

***An Assessment of Workplace Fire Safety Preparedness: A Study in
Kenya Medical Training College Campuses in Eastern Kenya Region***

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**A dissertation submitted in partial fulfillment for the award of the degree of
Masters of Public Health of the University of Nairobi**

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Declaration

I, Muindi Emma Mwikali declare that this is my original work and has not been presented for a degree award in any other university or institution.

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Dedication

This dissertation is dedicated to my Mother Juliana Muindi, my two sons, Abraham Mwangangi and Isaac Muindi and my late sister Bridie Ndumi Muindi for their immeasurable love, understanding, support and encouragement throughout the period of my study.

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Abbreviations and Acronyms

BLI	Better Living Institute
CBD	Central Business District
DEH/S	Department of Environmental Health and Safety
ERC	Ethical Research Committee
FEMA	Federal Emergency Management Agency
FPC	Finite Population Calculation
GoK	Government of Kenya
IDC	International Disaster Control
ILO	International Labour Organization
KEBS	Kenya Bureau of Standards
KMTC	Kenya Medical Training College
KMTCCs	Kenya Medical Training College Campuses
KNH/ UoN	Kenyatta National Hospital/ University of Nairobi
MoH	Ministry of Health
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act (2007), of Kenya
RAs	Research Assistants
SPHUoN	School of Public Health, University of Nairobi
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

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Definition of Terms

- i. Preparedness: this is the state of being ready for specific or unpredictable events or situations. It's an aspect of pre-disaster phase which entails acquisition and identification of logistics needed to handle an emergency.
- ii. Fire safety preparedness: is one of the four phases in fire emergency management.
- iii. Workplace: includes, any land, premises, location, vessel or thing, at, in, upon, or near which, a worker is, in the course of employment such the Kenya Medical Training College (KMTTC).
- iv. Occupational hazard: a situation that is likely to cause, an accident, body injury, acute and chronic health effects to the worker or death to the work or a non worker.
- v. Occupier: means the person or persons in actual occupation of a workplace, whether as the owner or not and includes an employer.
- vi. Risk: the probability of occurrence of an adverse effect from a substance on people or the environment combined with the magnitude of the consequence of that adverse effect.
- vii. Emergency exit: a window, door or other exit affording means of escape or giving access to other than the means of exit in ordinary use, in case of a fire.
- viii. Fire drill: an exercise involving practicing the evacuation of a building for a fire which is done to prepare people on precautions to be taken in event of a real fire outbreak.
- ix. Fire audit: an exercise which includes assessment of fire risks and their management.

Abstract

Introduction and Background: Fire safety preparedness is one of the four steps of fire emergency management. Occupational Safety and Health Act Legal Notice No. 15 of 2007 of the Laws of Kenya dictates that every workplace should promote safety and health of the workers and any other occupants in the premises.

Objective: The main objective of the study was to assess fire safety preparedness in KMTCCs in Eastern Kenya region.

Methodology: This was a descriptive cross-sectional study using quantitative methods. The study was assessing the status of fire safety preparedness in KMTCCs in Eastern Kenya region using interviewer-administered questionnaires and observational checklists. Data collection was done in May 2013. The study targeted staff working in the KMTCC. Staff were stratified into academic and support staff, then 145 participants were randomly sampled proportionately.

Results: Knowledge of staff on fire safety preparedness against OSHA, 2007 guidelines was low. Only 48.2% of the respondents had adequate knowledge on fire safety preparedness. A statistically significant association between staff knowledge level and cadre was noted ($\chi^2 = 34.565$; $p = 0.000$). Electrical faults were the most perceived fire hazard by 90.8% of the respondents. Majority (86.5%) of the respondents expressed the need for a basic training on fire safety preparedness. More than 60% of the respondents rated their fire safety preparedness level as below average. Most (83.3%) documentary items were missing across the institutions (i.e. fire safety preparedness policy document, copies with staff responsibility on fire management, evacuation plan, evacuation priority list, annual fire audit reports and fire drill reports). Most (84%) of the respondents had never been trained on fire safety preparedness. Fire safety committees as well as firefighting teams were also absent across the institutions studied. None of the colleges performed fire and safety drills. Majority (75.0%) of the buildings did not comply with the OSHA, 2007 building requirements on means of escape. Further, there was a statistically significant difference between the institutions and the availability of fire extinguishers ($\chi^2 = 10.791$; $p = 0.005$), the availability of evacuation plans in the workplaces ($\chi^2 = 10.146$; $p = 0.006$) and the availability of sand buckets ($\chi^2 = 10.401$; $p = 0.006$).

Conclusion: In regard to the study findings, most of the respondents had a positive attitude towards the need for a basic training on fire safety preparedness and there was perceived low level of fire safety preparedness among the respondents.

Non-compliance to OSHA, 2007 guidelines on fire safety preparedness was attributed to failure to have fire safety committees in place, inadequate staff training on fire safety preparedness, unavailability of fire safety policy documents and failure to undertake annual fire audits and fire drills. The KMTCCs were non-compliant with fire warning and detection systems, and 75% of the buildings were non-compliant with route of escape requirements.

Recommendations: In order for the KMTCCs to be compliant with the OSHA, 2007 guidelines on fire safety preparedness; the KMTC board of management should ensure that the OSHA, 2007 policy on fire safety preparedness is customized in the institutions. The principals should constitute fire safety committees, ensure fire safety preparedness policy documents are available and at least annual fire drills and fire audits are performed. All staff should be trained on fire safety preparedness and firefighting; fire safety preparedness guidelines should be observed in building construction. Further research is recommended to assess the hazard level in the institutions' buildings, assessment of fire safety preparedness among the KMTCCs in other regions of Kenya and on the students' level of fire safety preparedness.

CHAPTER I: INTRODUCTION AND BACKGROUND

1.1 Introduction

Fire outbreaks are disasters which are caused by actions of human beings directly or indirectly. Fire safety entails all the activities which are geared towards fire prevention, fire detection and fire control. These activities and processes are done to safeguard human life and to preserve property.

Fire safety preparedness is one of the four phases of fire emergency management which is aimed at fire disaster risk reduction. It is a continuous cycle of planning, organizing, training, equipping, exercising, evaluating and improving strategies to ensure effective coordination and enhancement of capabilities to respond to fire disasters (FEMA, 2007).

Fire safety preparedness is an essential aspect in both environmental and occupational safety and health. Fires being an example of physical hazards have affected many workplaces and most of them are mainly caused by inadequate strategies in fire prevention, detection and/ or fire control.

The potential for loss of life or injury from a fire-related incident is one of the most serious risks an institution can face. Therefore, institutions such as KMTC should have a comprehensive fire-safety preparedness programme to enhance fire safety. Careful planning, implementation, and maintenance are all essential ingredients of a successful fire safety programme. Due to the danger of injury or death from fire-related emergencies, faculty, staff, students and visitors to the institutions must comply with fire safety preparedness requirements (Florida Atlantic University, 2002).

Fire safety preparedness includes availability and effective use of procedures, infrastructure, equipments as well as knowledge and positive attitude of occupiers and workers towards implementation of fire safety preparedness guidelines. For instance, smoke alarms have saved thousands of lives in the United States following their introduction and wide use over the past two decades.

Collective efforts to eliminate deaths related to house fires in the United States indicates the need for distribution of smoke alarms, legislation to have fire detection and management equipment in all residences as well as enforcement of the existing fire safety codes (Istre and Mallonee, 2000).

Enforcement of legislations and fire safety preparedness guidelines are paramount to enhancing fire safety. Historically in England, one of the first fire prevention measures was a requirement to extinguish all fires before nightfall. In 1872 in England, authorities ordered a curfew bell to be rung at sunset to remind citizens to extinguish all indoor fires for the night (Bugbee, 1978). In Kenya, OSHA Legal Notice No. 15 of 2007 of the Laws of Kenya (OSHA, 2007) stipulates fire safety preparedness requirements for minimizing and controlling fire risks.

Learning institutions are national assets which contribute to national development (Adinku, 1999). Fires in learning institutions lead to deaths, destruction of buildings and property including students notes which also cause psychological stress to the affected. There is therefore need for occupiers to ensure that these institutions are free from fire hazards. Fire-free institutions can be achieved by enhancing fire safety preparedness through provision of infrastructure, equipments and fire policies. This calls for a proactive approach of both the management and staff in ensuring the availability and implementation of fire safety preparedness strategies.

Fire safety preparedness enhances achievement of fire disaster management goals, prevents and mitigates negative outcomes from fire outbreaks. In order for a fire outbreak to occur, three factors come into play. These factors are oxygen, flammable substance, also known as fuel and heat energy, also known as source of ignition which take part in a chemical reaction. Figure 1 shows a triad of these factors involved to start and sustain a fire. Prevention of fires therefore focuses on eliminating the occurrence of one or all the three components (Caplan *et al.*, 2008).

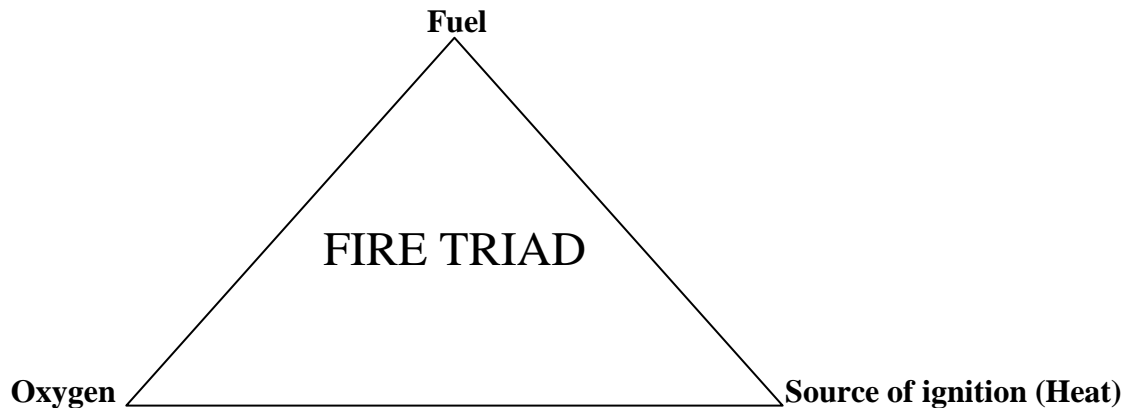


Figure 1: Fire Triad

Source: Caplan *et al.*, 2008

For any nation to attain its national development goals, for instance in Kenya, the Vision 2030 goals, it is imperative that the workforce is protected from fire hazards (National Economic and Social Council of Kenya, 2008). Fire safety preparedness ensures that human beings, buildings and property are protected from destruction by fires. This is achieved by having adequate and effective fire detection and fighting equipments in place and training staff on fire safety preparedness among other measures.

The increased fire outbreaks in learning institutions are attributed to ineffective fire safety preparedness among other factors, leading to lack or inadequate capacity to deal with the fire hazards (Draft National Policy for Disaster Management in Kenya, 2009; Ronoh and Kyalo, 2009; Mutiso *et al.*, 2002; Sarasola, 2006 and Klemola, 2008). Other factors include lack of knowledge of the workers in respect to fire safety preparedness measures as well as poor fire safety culture/ attitude to practice fire safety preparedness procedures. Inadequate resources and lack of enforcement of fire safety preparedness policies and guidelines are also major constraints facing the learning institutions in their efforts towards achieving fire safety preparedness standards (Draft National Policy for Disaster Management in Kenya, 2009).

Appropriate fire safety preparedness ensures that if fires occur, they are likely to be controlled and contained quickly, effectively and safely. Also if fires occur and grow people in the premises are able to escape to a place of safety easily and quickly. This leads to preservation of life and protection of property by fires.

The catastrophic consequences of fire outbreaks not only impacts on the individuals affected, but also to the institutions, communities and the nations at large. Effects of institutional fires includes; injury to personnel and students, deaths and disability; psychological trauma, loss of physical assets; financial loss to institution and parents/ guardians, closure of learning institutions and disruption of learning and loss of jobs. There are also many adverse effects of fires to the environment especially with chemical fires which release toxic gases and fumes to the environment (Degher, 1993).

The most crucial step is prevention of fires, but when they occur, optimal outcomes depend on coordinated team efforts (Hart *et al.*, 2008). This calls for the need for empowerment of the workers and managers with the necessary knowledge on fire safety preparedness and change of attitudes and perception towards the same. The workers should be trained on fire safety preparedness and accept to change their attitudes/ perceptions, so as to practice the right fire safety preparedness guidelines effectively.

Fire emergency management in institutions requires well planned and coordinated activities as well as collaboration of the fire fighting agencies/ bodies and fire rescue teams. These include the city/ municipal council, the police, the fire brigade department, the ambulance services.

The potential for loss of life or injury from a fire-related incident is one of the most serious risks institutions face. Therefore, an institution of higher education must have a comprehensive fire-safety preparedness programme to uphold the environmental and occupational safety and health regulations.

Adequate knowledge on fire safety as well as availability of fire safety equipments, procedures and precautions in every learning institution is paramount to attaining fire safety preparedness. Due to the danger of injury or death from fire-related emergencies, faculty, staff and students in the institutions must comply with fire safety requirements (Florida Atlantic University, 2002).

The front line of any fire protection system is fire fighting with available fire extinguishers. Unfortunately, not all occupiers realize how important it is to train their personnel in the safe operation of a fire extinguisher. It is important to appreciate that using an appropriate type of extinguisher on a small fire can prevent it from growing to a large devastating fire.

Fire safety preparedness measures in buildings should also be provided. This includes the provision of means of escape in case of fire, the ability for a building to resist the effects of fire and to minimize the spread of fire and smoke and the provision of means of access to enable firefighters to effectively rescue and fight fire (Government of Hong Kong, 2012).

Fire management therefore requires fire safety preparedness education, supported by strategic management. Such strategies are reinforced by law, requiring companies, industries and institutions to meet legislated fire safety objectives as part of their occupational safety and health and safety commitment to their workers. In Kenya, these strategies have been outlined by the Occupational Safety and Health Act, (OSHA) Legal Notice 15 of 2007 on Fire Risk Reduction Rules, as well as in the Kenya Bureau of Standards (KEBS), 2012.

According to OSHA Legal Notice No. 15 of 2007 of the Laws of Kenya (OSHA, 2007), workplace should promote safety and health of the workers and other occupants in the premises. However, many workplaces continue to expose the occupants to fire risks which adversely affect their wellbeing in terms of physical, social and psychological health.

It is therefore, important to assess the knowledge, attitude/ perception of workers and compliance to fire safety preparedness procedures, precautions and infrastructure to respond to fire outbreaks in KMTCCs. These institutions have many workers as well as students (KMTTC, 2011) who are at risk of fire disasters in case fire safety preparedness is not complied with. It is therefore imperative that KMTCCs adopt the guidelines outlined in the legal and policy documents on fire safety preparedness.

1.2 Back ground Information

Kenya has not been spared by the institutional fires, leading to loss of lives, properties and disruption of learning. In the recent past, fire tragedies seem to be increasing day by day in these learning institutions. This problem of fire out breaks in secondary schools in Kenya has also affected institutions within the Eastern Kenya region. The worst institutional fire tragedy was in 2001 at Kyanguli Secondary school dormitory in Machakos County where 68 students died (Draft National Policy for Disaster Management in Kenya, 2009). In 2013, St. Ursula girls' secondary school in Kitui County, which is a few kilometers from Kitui KMTCC, experienced a fire outbreak on 4th, September and a whole dormitory was reduced to ashes (Mrs Wambua, school principal, September, 2013). Again, on 6th, September, 2013 a dormitory at Kitui high school was razed down by fire, destroying school property and students' valuables worth thousands of money (Musyi FM local Radio broad casting station, 7th, September, 2013).

In Mombasa County, in 1998 a fire outbreak at Bombululu Secondary school resulted to death of 25 students (Draft National Policy for Disaster Management in Kenya, 2009). St. Augustine preparatory school in Tudor also experienced a fire incidence in September 2013 which razed down a dormitory (Daily Nation, 9th, September, 2013).

National disaster operation centre Kenya (2009), indicates that between 1982 and 2009, over twenty two (22) incidences of fire have been reported in learning institutions in Kenya where by seven (7) incidences were experienced from schools in the Eastern region of Kenya, the same region where this study was conducted.

