 40 hospitals which also formed part of the total target population.

The list of 40 hospitals clearly indicated that the statistical variable is not normally distributed in the population because it takes positive skewness, thus random sampling does not ensure normal distribution of that variable in the sample. According to Mugenda and Mugenda, (1999), randomization of a variable that is not normally distributed in the population would lead to inaccurate generalization of the findings. The highest and lowest bed capacities for instance, were 13 and 1804 respectively, with 27 hospitals having less than 100 beds, 11 hospitals with between 100- 350 beds, No hospitals with 400-1700 beds and 2 hospitals with between 1800-1900 beds. Therefore being difficult to establish a standard for stratifying the hospitals, the researcher opted to carry out research on the major hospitals with 'more than 100 beds',

Thus, the data collected from these hospitals was a census. The reason for choosing these hospitals is that, according to the England journal of medicine, in a typical disastrous situation hospitals with a bed capacity of more than 100 beds would be expected to face a little more difficulty in comparison to other small hospitals due to the great number of patients. This was also confirmed through interviews with the fire station staff. Out of 13 major hospitals, Kenyatta national hospital double wings were combined into one, and thus from a population of 12 number hospitals, only 9 hospitals were accessible due to time, need to enhance accuracy and financial constraints. This therefore formed the target census.

Table 3.1: List of sample hospitals in Nairobi with a bed capacity of more than 100 beds and their corresponding bed capacities

Hospital	Bed capacity
MATER MISERICORDIAE HOSPITAL NAIROBI	135
MASABA HOSPITAL	156
KENYATTA NATIONAL HOSPITAL (AMENITY WING)	225
KENYATTA NATIONAL HOSPITAL (GENERAL WARD)	1804
KAREN HOSPITAL LTD	102
WESTLANDS COTTAGE HOSPITAL	113
MBAGATHI DISTRICT HOSPITAL	250
NAIROBI HOSPITAL NAIROBI	220
PUMWANI HOSPITAL	350
H.H. AGAKHAN HOSPITAL (NAIROBI)	165
KAMITI HOSPITAL	195
S.S. LEAGUE M.P SHAH HOSPITAL NAIROBI	108
MATHARE MENTAL HOSPITAL(GENERAL WARD)	1138

Source: ministry of health annual report (2007/8).

3.6.2 Sampling size and technique for architectural firms in Nairobi

The architectural firms on the BORAQS list consisted of 228 firms. The firms operating in Nairobi were 225 numbers and this formed the target population. From the target population (225 firms), the accessible population due to time, need for accuracy and financial constraints were 136 firms.

When determining the sample size a confidence level of 95% of the target population was adopted and that the response achieved from the sample will be within –ve 5 or +ve 5 of the true state of the population targeted. This was in a bid to enhance precision. According to Lawrence Lapins, (1990) the smaller the standard error of the estimate, the higher is the precision of the sample.

$$n = \frac{z^2 pqN}{e^2 (N-1) + Z^2 pq}$$

Source :(Chava and Nachmias, 1996)

Where N=Population size

n= sample size

p= sample population estimated to have characteristics being measured

q=1-p

e= acceptable error (e=0.05, since the estimated should be 5% of the true value)

Z= the standard normal deviate at the required confidence level

$$n = \frac{1.96^2 * 0.95 * (1-0.95) * 136}{0.05^2 * (136-1) + 1.96^2 * 0.95 * (1-0.95)}$$

=48 architectural firms

Through stratified random sampling from various subgroups in the population in a bid to achieve the desired representation, first the firms were divided into strata according to the years of experience, with an attempt to secure homogeneity within subgroups and heterogeneity between subgroups.

8 strata of 17 elements each were obtained; from within which 6 elements were selected through use of random numbers on each stratum making a total of 48 elements; the desired architectural firms sample size.

3.6.4 The Fire Brigade

The fire brigade was incorporated in the research study because; being a body that deals with fire emergencies they are well acquainted with the requirements of safe evacuation measures hence their views as well as recommendations would help bring a contemporary edge to the study.

3.7 Data collection instruments and procedures

Primary data collection methods included the following:

3.7.1 Observation/surveys

With the aid of a checklist, evaluation was done on the type and availability of emergency facilities in hospital buildings, their positioning and the internal spatial arrangement of the building.

3.7.2 Questionnaires

The questionnaires, being main method of data collection, were self administered to the following groups of people:

- Sampled architects
- Sampled hospitals
- The NCC fire brigade personnel

3.7.3 Interviews

Interviews were also conducted with the various members of the hospital management personnel and or their representatives, (emergency and accidents department), architects as well as the employees of the NCC fire brigade (emergencies section.)

No photography was allowed in this research due to hospital security purposes.

3.8 Data analysis and presentation

Data collected with the use of checklist and the interviews as well was analyzed in frequency distribution tables and presented in form of charts to aid better understanding. The data collected through use of questionnaires was analyzed by use a computer program (SPSS) discussed in chapter one, frequency distribution tables and percentages. The data so analyzed was presented in the form of graphic presentation (bar and pie charts, and tables) for ease of interpretation to the researcher and ease of understanding to the reader.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

The field research set out to study disaster mitigation and readiness in hospitals with reference to design and facilities, case study of hospitals in Nairobi. The aim of this research project was primarily to find out whether hospital buildings are designed and equipped with adequate facilities to cater for evacuation of patients in case of an internal disastrous occurrence, protection of valuable equipments and medicine as well as establish the adherence to standard design measures. Disasters were limited to rapid onset emergencies; specifically fire and bomb explosions. Design was limited to positioning of elements and internal spatial arrangements, locomotion facilities; entrance and exit facilities and floor conditions.

Table 4.1: Tabulated response rate of questionnaires administered

Respondent	No. Administered	Response	Percentage Response
Hospitals	9 No.	8No.	89%
Architects	48 No.	39No.	81%
NCC fire brigade	2No.	2No.	100%

Source: field survey 2008

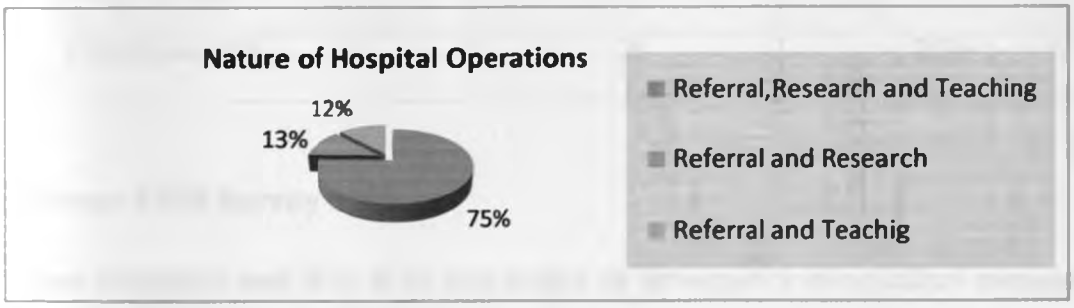
According to Mugenda 1999, a response rate of 50% is adequate for data analysis and reporting; 60% is good, while 70% is very good.

4.2 Responses from hospital management personnel

Nature of hospital operations

Among the hospitals that were issued with research questionnaires, 75% of the hospitals said that they are referral, research and teaching hospitals, 13% referral and research hospitals and 12 % being referral and teaching hospitals. Thus 100% of the interviewed hospitals offered referral services while 50% of hospitals offered research and training services.

Chart 4.1: Nature of Hospital Operations



Source: Field Survey 2008

Hospital profile key statistics

The average statistics for all the sample hospitals combined is shown in table 4.2 below.

Table 4.2: Hospitals Average Statistical Profile.

Statistic Element	Quantity
Staff Capacity	1,024 employees
Bed capacity	485 beds
Average annual outpatient attendance	124,455 visits
Average annual inpatient attendance	34,000 patients
Average length of stay **(Days)**	7 days

Source: Field Survey 2008

The hospitals also said that the disasters most likely to befall them are fire, 100%, followed by bomb explosions at 75%. Gas leakage and chemical spills are least with 13% and 25% respectively.

Table 4.3: Extent of Disasters in Hospitals

Disaster	No. of Hospitals	Percentage
Fire	8	100%
Bomb explosions	6	75%
Gas leakage	1	13%
Chemical spills	2	25%

Source: Field Survey 2008

Most hospitals said that they are aware of emergency evacuation measures. 88% of the hospitals were aware while 12% were not aware of emergency planning services and facilities.

