BIOHAZARD MANAGEMENT PRACTICES BY OCCUPATIONALLY-EXPOSED MEDICAL LABORATORY PERSONNEL IN HEALTH FACILITIES IN KISUMU EAST SUB-COUNTY, KISUMU COUNTY, KENYA

BY

OGUMBO FREDRICK ABONYO

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DECLARATION

This thesis is my original work; it has not been presented for any degree award at any other university or institution. Acknowledgement has been accorded to any other works touched as reference in this document. No part of this thesis may be reproduced without prior permission of the author or Maseno University.

Ogumbo Fredrick Abonyo

PG/MPH/0015/11

SIGNATURE..... DATE.....

Supervisors

This work is submitted for examination with our approval as university supervisors.

Prof. Collins Ouma, PhD

Department of Biomedical Science and Technology, Maseno University

SIGNATURE..... DATE.....

Prof. James Ombaka, PhD

Department of Biomedical Science and Technology, Maseno University

SIGNATURE..... DATE.....

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DEDICATION

I wish to dedicate this work to my parents, Mr Nahashon Ogumbo and Mrs Grace Ogumbo for their moral and financial support.

ABSTRACT

A WHO report on health workers infections during the 2014-2016 Ebola virus epidemics in Guinea and Liberia found a number of deficiencies from challenges in training to human factors and characteristics of PPE equipment. Studies have highlighted that ineffective management of biohazards in developing countries can compromise the quality of patient care and create occupational and environmental health risks. An assessment conducted in Kenya in 2013 showed that 18-64% of laboratory facilities do not practice adequate waste management, infection prevention and compliance practices. Studies show that Kisumu County has been burdened by TB and HIV and that this burden could be reincarnated among laboratory personnel who are responsible for patient samples processing. Despite the fact that there are a lot of laboratory health hazards in Kisumu County, statistics on the biohazard management practices in medical laboratories in Kisumu East Sub-County remains unreported. As such, the main objective of the study was to evaluate biohazards management practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County Kenya. The specific objectives were: to assess hazardous wastes disposal, examine infection control measures, determine training and compliance practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya. The study was conducted among laboratory personnel within Kisumu East Sub-County. Using a cross-sectional design, saturated sampling of 121 laboratory personnel was done. Self-administered questionnaires were used to collect information on biohazard management practices. Frequency tabulation was used to determine frequencies and percentages. Results on biological waste disposal showed 90 (74.4%) incineration while waste segregation 118 (97.5%). Infection control showed that 53(61.2%) of those working in BSL2 were not on immunization programmes and 44(73.7%) had no biosafety cabinets. Training and compliance practices showed that 36 (27.9%) had not been trained on Good Clinical and Laboratory Practice while 63(52.1%) had not been trained on laboratory biosafety and shipment 38(31.4%). It was concluded that: Hazardous waste management and segregation in few facilities were not in line with the WHO Laboratory Biosafety Standards prescribed. Most facilities lacked infection control items such as biosafety cabinets, immunization programs, eye wash, spill kits and first aid kits; majority of personnel have not been trained on Laboratory biosafety, GCLP and specimen shipment. The following were recomended in order to conform with the WHO Laboratoty Biosafety Manual Standards: All laboratory staff should be well trained on bioharzadous waste management, laboratories should have infection control measures like immunizations and biosafety cabinets. Additionally, trainings and compliance practices should be implemented in all laboratories. The Significance of this study is to identify gaps in laboratory biohazard management practices and use to findings to improve occupational health and safety in laboratory facilities in Kisumu East Sub-County, Kenya.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

BSL1, 2, 3, 4 - Biosafety Level 1,2,3,4

CDC- Centres for Disease Control

COSHH - Control of Substances Hazardous to Health

EQA - External Quality Assurance

GCLP - Good Clinical and Laboratory Practice

KDHS - Kenya Demographic and Health Survey

KHNA - Kisumu Health Needs Assessment

KNBS - Kenya National Bureau of Statistics

KSPA- Kenya Service Provision Assessment

LAI – Laboratory Acquired Infection

MSDS - Material Safety Data Sheet

NIOSH –National Institute for Occupational Health

PPE- Personal Protective Equipment

QMS- Quality Management System

SOP-Standard Operating Procedure

WHO - World Health Organization

OPERATIONAL TERMS

Biohazard Management: containment principles, technologies and practices that are implemented to prevent the unintentional exposure to pathogens and toxins, or their accidental release. They include waste disposal; infection control and adhering to policies procedures and training.