KMTCCS have also not been spared by the fire disasters. For instance, in 2010 Nakuru Campus was reported to have experienced an incidence of fire in one of the buildings as a result of an electrical fault. This is an indication that, Kenya Medical Training College Campuses, just like any other learning institutions are prone to fire disasters which have been occurring across the country, in many schools.

The government of Kenya has made various efforts to address the problem of fire incidences in learning institutions. These includes development of various Acts and policies such as the National disaster management policy, building code (Building Code, 1968), the Kenya Bureau of Standards (KEBS) 2012, the university code (Universities Act, Cap. 210B) and the fire safety for schools manual (Ministry of Education, Kenya, 2008) in collaboration with the Public Health Act (Public Health Act, Cap. 242) and the Occupational Safety and Health Act, (OSHA) legal Notice 15 of 2007 on Fire Risk Reduction Rules.

According to the fire safety for schools manual, it is recommended that complex premises such as sleeping areas of boarding schools or student accommodation buildings, are installed with automatic fire detection and warning system with control panel located near the entrance which is able to identify either the zone or the specific location where the alarm has been raised (Ministry of Education, Kenya, 2008). The KMTCCs have got these accommodation facilities and other many workrooms which are occupied by staff and many students as well. These institutions should therefore comply with fire safety preparedness approaches in their buildings, infrastructure and housekeeping in order to effectively manage and control fire outbreaks.

1.3 Statement of the Problem

There has been a global outcry from fire outbreaks with learning institutions also being affected. For instance, between 1.5 and 2 million fires occur each year in the United States with many other fires going unreported (Department of Environmental Health and Safety [DEH/S], 2001). International Disaster Control (IDC) (2008), also states that African countries are known to report more than 60% of the world fire disasters in learning institutions, which are responsible for as much as 1.6 million (70%) of the total cases of injuries in schools. In 2011 Ghana recorded 53 institutional fire outbreaks (Ghana National Fire Services, 2011). In Kenya, institutional fires have also been experienced in different parts of the country causing injuries, fatalities and massive destruction of properties (Draft National Policy for Disaster Management in Kenya, 2009).

The catastrophic consequences of fire outbreaks not only impacts on the individuals affected, but also on the institutions, communities and the nations at large.

In response to the Kenya school fire tragedies, years back a taskforce was formed that came up with guidelines on safety in learning institutions, including fire safety preparedness guidelines. The government also started an initiative aimed at installation of firefighting equipment and creating awareness among the students on fire safety in order to increase the level of fire safety preparedness (Ministry of Education, Kenya, 2008).

It is evident that tertiary institutions have also been affected by fire outbreaks. For instance, in June 2002 the University of Nairobi Kikuyu campus hall of residence was burnt down. This resulted in extensive losses due to the destruction of property (Mutiso *et al.*, 2002). The fact that there have been a number of fire outbreaks in various learning institutions, there is likelihood of such fire outbreaks occurring in KMTCCs. The government initiative for the secondary schools did not incorporate the institutions of higher learning in which KMTCC falls, yet, these institutions are also at risk of fire hazards.

Fire outbreaks in learning institutions are a public health problem. Although some incidences are unreported, the impacts of these fires cannot be ignored because of their immediate and long term consequences to the individuals, institutions and the country. There is no study that has ever been conducted in the KMTCCs to assess the level in which the staff are prepared to handle a fire outbreak. These institutions' level of fire safety preparedness needs to be assessed to ascertain whether they are adequately prepared to effectively manage a fire outbreak.

1.4 Conceptual Framework

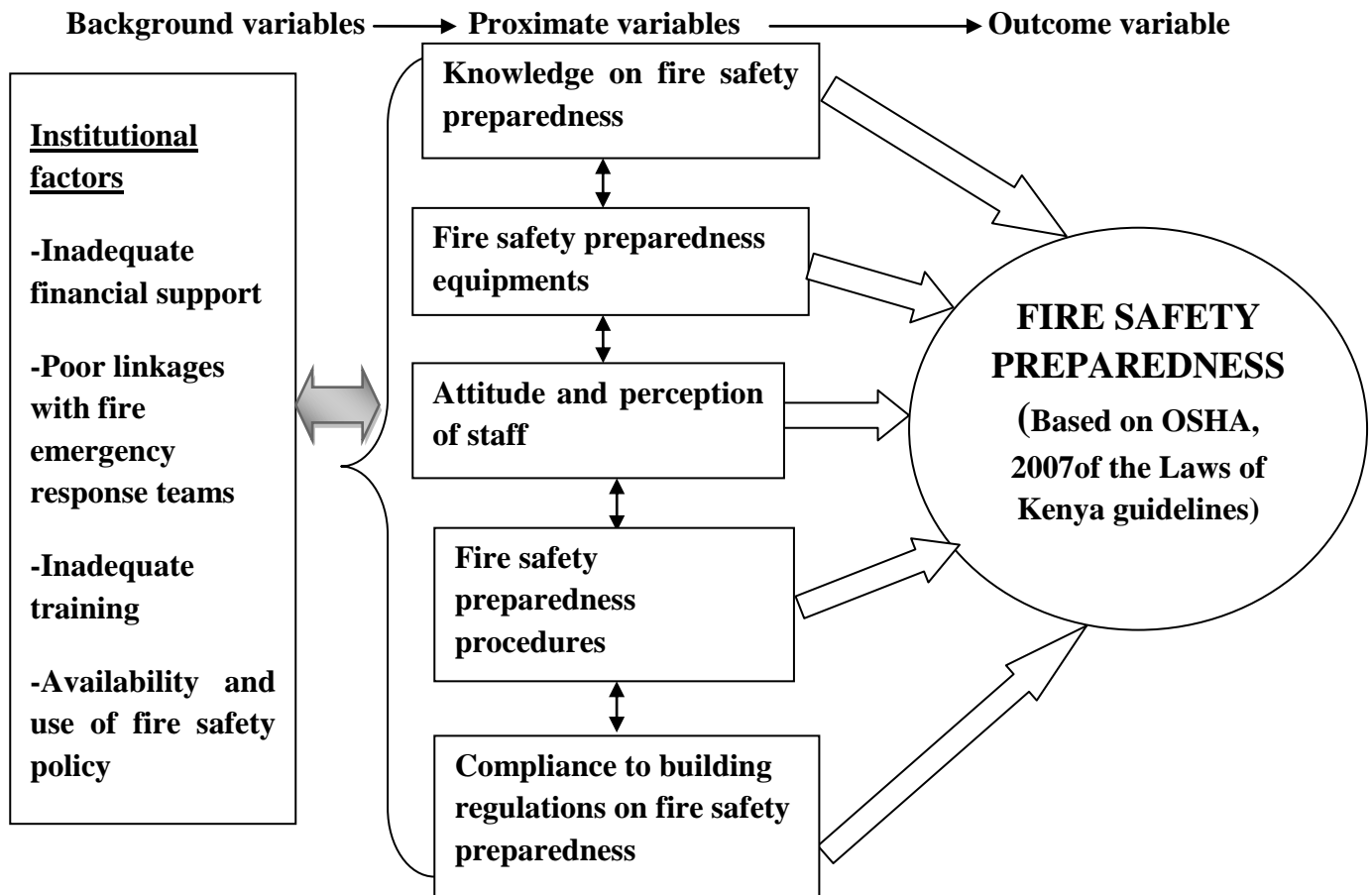


Figure 2: Conceptual Framework for Fire Safety Preparedness

1.5 Justification

Even with the increased fire outbreaks in Kenya, many learning institutions have not complied with the requirements for fire safety preparedness thus many people continue to be at risk of fire hazards. In every learning institution, fire safety preparedness regulations should be at the required level in order to achieve a safe environment. However, this is not the case when staff have inadequate knowledge and poor attitude and workplaces have inadequate fire safety preparedness equipments, procedures and precautions and other preparedness capacities.

The increased fire outbreaks in learning institutions in Kenya should act as eye-openers to the managers and staff of the institutions that fire disaster can occur anytime thus, the lives of the staff, clients and properties are at risk. Managers and staff should therefore be proactive in fire safety preparedness measures in order to make the workplaces safe. Fire risks assessment and fire safety preparedness compliance in the learning institutions is therefore paramount.

The GoK has Acts of parliament, policies and guidelines on fire safety preparedness. Despite this effort, KMTCC has not come up with a fire safety preparedness policy to ensure its mandate to achieve a safe working environment. To add on, there is no study that has ever been conducted in the KMTCCs on fire safety preparedness.

This study therefore seeks to assess fire safety preparedness among the KMTCCs in Eastern Kenya region so as to determine compliance to fire safety preparedness guidelines as outlined by OSHA, Legal Notice No.15 of the Laws of Kenya (OSHA, 2007). The study results and recommendations may be utilized by KMTCC Board of Management in reinforcing strategies to promote fire safety preparedness in the learning institutions and by the human resource within the KMTCCs to develop an enhanced focus on fire safety preparedness. This would be expected to reduce the impact of fire outbreaks, reduce fire morbidities, injuries, disabilities and deaths as well as loss of properties.

CHAPTER II: LITERATURE REVIEW

2.1 Literature Review

This section contains literature of various studies that have been conducted on fire safety preparedness globally, regionally and locally. Literature was sourced from published and unpublished journal articles and research papers.

2.1.1 Fire safety preparedness globally

There has been a global outcry from fires. For instance, between 1.5 and 2 million fires occur each year in the United States with many other fires going unreported. Between 3,500 and 4,000 Americans lose their lives each year, and another 20,000 to 30,000 are injured as a result of fires (DEH/S, 2001).

Data from United Kingdom reveals that in 2006, there were about 2000 fires in the hotels, boarding houses and other similar facilities (Klemola, 2008). In USA, a study done by Ahrens (Ahrens, 2008) found that hotels with sprinklers did not incur fire- induced deaths between the years 2003-2007, and material losses were 73% lower than in hotels which were not equipped with sprinklers. This emphasized the importance of installing sprinklers in any building to manage and control fires.

According to a study on the status of facilities for fire safety in hotels in Spain, it was found that some of the defects detected were on documentary issue such as absence of a technical installation project certificate or certificates of compulsory maintenance contracts for the fire safety equipments. Other defects included absence of smoke detectors and alarm devices, defective signage as well as difficult access to firefighting equipment (Francisco *et al.*, 2004).

The study in Spain hotels revealed a high level of fire safety preparedness in terms of compliance to fire safety preparedness equipment which was 90.4% compliance in number and availability of fire extinguishers. In addition, there was alarm push buttons correctly located in corridor areas and an alarm centre with permanent monitoring in most of the hotels. However, there was non-compliance to fire detection systems since some hotels had no smoke detectors in rooms and corridors (Francisco *et al.*, 2004).

Institutions or residential dwellings with fire escape/ evacuation plans may not know how to use them in the event of a fire outbreak. A study conducted on adults living in private households in the United States found that majority of Americans who were interviewed had an escape plan for use in case of a fire, and among them, the larger percentage had not implemented the plans. On the contrary, 75% of the respondents believed it took 10 minutes or less for a fire to turn deadly, meaning that they were aware that practicing an escape plan would shorten the time of escape of people to safe environment. In this case, knowledge did not correspond to the people's practices (Harris, 2004).

The Harris study revealed that only 8% of the Americans whose smoke alarms went off thought it was a fire and so they needed to get out of the house. Less than half of the respondents felt that they could install a home fire sprinkler if they were building a new home. Those who had a different opinion said that the fire sprinklers were expensive and led to destruction which was worse than fire damage. These findings give a picture of people's poor attitude on fire safety preparedness which consequently leads to failure to practice fire safety preparedness measures.

An on- site survey of homes on smoke alarms and prevention of house-fire-related deaths and injuries highlighted that although most (90%) of the houses in the United States have at least one smoke alarm, 25-30% were not functional (Douglas *et al.*, 1999).

The level of fire safety preparedness is higher following fire outbreaks in institutions. For instance, following 6 fire outbreaks which occurred at the Cleveland Clinic operating suites in 2010 (Suchetka, 2010), all the operating room employees underwent training on surgical fire prevention and fire safety preparedness procedures. The staff were thereafter undertaking monthly fire drills (Hart *et al.*, 2011). These strategies were geared towards improving the workers' fire safety preparedness.

Some institutions of higher learning have not yet complied with the fire safety preparedness standards, and are putting many people to fire risks. This is evidenced by a study conducted by the Ministry of Education in Malaysia which found that fire safety preparedness condition in the institutions was at 76% in compliance level. Poor staff attitude on the importance of fire safety preparedness and knowledge on the same were some of the fire safety preparedness elements identified (Chandrakankan, 2004).

2.1.2 Fire safety preparedness in Africa

Africa as well has been affected by fire disasters. For instance, in 2011 Ghana recorded 53 institutional fire outbreaks (Ghana National Fire Services, 2011). Buildings compliance to fire safety preparedness regulations should be observed to reduce the impact of fires. A study on disaster risk assessment at the University of Ghana in Balme library found that the library annex had no balconies and had one exit for a three- stored building. The presence of balconies as a vital component in disaster response by acting as landing pads for trapped victims awaiting rescue was therefore overlooked (Adinku, 1999).

In the same study, library staff had not been trained on disaster management. The library annex did not have fire extinguishers and most of the fire extinguishers available in the main library were not working (Adinku, 1999). This is not an unusual phenomenon in most buildings in which inadequate infrastructure and firefighting equipment hinders timely and effective fire emergency management.

Another study on disaster readiness in academic libraries in Ghana revealed that none of the academic libraries had a plan in place to prevent or mitigate the impact of fire (Akussah and Fosu, 2001). It is in this point of view that the institutional commitment is deemed paramount in fire safety preparedness in terms of writing policies/ guidelines and enforcing the fire policy implementation strategies. This ensures that fire safety preparedness practices are fully integrated in the institution's administration (Adunki, 1999).

The non compliance on documentary issues and fire safety equipments is a common problem in most of the institutions of learning especially in the developing countries which have experienced numerous morbidities and mortalities following fire outbreaks (Adinku, 1999; Akussah and Fosu, 2001).

2.1.3 Fire safety preparedness in Kenya

Kenya has been affected by fire outbreaks in various parts of the country with most of them going unreported. This brings a problem to the managers and policy makers in quantifying the impact of fires to the nation (Draft National Policy for Disaster Management in Kenya, 2009). There are no national statistics on fire outbreaks in the country although a few studies have been conducted to assess compliance to fire safety preparedness guidelines and knowledge and attitudes of staff in various learning institutions.

A survey on safety awareness and preparedness in secondary schools in Turkana district in Kenya found that none of the teachers had participated in any fire drill within a year before the study. Also most of the teachers did not know how to effectively use a fire extinguisher. This was said to have been contributed by the fact that there were no awareness programme of school safety needs in terms of fire drills in schools in Turkana district (Ronoh and Kyalo, 2009).

Compliance to fire safety preparedness was noted to be quite low since only one out of the seven secondary schools studied in Turkana district had performed fire drills. Fire safety preparedness was attributed to fire safety training and awareness programmes. This study made the assumption that knowledge on effective use of a fire extinguisher was a sign of preparedness where else performance of fire drills depended on availability of training and awareness programmes in the schools. A high percentage (87.5%) of students in the school that performed fire drills knew how to effective use a fire extinguisher as compared to 21.2% of the students in the schools which did not conduct fire drills (Ronoh and Kyalo, 2009).

A cross- sectional survey on fire safety among students at the medical school of the University of Nairobi in 2002 found that most of the students felt that they were at risk of fire hazards. Most (71%) of respondents pin pointed electricity as the greatest fire hazard. Although more than half of the respondents had knowledge on what fire drill was, less than 50% said that they knew how

to put out a fire correctly (Mutiso *et al.*, 2002). This study concluded that ineffective fire emergency management was one of the causes of loss of lives and massive property destruction which was attributed by inadequate knowledge and fire safety preparedness procedures, fire detection and firefighting equipment (Mutiso *et al.*, 2002).

Most of the infrastructure in learning institutions' buildings does not promote fire safety preparedness. According to the study on students in medical school, the buildings were non-compliant with the fire safety preparedness guidelines. Most of the buildings had no fire exits, fire points and fire emergency plans (Mutiso *et al.*, 2002).

2.2 Research Question

Information on the situation in Kenya as well as the background shows the need for this question which this study seeks to answer through the following specific objectives. What is the state of fire safety preparedness among the KMTCCs in Eastern Kenya region?