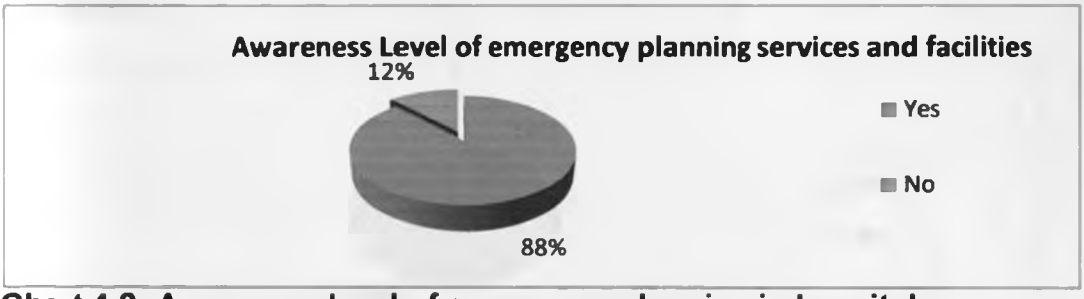


Chart 4.2: Awareness level of emergency planning in hospitals

Source: Field Survey 2008

The emergency planning facilities and services which are considered in particular include evacuation chair, safety kits and ramps at 100%, the buddy system at 75%, areas of refugee at 50%. The spinal board and trained personnel are least designed for at 25%.

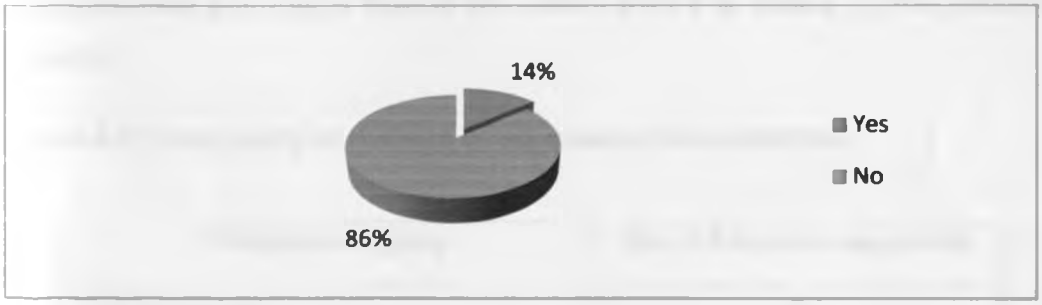
However, most hospitals said that they are not aware of the med sled and the helipad, the reason being that they are not trained in emergency evacuation tools and facilities. The above information is tabulated in table 4.4 below.

Table 4.4: Tools/Services Awareness in Hospitals

Tool /service	N. of hospitals	Percentage
Evacuation chair	8	100
Ramps	8	100
Spinal board	2	25
Med sled	Nil	Nil
Buddy system	6	75
Trained personnel	2	25
Safety kits	8	100
Areas of refugee	4	50
Helipad	Nil	Nil

Source: field study 2008

Chart 4.3: Level of involvement in emergency planning and safety practices

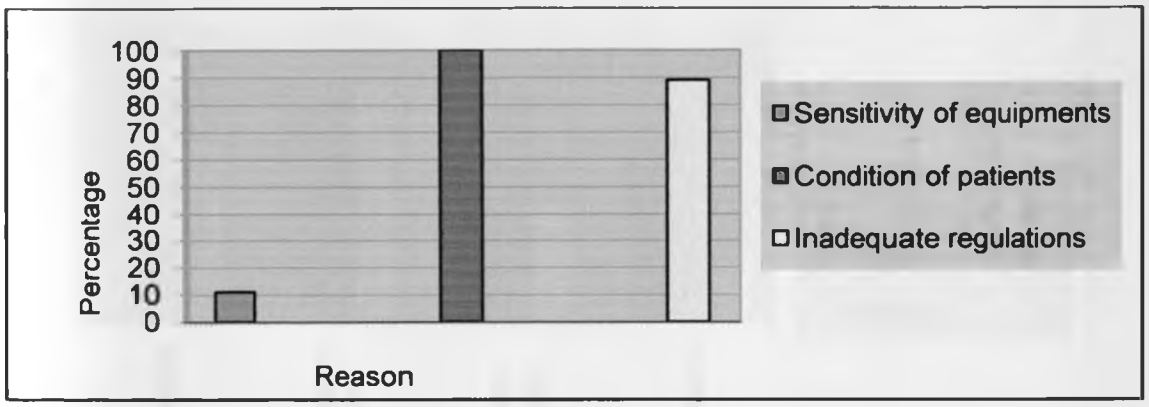


Source: Field Survey 2008

Reasons why hospitals are not involved in emergency planning and safety practices such as fire drills are condition of patients at 100%, inadequate regulations at 90%. Sensitivity of equipments was least at 10%.

Most hospitals however, said that in case of an internal disastrous occurrence they would find it too difficult to evacuate patients from hospital wards solely due to the lack of awareness caused by inadequacy of regulations. They also said that fire drills could be successfully carried out in a controlled environment. They said that they are mostly concerned with external emergencies that that usually involve admission of patients in hospitals.

Chart 4.4: Reasons why hospitals don't carry out fire drills



Source: Field Survey 2008

The table below shows the number of nurses required to effectively evacuate patients from hospital wards and the corresponding patient category. The hospitals said that this is true to the extent that it is based on the condition of patients.

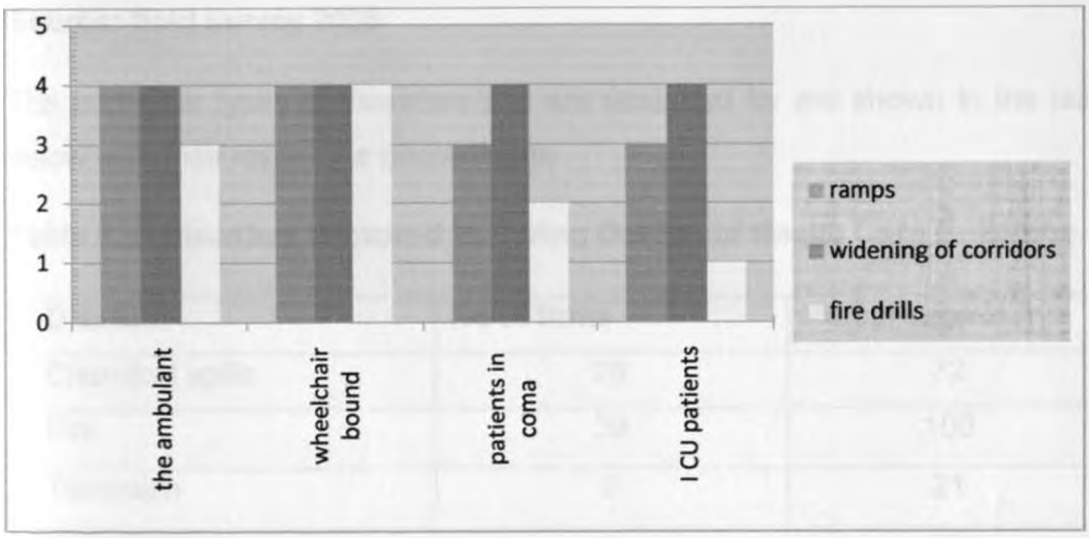
Table 4.5: Adequacy of nurses in an evacuation situation

Patient category	No. Of nurses required
The ambulant	1
Wheelchair bound	2
Patients in coma	3
ICU patients	4

Source: Field Survey 2008

Apart from fire drills, widening of corridors and installation of ramps, they also recommended that hospital personnel to be incorporated in the design team during the initial stages of design of hospital buildings, compulsory training of medical personnel on emergency planning and safety practices among other lessons.

Chart 4.5: priority levels in improving the emergency preparedness in hospitals

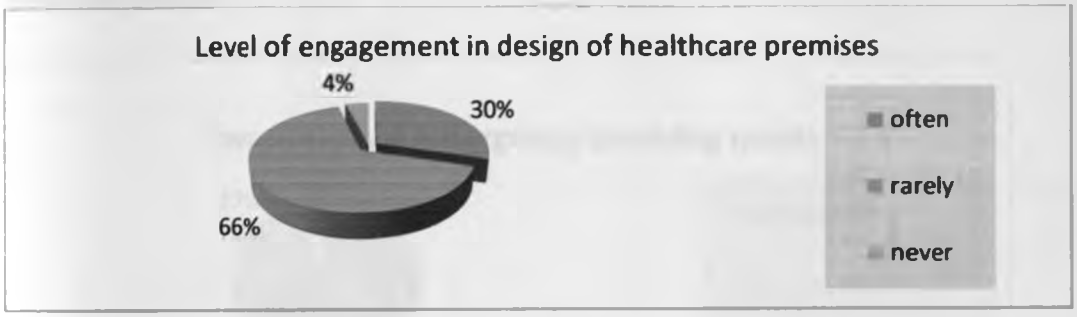


Source: Field Survey 2008

4.3 Responses from architects

Among the architectural firms issued with questionnaires, 66% were rarely engaged in design of healthcare buildings 30% were often engaged, while 4% have never been engaged in design of healthcare buildings. As indicated in the questionnaires, the main reason being that there are few cases of heath care designs specialization. However, most firms said that healthcare buildings require a design criterion that is geared towards achieving a conducive environment for safe evacuation of patients.