Hazard: a danger or source of danger or the potential to cause harm.

Medical laboratory: a facility within which microorganisms, their components or their derivatives are collected handled and/or stored. Medical laboratories include diagnostic facilities, regional and/national reference centers, public health laboratories, research centers.

Material Safety Data Sheets: are written or printed materials providing workers and emergency personnel with procedures for handling or working with hazardous substances.

Occupational health: workers' physical, social, and cognitive elements for better efficiency in job-tasks.

Occupational safety: working situations where injury risks or production loss have not begun, or unsafe act, poor work environment, or non-ergonomic practices are minimized by safety measures and adopting ergonomic means to control work hazards.

LIST OF TABLES

LIST OF FIGURE

CHAPTER ONE

INTRODUCTION

1.1Background

The study of occupational safety and health has been in existence for as long as there have been structured work environments (Weaver, 1980). Occupational Health Safety application focuses on the ways in which the workers should be protected from various exposures in their workplace (Pheasant, 1991). Early in the history of laboratory activities involving microorganisms, it was recognized that laboratory staff were contracting infections from the work being performed in the laboratory and in some cases individuals not directly associated with laboratory activities were also being infected in an unknown manner (Taylor, 2001). In a 1979 outbreak of Ebola virus infection in Sudan, persons who provided nursing care were five times more likely to develop disease than were those who provided no care (Baron, 1983). Among the recommended practices were use of universal precautions, use of strict barrier protection, restriction of workers and visitors, and use of negative-pressure ventilation in the presence of respiratory symptom (Altman, 1995). Similar outbreaks involving health care workers have been reported with South Sudan where 10 of 17 exposed workers developed disease and 2 died; Lassa fever virus infection on an obstetrics ward, where 7 of 26 exposed workers developed disease and at least 1 died, and Marburg virus infection (CDC, 2014a).

Humans are exposed to biological hazards in the work environment in a variety of ways. For example, workers in health care professions are exposed via contact with human bodily matter, such as blood, tissues, saliva, mucous, urine and faeces, because these substances have a high risk of containing viral or bacterial diseases (Fisher-Hoch, 1995). A WHO report on health workers infections during the 2014-2016 Ebola virus epidemics in Guinea, Liberia,

and Sierra Leone found a number of deficiencies, including "inappropriate use or lack of PPE". Factors contributing to these deficiencies ranged from challenges in training to human factors and characteristics of PPE equipment (WHO, 2015). Occupational transmission is usually associated with violation of one or more of three basic principles of infection control: hand washing, vaccination of health care workers, and prompt placement of infectious patients into appropriate isolation (Kent, 1996).

Laboratory acquired infections and injury are preventable when working in a laboratory that manipulates infectious materials, biological toxins and other biologically active materials and by use of proper laboratory techniques, procedure and safety equipment, laboratory acquired infections and injury can be prevented (Richmond, 1999). The laboratory environment being hazardous place to work, workers additionally get exposed to numerous potential threats to health including chemical, biological, physical and radioactive hazards, as well as musculoskeletal stresses (CDC, 2014a). Incidents of secondary transmission of disease to the public at large, which may be due to possible contamination of the environment or personnel, are also occurring (Richmond, 1999). The disposal system for infectious waste is considered adequate if the waste is disposed of externally, incinerated or burned in a protected area or pit (WHO, 2014). Each year Nyanza region experiences cholera outbreaks and Kisumu East Sub-County is usually one of the worst affected localities(Moumie, 2011). Waterborne diseases such as cholera, amoebas, *E-coli* and typhoid are among the leading causes of death in Kisumu East sub-County, particularly among children(G.O.K, 2009). This is mainly because Kisumu's surface water and high water tables are contaminated with both human and animal faeces, particularly during floods, thus serving as a biorisk to those working in laboratories since they handle infectious samples (Moumie, 2011). This outbreak exposes laboratory personnel in this region at high risk because of handling patient samples. As such,

the study was to examine biohazard management practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya.