2.3 Objectives

2.3.1 Main objective: To assess fire safety preparedness in KMTCCs in Eastern Kenya region

2.3.2 Specific objectives

1. To determine knowledge on fire safety preparedness among the KMTC staff;
2. To describe the attitudes/ perceptions of KMTC staff on fire safety preparedness;
3. To determine KMTCCs' compliance to fire safety preparedness based on the OSHA, 2007 guidelines.

2.4 Study Limitations

1. Study findings would not be generalized to give the state of fire safety preparedness in all KMTCCs but only to those in Eastern Kenya region where the study was carried out.
2. Since the exact number of fire extinguishers and other fire safety preparedness equipments required vary based on the hazard level of the building, this study was limited to assess compliance in terms of their availability but did not assess the hazard level in the buildings.

3. The study did not assess the academic qualification of the heads of the KMTCCs (principals) which could be contributing to the existing status of fire safety preparedness in the various campuses.
4. Since consent had to be sort from the institutional heads, some fire safety preparedness items might have been put in place before data collection which could alter the true findings of the study.

CHAPTER III: STUDY DESIGN AND METHODOLOGY

3.1 Description of the Study Area

The Kenya Medical Training College (KMTC) was established as a corporate training Institution by an Act of Parliament, Chapter 261 (Legal Notice No. 14 of 1990) of the Laws of Kenya. Before the Act came into existence, KMTC was operating as a medical training institution under the Ministry of Health (MoH) since the year 1927. It has evolved over the years, experiencing a tremendous increase in the medical training college campuses, student numbers and staff establishment (KMTC, 2011).

This study was carried out in Kenya Medical Training College, which is currently made up of more than 30 constituent medical training college campuses located all over the eight Kenya regions initially known as the provinces. The KMTCCs have over 1,960 permanently employed staff comprising of the academic and the non- academic staff. The institutions also have few contracted lecturers and support staff who are mainly work as security officers in the campuses (KMTC Human Resource Statistics, 2012). The medical training college campuses are of different sizes in terms of the students' population and infrastructure (KMTC, 2011).

The buildings of most medical training college campuses were built by the government using a common structural blueprint. These buildings have got similar structures such as the hostel facilities and the administration blocks. These old buildings were constructed and installed with fire safety preparedness equipments such as the hose reels, manual fire alarm bells. However, the recent buildings and also the newly established campuses have not used the same structural blue print and others were taken over from government ministries which had been using them. The adopted buildings from the government ministries may not have the fire safety preparedness measures in their structures. The main buildings in the KMTCCs include the student hostels, administrative/ staff workrooms, classrooms, library, computer laboratories, medical and skills laboratories, workshops, kitchen and dining rooms.

The study focused on the KMTCCs in Eastern Kenya region (**Appendix i**). There are four medical training college campuses in this region namely Meru, Embu, Machakos and Kitui Campuses.

The Kitui KMTCC was started in 2004 and is located within Kitui town in Kitui Central Constituency, Kitui County. Kitui town is 180 kilometres east of Nairobi and 105 kilometres east of Machakos. Kitui town is now the headquarters of Kitui County (KMTC, 2011). Kitui Campus is located along the hospital road next to Kitui District Hospital. It occupies the premises that formerly housed Better Living Institute (BLI) and all its buildings were formally used by this institute apart from the female hostel, the administration block, 3 classrooms and the resource centre which were constructed recently.

The college has a multistoried hostel block that accommodates 264 female students. The male students' hostels are 4 blocks and one hired multistoried hostel from Social Services department. In total, the male hostels accommodate 269 students and the other students are non residents. Currently the campus uses the dining hall inherited from the BLI. It has a sitting capacity of approximately 60 students. The kitchen is adjacent to the dining hall (KMTC, 2011).

Machakos KMTCC was started in 1959 and is located in Machakos town which is the headquarters of Machakos County. It is a major centre, and also a satellite town due to its proximity to Nairobi. Machakos is a town situated 64 kilometres southeast of Nairobi. Machakos Campus is within Machakos town on the eastern side less than 600 metres from Katoloni to Makueni road. It is a few metres from Machakos Level IV Hospital. All its buildings were constructed by the government using a common structural blueprint (KMTC, 2011).

Meru KMTCC was started in 1979 and is situated in Meru town, Meru County. The Medical centre is situated about 1 kilometre off town centre via hospital road within Meru Municipality, about 240 kilometres from Nairobi city, using Nairobi – Embu - Maua road. It borders Meru level IV Hospital. The college has a population of approximately 772 students. About 500 students are accommodated in the college hostels while the rest are non-residents. The college has three main blocks of hostels and two dining halls (KMTC, 2011). Most of its buildings were constructed by the government using a common structural blueprint.

Embu KMTCC was started in 1975 and is situated within Embu town which is located approximately 120 kilometres north-east of Nairobi towards Mount Kenya.

Embu serves as the headquarters of Embu County and was formerly the provincial headquarters of Eastern Province in Kenya. Embu Campus is situated one kilometre from Embu town, along Embu-Meru highway, behind Embu level V Hospital. It has a hostel capacity of 378 students and approximately 200 students are non-residents (KMTC, 2011). Most of its buildings were constructed by the government using a common structural blueprint.

3.2 Study Design

This was a descriptive cross-sectional study using quantitative methods. The study assessed the current status of fire safety preparedness in three (3) Campuses in Eastern Kenya region using interviewer-administered questionnaires with both closed and open-ended questions as well as observational checklists. Data collection was done in May 2013.

3.3 Study Population

The target population was all staff (academic and support staff) working in the KMTCCs in Eastern Kenya region. This population was easily accessible at the Campuses since most of them were on duty. The targeted population in these health training institutions needed to have been inducted within one month of their work into the fire safety preparedness procedures as a health promotion practice and as a requirement to enhance workplace fire safety.

3.4 Inclusion-Exclusion Criteria

The eligibility criteria for the study participants were all staff employed by KMTCCs and who had worked in the institution for a period of at least one month. Consent was first sought from the KMTC Director for the study to be undertaken in the respective campuses. The staff who declined to participate were excluded from the study.

3.5 Sampling and Sample Size Calculation

3.5.1 Sample size Calculation

A sample size of 384 respondents was first calculated using the Fisher's formula. The formula was as follows:

$$n = \frac{z^2 pq}{d^2}$$

Where;

n = sample size

z = 1.96 (reliability coefficient at 95% confidence interval)

p = 50% estimate of the proportion under study since studies on the characteristics was unknown.

q = 1 - p

d = margin of error (0.05 degree of precision)

Using the formula given above, the sample size was calculated as follows;

$$n = (1.96)^2 0.5(1-0.5)/0.05^2 = 384$$

Finite Population Calculation (FPC) was then used since the total population (N) was less than 10,000. In my case the total population of staff was 200 (KMTC Human Resource Statistics, 2012).

$$n_f = \frac{n}{1+n/N} = \frac{384}{1+384/200} = 384/2.92 = 132$$

The sample size, n = calculated sample size + (10% to cover for non-response (Ronoh and Kyalo, 2009).

Thus, the total sample size (n) = 145

3.5.2 Selection of Study Participants

The lists of members of staff who had worked in the institutions for a period of at least one month were used as sampling frames. Staff members in the KMTCCs under study were first stratified according to the cadre; into academic and support staff. Then staff members were selected using simple random sampling which was applied proportionately to select the 145 participants from the three KMTCCs in Eastern Kenya region (Meru, Embu and Kitui). Machakos Campus was not part of the participating institutions in data collection since it had been selected for the pilot study.

3.6 Variables

3.6.1 Dependent (Outcome) and Independent variables

The dependent variable was fire safety preparedness while the independent variables were as follows:

- i. Staff socio-demographic characteristics
- ii. Knowledge on OSHA, 2007 fire safety preparedness guidelines.
- iii. Attitude/ perception on fire safety preparedness.
- iv. Availability of fire safety preparedness equipments
- v. Adherence to fire safety preparedness procedures.
- vi. Compliance to OSHA, 2007 building regulations on fire safety preparedness.

A. Staff knowledge scoring

The criteria of assessing knowledge level involved scoring of seven knowledge variables by rating from 1 to 7. This included staff knowledge on the use of fire extinguisher, the emergency numbers to report a fire outbreak, the location of the closest fire extinguisher from one's workstation, whether staff were aware of the people responsible for fire outbreak management, and the factors involved in starting and sustaining a fire. 1-5 scores were rated as inadequate knowledge while 6 and 7 scores were considered to be adequate knowledge.

B. Assessment of staff's attitude/ perception

Staff attitude/ perceptions on fire safety preparedness was assessed by asking questions about the following: perceived risk of fires in the workplace, potential sources of fires in the workplace, need for fire safety preparedness training, and perceived level of respondent's fire safety preparedness. A likert scale of 0 to 5 was used to rate the staff attitude/ perception in every variable. These included none, poor/low, fair/moderately low, average, moderately high and high representing 0, 1, 2, 3, 4, and 5 respectively.

C. Assessing availability of fire safety preparedness equipments and procedures

Assessment of fire safety preparedness equipment included checking for the presence of functional fire detection devices (smoke detectors/ sensors, fire alarm bells), warning systems (connections of fire detection and warning system to a back-up power supply, to fire emergency response teams), firefighting equipment (fire extinguishers, sand buckets, fire blankets, automatic sprinklers and hose reels with water). Assessment of fire safety preparedness procedures included checking for annual fire audit reports, whether the institutions performed fire drills, existence of fire management committees, trainings on fire safety preparedness and availability of fire safety policy document in the institutions.

D. Assessing compliance to means of escape building safety rules for fire preparedness

Assessment of means of escape compliance was based on availability of structural design and signage to facilitate easy escape of persons from building in the event of a fire. It included checking for the presence of following seven means of escape requirements which were rated from 0 to 7: an exit door/ corridor, labeled exit, emergency escape route illustrated on the walls, exit route being free from obstruction, exit door readily opening from inside, exit routes with lighting and the exit lighting being in working condition. A score of ≤ 3 was rated as non compliance while a workroom which scored 4-7 was said to be compliant.

3.7 Instruments for data collection

Interviewer- administered questionnaires were used to collect data from the staff, while the observational checklists assessed the KMTCCs' buildings and procedures on fire safety preparedness.

3.8 Data Collection Procedure

Semi-structured questionnaires with closed and open- ended questions were administered to the staff, while the observational checklists were also used to collect quantitative data focusing on compliance to fire safety preparedness and standards. Data collection was done by the principal researcher and research assistants (RAs). The questionnaires were written in English and because the respondents had understanding of the English language, no translation was done.

3.9 Data Processing, Analysis and Presentation

Raw data were coded, cleaned and entered into Excel computer package then imported to Statistical Package for the Social Sciences (SPSS) version 17.0 software for analysis. Test for statistical significance was performed using the *chi square test* to ascertain the association between staff knowledge and socio-demographic characteristics and statistically significant differences between the Campuses and compliance level to fire safety preparedness equipments and building requirements. The data were summarized and presented in form of frequency tables, percentages, proportions and figures (bar charts and pie charts).

3.10 Minimization of Biases and Errors

To minimize of errors and biases, pre-testing of the data collection tools was done on 10% of the sample size by the principal investigator and RAs. Revision of the questionnaires and observational checklist items was done based on the results of the pilot study. The findings of the pre-test were used to improve validity of the data collection tools and the reliability of the research findings. Pre-testing was done using a sample which did not take part in the main study. There were few recall questions in the questionnaires. Further, a large sample size that included a 10% addition to cover for non-response was used for data collection.

The study participants were proportionately and randomly selected to avoid bias. The principal investigator trained the RAs to ensure uniformity in data collection. The filled questionnaires were collected daily and stored by the principal investigator for quality control.

3.11 Ethical Considerations

In order to undertake the study which is ethically acceptable and does not inflict harm/ violate the respondents' rights, the stages were followed:

1. Approval of research by the Kenyatta National Hospital and University of Nairobi (KNH/ UoN) Ethical Research Committee (ERC).
2. Institutional authorization by the Director of KMTCC and principals of the respective campuses.
3. Respondents: The purpose of the study was clearly explained to the research subjects. Respondents were required to participate voluntarily upon signing an informed consent form. Confidentiality of the information obtained was maintained and no names were written on the questionnaires, instead code numbers were used. The respondents were free to discontinue from the research at any given time without facing any consequences.
4. Custody of data: The data was protected by storing it under a lockable cabinet.

3.12 Use of the study findings

This study was undertaken in partial fulfillment of a Master of Public Health degree at the School of Public Health, University of Nairobi (SPHUoN). The findings will be published and shared with the Director's office, principals and staff of the four KMTCCs which took part in the study and other institutions of higher learning, which may utilize them to improve the level of fire safety preparedness and for policy formulation. The study has also made suggestions for future research on unstudied areas of fire safety preparedness.

CHAPTER4: RESULTS

This chapter contains findings of the study after analysis of the questionnaires and the observational checklists. It shows the distribution of the socio-demographic characteristics of the respondents as well as findings on fire safety preparedness in the KMTCCs. Chi square test of association has been used to test for any statistically significant association between the socio-demographic characteristics of respondents and staff knowledge on fire safety preparedness and to test statistically significant differences between the campuses and availability of fire safety preparedness equipments, infrastructure and documents.

4.1 Socio-demographic characteristics of respondents

A total of 145 staff members met the inclusion criteria for the study. However, four (4) of the respondents declined to take part in the interview thus the response rate was 97.2 %.

Among the respondents, 53.2% were male and 46.8% were female. The modal age group was 36 – 45 years (34.0%) and 26-35 years (33.3%). The respondents were mostly non-teaching staff (61.7%) while the rest were academic staff. Almost all (95.7%) of the respondents interviewed were employed on permanent and pensionable terms. About 62% of the respondents had worked at their present jobs for more than 6 years. Among the institutions visited, Embu had the most respondents (36.2%), while Meru and Kitui Campuses had 33.3% and 30.5% respectively (Table 1).

Table 1: Socio- demographic characteristics of respondents (n=141)

Variable	Variable	Frequency	Percentage (%)
Gender	Male	75	53.2
	Female	66	46.8
Age in years	≤ 25	2	1.4
	26-35	47	33.3
	36-45	48	34.0
	46-55	39	27.7
	>55	5	3.5
Cadre	Academic	54	38.3
	Non-academic	87	61.7
Job tenure	Permanent and pensionable	135	95.7
	Contract	6	4.3
Duration at current station	1-23 months	18	12.8
	2-5 years	35	24.8
	6-10 years	52	36.9
	11-20 years	20	14.2
	>20 years	16	11.3
Campus	Kitui	43	30.5
	Embu	51	36.2
	Meru	47	33.3

4.2 Fire safety preparedness procedures in the KMTCCs

Fire safety preparedness procedures studied included staff training on fire safety and staff performance of fire and safety drills. Majority of the respondents, 96.3% and 93.0% in Meru and Embu Campuses respectively reported that the colleges did not undertake fire safety preparedness training. However, 82.1% of the respondents in Kitui reported that their campus undertook fire safety preparedness training. Fire safety preparedness trainings were said to have been undertaken only once in the three KMTCCs and involved just a few members of staff.

Although some respondents indicated that the institutions undertook fire safety preparedness training, very few of them had been trained (Fig. 3). Overall, 84.4% of the respondents reported that they have never been trained on fire safety preparedness with Embu Campus having the highest proportion of 92.2 % of the untrained respondents. None of the campuses performed fire and safety drills. In addition, all the respondents had never participated in a fire drill even elsewhere.