Chart 4.6: Level of engagement in design of health care buildings



Source: field survey 2008

The particular types of disasters that are designed for are shown in the table below with their respective percentages.

Table 4.6: Disasters Factored In During Design of Health Care Buildings

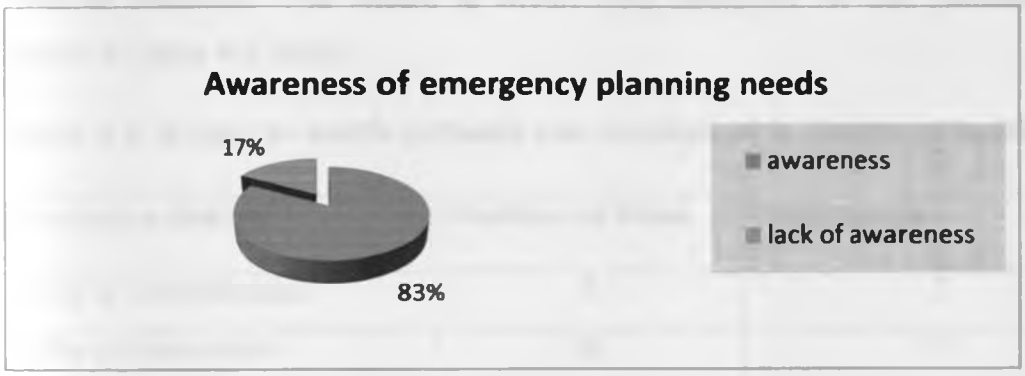
Disaster	No of firms	Percentage
Chemical spills	28	72
Fire	39	100
Terrorism	8	21
Earth tremors	3	51
Gas leakage	20	53

Source: field survey 2008

Much consideration was given to fire as a disaster, 100% followed by chemical spills, 72%, and then bursting of water tanks and terrorism at 53% and 21% respectively.

Among the architectural firms that were issued with questionnaires, (83%) were aware of emergency planning needs patients in hospital wards while (17%) were not aware of any emergency planning needs for them.

Chart 4.7: Awareness emergency planning needs for the patients in hospital wards



Source: Field survey, 2008.

The particular categories of emergency planning requirements which were mostly designed for are the wheelchair use (92%), followed by the evacuation chair (79%). None of the architectural firms confirmed to have designed for a helipad or med sled evacuation. However 90% of the interviewed architectural firms recommended the design of fire escape staircases or ramps for ease of movement.

Table 4.7: Level of emergency planning requirements in hospital buildings

Emergency requirement	Number of firms	Percentage
Wheelchair use	36	92%
Med sled evacuation	Nil	-
Evacuation chair	31	79%
Helipad positioning	Nil	-

Source: Field survey, 2008.

Most architectural firms (90%) said that little consideration was given special emergency requirements in regard to patient evacuation during design of hospital buildings. The extent to which they designed for the patients is as shown in table 4.8 below.

Table 4.8: Extent to which patients are considered in design of buildings

Inclusive design	Number of firms	Percentage
A lot of consideration	1	3
Little consideration	36	97
No consideration	Nil	-

Source: Field survey, 2008.

The reasons given for little consideration in the design of buildings are as shown in table 4.9 below.

Table 4.9: Reasons for little consideration of the patients in the design of high-rise buildings

Reasons	Number of firms	Percentage
Inadequate building regulations	24	62
Cost considerations	31	79
Minority group	2	5
Lack of general awareness	33	85
Others	1	3

Source: Field survey, 2008

The main reason for little consideration was lack of general awareness (85%), followed by cost considerations (79%). Inadequate building regulations was also a major reason for little consideration (62%).

Table 4.10: Effects of emergency planning facilities evacuation of patients from hospital wards

	Likely effects			
Item	**Great**	**Medium**	**Little**	**Negligible**
Cost	87%	11%	2%	-
Safety improvement	74%	2%	-	24%
Aesthetic	-	24%	71%	5%
Social relations	81%	19%	-	-
User friendly	46%	51%	3%	-

Source: Field survey, 2008

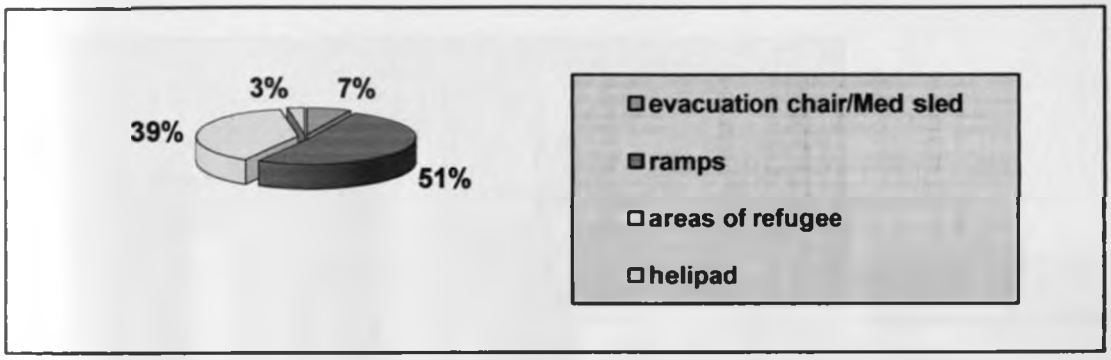
Table 4.11: Frequency of consideration given to evacuation of patients in various design aspects (%)

Item	description	Often	Rarely	Never
a	Alarm points	8	57	35
b	Call button	11	59	30
c	Fire extinguishers	46	37	16
d	Door locks	14	62	24
e	Horse reels	11	62	27
f	Wide corridors	8	49	43
g	Floor surface conditions	76	24	-
h	Entrance and exit ramps	19	78	3

Source: Field survey, 2008

Only entrance ramps were given the most consideration (76%) to the patients during design of buildings. Other design aspects were rarely considered.

Chart 4.8: Provisions for emergency evacuation accessories for patients in hospitals



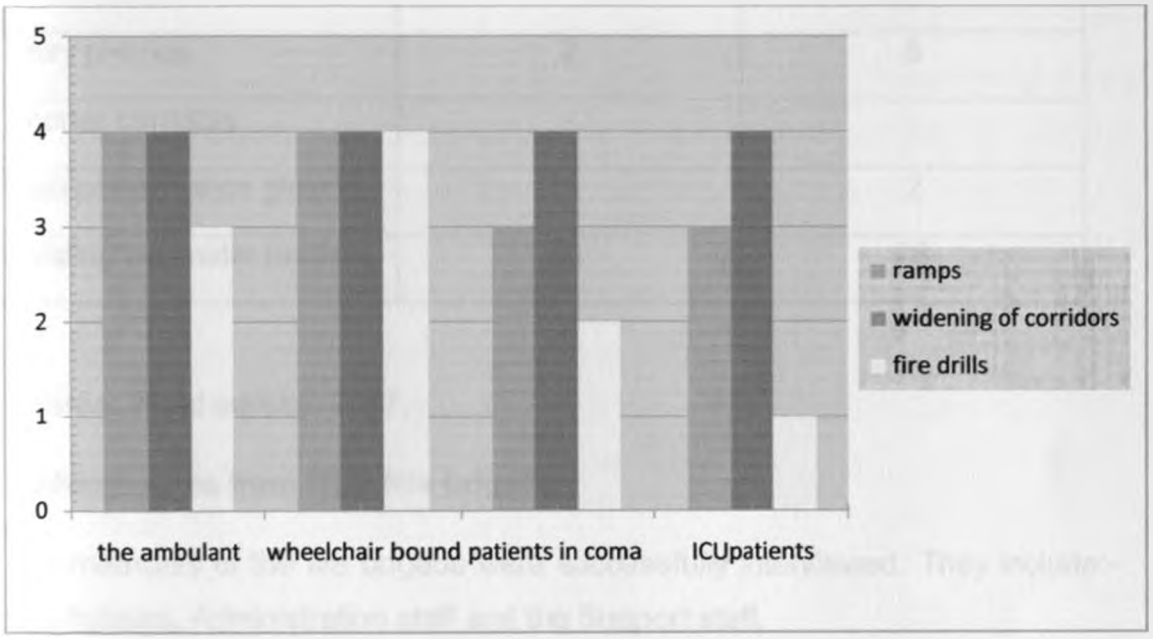
Source: Field survey, 2008

The use of ramps was the most recommended way of providing emergency evacuation accessories from hospitals (51%). This was followed by designing of areas of refuge (39%). (7%) of the architectural firms were aware of the use of evacuation chairs and med sled evacuation.