1.2 Statement of the Problem

The status of occupational health and safety conditions in Kenya is an issue of growing concern to the industrialists, medical practioners, the Government and consumers. (Nyakango, 2005). Increasingly ineffective techniques and the non-availability of personal protective equipment and human error remains the most important factors at the origin of safety hazards and laboratory-acquired infections and injury (Richmond, 1999). Despite a greater awareness of biosafety and bio-containment practices, handling infectious microorganisms remains a source of infection, and even mortality, among laboratory workers in Kenya (Collins, 1999).

Majority of facilities in Kenya do not have infection control measures, only 16% of facilities have infection control guidelines (KNBS, 2011). Only 36% of all facilities in Kenya have infection control items (soap and running water, or else hand disinfectant, sharp box, disinfectant and latex gloves) (KNBS, 2011). In Kisumu East Sub-County, the major issue related to current biomedical waste management in many laboratories is that the implementation of bio-waste regulation is unsatisfactory as some laboratories are disposing of waste in a haphazard, improper and indiscriminate manner (Moumie, 2011). Lack of segregation practices results in mixing of medical wastes with general waste making the whole waste stream hazardous (Moumie, 2011). As such, the current study was to evaluate biohazard management practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya and use its findings and

recommendations in reducing threats to health associated with poor biohazard management practices.

1.3. Objectives

1.3.1 Main objective

To evaluate biohazard management practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya

1.3.2 Specific objectives

i. To assess hazardous wastes disposal procedures by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya

ii. To examine infection control measures employed by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya

iii. To determine training and compliance practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya

1.3.3 Research questions

i. What are the hazardous wastes disposal procedures by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya?

ii. What are the infection control measures employed by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya?

iii. What are the training and compliance practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya?

1.4 Significance of the study

Despite international initiatives and national regulations on occupational health and safety issues, laboratory occupational hazards continue to rise. For example, the laboratory-acquired infections of SARS in 2003 occurred in biosafety level 3 (BSL3) and BSL4 (maximum containment) laboratories (CDC, 2005b). A WHO investigation attributed these infections to negligent program management (e.g., poor laboratory practices, insufficient training).The spread of bloodborne pathogens in health care waste motivated the WHO in 2004 to call for the development of national policies, guidance and plans for health care waste management (WHO, 2000). Kenya is not an exception to occupational health risk especially among personnel working in hazardous laboratory environment and few studies have been done in Kisumu East Sub-County to assess biohazard management practices among occupationally-exposed laboratory personnel. This study was aimed at identifying gaps in: biohazard waste management, infection control measures and items; training and compliance practices among occupationally vulnerable laboratory personnel in medical facilities in Kisumu East Sub-County, Kisumu County, Kenya. These findings will help in improvement of laboratory biological safety and OHS and identify risks associated with poor biomedical waste management practices and infection prevention measures and will further open up a window of opportunity for building up a comprehensive biohazard management systems in health facilities and raising awareness and training about laboratory occupational risks.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Occupational health and safety (OHS) primarily seeks to maintain the working ability of the labour force as well as to identify, assess and prevent hazards within the working environment (Richmond, 1999). Individuals who work in a laboratory that handles infectious substances are at risk of infection from the substances they handle (Harding, 2000) .Laboratory-acquired infections (LAIs) are not uncommon since over 5,000 cases and 190 deaths had been reported up to 1999 (Harding, 2000). Although these figures are believed to be a significant underestimate because of under-reporting, there are a number of ways in which infectious substances can enter the body and cause infection among laboratory workers including ingestion, inhalation, or contact with mucous membranes (Collins, 1999). Additionally, only about 20% of infections can be attributed to any known, single exposure event and studies indicate that health care workers are exposed to blood-borne infections from needle stick injuries and contact with body fluids (CDC, 2005a). Medical care is vital for our life and health, but the waste generated from medical activities represents a real problem of living nature and human world (Sharma, 2005). Every day, relatively large amount of potentially infectious and hazardous waste are generated in the health care hospitals and facilities around the world(WHO, 2014). Improper management of waste generated in health care facilities causes a direct health impact on the community, the health care workers and on the environment (WHO, 2000). Indiscriminate disposal of biomedical waste or hospital waste and exposure to such waste possess serious threat to environment and to human health that requires specific treatment and management prior to its final disposal (CDC, 2014b).