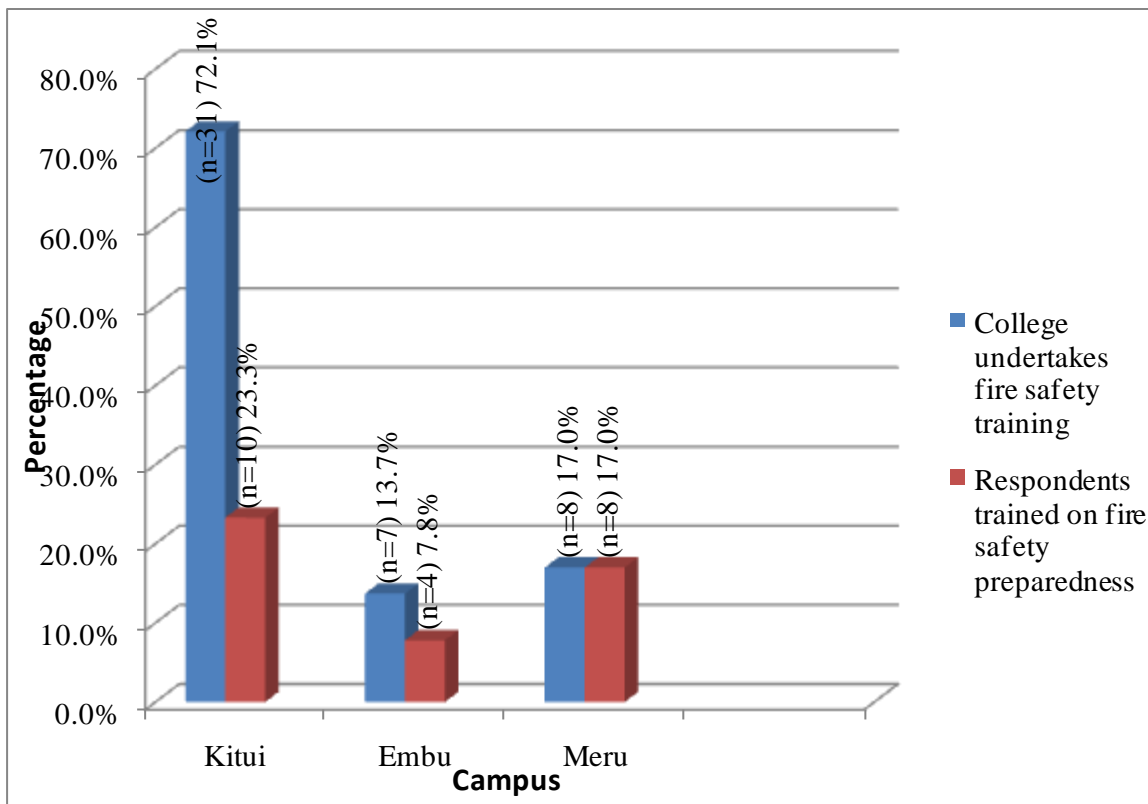


Figure 3: Fire safety preparedness procedures in the KMTCCs (n=141)

4.3 Fire safety preparedness documentary items

Documentary items such as fire safety preparedness policy documents, annual fire audits reports, evacuation priority list, fire drill reports, evacuation plans and staff responsibilities in fire management were studied for their availability. All these documents were missing apart from only a few (26.3%) evacuation plans which were present in the workplaces (Table 2).

4.3.1 Proportion of evacuation plans in the workplaces

Many (73.7%) workplaces across the institutions did not have evacuation plan posted on the walls, even though these plans were available in all the administration blocks in the three institutions. Embu Campus had the highest number (42.9%) of workplaces with the evacuation plans while Meru had the least (4.0%) as shown on table 2. A statistically significant difference between the institutions and the availability of the evacuation plans existed ($\chi^2=10.146$; p- value= 0.006).

Table 2: Differences between institutions and availability of evacuation plan

Availability of evacuation plan in each workplace(n =76)						
Campus	proportion	Yes	No	Total	χ square	p - value
Kitui		10	20	30	10.146	0.006
	%	33.3	66.7	100.0		
Embu		9	12	21		
	%	42.9	57.1	100.0		
Meru		1	24	25		
	%	4.0	96.0	100.0		
Total		20	56	76		
	%	26.3	73.7	100.0		

4.4 Knowledge on fire safety preparedness based on OSHA guidelines

4.4.1: Knowledge on people responsible for fire outbreak management

The respondents were asked whether they were aware of the persons responsible for fire outbreak management in the campus. Overall, it was revealed that a large percentage (39.8%) thought that it was only the responsibility of the security personnel to take part in fire outbreak management. Thirty nine percent (39.0%) of the respondents did not know who should be responsible for fire outbreak management in the colleges. Embu Campus had the highest percentage (43.1%), followed by Kitui and Meru with 41.9% and 31.9% respectively of the respondents who gave a “Don’t know” response.

Other responses given by the other respondents were that fire management was undertaken by the administration, staff and students, housekeeping department, human resource managers and the maintenance department (Fig. 4). Meru Campus was the only institution reported to have experienced a fire once as reported by 14.9 % of its respondents.

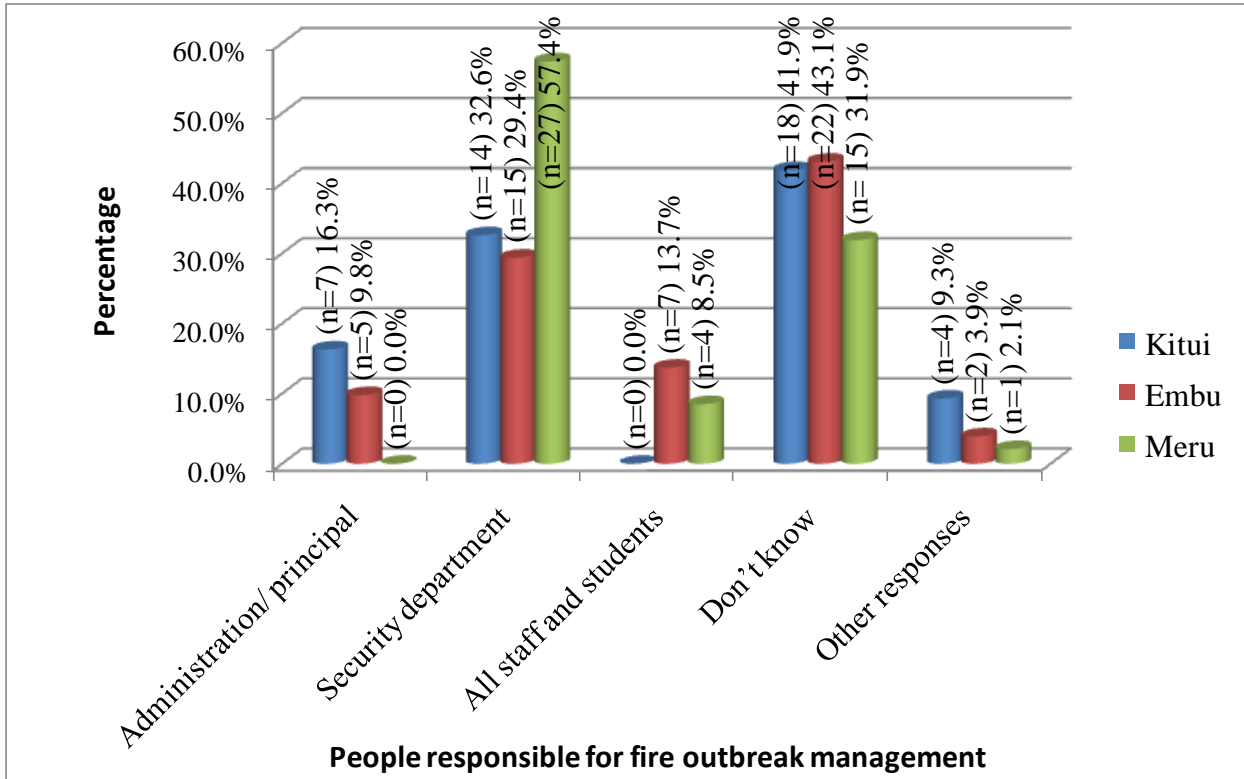


Figure 4: Knowledge on people responsible for fire outbreak management (n=141)

4.4.2: Knowledge on the use of fire extinguisher

More than half (55.1%) reported that they knew how to use a fire extinguisher (Fig. 5). Further analysis of the individual colleges revealed that about seventy percent (70%) and fifty six (56%) of the respondents in Meru and Kitui Campuses respectively knew how to use fire extinguishers. However in Embu Campus, 60.8% of the respondents had no idea of how to use the extinguishers. There was a statistically significant difference in knowledge on use of extinguishers among respondents in the various training institutions ($\chi^2=9.517$; p- value=0.009).

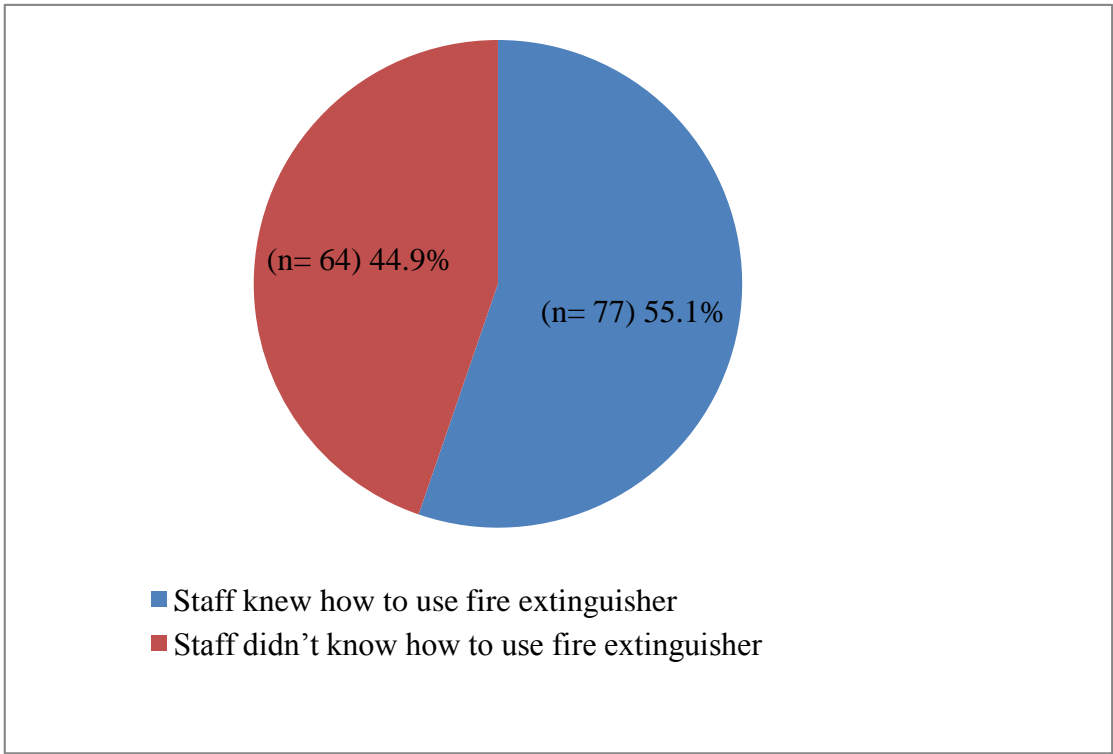


Figure 5: Knowledge on use of fire extinguisher (n =141)

4.4.3: Knowledge on the location of the closest fire extinguisher from one's workroom

A large proportion (83.3%) of the respondents in the institutions knew where the closest fire extinguisher was located. The proportions were 72.5%, 83.7% and 93.6% in Embu, Kitui and Meru Campuses respectively (Fig. 6).

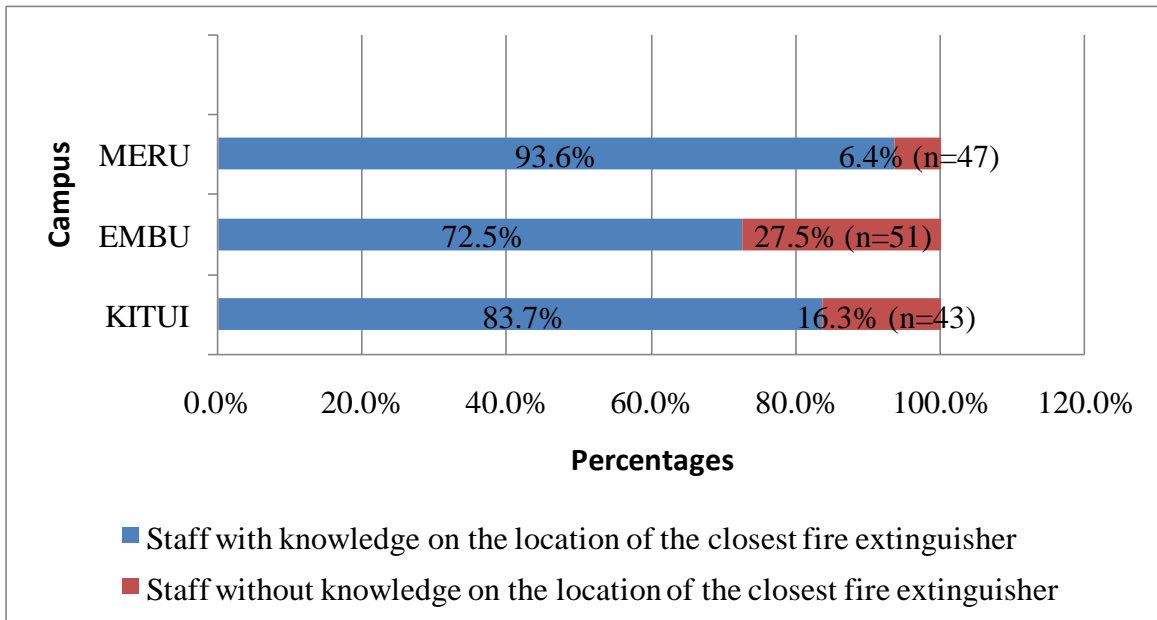


Figure 6: Knowledge on the location of the closest fire extinguisher from workstation

4.4.4: Knowledge on the emergency telephone numbers to report a fire outbreak

The emergency telephone numbers included contacts of the police hotline, fire brigade and ambulance services within Campuses. More than seventy percent (72%) of the staff did not know the emergency telephone numbers used to report a fire outbreak. Kitui Campus had the highest percentage (79.1%), Meru Campus (70.2%) and Embu Campus (66.7%) of the respondents (Fig. 7).

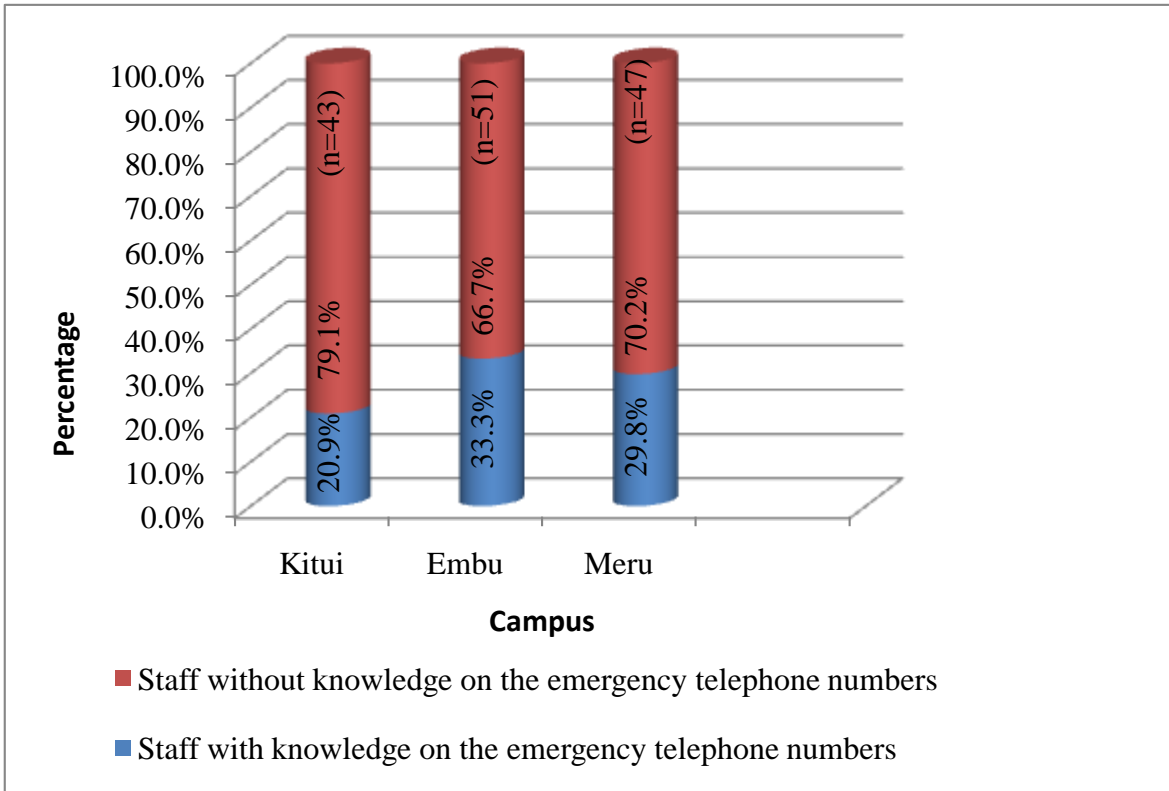


Figure 7: Knowledge on the emergency telephone numbers (n=141)

4.4.5: Knowledge on components necessary to start and sustain a fire

Majority (87.5%) of the respondents knew the components necessary to start and sustain a fire in all the institutions. Kitui and Meru Campuses had the most (89.9% and 91.5%) respondents respectively compared to Embu with the least number of 81.0% (Fig.8).