The other methods recommended were chutes and use of emergency fire proof lifts with an independent source of power supply where the hospital is a multi-storey building.

(28%) of the architectural firms that were issued with research questionnaires said that some particular aspects of their designs took into account the threat of terrorism while the other firms (72%) did not design against terrorism in hospitals.

Column chart 4.9: Priority Levels of Various Facilities Requirements With Reference to the Different Patient Categories (The Ambulant, Wheelchair Bound, Patients in Coma and ICU Patients)



Source: Field survey, 2008

Probable recommendations pertaining disaster mitigation and readiness in hospitals, with reference to design only (architects opinions)

a) Have wide staircases ramps and fire escape staircase.
b) Spacious areas of refugee
c) widening corridors
d) helipad installation where necessary
e) For hospitals departments that deal with specialized cases , ensure all necessary measures for emergency are taken e.g. HIV/AIDS department should have open shower points along corridor incase of blood spills.
f) Good ventilation for TB treatment rooms.
g) Use of thick reinforced concrete walls meeting specific standards in X-ray rooms.

Table 4.12: Level of Design against Terrorism in hospitals

Design aspect	Number of firms	Percentage
Blast curtains	-	-
Entry phones	2	5
Shorter corridors	-	-
High performance glazing	1	2
Building perimeter barriers	11	28

Source: Field survey, 2007.

4.4 Responses from NCC fire brigade

The members of the fire brigade were successfully interviewed. They include:- Fire fighters, Administration staff and the Support staff.

The employees are trained in emergency evacuation procedures of patient from hospital wards. In less often than not occasions, they have been involved in evacuation procedures involving the patients from hospital wards. Among the groups evacuated, they experienced difficulty to a large extent when evacuating the patients in coma, ICU patients, and patients with spinal malfunctions, those with fractures and those undergoing surgery. Wheelchair bound posed effects only to a fair difficulty.

The ambulant had no difficulties at all. It was also mentioned that evacuation of patients from hospital wards is an issue that has not received adequate attention because there are only rare cases of such incidences. However, one of the fire officers said that in those rare cases they experience great extent of difficulties. He recommended the use of modern facilities such as the med sled, chutes, helipad, spine board, extrication kits, and vacuum splints et al. he said that they had major problems when evacuating babies from the maternity ward third floor at Pumwani hospital and the patients in coma and those in ICU at

Garissa District Hospital and thus the most important thing according to them was mitigation factors to curtail the sources of hospital fires in the first place.

The NCC fire brigade was not in possession of any specialized equipment specifically designed to cater for the patients. They attributed this to cost factors. The fire brigade personnel said that, ideally, they are meant to conduct an annual fire drill in all buildings that house more than 20 people although in reality, this does not happen in hospital buildings, the reason being that the condition of patients can only allow such drills in a controlled environment. However, they did not disclose what those conditions are. However, no special conditions have ever been facilitated, hence no fire drills have ever been carried out in hospital buildings and this can be attributed to lack of general awareness and inadequate policies and regulations with the latter carrying more weight than the former.

4.5 Interviews

4.5.1 Interview with architects

Most architectural firms said that the level of design against terrorism in hospitals is not a major factor of consideration because it has never come to the minds of designers, aspects of terrorism in hospitals.

However, they admitted that since some national hospitals and mostly private hospitals host casualties of the countries superpowers and that also some hospitals either belong or are linked in some way or another to the countries political icons, or just merely by the virtue of the fact that its almost impossible to read the mind and intention of those involved in terrorism, design against terrorist attacks is therefore a crucial part of security considerations.

Building perimeter barriers was the most used design criteria by the architectural firms. The architects interviewed said that use of blast curtains and

high performance glazing was not common because they are expensive and would eventually not prove to be cost effective.

The main reason given was that, although Kenya experienced a major bomb blast in 1998, the likelihood of another bomb blast though unpredictable is little and the occurrences are far between hence not justifying the need for blast curtains and high performance glazing.

The other methods used by architects to design against terrorism are as follows:

- Use of screen areas or screen rooms hence ensuring that movement of people, vehicles or goods in and out of the building is monitored.
- Designing of areas in buildings that have restricted access or placing balconies at strategic positions to offer natural surveillance.

Most firms recommended the use of cross ventilation in **TB** treatment centres and emergency showers in **HIV** treatment centres.

The architects interviewed said that the building by laws and regulations that considered patients were scant and their implementation rate was also low. The other reason which was specified for little or no consideration was inadequate space in buildings to provide for facilities such as ramps.

4.5.2 Interview with medical personnel

The nurses, attending doctors and the officials of the department of standards and regulatory services (DSRS) and other respondents said that the hospital personnel do not undergo training on internal disaster readiness in hospitals but are rather trained to handle external emergencies. That is; they are trained in admission of inpatients or outpatients of external emergencies and not evacuating patients from hospital wards out of internal disastrous occurrences.

The respondents also said that they are not aware of emergency evacuation procedures out of a disastrous occurrence since the only evacuation policies

that subsist are those written down during the establishment of hospitals for registration formalities only and thus have not undergone any review to make them fit for implementation and create an aspect of user friendliness.

However, they said that they are aware of many evacuation tools and services apart from med sled, chutes, helipad and the buddy system. The most common tools according to the hospital personnel include the ramps, spinal board and evacuation chairs.

They argued that failure of regulatory bodies like The Nairobi City Council (NCC) to implement various regulations due to laxity and also not carrying out education programs on internal disaster management in hospitals has led to the little concern of emergency aspects in hospitals . For instance, 80% of the hospitals said that they have never received fire education program since their establishment.

In conclusion, the hospital personnel recommended the following measures: Revision of emergency regulations and policies, establishment of emergency programs on internal disasters in hospitals, emergency evacuation practices under controlled environment (which they did not specify) and educating the community around hospitals on disaster preparedness and voluntary services. They also said that they need to be involved in design of hospitals since they could be in a position to address some of safety design aspects like internal spatial arrangement in wards.

4.6 Survey of sample hospitals

Out of nine hospitals in the sample list, only eight were accessible for survey. This physical survey was carried out in two aspects.

4.6.1 The Facility Mission Aspect

A checklist was used to find out whether the facilities in hospitals do measure up to requirements of safe evacuation of patients in a typical internal disastrous occurrence.

Table 4.13: Facilities Considered In Safe Evacuation

Facility	No. of Hospitals	Percentage
Med sled	Nil	-
Evacuation chair	6	75
Spinal board	2	25
Safety kits	6	75
Extrication kit	Nil	-

Source: Field survey, 2007.

None of the hospitals surveyed had a med sled or extrication kits but at least most hospitals had evacuation chairs. (75%). 25% of the hospitals had spinal boards but most hospitals had safety kits (75%). however even those hospitals with safety kits, spinal board and evacuation chairs either most of these were in a poor state or they were not sufficient at all; for instance a hospital with a bed capacity of 450 patients had only eight evacuation chairs, no safety kits and one spinal board.

4.6.2 The Architectural Design Aspect

4.6.2.1 Access

Table 4.14: Level of consideration of access design aspects

Access facility	No. of Hospitals	Percentage
Ramps	4	50
Level entrances	8	100
Staircases and steps	6	75
Doors	8	100

Source: Field survey, 2007.

All the hospitals surveyed had their doors level entrances and doors.75% of the hospitals had staircases and 50% had ramps. However, most of the hospitals had ramps and or staircases either too steep or their width too narrow for ease of movement or such that they could not aid safe evacuation of patients in case of an internal disaster.

Most of the doors at the internal entrances were the type that cannot swing through 180^0 both directions.

4.6.2.2 Escape

Table 4.15: Level of consideration of escape facilities

Escape facility	No. of Hospitals	Percentage
Lighting	8	100
Doors	8	100
Areas of refugee	8	100

Source: Field survey, 2007

All the hospitals which qualified the survey had lighting, doors and escape routes but had no areas of refugee. However, most hospitals had very poor lighting of escape routes with some of the staircases being too steep for ease of movement. Some had no clear warning signals present in most of the escape routes.

Incidentally, many hospitals had their escape routes used to store furniture and this would prove risky in a typical evacuation scenario.