2.1.1 Bioharzadous waste management

Bioharzadous waste includes micro-organisms, plant, animal, and human products (such as blood, urine, and organ parts) and any materials contaminated with these products (Columbia, 2008). Studies have highlighted that in-effective management of infectious laboratory waste in developing countries can compromise the quality of patient care and create significant occupational public and environmental health risk (Bavoil, 2005). Studies conducted in developing counties regarding medical waste management have described it as being poor and that the general awareness on related issues is lacking among generators and handlers (Pheasant, 1991). Despite the fact that health care waste is labeled as hazardous because of the serious direct threat it poses to human health its management and segregation still remains a challenge to health practitioners (WHO, 1999). The situation of poor waste management is still common in developing countries like Kenya which needs to develop a comprehensive biohazard waste stream management plan (Moumie, 2011).

The bio-medical wastes generated from health care units depend upon a number of factors such as waste management methods, type of health care units, occupancy of healthcare units, specialization of healthcare units, ratio of reusable items in use, availability of infrastructure and resources (Mandal, 2009). World Health Organization states that 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are non-infectious but they are included in hazardous wastes (WHO, 2014).

The practice of indiscriminate dumping of medical waste is prevalent in a majority of health facilities in Kenya (NASCOP, 2007). Incineration facilities are limited and where available, they are either broken down or improperly used (KNBS, 2014a). According to National Policy on Injection Safety and Health Care Waste Management in Kenya, the limiting factors in proper management of waste include; inadequate training, supplies, and lack of standards

and guidelines (NASCOP, 2007). Many laboratory workers encounter daily exposure to biological hazards. These hazards are present in various sources throughout the laboratory such as blood and body fluids, culture specimens, body tissue and cadavers, laboratory animals, as well as other workers. Studies have been conducted on waste generation, segregation and disposal but little attention has been given to awareness of the potential risks associated with medical waste and the need for personal protection (KNBS, 2014a). Sharps are items that could cause cuts or puncture wounds and can spread infection. They include needles, scalpels and other blades, knives, infusion-sets, saws, broken glasses, and nails. Whether or not they are infected, such items are usually considered as highly hazardous health-care waste (WHO, 1999). In Kisumu East Sub- County, Most facilities use "safety boxes" for needle waste and pits for medical waste disposal, with the exception of a few which use on-site incinerators (Moumie, 2011). Needle waste is collected and taken to be incinerated but many facilities experience delays in needle waste collection, making storage a problem (Moumie, 2011). Disposal system for sharp waste is considered adequate if sharps waste is collected and disposed of externally, incinerated or burned in a protected area or pit, or dumped in a protected area or covered pit (KNBS, 2011).

Lack of segregation practices results in mixing of medical waste with general waste making the whole waste stream hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal (Moumie, 2011).