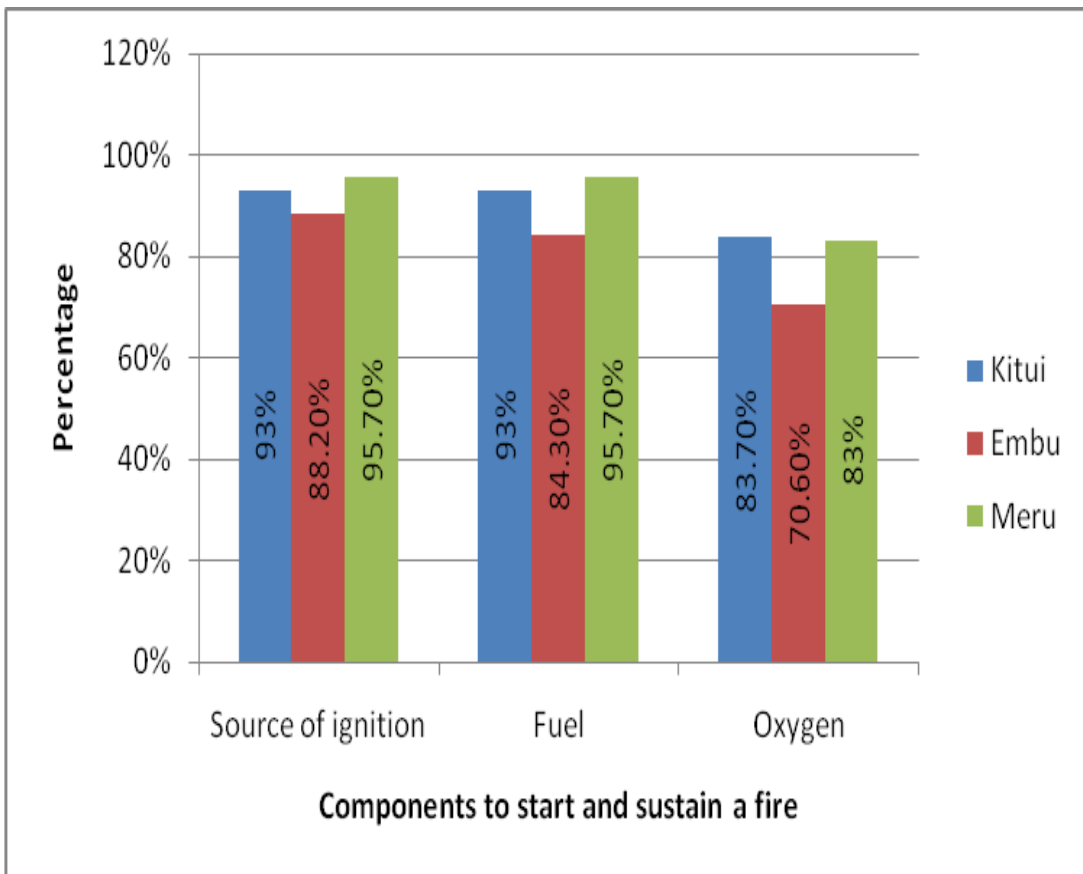


Figure 8: Knowledge on components necessary to start and sustain a fire (n=141)

4.4.6: Institutions' scoring on staff knowledge

An overall scoring of the seven knowledge variables indicated that less than half (48.2%) of the respondents scored 6 and 7 scores on the knowledge rating scale, representing the proportion of respondents with adequate knowledge. However, in Meru alone, more than sixty percent (63.8%) of the respondents had adequate knowledge on the fire safety preparedness variables assessed (Table 3).

Table 3: Institutions' staff knowledge (n=141)

Campus	Knowledge score								Adequate knowledge (6 and 7 scores)	Inadequate knowledge (1 to 5 scores)	Total
	1	2	3	4	5	6	7				
Kitui	1	1	1	3	17	15	5	20	23	43	
	%	2.3	2.3	2.3	7.0	39.5	34.9	11.6	46.5	53.5	100.0
Embu	2	3	4	12	12	8	10	18	33	51	
	%	3.9	5.9	7.8	23.5	23.5	15.7	19.6	36.3	63.7	100.0
Meru	0	0	2	0	15	23	7	30	17	47	
	%	0.0	0.0	4.3	0.0	31.9	48.9	14.9	63.8	36.2	100.0
Total	3	4	7	15	44	46	22	68	73	141	
	%	2.1	2.8	5.0	10.6	31.2	32.6	15.6	48.2	51.8	100.0

4.4.7: Comparison between respondents' knowledge and cadre

When knowledge and staff cadre were compared, most (79.6%) of the academic staff had adequate knowledge on fire safety preparedness. However, approximately 71% of the non-academic staff had inadequate knowledge. Therefore, there was a statistically significant association between staff knowledge and their cadres ($\chi^2=34.565$; p- value= 0.000) (Tables 4).

Table 4: Comparison between respondents' knowledge on fire safety preparedness and cadre (n=141)

Cadre	Knowledge rating		Total	χ square	p- value
	Inadequate knowledge	Adequate knowledge			
Academic	11	43	54	34.565	0.000
	%	20.4	79.6		
Non-academic	62	25	87		
	%	71.3	28.7		
Total	73	68	141		
	%	51.8	48.2		

4.4.8: Comparison of staff knowledge and their duration of work in the current station

A large proportion (80.0%) of staff who had worked at the current work station for 11 to 20 years had adequate knowledge compared to the ones who had worked for a shorter duration in the current station. Respondents who had worked for less than two years had the least (27.8%) level of knowledge. However, it was also found out that the staff who had worked in the current campuses for more than 20 years also had inadequate knowledge on fire safety preparedness represented by approximately 69% in that cohort. There was a statistically significant association between staff knowledge on fire safety preparedness and the duration of work in the current station ($\chi^2=12.950$; $p=0.012$) (Table 5).

Table 5: Comparison of staff knowledge and the duration of work in the current station

Knowledge rating(n=141)						
Work duration current station	Proportion	Inadequate knowledge	Adequate knowledge	Total	χ square	p –value
1-23 months		13	5	18	12.950	0.012
	%	72.2	27.8	100.0		
2-5 years		18	17	35		
	%	51.4	48.6	100.0		
6-10 years		27	25	52		
	%	51.9	48.1	100.0		
11-20 years		4	16	20		
	%	20.0	80.0	100.0		
>20 years		11	5	16		
	%	68.8	31.2	100.0		
Total		73	68	141		
	%	51.8	48.2	100.0		

4.5 Attitude and perceptions of the staff on fire safety preparedness

4.5.1: Staff perception on the risk of fires in the workplace

A likert scale of 0 to 5 to represent no fire risk to high risk was used to assess staff perception on the risk of fires in the workplaces. More than half (57.2%) of the respondents in the three institutions perceived the risk of fires in their workplaces to be below average. The various respondents' perception on the risk of workplace fires in the three institutions is illustrated on Figure 9.

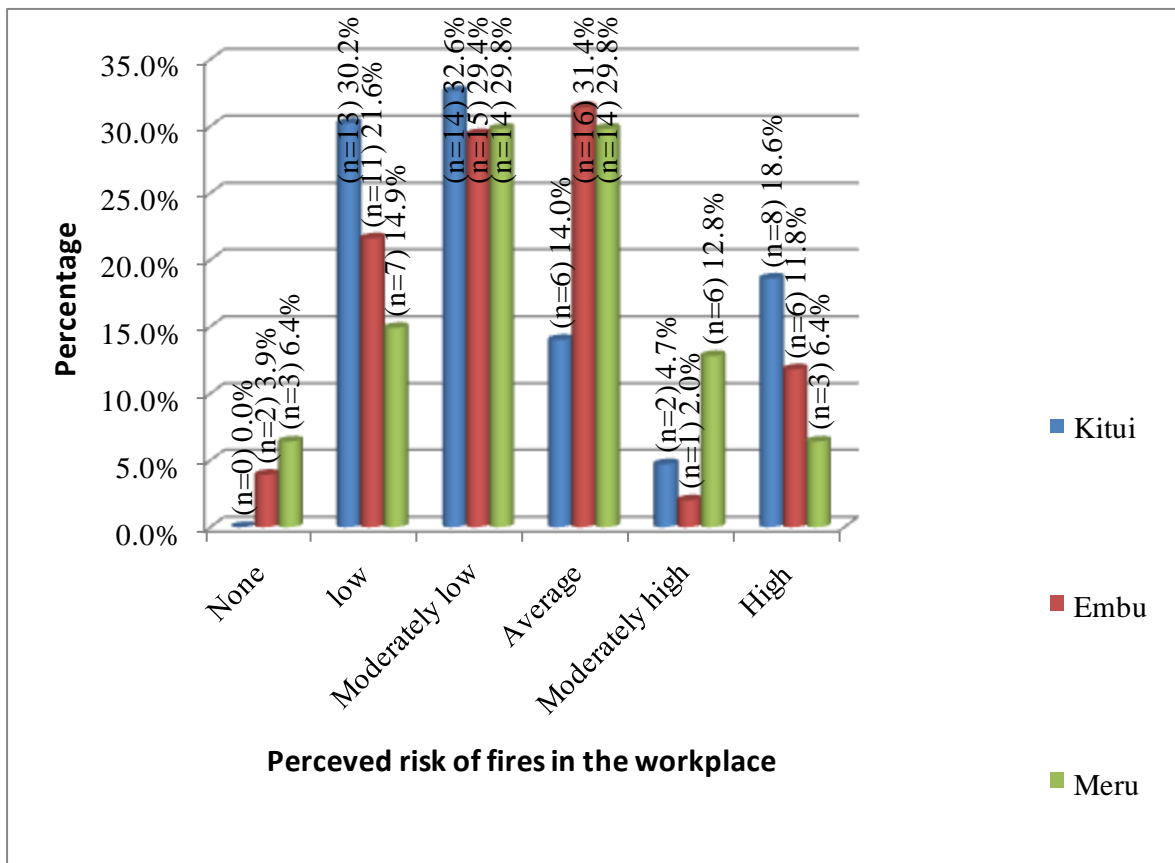


Figure 9: Rating of the risk perception of fires in the workplace (n=141)

4.5.2: Perceived sources of fires in the workplaces

Electrical faults were perceived as the most possible source of fires in the three institutions with 90.8% of all the staff agreeing to this. A comparison between the institutions revealed 100%, 82.4% and 91.5% in Kitui, Embu and Meru Campuses respectively perceived that electricity was the top most fire risks within the workplace. The kitchen fires were perceived as the second most fire risks. In Kitui Campus, 69.8% respondents perceived that destructive violence such as students strikes could be a major source of fire in the institution. Heaters and cookers in the hostel were perceived as the least fire risk in the campuses (Fig. 10).

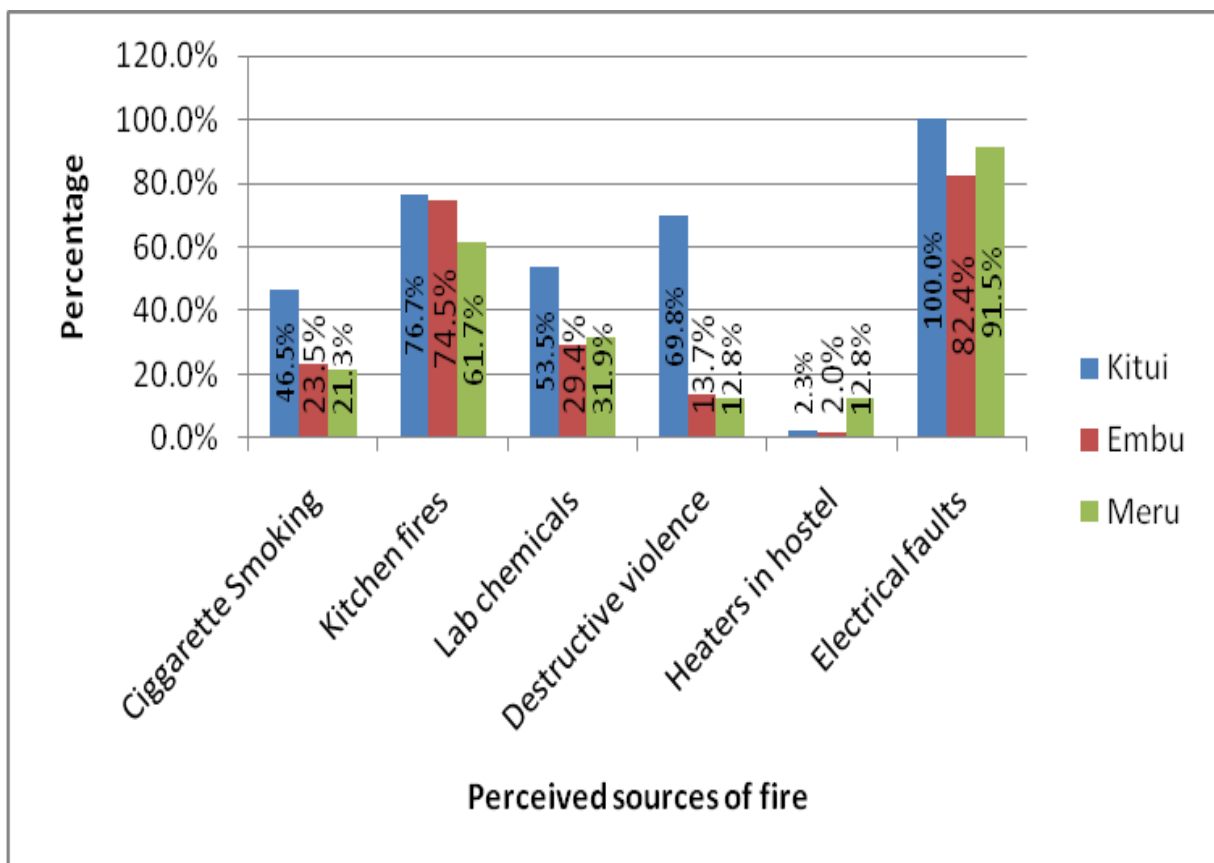


Figure 10: perceived sources of fires in the workplaces (n=141)

4.5.3: Perceived need for training on fire safety preparedness

This study determined the perceived need for staff training on fire safety preparedness. Majority (75.2%) of the respondents across the three institutions felt a high need for training on fire safety preparedness. A comparison of the various campuses indicated that Kitui Campus was leading at 93.0%, while Embu and Meru Campuses had 68.6% and 66% respectively (Table 6).

Table 6: Perceived need for training on fire safety preparedness (n=141)

Perceived need for training on fire safety preparedness								
Campus	Proportion	None	low	Moderately low	Average	Moderately high	High	Total
Kitui		0	1	0	1	1	40	43
	%	0.0	2.3	0.0	2.3	2.3	93.0	100
Embu		1	3	0	4	8	35	51
	%	2.0	5.9	0.0	7.8	15.7	68.6	100
Meru		1	2	3	3	7	31	47
	%	2.1	4.3	6.4	6.4	14.9	66.0	100
Total		2	6	3	8	16	106	141
	%	1.4	4.3	2.1	5.7	11.3	75.2	100

4.5.4: Perceived level of respondent's fire safety preparedness

About 62% of the respondents rated their level of fire safety preparedness as below average. This included a total of the respondents who felt that their level of fire safety preparedness was nil, low or moderately low. A comparison of the three campuses revealed 72.1% of the respondents in Kitui Campus with preparedness level below average, while Embu and Meru campuses had 68.6% and 44.7% respectively. Only 12.8% of respondents reported their fire safety preparedness as above average (Table 7).