4.6.2.3 Signage position of emergency alerts

The standard height according to the building code (1968) is one metre above the floor level. However, most of the hospitals surveyed had fire suppression and alert systems positioned at between 1.2 metres and 1.8 metres high 50% of the hospitals.

This obviously made it difficult for patients to access them in case of a need to. In addition, the emergency control systems were either vandalized, in improper conditions or either not visible or clear.

The other 50% of the hospitals had their emergency control systems correctly positioned and emergency signals affixed at recommended heights with clear and visible signage.

4.6.2.4 Internal spatial arrangements

Items considered in this respect include; Corridors, Floors, Wards and Doors

Most of the corridors of hospital buildings surveyed met the minimum standards about 80% of 1.5 metres corridor width. This is sufficient for allowable rotation of patients who are wheelchair bound. Wards in most hospitals were spacious enough to allow movement during emergencies.

However, most hospitals 75% had their corridors finished with a slippery floor finish making them very hazardous during emergencies. This, according to hospitals was in a bid to improve on aesthetics. In addition, although the entrances were spacious enough to accommodate and ease movement of many patients and visitors, this was counteracted by influx of outpatients making them crowded more often than not.

Most of the doors into hospital wards were not the swinging types (180^0 turning types).

4.7 Summary of findings

Safe evacuation of patients from hospital wards is not put into consideration during the design of hospital buildings. This is mainly due to lack of general awareness by the planning and legislative authorities. Other factors include; cost considerations and laxity in implementing building regulations.

The hospital personnel are not trained to safely evacuate patients from hospital wards, among other training sessions done in hospitals.

There are few facilities for safe evacuation of patients from hospital wards. This hence would make evacuation difficult obviously depending on the hospitals patient profile.

Thus, patients' safety depend, to a great extent, on the outside intervention in terms of peripheral rescue teams such as the St. Johns ambulance and voluntary services from rescue teams such as the community around. However, ordinarily, disaster mitigation and readiness does not depend on external intervention. This comes as a tertiary service.

The respective authorities do not carry out fire education programs significant in hospitals and the community around. This puts the personnel at a detriment of being unable to evacuate patients effectively from hospital wards.

The emergency control systems of hospital buildings especially those constructed before 1999, before establishment of EMCA, do not adequately meet their intended purposes, either because they are in a very poor state of functionality or else they have been vandalized making them inadaptable for current user needs.

4.8 Interpretation of data

It has been vividly shown from data analysis that 75% of the hospitals had little consideration for evacuation of patients from hospital wards.

None of the hospitals surveyed was adequately designed and furnished with facilities that could adequately aid in effective evacuation measures from hospital wards in the event of an ideal disastrous occurrence.

The hospital buildings constructed before the establishment of the environmental management and co ordination act of 1999 which implements its regulations through national environmental and management authority.

Most of those hospital buildings have their emergency control systems either out of order, vandalized or devoid of the ability to perform their intended purposes. In more hazardous situations, some hospitals have a number of emergency control systems missing.

Apparently, it's evident as reflected by feedback from respondents and the researchers' survey of sampled hospitals that there are scant planning and building regulations that cater for safety and emergency preparedness in hospitals and even the existing scanty regulations are not are not implemented effectively.

This could be attributed to lack of a central enforcing authority to implement and make proposal for review and amendment of the existing regulations.

The above inferences have thus tested the following research hypotheses and proven them to be true.

H01 Most of the hospitals in Kenya are not designed in the design criterion such as to aid safe evacuation of patients from the wards in the event of an internal disastrous occurrence.

H02 Most of the hospitals in Kenya are not equipped and furnished with relevant facilities and services [tools and human resource] that would aid efficient evacuation of patients from hospital wards in the event of an internal disaster.

4.9 Problems encountered in the field

There were various problems that were encountered during the field survey. They included:

(a) In some buildings, the researcher was not allowed to get any information, the main reason being security. In all hospitals, photography was faced with mixed security reactions.

(b) The researcher was not allowed to take any photos in any of the hospitals according to the discretion of the hospital chief executive officers of the various hospitals.

(c) Some specific hospitals denied the researcher authorization to carry out research in their hospitals through written mails (letters). In fact, they were not willing to discuss the matter further.

(d) Excessive bureaucracy in a number of places. This resulted in the researcher spending a lot of time before being directed to the concerned persons or obtaining a research authorization from respective hospitals. In some extreme cases, it took five weeks to obtain such permits.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The research sought to evaluate disaster preparedness in hospitals in terms of design of buildings and the facility mission. This chapter presents in summary, the conclusions and discusses the recommendations made in the light of the study objectives, as well as the research problems and assumptions

The study aimed at achieving the following objectives.

- To evaluate the adequacy of facilities that have been incorporated in hospitals to aid evacuation of patients in the event of an internal disastrous occurrence.
- To find out whether the basic design criterion by architects factors-in 'safe evacuation of patients' without compromising space requirements and the overall planning standards.
- To find out whether the hospital personnel (attending nurses, doctors and rescue team) are trained to respond to internal disasters among other duties.
- To recommend on the special measures that should be taken to aid safe evacuation of patients from hospital wards during internal disasters both in terms of design, human resource and facilities as well as protection of equipments.

5.2 Conclusion

Based on the findings presented in chapter four, most of the hospitals gave little or no consideration to internal rapid onset emergencies hence no attention therefore was sought for evacuation of patients especially during design of hospital buildings.

The hospital staff also seemed to over concentrate on external emergencies other than internal emergencies. The staff is trained to tackle external emergencies. In terms of design, most of hospital buildings surveyed as well as study findings based on response from architects clearly showed that safe emergency planning is given little or no consideration in hospital buildings.

In terms of facilities, most hospitals have a fair number of evacuation facilities but in an ideal emergency scenario, these would not efficiently aid in safe evacuation of patients.

In an effort to create a safety sound environment suitable for the patient population, a great deal needs to be done in terms of emergency planning facilities and services.

Safe evacuation of patients is an issue that presents difficulties more so to the emergency staff. The bed ridden patients in particular present difficulties inherent in almost all areas of a building especially in entrance points, locomotion through narrow corridors and staircases.

Inadequate building and planning regulations that compel design professionals and legislations that guide planning authorities in the construction industry are some of the causative factors to the little consideration of safe emergency planning in hospital buildings. The EMCA act of 1999, through NEMA which is a regulatory body requires the provision of ramps for the physically challenged, a category one would wish to include patient as well. However, such legislations mainly focus on accessibility requirements of the physically challenged as well as aspects of employment and social welfare. Little consideration is given to safety requirements of patients.

Lack of a central authority to address issues of internal emergency in hospitals in which safety concerns can be voiced to the relevant authorities involved has also led to this lack of concern. Such concerns from the authorities bestowed with the mandate to oversee safe construction only come to board when a major disaster such as fire emergency occurs.

5.3 Recommendations

Based on the research findings and conclusions the following measures are recommended.

1. Safety audits should be done on all existing buildings and adjustments to be made should be identified in order to ensure that the emergency planning facilities and equipments in the buildings cater for the needs of patients.
2. Immediate retrofitting of the adjustments identified in number one above.
3. Ambulant patients should be involved in safety planning practices such as the fire drills which improves their safety awareness. The buddy system should be introduced as a management policy
4. Public awareness campaigns, especially the public around hospitals this can be done through public fire education specifically targeting the patient population. Such campaigns could also be done through the media.
5. Training of hospital personnel on safety evacuation measures over and above other professional training sessions.
6. Revision of disaster management policies for hospitals. Those which do not have should write down such policies.
7. Future concerns on establishment of healthcare facilities should take into consideration the emergency planning needs of the patient population. In terms of design the following facilities should be incorporated.
    - safety controls at lower heights
    - properly designed kerb ramps , entrance ramps or level entrances
    - use of nonslip floor finishes
    - clear signage of safety precautions and escape routes
    - Retrofitting of building controls such as fire alarms triggers.

5.4 Areas of further study

a) A study of the cost implications of incorporating emergency planning facilities for the patient evacuation in hospitals.

b) A further study can be done on other non rapid onset emergencies such as the floods, chemical spills, gas explosion, bursting of water tanks et al.

c) This study was done in Nairobi area. A further study may be done on disaster mitigation and readiness in hospitals with reference to informal settlements.

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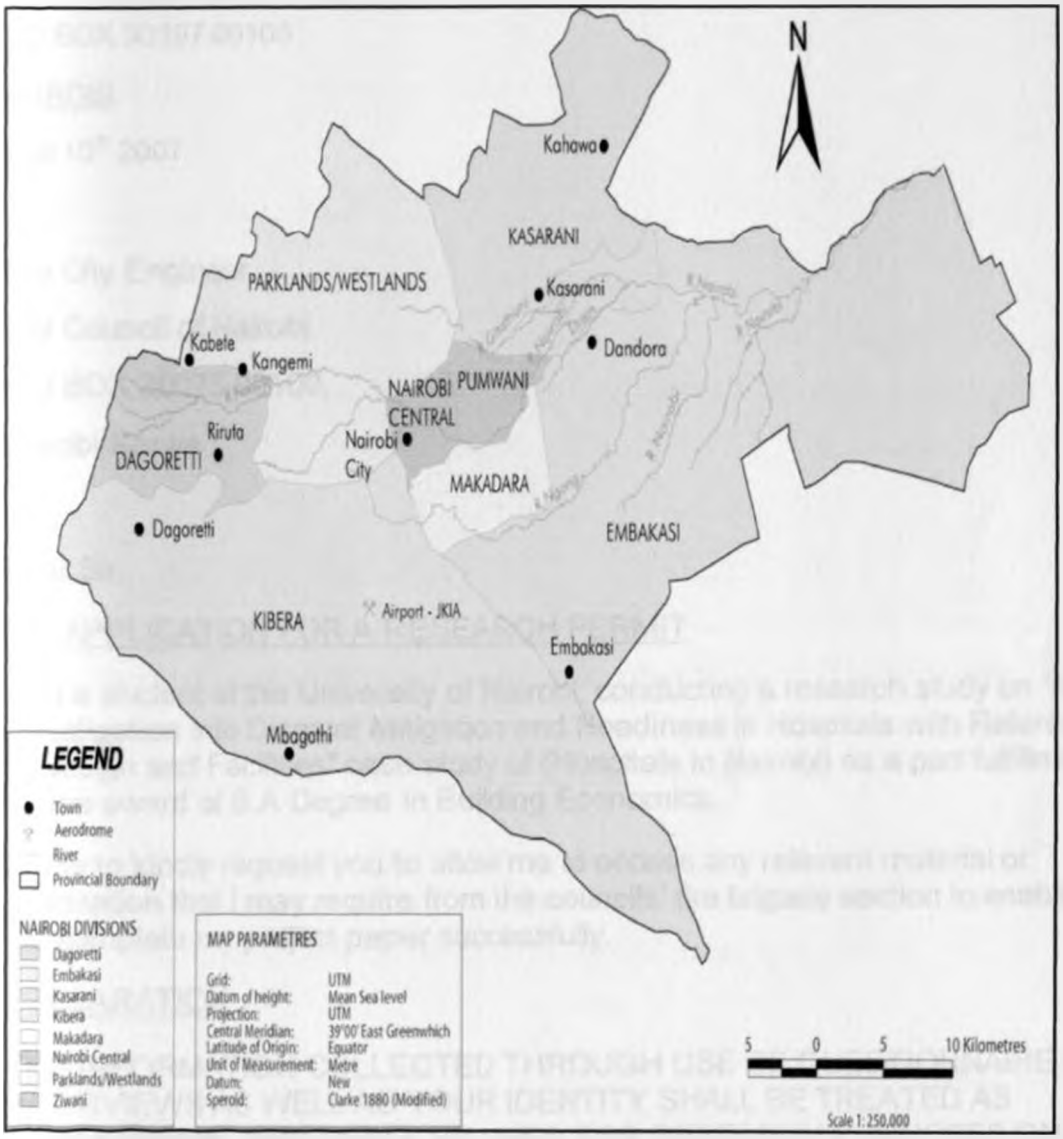
Appendix 2: Map of Nairobi Area



Source: nairobimaps.com

Appendix 3: Application for Research Authorization to NCC

Nguru Eric Munene.

School of the Built Environment,

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P.O BOX 30197-00100

NAIROBI

April 10th 2007

The City Engineer,

City Council of Nairobi

P.O BOX 30075-00100,

Nairobi-Kenya

Dear Sir,

RE: APPLICATION FOR A RESEARCH PERMIT

I am a student at the University of Nairobi, conducting a research study on "An Investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities" case study of (Hospitals in Nairobi) as a part fulfillment for the award of B.A Degree in Building Economics.

I write to kindly request you to allow me to access any relevant material or information that I may require from the councils' fire brigade section to enable me complete my project paper successfully.

DECLARATION

THE INFORMATION COLLECTED THROUGH USE OF QUESTIONNAIRE (s), INTERVIEWS AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

Your assistance will be highly appreciated

Yours Faithfully

Eric Munene [Researcher]

Appendix 4: Application for a Research Authorization to the MOH

School of the Built Environment,

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P.O BOX 30197-00100

NAIROBI-KENYA

April 22, 2008.

The Permanent Secretary

Ministry of Health

P.o Box **30016**-00100,

Nairobi-Kenya

Dear Sir,

RE: APPLICATION FOR A RESEARCH AUTHORIZATION

I am a student at the University of Nairobi, conducting an academic research study on **"An Investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities"** case study of (Hospitals in Nairobi) as a part fulfillment for the award of B.A Degree in Building Economics.

I hereby write kindly requesting you to allow me to access any relevant material or information that I may require from the major Hospitals in Nairobi as well as the ministry of health to enable me complete my project paper successfully.

DECLARATION

THE INFORMATION COLLECTED THROUGH USE OF QUESTIONNAIRE(s), INTERVIEWS AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

Your assistance will be highly appreciated

Yours Faithfully

Eric Munene [Researcher]

Appendix 5: Application for a Research Authorization in Hospitals

May 2, 2008

Nguru Eric Munene.

School of the Built Environment,

UNIVERSITY OF NAIROBI

P.O BOX 30197-00100

NAIROBI

The Director,

Hospital Management

Dear Sir/Madam,

RE: APPLICATION FOR A RESEARCH AUTHORIZATION

I am a student at the University of Nairobi, conducting a research study on "**An Investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities"** case study of (Hospitals in Nairobi) as a part fulfillment for the award of B.A Degree in **Building Economics.**

I hereby write kindly requesting you to allow me to access any relevant material or information that I may require from the hospital to enable me complete my project paper successfully.

DECLARATION

THE INFORMATION COLLECTED THROUGH USE OF QUESTIONNAIRE (s), INTERVIEWS AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

Your assistance will be highly appreciated

Yours Faithfully

.....

Eric Munene

Appendix 6: Questionnaire to Hospitals

Letter of Introduction to the Hospital Management Personnel

Nguru Eric Munene

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P.O BOX 30197-00100,

NAIROBI

May 2, 2008

To

Respondent,

I am a student at the University of Nairobi conducting a research on **"An Investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities"** case study of (Karen hospital, Kenyatta National Hospital and the Nairobi hospital) as a part fulfillment for the award of **B.A** Degree in **Building Economics.** I am intending to administer questionnaires to yourselves as a tool for data collection.

DECLARATION

THE INFORMATION COLLECTED THROUGH THIS QUESTIONNAIRE AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

INSTRUCTIONS

Please tick and/ or state the appropriate answer in the space (s) or box (es) provided. More than one answer may be ticked or stated where applicable.

Your assistance will be highly appreciated

Thanks

Eric Munene

UNIVERSITY OF NAIROBI

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

QUESTIONNAIRE TO THE HOSPITAL MANAGEMENT PERSONNEL

1. What is the overall systems goal of the hospital, vision, mission and core-values?

   .....

   .....

2. What are the major medical services carried out by your hospital?

   a) Referral { }
   b) Teaching { }
   c) Research { }
   d) All the above { }
   e) Others

   (specify).....

   .....

3. Kindly fill in the hospital profile key statistics provided below.

STATISTIC ELEMENT	**NUMBER**
Staff Capacity	
Bed capacity	
Average annual outpatient	
Average annual inpatient	
Average length of stay **(Days)**	

5. Disasters are inevitable occurrences; given the nature of the hospitals internal activities, which disastrous occurrences are most likely to befall your hospital?

a) Fire outbreaks { }
b) Bomb explosions { }
c) Gas leakage { }
d) Chemical spills { }
e) Others
(specify).....
.....

6. Are you aware of any emergency planning facilities as well as services for evacuation of patients from hospitals wards in case of an internal disastrous occurrence?

Yes { } No { }

7. If **yes** in **No. 6 above**, which ones in particular?

Evacuation chairs { } Med sled evacuation { } Safety kits { }

Ramps { } The buddy system { } Areas of refugee { }

Spinal board { } Trained personnel { } Helipad { }

Others (specify).....
.....

8. Are you involved in any emergency planning and safety practices such as conducting fire exit drills?

Yes { } No { }

9. If **No** in No.**8 above**, what can you attribute this to?

a) Sensitivity of hospital equipments { }
b) Condition of patients would not allow { }
c) Inadequate regulations { }
d) Others (specify) { }.....
.....
.....