Table 7: Perceived level of respondent's fire safety preparedness (n=141)

Perceived level of respondent's fire safety preparedness								
Campus	Proportion	None	Poor/low	Fair/moderately low	Average	Moderately high	High	Total
Kitui		0	11	20	8	2	2	43
	%	0.0	25.6	46.5	18.6	4.7	4.7	100
Embu		2	24	9	10	3	3	51
	%	3.9	47.1	17.6	19.6	5.9	5.9	100
Meru		0	17	4	18	6	2	47
	%	0.0	36.2	8.5	38.3	12.8	4.3	100
Total		2	52	33	36	11	7	141
	%	1.4	36.9	23.4	25.5	7.8	5.0	100

4.6 Compliance to fire safety preparedness equipments, systems and infrastructure

4.6.1 Fire detection/ warning systems

There were no automatic smoke detectors/ sensors installed in the workrooms or on the corridors in all the three institutions. Kitui Campus had no fire alarm bell installed in all its buildings. Although 71.4% of the buildings in Embu Campus had fire alarm bells, all were non functional. Non functional fire alarm bells were also found in the medical engineering workshops and one hostel in Meru Campus.

Fire detection and warning systems were not connected to any fire emergency response team. Telephone contacts of police hotline were included on the evacuation plans posted in few (26.3%) workplaces.

4.6.2 Fire fighting equipments

i) Availability of fire extinguishers

The availability of fire extinguishers in the workplaces was less than half (35.5%). Embu Campus had almost all (90.5%) of the workplaces without fire extinguishers (Table 8), since they were stored in a room apart from those located in the computer and skills laboratories.

All the fire extinguishers in the three institutions were inspected and tagged annually by a licensed fire protection services company and were in working condition. However, only 4.5% of those in Embu Campus located in the computer and skills laboratories were not tagged. A large number (73%) of the fire extinguishers were red-colored, containing water. The water containing fire extinguishers were 100%, 64.3% and 54.5% in Embu, Meru and Kitui Campuses respectively. Other available fire extinguishers were blue-colored, which contained dry powder represented by 35.7% and 27.3% in Meru and Kitui Campuses respectively. Only two fire extinguishers were black-colored, containing carbon dioxide. Cream extinguisher were however not available in the institutions. There was a statistically significant difference between the institutions and the availability of fire extinguishers ($\chi^2= 10.791;p=0.005$)

Table 8: Availability of fire extinguishers based on the study sites (n=76)

Availability of a fire extinguisher in the workroom						
Site	Proportion	Yes	No	Total	χ square	p- value
Kitui		11	19	30	10.791	0.005
	%	36.7	63.3	100.0		
Embu		2	19	21		
	%	9.5	90.5	100.0		
Meru		14	11	25		
	%	56.0	44.0	100.0		
Total		27	49	76		
	%	35.5	64.5	100.0		

ii) Availability of sand buckets

Most (78.9%) of the workplaces had sand buckets placed outside the workrooms, with Meru KMTTC having almost all (96.0%) the workplaces. Embu Campus had about 43% of the workplaces without the sand buckets. There was a statistically significant difference between the institutions and availability of sand buckets in the workplaces ($\chi^2=10.401$; $p=0.006$) (Table 9).

Table 9: Availability of sand buckets (n=76)

Availability of sand buckets						
Campus	Proportion	Yes	No	Total	χ square	p- value
Kitui		24	6	30	10.401	0.006
	%	80.0	20.0	100.0		
Embu		12	9	21		
	%	57.1	42.9	100.0		
Meru		24	1	25		
	%	96.0	4.0	100.0		
Total		60	16	76		
	%	78.9	21.1	100.0		

iii) Availability of other fire extinguishing equipments

All the institutions did not have fire blankets in the workrooms apart from the kitchen in Embu Campus. In addition, all the workplaces lacked automatic sprinklers and functional hose reels with water, except one hostel in Kitui Campus which had working hose reels with water for putting off a fire (Table 10). Embu Campus had 66.7% of the workplaces with vandalized hose reels.

Table 10: Availability of other fire extinguishing equipments in workplaces (n=76)

Equipment	Workplaces with equipments (%)	Workplaces without equipments (%)
Sand buckets	78.9	21.1
Functional hose reels	3.3	96.7
Fire blanket	4.8	95.2
Automatic sprinklers	0	100

iv) Workrooms and their compliance to fire extinguishing devices

Workroom compliance was determined by the presence of at least one firefighting equipment such as the fire extinguishers, sand buckets or a fire blanket. According to this criterion approximately 87% of the workrooms were compliant. The administration blocks, the libraries and laboratories were all compliant. However, only two out of the three kitchens and dining halls were compliant to the firefighting devices (Table 11).

Table 11: Compliance to fire extinguishing device (n=76)

Compliance to fire extinguishing device				
Types of workrooms	Proportion	No	Yes	Total
Hostel		4	13	17
	%	23.5	76.5	100.0
Offices outside the administration block		1	14	15
	%	6.7	93.3	100.0
Administration block		0	3	3
	%	0.0	100.0	100.0
Dining Hall		1	2	3
	%	33.3	66.7	100.0
Kitchen		1	2	3
	%	33.3	66.7	100.0
Classroom		3	15	18
	%	16.7	83.3	100.0
Medical laboratory		0	3	3
	%	0.0	100.0	100.0
Skills laboratory		0	3	3
	%	0.0	100.0	100.0
Computer Laboratory		0	3	3
	%	0.0	100.0	100.0
Library		0	3	3
	%	0.0	100.0	100.0
Medical Engineering workshop		0	5	5
	%	0.0	100.0	100.0
Total		10	66	76
	%	13.2	86.8	100.0

4.6.3 Compliance to means of escape

i) Presence of an exit door in workplaces (n=76)

Among all the workplaces assessed approximately 65% lacked an exit door (Fig.11). Meru Campus had the largest percentage (44.0%) of workplaces with exit doors. In Kitui Campus, only 33.3% of the workplaces had exit doors. These included the dining hall, kitchen, and library and skill laboratory and 60% of the hostels. Embu KMTC had the least (28.6%) of its workplaces with exit doors, which were all the hostels, administration block, dining hall and only one classroom.

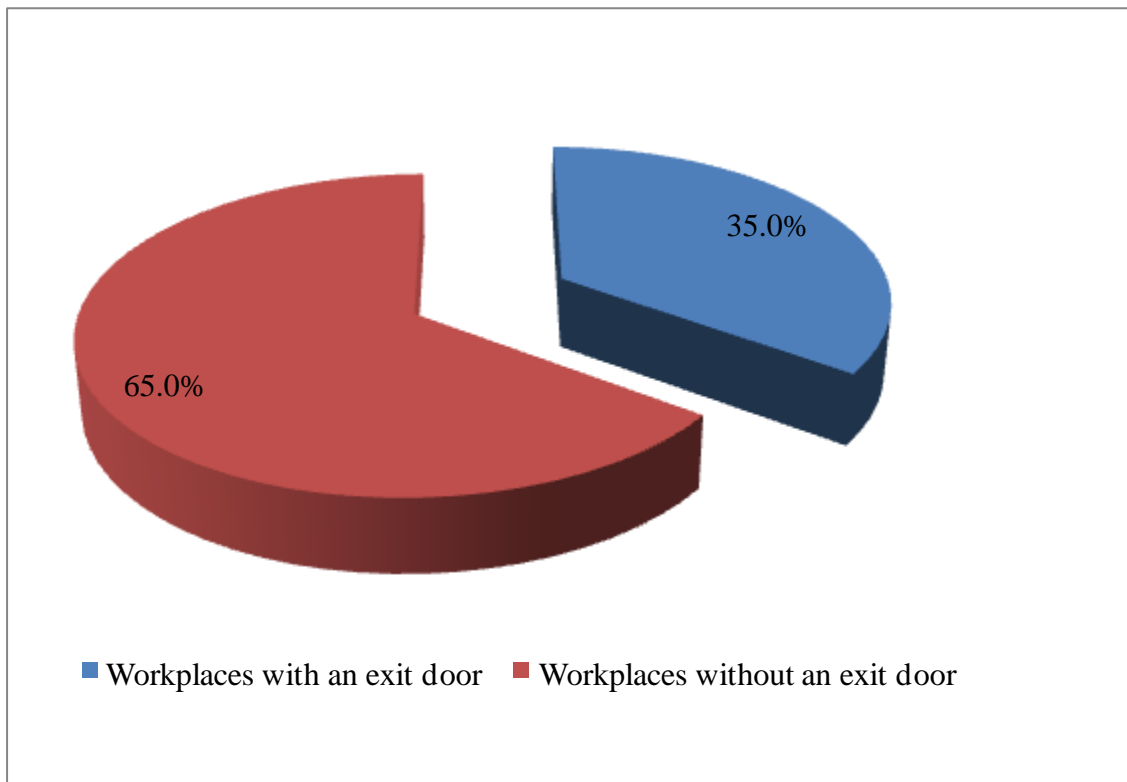


Figure 11: Presence of an exit door in workplaces (n=76)

ii. Compliance of the existing exit doors/ routes to OSHA 2007 requirements

Assessment of the exit doors and routes was done as regards to their labeling, lighting, guarding and freedom from obstruction. Only 3.7% of the available exit doors were labeled 'EXIT'. Half (50%) of the exit doors in Embu Campus had labeled illustrations of the escape routes while in the other two campuses; escape routes were completely unlabeled. Overall, most (85.2%) of the fire exit doors were free from obstruction. More than half (63.2%) of the exit doors readily opened from inside without the use of a key. Most (80.9%) of the buildings had lighting provided on the exit routes although some of the lighting was non functional. Figure 12 shows the condition of the exit doors/ routes in each campus. On the other hand, all storeyed buildings had staircases and the exit routes had balustrades and handrails to prevent people from falling over the staircases when escaping from the buildings if a fire occurs.

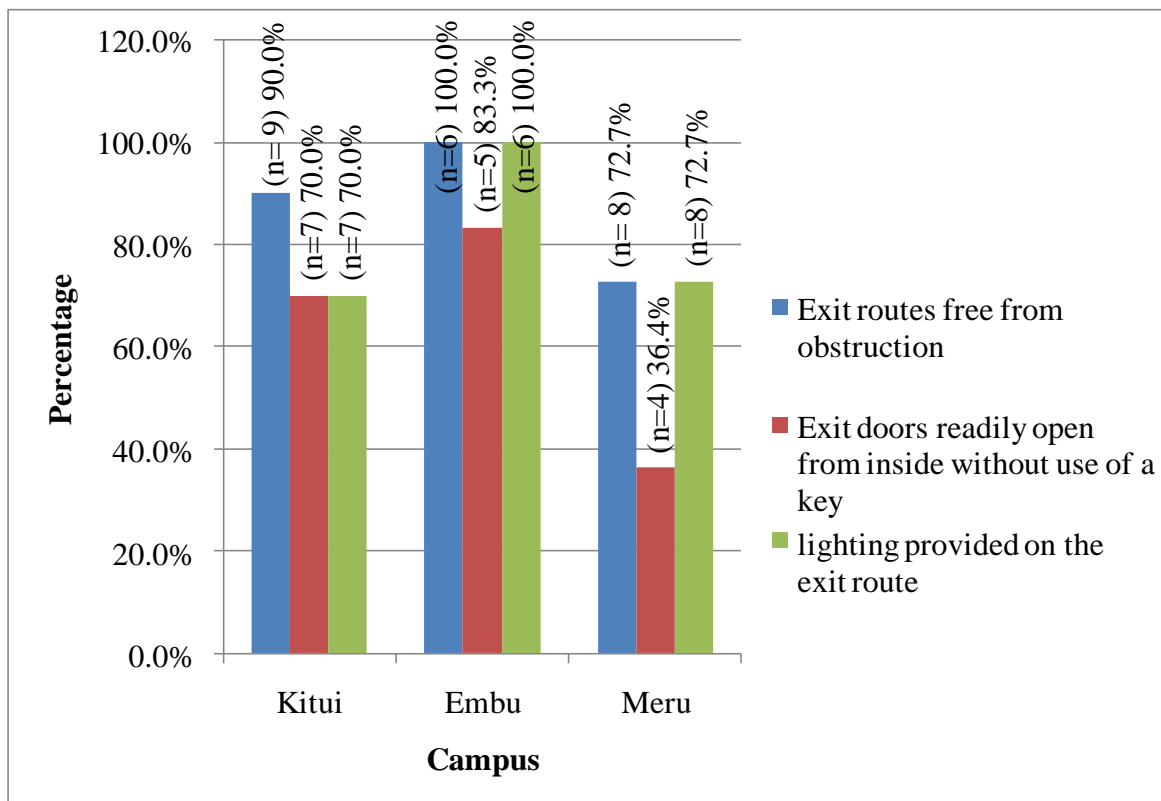


Figure 12: State of the exit doors/ escape routes (n= 27)

iii) Building's compliance to means of escape

An overall scoring of the seven means of escape variables were rated from 0 to 7. This included presence of an exit door/ corridor, labeled exit, escape route being labeled with signs/ illustrations on the walls, exit route being free from obstruction, exit door readily opening from inside, exit routes with lighting and the exit lighting being in working condition. A score of ≤ 3 was rated as non compliance while a building with ≥ 4 of the requirements was said to be compliant.

Assessment of compliance to the buildings requirement on means of escape indicated that 75% of the workplaces did not comply with means of escape as per the scoring criteria. This meant they did not meet 50% of the characteristics assessed. There was no statistically significant difference between the institutions and compliance to means of escape (Table 12).

Table 12: Institution's compliance to means of escape (n=76)

Compliance to means of escape						
Campus	Proportion	No (≤ 3 score)	Yes (≥ 4 score)	Total	χ square	p- value
Kitui		23	7	30	4.972	0.905
	%	76.7	23.3	100.0		
Embu		15	6	21		
	%	71.4	28.6	100.0		
Meru		19	6	25		
	%	76.0	24.0	100.0		
Total		57	19	76		
	%	75.0	25.0	100.0		

CHAPTER 5: DISCUSSION

The requirements of OSHA Legal Notice No. 15 of 2007 of the Laws of Kenya (OSHA, 2007), emphasizes that workplace should promote safety and health of the workers and other occupants in the premises. Fire safety preparedness is an important step of fire emergency management which is aimed at fire disaster risk reduction. This can be achieved through continuous planning, organizing, training, equipping, exercising, evaluation and improvement activities pertaining fire safety preparedness (FEMA, 2007). This study thus aimed at assessing the state of fire safety preparedness in the KMTCCs in Eastern Kenya region and the study findings are discussed below.

5.1 Staff knowledge on fire safety preparedness

According to OSHA, 2007 all workers should be trained on fire safety preparedness measures and instructed in the safe use of fire fighting appliances. This should be done through regular basic fire safety training and fire drills to establish the level of fire safety preparedness. In addition to that, every occupier should establish and implement fire safety policy, outline the organization and arrangements for carrying out the policy and all workers should be informed on the contents of the policy.

Knowledge of staff on fire safety preparedness based on OSHA, 2007 guidelines was found to be low. When knowledge components were rated on a scale of 1-7 scores, slightly less than half (48.2%) of the respondents had adequate knowledge. There was evidence of a statistically significant association between staff knowledge and their cadres ($\chi^2 = 34.565; p=0.000$), with 79.6% of academic staff and only 28.7% of the non-academic staff having adequate knowledge. Again, there was evidence of a statistically significant association between staff knowledge and the duration the staff had worked in the current station ($\chi^2 = 12.950; p=0.012$). However, there was no statistically significant association between the staff knowledge and job tenure.

Awareness of fire safety preparedness was influenced by the institutions' failure to have fire safety policy in place which would orientate the staff on fire safety preparedness and ensure that they are aware of the persons responsible for fire management.

More than half (55.1%) of the staff knew how to use a fire extinguisher. These findings contrast with findings on knowledge level study done five years back in secondary schools in Turkana district in Kenya, in which most teachers did not know how to effectively use a fire extinguisher (Ronoh and Kyalo, 2009). Most (83.3%) of the respondents were aware of the location of the closest fire extinguisher from their workrooms. However, 44.9% of the respondents did not know how to use a fire extinguisher in case of a fire outbreak. Therefore, availability of firefighting equipment did not correspond to the staff knowledge on their use.

A large percentage (72%) of the respondents did not know the emergency telephone numbers to dial in order to report a fire outbreak. This meant that in case of a fire outbreak, the response time by the staff and fire response teams would be prolonged since the colleges had no fire detection and warning systems connected to fire emergency response teams e.g. fire brigades and the police, and much time would be spent searching for the contacts to dial the fire response teams.

5.2 Staff attitude and perception on fire safety preparedness

All employers and workers are meant to be committed to health and safety in the workplaces (OSHA, 2007). Staff knowledge alone is not enough to have fire safety preparedness. It is therefore imperative that all the workers have a positive attitude on the various strategies geared towards fire safety preparedness.

Overall, more than half (57.2%) of all the respondents across the three institutions perceived the risk of fires in their workplaces to be below average. However, the most perceived fire hazard was electrical faults by 90.8% of the respondents. Staff perception of electricity as the greatest fire hazard in a learning institution was also highlighted by medical students on an earlier study done in the University of Nairobi, Kenya (Mutiso *et al.*, 2002).

Majority of the respondents in the three institutions had a positive attitude towards the need for a basic training on fire safety preparedness, with 75.2% of the respondents saying that their perceived need for basic fire safety preparedness training was high. This was attributed to the perceived level of preparedness since a large proportion (61.7%) of the respondents rated their preparedness level as below average. Only 5 % of the respondents rated their level of fire safety

preparedness as high. This calls for the staff to be trained on fire safety preparedness for effective fire emergency management similarly to other studies (Hart *et al.*, 2011; Suchetka, 2010).

5.3 Compliance to fire safety preparedness; documents, procedures, systems, equipments and infrastructure

Requirements on OSHA 2007 dictate that fire drills and fire safety audits of the workplace should be conducted at least annually and records kept for reference. Again, every workplace should have an established fire safety policy which all workers should be informed of its contents.

The study found that documentary items such as fire safety policy documents, evacuation priority list, copies of persons responsible on fire management, annual fire audits reports and fire drill reports were missing in all the three institutions. Only 26.3% of the workplaces had evacuation plans. This contravenes the OSHA, 2007 requirements on availability of fire safety preparedness documents in the workplaces. These findings concur with other studies conducted globally and also in Africa (Francisco *et al.*, 2004; Akussah and Fuso, 2004).

Majority (96.3% and 93.0%) of the respondents in Meru and Embu Campuses respectively reported that the colleges did not undertake fire safety training. However, 82.1% of the respondents in Kitui reported that their college undertook fire safety training. Fire safety preparedness training had been undertaken only once in the three Campuses. None of the colleges performed fire and safety drills, annual fire audits and neither of the respondents had ever participated in a fire drill even elsewhere. The institutions had not experienced fire outbreak in the past apart from Meru campus, in which one fire outbreak occurred ten years ago. These findings on fire drills contrasts with those of a study conducted three years ago which found that staff were undertaking regular fire drills following several hospital fire outbreaks which at Cleveland clinic operating suite (Hart *et al.*, 2011).

Most (84.4%) of the respondents in the three institutions reported that they had never been trained on fire safety preparedness with Embu having the highest proportion (92.2 %) of untrained respondents. This corresponds to the low percentage (39.2%) of the respondents who reported to have known how to use a fire extinguisher in the same institution.

This shows that installation of fire extinguishers in the workplaces was done to fulfill a policy requirement and lacked the required strategies to ensure their effective use in case of a fire outbreak such as staff training on their use.

According to OSHA 2007, every occupier shall provide and maintain fire detection appliances such as fire alarm bells or automatic fire detection and extinguishing systems. The fire detection appliances should be linked to fire response teams to ensure fast emergency response. Every occupier shall also provide means of extinguishing fire at the workplace. All fire extinguishers should be properly maintained through inspection and testing annually by a competent person. Selection and distribution of fire extinguishers in the workplace should be based on the classes of fire anticipated and the size and degree of hazard caused by a fire.

There were no automatic smoke detectors/ sensors available in the workrooms or on the corridors in all the three institutions. Kitui Campus had no fire alarm bells installed in any of the buildings. Although most of the buildings in Embu Campus had fire alarm bells, all of them were nonfunctional. Other places with faulty fire alarm bells included the medical engineering workshops and one hostel in Meru Campus. Similarly, previous studies have shown non compliance to fire detection and warning systems (Francisco *et al.*, 2004; Douglus *et al.*, 1999; Chandrakankan, 2004).

Approximately 87% of the workrooms were compliant with fire fighting equipments. The administration blocks, the libraries and laboratories were all compliant. In the event of a fire outbreak, it could be effectively put off in those workplaces. However, only two out of the three kitchens in the institutions were compliant to the firefighting devices, yet kitchen fires were ranked second as sources of fires in the campuses. This portrayed that the management did not give much attention to have firefighting equipment installed in all the kitchens which always had open fires for foods preparation.

The availability of fire extinguishers in every workplace was less than half across the institutions. Embu Campus had almost all the workplaces without fire extinguishers since they had been stored in a room.

It was reported that this was due to security reasons and to protect them from misuse. However, this practice puts the staff, property and buildings at more risk of fires destruction since the fire extinguishers are not readily available in the event of a fire outbreak.

In line with the OSHA 2007 requirements, all the fire extinguishers in the three institutions were inspected and tagged annually by a licensed fire protection services company and were in working condition. Approximately 73% of the fire extinguishers were red in color. Contrary to the OSHA, 2007 requirements on fire extinguishers, selection of the fire extinguishers in the workplaces was not based on the types of fires anticipated. This was evident because electricity was the main fire risk in all the workplaces since all the workplaces were supplied with electricity. Dry powder (blue-coded) or carbon dioxide (black-coded) fire extinguishers should have been installed in all the workplaces instead of water(red- coded) extinguishers which were absolutely not useful for putting off class C fires which involves electricity.

Since the exact number of fire extinguishers and other fire detection and fire management equipments required in each building varies based on the hazard level of the building, this study was only limited to assess compliance in terms of equipments availability because it did not first assess the hazard level in the buildings.

Most (87%) of the workplaces were compliant with fire fighting devices, meaning that at least one firefighting equipment was available within the workplace. They had either fire extinguishers, sand buckets, hose reels with water or a fire blanket. Sand buckets were however shared among several workplaces; therefore this study only evaluated their availability within the vicinity. This would lead to ineffective fire fighting particularly if fires occurred in workplaces without complementary fire extinguishers and/ or other fire fighting equipments.

Age of the institutions might have been a contributing factor to the availability of functional fire alarm bells and fire fighting equipments particularly the hose reels because maintenance of the equipments was not done years after installation.

Embu and Meru Campuses which were started in the years 1975 and 1979 respectively had non-functional hose reel and fire alarm bells. The functional hose reels with water were only found in Kitui KMTC which was established in 2004.

The OSHA, 2007 guidelines specify that every workplace should be fitted with a fire emergency exit which should open outwards and should be easily and immediately opened from the inside. Again, fire escape routes should be adequately aerated and well lit.

Fire exit door should be clearly marked “EXIT” and fire escape routes conspicuously marked in writing or by signs indicating the direction of exit and should all be free of obstruction. Evacuation routes shall be posted in prominent positions in the workplace.

This study revealed that three quarters of the workplaces did not comply with means of escape requirements as per the scoring criteria of attaining 50% or more, of the assessed requirements. Approximately 65% of the workplaces in the institutions studied lacked an exit door or corridor. Only half of the available escape corridors in Embu Campus had labeled illustrations of the escape routes to be used for evacuation during a fire emergency, while labeled escape routes were completely missing in the other two institutions. Some other studies which revealed these non-compliance of buildings to fire safety preparedness include; Mutiso *et al.*, 2002 and Adunki, 1999. However, most of the available fire exit doors/ corridors were free from obstruction and working lighting were present in more than half of the escape routes in the three institutions which would facilitate effective evacuation during an emergency.

The few storeyed buildings in the institutions had staircases and exit routes with balustrades and handrails, although assessment of the availability of these parameters as a requirement of an escape route could not be generalized since most of the buildings were not storeyed.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study's main objective was to assess workplace fire safety preparedness in KMTCCs in Eastern Kenya region. In regard to the study findings, the following conclusions were made:

1. In respect to objective one (to determine knowledge on fire safety preparedness against the OSHA, 2007 guidelines among the KMTCC staff); knowledge of staff on fire safety preparedness was low since the institutions did not undertake fire drills, and most of the staff had not been trained on fire safety preparedness even during their orientation period.
2. In regard to objective two (to describe the attitudes/ perception of KMTCC staff on fire safety preparedness); majority of the respondents felt the need for training on fire safety preparedness and a large proportion rated their fire safety preparedness level to be low.
3. With reference to objective three (to evaluate compliance to fire safety preparedness; Documents, procedures, systems, equipments and infrastructure in KMTCCs); KMTCC had not adopted the OSHA, 2007 fire safety policy, which was missing in all Campuses. Thus, the institutions were not compliant to issues stipulated in the policy such as availability of fire safety preparedness documents, installation of systems and firefighting equipments, participation in fire safety preparedness procedures, and putting in place the infrastructure requirements on fire safety preparedness. Maintenance of fire fighting equipments such as hose reels and alarm bells was not regularly done thus rendering them non- functional.

6.2 Recommendations

In order for the medical training institutions to comply with the OSHA, 2007 guidelines on fire safety preparedness:

1. The KMTTC board of management should ensure that fire safety policy is adopted in reference to the national guidelines outlined in OSHA, 2007. These fire safety policy documents should trickle down from the national to the campus level.
2. The Campus Principals should ensure all staff are trained on fire safety preparedness. Induction of staff after employment should include orientation on fire safety preparedness, and subsequent regular refresher trainings done.
3. The Campus Principals should ensure all the existing buildings are reconstructed to have the required infrastructure for fire safety preparedness. Fire safety preparedness guidelines should also be followed in construction of new buildings.
4. The Campus Principals should ensure all workplaces are provided with functional firefighting equipments. Whenever fire extinguishers are provided, they should be appropriate for extinguishing the types of fires that may occur in the workplaces.
5. Further research is recommended on the assessment of hazard level in the institutions' buildings to ascertain their compliance and on fire safety assessment of the other phases of disaster management (response, recovery and mitigation/ control). Also a study on assessment of fire safety preparedness in KMTCCs in other regions of Kenya is recommended.

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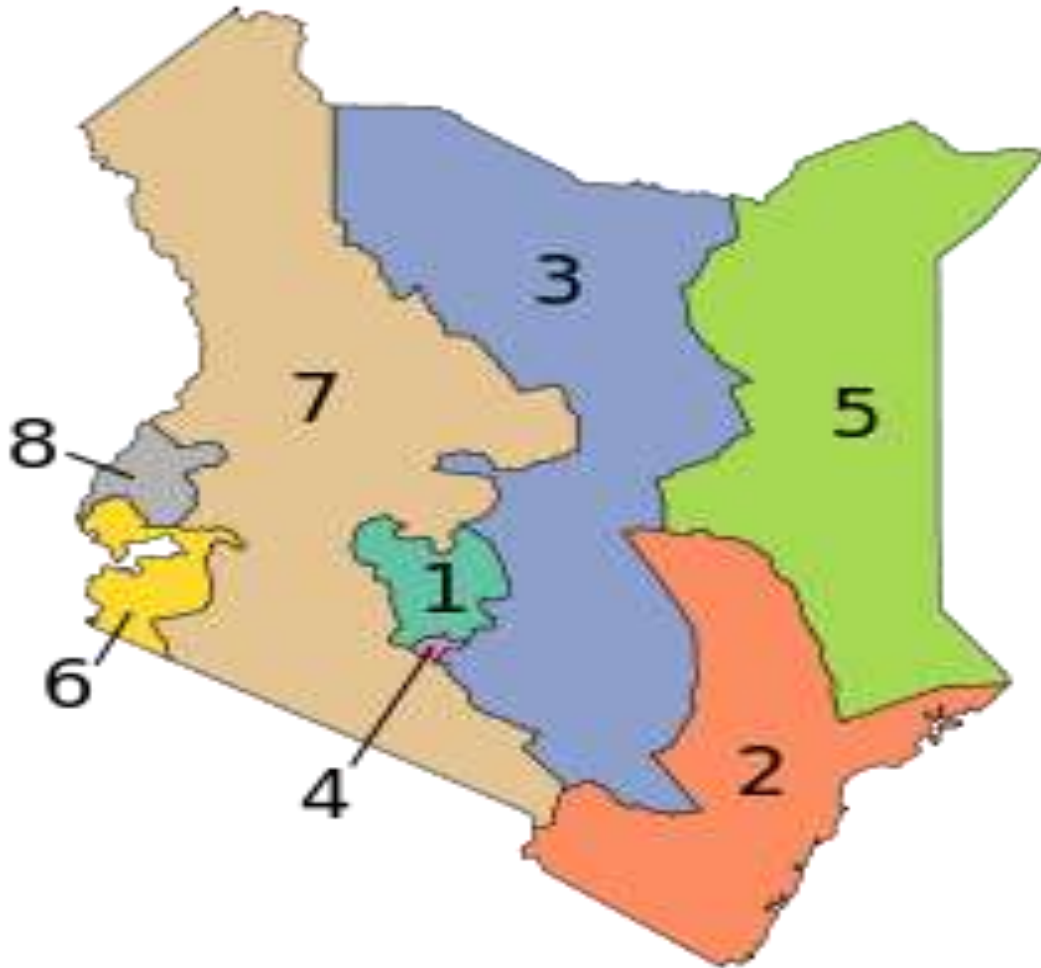
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APPENDICES

Appendix i: Map of Kenya showing the geographical regions



Regions

1. Central
2. Coast
3. Eastern
4. Nairobi
5. North Eastern
6. Nyanza
7. Rift Valley
8. Western

Appendix ii: OSHA, 2007 Fire Safety Preparedness Guidelines

1. Fire escape exits: Every workroom should be fitted with an emergency exit situated as far away as possible from the ordinary exit.
2. All doors affording a means of exit from the workplace shall, except in the case of sliding doors, be constructed to open outwards and should be easily and immediately opened from the inside.
3. Fire escape route: An external staircase or ramp affording a means of escape in case of a fire should be adequately aerated and well lit. However, a spiral staircase shall not be considered as a suitable emergency exit.
4. Fire exit door, gangway and exit staircases should be free of obstruction.
5. All persons employed in the workplaces should be familiar with the means of escape in case of fire, and with the routine to be followed in case of fire.
6. Every emergency exit should be distinctively and conspicuously marked by a notice printed in red letters of an adequate size as 'EXIT'.
7. Every emergency escape route should be clearly marked in writing or by signs indicating the direction of exit
8. Evacuation routes: a drawing or map showing evacuation routes shall be posted in prominent positions in the workplace.
9. Means of evacuation: where a workplace is a storey building, every occupier shall ensure that a workplace is constructed in such a manner as to enable workers have access to other suitable outlet or exit for evacuation other than the emergency exits.
10. Every workplace should have an established and active fire fighting team that shall consisted depending on the number of workers in the workplace.
11. Training in fire safety: all workers should be instructed in the safe use of fire fighting appliances.
12. Fire drills: fire drills should be conducted at least once in every period of twelve months and a record of such drills kept available for inspection.
13. Assembly point: Every occupier shall identify a location in the workplace where every worker shall assemble in the event of a fire. This assembly points should be labeled and known by all workers.
14. Means of communication: suitable means of alerting person should be provided in the workplace, in the event of a fire, and such means shall be made known to all workers e.g. fire alarms.

15. Fire detection system: Every occupier shall provide and maintain fire detection appliances. Fire detection appliances should be located in the appropriate places for immediate activation of an alarm or automatic fire extinguishing systems.
16. Fire fighting appliances: Every occupier shall provide means of extinguishing fire at the workplace by ensuring that the position of the firefighting appliances shall be distinctively and conspicuously marked. Such equipments include fire extinguishers, hose reels with water reservoir, sand buckets, fire blankets etc
17. Maintenance, inspection and testing of cylinders: all means of extinguishing fire are properly maintained through;
 - a. Inspection and testing of all fire fighting appliances in the workplace by a competent person at least once every twelve months;
 - b. Keeping a record indicating the date of inspection and tests including the name of persons carrying out the inspection and test; and
18. Selection and distribution of fire extinguishers: selecting and distributing fire extinguishers in the workplace should be based on the classes of fire anticipated and the size and degree of hazard caused by a fire. The exact number of fire extinguishers required for each building varies based on the hazard level of your building.
19. Color coding of cylinders: Every occupier shall ensure that all pipes/ cylinders conveying various fire fighting substances shall be color-coded for the purpose of identification.
20. Fire safety policy: Every work place shall have an established fire safety policy and implement it. All workers should be informed on the contents of the fire safety policy.
21. Fire safety audit: a fire safety audit of the workplace should be taken at least once every twelve months by an approved fire safety auditor and a report kept or reference.