10. If **yes** in **No. 8 above**, how frequently is this carried out?

a) Monthly { }
b) Quarterly { }
c) Half yearly { }
d) Annually { }
e) Others (specify)
.....
.....

11. Healthcare premises present a unique problem in terms of evacuation in a disastrous situation. The main factor, which differentiates healthcare buildings from other occupancies, is that no other building type presents such a wide spectrum of occupants with such varying physical capabilities or has such a need for the main operational functions of the building to remain active during a disaster. With regard to the above statement, do you have any documented emergency planning policies in operation, annotating the **Available Safe Egress Time** and **Required Safe Egress Time?**

Yes { } No { }

12. In your own opinion, how many nurses would effectively assist evacuation of patients in the following categories, in the event of a disaster?

PATIENT CATEGORY	NO. OF NURSES
The ambulant	
Wheelchair bound	
Patients in coma	
ICU patients	
Other categories a)	
b)	

13. By considering the choices given below, give a professional opinion on the best way of improving disaster mitigation and readiness in hospital wards by ranking them in order of priority for each category of choices.

Key: {1}.....No priority

{2} ..... Little priority:

{3}.....Moderate priority

{4} .....High priority

a) The Ambulant

- Installing entrance and exit ramps {1} {2} {3} {4}
- Widening of corridors {1} {2} {3} {4}
- Training and or fire drills {1} {2} {3} {4}
- Others (specify) .....

.....

.....

b) Wheelchair Bound

- ❖ Installing entrance and exit ramps {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ training or fire drills {1} {2} {3} {4}
- ❖ Others (specify).....
  .....
  .....

c) Patients In Coma

- ❖ Installing entrance and exit ramps {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Training Or Fire Drills {1} {2} {3} {4}
- ❖ Others (specify).....
  .....
  .....

d) I C U Patients

- ❖ Installing entrance and exit ramps {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Training Or Fire Drills {1} {2} {3} {4}
- ❖ Others (specify).....
  .....
  .....

e) **Other categories of patients** (specify)

.....

.....

.....

.....

.....

14. What are some of the most expensive equipments used in hospitals that you would not hesitate to protect from destruction, in case you are given a chance to, if and when a disaster occurs?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

THANK YOU

Appendix 7: Questionnaires to Architects

Letter of Introduction to the Architects

Nguru Eric Munene.

School of the Built Environment,

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P.O BOX 30197,

NAIROBI

April 10th 2008

To

Respondent,

I am a student at the University of Nairobi conducting a research on "**An Investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities**" case study of (Karen hospital, Kenyatta National Hospital and the Nairobi hospital) as a part fulfillment for the award of **B.A** Degree in **Building Economics.**

DECLARATION

THE INFORMATION COLLECTED THROUGH THIS QUESTIONNAIRE AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

Your assistance in the completion of this questionnaire will be highly appreciated.

INSTRUCTIONS

Please tick { } and/ or state the appropriate answer in the space (s) or box (es) provided. More than one answer may be ticked or stated where applicable.

Your assistance will be highly appreciated

Eric Munene (Researcher)

UNIVERSITY OF NAIROBI

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

QUESTIONNAIRE TO ARCHITECTS

1. How often are you engaged in design of health care buildings?

   Often { } Rarely { } Never { }

2. If **rarely** or **never** in NO.2 above, what is this attributable to?

   a) Specialization { }

   b) Others (specify).....

   .....

3. Which disasters, in your own opinion do the experts factor- in/are likely to factor- in for emergency planning requirements in hospitals buildings?

   a) Chemical spills { }

   b) Fire { }

   c) Terrorism { }

   d) Earth tremors { }

   e) Gas leakage/explosion { }

   f) Bursting of water tanks { }

   g) All the above { }

   h) None { }

   i) Others (specify

   .....

   .....

   .....

4. Are you aware of any emergency planning and evacuation requirements for patients in hospitals wards?

Yes { } No { }

5. If **Yes in no.4** above, which particular category of emergency requirements are supposed to be designed for?

a) Wheelchair use { }
b) Med sled evacuation { }
c) Evacuation chair { }
d) Helipad positioning (where applicable) { }
e) None { }
f) Others
(specify).....
.....

6. How much consideration is given to special emergency requirements of patients in the design of hospitals?

Ample consideration { } Little consideration { } No consideration { }

7. If little or **no consideration in** No. 6 **above**, what would you attribute this to?

a) Inadequate building regulations { }
b) Cost considerations { }
c) Discrimination of patients { }
d) Lack of awareness { }
e) Others (specify).....
.....

8. What effects does the incorporation of emergency planning requirements for evacuation of patients from hospital wards have on the building? (Tick where appropriate)

	Likely Effects			
ITEM	**Great**	**Medium**	**Little**	**Negligible**
Cost				
Safety improvement				
Aesthetic				
User friendly				
Social Relations				

9. How often have your designs taken/ likely to take into account specific areas of accessibility for the ambulant and wheelchair users in specifying the height of safety control points and facilities in hospitals?

(Tick where appropriate)

	Level of consideration		
ITEM	**Often**	**Rarely**	**Never**
Alarm points			
Call button			
Fire extinguishers			
Door locks			
Horse reels			
Wide corridors			
Floor surface conditions			
Entrance and Exit ramps			

10. Apparently, where used in multistoried hospital buildings, staircases present challenge in evacuation of the I C U Patients, patients in Coma and the wheelchair bound in the event of an internal disastrous occurrence. With reference to the considerations listed below what provisions are made necessary in the design of such hospital buildings to aid emergency escape without compromising the health of patients and design standards.

a) Evacuation chair/Med sled { }
b) Ramps { }
c) Areas of refugee { }
d) Helipad { }
e) Others (specify)
.....

11. By considering the choices given below, give a professional opinion on the best way of improving disaster mitigation and readiness in hospital wards, by rating them in order of priority for each category of choices.

Key

{1}.....No priority
{2}.....Little priority
{3}.....Moderate priority
{4}.....High priority

f) The Ambulant

- installing entrance and exit ramps {1} {2} {3} {4}
- Widening of corridors {1} {2} {3} {4}
- Training and or fire drills {1} {2} {3} {4}
- Others (specify).....
.....

g) Wheelchair Bound

- Installing entrance and exit ramps {1} {2} {3} {4}
- Widening of corridors {1} {2} {3} {4}
- Lowering heights of controls {1} {2} {3} {4}
- Others (specify).....

.....

h) Patients In Coma

- Installing evacuation chairs and or med sled {1} {2} {3} {4}
- Widening of corridors {1} {2} {3} {4}
- Buddy system {1} {2} {3} {4}
- Others (specify).....

.....

i) I C U Patients

- Installing evacuation chairs and or med sled {1} {2} {3} {4}
- Widening of corridors {1} {2} {3} {4}
- Buddy system {1} {2} {3} {4}
- Others (specify).....

.....

.....

.....

.....

.....

.....

j) **Other categories of patients**

(specify).....

.....

.....

.....

.....

12. By citing probable recommendations and with regard to **design only**, give a professional advice on disaster preparedness and mitigation in hospital buildings,

---

Thank you

Appendix 8: Questionnaire to the Fire Brigade

Letter of Introduction to the Fire Brigade

Nguru Eric Munene

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P.O BOX 30197,

NAIROBI

April 10th 2008

To

Respondent,

I am a student at the University of Nairobi conducting a research on "**An Investigation into Internal Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities"** case study of (Karen hospital, Kenyatta National Hospital and the Nairobi hospital) as a part fulfillment for the award of **B.A** Degree in **Building Economics.** I am intending to administer questionnaires to yourselves as a tool for data collection.

DECLARATION

THE INFORMATION COLLECTED THROUGH THIS QUESTIONNAIRE AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY.

INSTRUCTIONS

Please tick and/ or state the appropriate answer in the space (s) or box (es) provided. More than one answer may be ticked or stated where applicable.

Your assistance will be highly appreciated

Eric Munene (researcher)

UNIVERSITY OF NAIROBI

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

QUESTIONNAIRE TO THE NCC FIRE BRIGADE

1. Are any of your employees trained in emergency evacuation procedures of patients from hospital wards?

   Yes { } No { }

2. Have your employees ever been involved in rescue of patients from hospital wards?

   Yes { } No { }

3. If **Yes** or even **No in no. 3 above** to what extent were the difficulties experienced /likely to be experienced for various categories of patients?

Patient category	**Large extent**	**Fair extent**	**Little extent**	**None**
Ambulant				
Wheelchair bound				
Patients in coma				
ICU patients				
Others a)				
b)				
c)				

4. Are you possession of any emergency evacuation equipment specifically designed for patients?

   Yes { } No { }

5. If Yes in **no. 5 above** which ones in particular?

- ❖ Evacuation chair { }
- ❖ Chutes { }
- ❖ Med sled { }
- ❖ None { }
- ❖ Others
  (specify).....
  .....
  .....

6. Do you conduct any safety and evacuation drills in hospital buildings involving patients with all varying physical and psychological capabilities?

Yes { } No { }

7. If **Yes** in **no. 7 above** how frequently is this done?

- ❖ Monthly { }
- ❖ Quarterly { }
- ❖ Half yearly { }
- ❖ Annually { }
- ❖ Others (specify)
  .....
  .....
  .....

9. If **No** in **no. 7 above** what can you attribute this to?

- ❖ Inadequate policies and regulations { }
- ❖ The sick are invalids not warranting any consideration { }
- ❖ Lack of general awareness { }
- ❖ Others(specify).....
  .....
  .....

10. Are you involved in the design process of fire escape and safety equipment as well as service provision in hospital buildings?

Yes { } No { }

11. If **Yes** in **no. 10 above** which service equipment or design parameters do you consider so as to cater for the needs of patients in hospital wards?

- ❖ Evacuation chairs use and storage { }
- ❖ Med sled use and storage { }
- ❖ Safe rooms/refugee areas { }
- ❖ Helipad { }
- ❖ Buddy system { }
- ❖ Ramps and their specifications { }
- ❖ Staircases treads and risers details { }
- ❖ None
- ❖ Others

(specify).....

.....

.....

12. Do you have any special fire education programs for hospital staff and the community around?

Yes { } No { }

13. By considering the choices given below, give a professional opinion on the best way of improving disaster mitigation and readiness in hospital wards, by rating them in order of priority for each category of choices.

Key

{1}.....No priority

{2} ..... Little priority

{3}.....Moderate priority

{4} .....High priority

k) The Ambulant

- ❖ Ample evacuation facilities {1} {2} {3} {4}
- ❖ Installing entrance and exit ramps {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Training and or fire drills {1} {2} {3} {4}

l) Wheelchair Bound

- ❖ Ample evacuation facilities {1} {2} {3} {4}
- ❖ Installing entrance and exit ramps {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Lowering heights of controls {1} {2} {3} {4}
- ❖ Buddy system {1} {2} {3} {4}
- ❖ Others (specify).....
  .....
  .....

m) Patients In Coma

- ❖ Ample evacuation facilities {1} {2} {3} {4}
- ❖ Installing evacuation chairs and or med sled {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Buddy system {1} {2} {3} {4}
- ❖ Others(specify).....

.....

n) I C U Patients

- ❖ Ample evacuation facilities {1} {2} {3} {4}
- ❖ Installing evacuation chairs and or med sled {1} {2} {3} {4}
- ❖ Widening of corridors {1} {2} {3} {4}
- ❖ Buddy system {1} {2} {3} {4}
- ❖ Others

(specify).....

.....

o) **Other categories of patients** (specify)

.....

.....

.....

Thank you.

Appendix 9: Implementation Checklist

Theme: disaster mitigation and readiness in hospitals with reference to design and facilities

IMPLEMENTATION CHECKLISTS

TROUBLESHOOTING

1. Patients bound in wheel chairs.

Problem	Measure
▪ Overcoming differences in level between road and pavement	▪ Install kerb ramps
▪ Bridging great differences in height usually tackled by providing stairs	▪ Provide ramps, wide elevator cabs or platform lifts
▪ Maneuvering in tight spaces	▪ Provide wide routes and spaces
▪ Passing through narrow door openings and over high thresholds	▪ Provide sufficiently wide door openings with low beveled thresholds or none at all
▪ Reaching high-mounted controls and objects	▪ Provide low-mounted controls
▪ Escape using the stairs during emergency situations e.g. fire	▪ Install 'refuge areas' and/ or evacuation chairs

2. Mobility Impaired Patients

Problem	Measure
▪ Overcoming differences in level	▪ Provide kerb ramps, ramps, elevators or platform lifts
▪ Maneuvering in situations requiring speed	▪ Increase the opening interval of elevators and automatic doors
▪ Climbing stairs and ramps	▪ Provide handrails for gripping
▪ Passing through narrow door openings and over high thresholds	▪ Provide sufficiently wide door openings with low beveled thresholds or none at all

Attachments 1: Ministry of Health Research Authorization

Where replying please quote

Ref. No .....
and date

REPUBLIC OF KENYA

MINISTRY OF HEALTH

DEPARTMENT OF STANDARDS AND
REGULATORY SERVICES (DSRS)
Afya House Cathedral Road,
P.O. Box 30016, Nairobi, Kenya
Tel: 254-20 717077 Fax: 254-20 722986
E mail: dsrs@africaonline.co.ke

DSRS

RES/18/A VOL.XIII **25th April 2008**

Eric Munene Nguru
School of Built Environment
Department or Real Estate and Construction Management
University of Nairobi
P.o. Box 30197-00100
NAIROBI-Kenya

RE: RESEARCH AUTHORIZATION

Refer to your letter dated 10th April 2008 on the study "An investigation into Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities, A case study of Hospitals in Nairobi."

The Ministry has reviewed and approved your request to conduct the study at Kenyatta National Hospital.

DR. STEPHEN K. MULESHE
FOR: HEAD DSRS

cc. Director
Kenyatta National Hospital

Attachments 2: Kenyatta National Hospital Research Authorization

KENYATTA NATIONAL HOSPITAL
P O Box 20723
NAIROBI
Tel 2726300-9
Fax 725272
Telegrams "MEDSUP" Nairobi
Email clinical@knh.or.ke

REF: KNH/DD(CS)/30B

Date 18th May 2008

Eric Munene Nguru
School of Built Environment
Department of Real Estate and
Construction Management
University of Nairobi
P.O. Box 30197 – 00100
NAIROBI

RE: RESEARCH AUTHORIZATION

In reference to the letter dated 25th April Ref. RES/18/A VOL.XIII, the Hospital Management has reviewed and approved your request to conduct the study in Kenyatta National Hospital.

DR. R.P. LUBANGA
AG. DEPUTY DIRECTOR CLINICAL SERVICES

c.c. The Chief Executive Officer - KNH

The Secretary, Ethics & Research Committee KNH

Dr. Stephen K. Muleshe
Ministry of Health – Dept. of Standards and
Regulatory Services (DSRS)
Afya House - Nairobi

Attachment 3: The Nairobi Hospital Research Denial

THE NAIROBI HOSPITAL

Ref: Pers/05/08/cmw.cm

22nd May 2008

Mr. Nguru Eric Munene,
School of Built Environment,
University of Nairobi,
P.O. Box 30197 - 00100
NAIROBI.

Dear Ms. Munene,

Re: Research Project Authorization

Reference is made to your letter dated 2nd May 2008 regarding a research for your school case study.

We regret to inform you that we are unable to grant approval to undertake the proposed research.

Yours sincerely
For: **Kenya Hospital Association**

Christina M. Were
For: Chief Executive Officer

Healthcare with a difference!

P.O. Box 30026-00100 Nairobi - Kenya • TEL: 254 - 020 - 2845000 • FAX: 254 - 020 - 2728003 Dropping zone No. 53
E-mail: hosp@nbihosp.org • website: www.nairobihospital.org

Attachments 4: Research Certification from NCC Fire Station

LETTER OF INTRODUCTION TO THE FIRE BRIGADE

Nguru Eric Munene

School of the Built Environment,

Department of Real Estate and Construction Management

UNIVERSITY OF NAIROBI

P O BOX 30197,

NAIROBI

April 10th 2008

21/04/08

DEPUTY CHIEF FIRE OFFICER
NCC FIRE SERVICES

I Certify he acquired the information from the institution.

To

Respondent,

I am a student at the University of Nairobi conducting a research on "**An *investigation into internal Disaster Mitigation and Readiness in Hospitals with Reference to Design and Facilities***" case study of (Karen hospital, Kenyatta National Hospital and the Nairobi hospital) as a part fulfillment for the award of **B.A Degree in Building Economics**. I am intending to administer questionnaires to yourselves as a tool for data collection

DECLARATION

THE INFORMATION COLLECTED THROUGH THIS QUESTIONNAIRE AS WELL AS YOUR IDENTITY SHALL BE TREATED AS CONFIDENTIAL AND SHALL BE USED FOR RESEARCH PURPOSES ONLY

INSTRUCTIONS

Please tick and/ or state the appropriate answer in the space (s) or box (es) provided. More than one answer may be ticked or stated where applicable.

Your assistance will be highly appreciated

Thanks

Eric Munene

.....

RESEARCHER

UNIVERSITY OF NAIROBI