Appendix iii: Plagiarism form

UNIVERSITY OF NAIROBI

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student: EMMA MWIKALI MUINDI

Registration Number: H57/61666/2011

College: Health sciences

Faculty/School/Institute: Public Health

Department: Community health

Course Name: Master of Public Health

Title of the work: *An Assessment of Workplace Fire Safety Preparedness: A Study in Kenya Medical Training Centre Campuses in Eastern Kenya Region*

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this thesis is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work
5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature: -----

Date: -----

Appendix iv: Respondent's consent form

Introduction

My name is, my colleagues and I are gathering information on workplace fire safety preparedness in the KMTC campuses in Eastern Kenya region in terms of staff Knowledge, attitude/ perception and institution's compliance on fire safety preparedness guidelines. This information will be obtained from the KMTC staff using interviewer-administered questionnaires with both closed and open-ended questions. The questionnaires will be administered to sampled staff (academic and support staff) working in the KMTC campuses. These will include all cadres including the permanent and pensionable, staff on contract and casuals who have worked in the institution for a period of at least one month.

The study is being carried out following approval by the University of Nairobi/ Kenyatta National Hospital Ethical Research Committee and permission from the KMTC director as well as the principals of the participating training centre campuses.

This study is for academic purposes and I would like to ask for your permission to administer a questionnaire. Your names will not be written on the questionnaire and will never be used in connection with any of the information I will collect from you. I will require about 30 minutes administering the questionnaire. If any question makes you feel uncomfortable or you don't want to answer, you don't have to.

The information you give us may be used by policy makers to improve fire safety preparedness in the institutions. You will not receive any money or other compensation for participating in the study. I would appreciate if you answer the questions honestly so that I can gather accurate information. All the information you provide will be considered private and confidential and will only be used for purposes of this study. I would greatly appreciate your help in participating in this study. You may ask questions for clarifications or contact the principal researcher or/ and the UoN/ KNH Ethical Research Committee using the contacts given below. Would you be willing to participate? If your response is yes, please sign below.

Signature of respondent..... (Certifying that informed consent has been given)

If No, thank the staff and do not fill the questionnaire. Move on to the next respondent

Emma MwikaliMuindi

Contacts: 0721629682

Email: emmamuindi@gmail.com

Principal researcher

Or

UoN/ KNH Ethical Research Committee

Email: uonknh_erc@uonbi.ac.ke

Appendix v: Request letter to the institutions

Emma Mwikali Muindi,
University of Nairobi,
College of Health Sciences,
School of Public Health,
P.O.BOX 30197-00100, Nairobi.

Date.....

TO
The Principal,
.....KMTC,
P.O.BOX.....,

Dear Sir/Madam,

REF: REQUEST TO CARRY OUT A RESEARCH AT YOUR INSTITUTION

I am Emma Muindi pursuing a Master's of Public Health degree in the University of Nairobi, School of Public Health. I am in part II currently and one of the requirements for the award of the degree is a research project. I have proposed to carry out a research on '**Assessment of Workplace Fire Safety Preparedness in KMTCCs' in Eastern Kenya Region**' with approval of the University of Nairobi/ Kenyatta National Hospital Ethical Research Committee.

My colleagues and I will be using questionnaires and observational checklists to assess to the KMTC's compliance to fire safety preparedness guidelines. I don't intend to interfere with the smooth running of your institution and the data collected will be completely confidential. However, the staff will be required to sign a consent form. The results of the study shall be disseminated to your office upon completion of my study for your future use. I look forward to your positive consideration.

Thank you in advance.

Yours faithfully,

Emma Mwikali Muindi

Appendix vi: Request letter to the KMTC Director

Emma Mwikali Muindi,
University of Nairobi,
College of Health Sciences,
School of Public Health,
P.O.BOX 30197- 00100, Nairobi.

Date.....

TO

The Director- KMTC,
P.O.BOX 30195 (00100),
Nairobi.

Dear Sir,

REF: REQUEST TO CARRY OUT A RESEARCH AT KMTCCs IN EASTERN KENYA REGION

I am Emma Mwikali Muindi pursuing a Master's of Public Health degree in the University of Nairobi, School of Public Health. I am in part II currently and one of the requirements for the award of the degree is a research project. I have proposed to carry out a research on '**Assessment of Workplace Fire Safety Preparedness in KMTCCs' in Eastern Kenya Region**' with approval of the University of Nairobi/ Kenyatta National Hospital Ethical Research Committee between April and June 2013.

During the study, Machakos Campus will be used to conduct the pilot study; where else the other three Campuses (Meru, Embu and Kitui) will be used for the actual data collection. I will be using questionnaires and observational checklists to assess the compliance to fire safety preparedness guidelines. I don't intend to interfere with the smooth running of the institutions and the data collected will be confidential and will only be used for research purposes. Upon completion of my study, I shall disseminate the results of the study to your office for your future use to improve fire safety preparedness in the institutions. I look forward to your positive consideration. Thank you in advance.

Yours faithfully,

Emma Mwikali Muindi

Appendix vii: Fire disasters in various regions in Kenya

Table 13: Fire disasters in various regions in Kenya from 1982-2009 and their impact

YEAR	AREA COVERAGE	PEOPLE AFFECTED
1982	Lamu ^{2,3}	4,000 people affected
1982	Nairobi ^{2,3}	10,000 people affected
1990	Lamu ^{1,3}	20 people died
1998	Bombolulu Girls (In the Coast) ^{1,3}	25 students burnt to death and dormitory and property destroyed
2001	Free Market (UhuruPark–Nairobi) ^{1,3}	Entire market and property destroyed by fire
2001	Kyanguli Boys (Machakos) ^{1,3}	68 students burnt to death and property destroyed
2004	City Hall –Nairobi ^{1,3}	No deaths occurred. Entire 3rd floor and valuable documents and property worth KShs.70 million destroyed
2005	Wild fire in rift valley ^{1,3}	Extensive environmental and ecological damage; however, no human life lost
2006	Elburgon ^{2,3}	7 members of the family burned beyond recognition
2006	Libra House in Nairobi ^{2,3}	11 workers died, while 3 people were missing (unidentified bodies)
2009	Nakumatt Nairobi ³	30 People died

Source: Government Disaster Preparedness Discussion Paper, (1992)¹;

National Disaster Operations Centre Calendar of Disasters, (1998)²;

Draft National Policy for Disaster Management in Kenya, (2009)³.

Appendix viii: Fire fighting appliances and their color coding

Table 14: Fire fighting appliances and their coding

Extinguishing agent	Extinguisher body color
Water	Red
Foam	Cream
Powder (all types)	Blue
Carbon dioxide	Black

Source: OSHA, 2007

Appendix ix: Sampling frame and number of sampled staff

Table 15: Sampling frame and the number of sampled staff

Sampled KMTCS	Staff population	Proportion sampled(total)	Sampled academic staff	Sampled support staff
Embu	74 (32 academic; 42 support staff)	54	23	31
Kitui	60 (27 academic;33 support staff)	43	19	24
Meru	66 (25 academic;41 support staff)	48	18	30
TOTAL	200	145	60	85

Appendix x: Number of workplaces in the various KMTCCs

Table 16: Number of workplaces in the various KMTCCs

Workrooms	Kitui	Embu	Meru
Hostel	10	3	4
Offices outside the administration block	6	4	5
Administration block	1	1	1
Dining Hall	1	1	1
Kitchen	1	1	1
Classroom	7	7	4
Medical laboratory	1	1	1
Skills laboratory	1	1	1
Computer Laboratory	1	1	1
Library	1	1	1
Medical Engineering Workshop	0	0	5
Total	30	21	25

Appendix xi: Observational checklist

Serial No..... Name of institution:Date.....

Observation area: 1. Hostel 2. Offices 3. Administration block 4. Dining hall

5. Kitchen 6. Classroom 7. Medical laboratory 8. Skills laboratory

9. Computer laboratory 10. Library 11. Medical Engineering Workshops

Item	Action	YES	NO
Fire detection and warning systems			
1a.	Automatic Smoke detectors/ sensors with alarms available In the Rooms		
	On the Corridors		
b.	i. Fire/ smoke detectors in the rooms are in working condition		
	ii. Fire/ smoke detectors on the corridors are in working condition		
2	Fire alarm bells available in the building		
3	If the fire-detection and warning system is electrically powered, does it have a back-up power supply?		
4	Are the smoke/ fire alarms connected to fire emergency response teams e.g. fire brigades		
Firefighting equipments available			
5 a.	Fire extinguishers		
b.	<u>Color code</u>		
	Blue		
	Black		
	Red		
c.	Fire extinguishers are inspected and tagged annually by a licensed fire protection services company		
	Fire extinguishers are in working condition		
6	Sand buckets		

7	Fire blanket		
8	Automatic sprinklers		
9	Hose reels with water		
Means of escape			
10	Exit door/ exit corridor present		
11	Labeled exit doors		
12	Emergency escape route with labeled signs/ illustrations on the walls		
13	Exit routes are free from obstruction		
14	Exit doors readily open from inside without the use of a key		
15 a.	Lighting provided on the exit route		
b.	Exit route lighting in working condition		
16	Staircases and exit routes have balustrades and handrails		
Documentary items available in the college			
17	Annual fire audits reports		
18	Evacuation plan posted in each workroom/ office		
19	Fire drill reports		
20	Fire safety policy document		

- ✓ *Availability of at least 1 functional fire detection and warning system= compliance, if both the functional smoke detectors and alarm bells are missing = non-compliance*
- ✓ *Availability of at least 1 firefighting equipment = compliance*
- ✓ *If fire extinguishers are available, further analysis of their state will be assessed and indicated.*
- ✓ *Means of escape: each YES = 1 score. Total score = 7; score of ≤ 3 = non compliance, ≥ 4 = compliance*
- ✓ *Documentary items available: each YES = 1 score. Total score = 4; score of ≤ 2 = non compliance, ≥ 3 = compliance*

Appendix xii: KMTCs staff questionnaire

Serial Number

Date.....

Instructions: Tick the given response to the multiple answer questions. For the other questions, write the response to the questions on the space provided after the question.

1. Gender
 1. Male
 2. Female
 2. Age of respondent
 1. ≤25 years
 2. 26-35 years
 3. 36-45 years
 4. 46-55 years
 5. >55 years
 3. Cadre
 1. Academic staff
 2. Non- academic staff
 4. Job tenure of the respondent
 1. Permanent and pensionable
 2. Contract
 3. Casual worker
 5. Duration of work in the current work station
 1. 1 -23 month
 2. 2-5 years
 3. 6-10 years
 4. 11-20 years
 5. >20 years
 6. During your stay in the current work station, have you experienced any fires outbreak in the college?
 1. YES
 2. NO
- If the response to question 6 is **YES**, go to question 7. If the response is **No**, skip question number 7.
7. How many times have you had fire outbreaks in the college?
.....
 8. Do you have a copy of staff and their specific responsibilities during a fire emergency?
 1. YES
 2. NO
 9. Who is responsible for fire outbreak management in the college?
.....
 10. Do you have a copy of the priority list to be used for evacuation in case of a fire outbreak?
 1. YES
 2. NO

11. Does your college undertake fire safety preparedness trainings?

1. YES 2. NO

If the response to question 11 is **YES**, go to question 12. If the response is **No**, skip question number 12.

12. How often are the fire safety preparedness trainings done?

1. Quarterly
2. Bi-annually
3. Annually
4. Other times, specify.....

13. Have you ever been trained on fire safety preparedness?

1. YES 2. NO

14. Does your college perform fire and safety drills?

1. YES 2. NO

If the response to question 14 is **YES**, go to question 15. If the response is **No**, skip question number 15.

15. How often are the fire drills done?

1. Quarterly
2. Bi-annually
3. Annually
4. Other times, specify.....

16. Have you ever participated in any fire drill?

1. YES 2. NO

Criteria for assessment of knowledge and attitude/ perception on fire safety preparedness

A. Assessment of knowledge

17. Do you know how to use a fire extinguisher in case of a fire outbreak?

1. YES 2. NO (a Yes answer = 1score)

18. Are you aware of the location of the closest fire extinguisher from your workroom/ work station?

1. YES 2. NO (a Yes answer= 1score)

19. What is the emergency number to dial in order to report a fire outbreak?

(Correct answer= 1score)

20. For a fire to start and be sustained, this/these component/s need to be present;

	COMPONENT	YES	NO	Don't know
1	Source of ignition/ Fire			
2	Fuel			
3	Oxygen			

(Each YES is 1 score = 3) Total score = 7; score of ≥ 6 = adequate Knowledge; Less than 6 = low/ inadequate knowledge

B. Assessment of attitude/ perception

21. On a scale of 0-5, how do you rate the risk of fires in your workplace?

0. None 1. Poor/ low 2. Fair/ moderately low
 3. Average 4. Moderately high 5.High

If the response to question 21 is any other response apart from **none** option, go to question 22. If the above response is **none**, skip question 22.

22. What are the sources of fire risks in the workplace?

1. Electricity faults 2. Cigarette smoking 3. Kitchen fires
 4. Laboratory chemicals 5. Destructive violence 6.Others specify.....

23. On a scale of 0-5, how do you rate the importance of having a basic training on fire safety preparedness?

0. None 1. Poor/ low 2.Fair/ moderately low
 3. Average 4. Moderately high 5.High

24. On a scale of 0-5, how do you rate your level of fire safety preparedness?

0. None 1. Poor/ low 2.Fair/ moderately low
 3. Average 4. Moderately high 5.High

Appendix xiii: KMTC Director's approval letter

Telegrams: "MEDTRAIN" Nairobi
TELEPHONE: NAIROBI 2725191, 2725711/14
Fax:2722907 Email: info@kmtc.ac.ke
Please address all correspondence to:
The Director
When replying please quote



KENYA MEDICAL TRAINING COLLEGE
P.O BOX 30195-00100
NAIROBI

Ref: No.
KMTC/ADM/74/VOL.II (49)

Date.....
3rd May, 2013

Emma Mwikali Muindi
University of Nairobi – CHS
School of Public Health
P O Box 30197 - 00100
NAIROBI

RESEARCH AUTHORIZATION

We acknowledge receipt of your letter dated 24th April, 2013 requesting for an authorization to carry out research proposal in MTCs in Eastern Province of Kenya on *'Assessment of Workplace Fire Safety Preparedness'*.

This is to inform you that your request has been granted. Please note that you are required to present yourself to the Principal Machakos, Meru, Embu and Kitui MTCs, before embarking on the study to facilitate your access to the site.

Further, note that you will be required to share your findings with the colleges by depositing both a hard and soft copy to this office.

Best wishes

Dr. C. Olang'o Onudi
DIRECTOR

Copy to: *Principal, Kitui MTC*
Principal, Meru MTC
Principal, Machakos MTC
Principal, Embu MTC

KMTC ISO 9001:2008 CERTIFIED

Appendix xiv: ERC/ KNH/ UoN approval letter



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44355
Ref: KNH-ERC/A/95

KNH/UON-ERC
Email: uonknh_erc@uonbi.ac.ke
Website: www.uonbi.ac.ke
Link: www.uonbi.ac.ke/activities/KNHUoN



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi
21st April 2013

Emma Mwikali Muindi
Reg.No.H57/61666/2011
School of Public Health
College of Health Sciences
University of Nairobi

Dear Ms. Muindi

Research proposal: Assessment of Workplace fire Safety Preparedness: A study in Medical Training Centres in Eastern Province of Kenya (P6/01/2013)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above revised proposal. The approval periods are 21st April 2013 to 20th April 2014.

This approval is subject to compliance with the following requirements:

- a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
- c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
- d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- g) Submission of an *executive summary* report within 90 days upon completion of the study
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website www.uonbi.ac.ke/activities/KNHUoN

Protect to Discover

Yours sincerely



PROF. M. L. CHINDIA
SECRETARY, KNH/UON-ERC

c.c. Prof. A.N. Guantai, Chairperson, KNH/UoN-ERC
The Deputy Director CS, KNH
The Principal, College of Health Sciences, UoN
The Director, School of Public Health, UoN
The HOD, Records, KNH
Supervisors: Prof. Mutuku A. Mwanthi, School of Public Health, UoN
Ms. Mary Kinoti, School of Public Health, UoN

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