2.1.2 Infection control

Infections acquired in health facilities often complicate the delivery of healthcare worldwide and strict compliance with infection control guidelines and constant vigilance are necessary to prevent such infections (KNBS, 2014a). The items considered relevant and necessary to prevent these infections include soap, running water, hand disinfectants, sharps boxes for appropriate disposal of sharps waste, disinfectant solution and gloves (WHO, 2014). Health care-associated infections (HAIs) are a national problem and have been a problem of health care facilities since their inception as institutions for the healing of the sick (G.O.K, 2010). These infections are acquired during (or are associated with) the provision of health care services, in contrast to infections that are already present or incubating at the time of a health care delivery episode. Increased facility-based health care of immunocompromised patients and the extensive use of invasive techniques have exacerbated this problem (KNBS, 2014a). To prevent, identify, monitor, and control the spread of infections in health care facilities, comprehensive infection prevention and control (IPC) practices are required (G.O.K, 2010). The consistent use of IPC policies and guidelines ensures that IPC practices are carried out in a standard way across all health care facilities. In Kenya, only thirty six percent of facilities have infection control items available (KNBS, 2011). Infection control items include personal protective equipment, immunization programmes and disinfection. Majority of facilities in Kisumu East sub-County do not have infection control measures, and only 16% of facilities have infection control guidelines (KNBS, 2011).

Vaccination against common infections is necessary for occupationally-exposed laboratory personnel and some of these vaccines for communicable diseases include hepatitis B, seasonal influenza, typhoid fever vaccine and tetanus (CDC, 2014b).

Personal protective equipment include laboratory clothing (such as gowns, coats, and aprons) should always be worn, and in most cases must be worn, depending on the risk factors present in the laboratory and should cover the arms and most of the middle part of the body (Collins,1999). Studies in Nyanza Province revealed that Personal Protective Equipment (PPE) is not provided by most of private sector players to their staff except for overalls and gloves (Moumie, 2011).

Spills of biological agents are second only to aerosols in terms of health hazard posed to those working with bioharzadous agents (WHO, 2014). Spills may be large or small, confined or spread out, liquid or dry. Each laboratory must have written procedures for dealing with spills. The procedures must be specific to the biological agents, equipment, and techniques used in the lab (CDC, 2014b). Thus, it is always recommended that all workers be trained in these procedures. To date, the documentation on infection control measures and how to mitigate occupational hazards in laboratory facilities in Kisumu East Sub-County remains unknown. As such, the current study examined infection control measures put in place in laboratory facilities in Kisumu East Sub-County to mitigate occupational hazards.

2.1.3 Training and compliance Practices

Employers must provide workers with adequate training on the hazards of the workplace, and how to do their work safely and written safe work procedures should form the primary source of information (CDC, 2014b). Many laboratory workers may have advanced formal education, but they still need site-specific training on work methods involving particular hazards such as chemicals, biological hazards, radiation, or animal handling (Columbia, 2008). The training must include proper handling and disposal of hazardous chemicals or materials and the need for compliance practices and use of Standard Operating Procedures (Columbia, 2008). These trainings include Good Clinical and Laboratory Practice, Specimen Shipment and Laboratory Biosafety and biosecurity. Poor personnel training may increase the risk of a LAI or other biological accident in the laboratory, and may also contribute to improper pathogen accounting, storage and transportation, which in turn could contribute to the illicit acquisition of biological agents by terrorists or would-be bio-criminals (Bavoil, 2005). According to National Policy on Injection Safety and Health Care Waste Management, the limiting factors in proper management of waste include; inadequate training and lack of standards and non adherence to guidelines and procedures (NASCOP, 2007).

Compliance with this standard provides public assurance that the rights, safety and well-being of health workers are protected, consistent with the set principles that have their origin in the Declaration of Helsinki (Knight, 1998). All laboratory workers should be trained on the need for compliance practices and use of established work practices and procedures to ensure their safety, co-workers as well as environment (WHO, 2004). In Kisumu East Sub-County, studies to determine the role of training and compliance practices with regard to occupational health in medical facilities have not been done. As such, the study determined training and

compliance practices by occupationally-exposed medical laboratory personnel in health facilities in Kisumu East Sub-County, Kisumu County, Kenya.

2.2 Conceptual framework

The conceptual framework is the structural equation model diagram explaining flow and direction of variable relationships between various exposures/threats to health and outcomes (CLSI, 2004). Based on review of literature on biohazard management practices by occupationally-exposed laboratory personnel, conceptual framework illustrates the theoretical relationship between independent and possible outcomes. Biohazard management practices which include waste disposal; Infection control and compliance to practices and training could lead to occupational outcomes which are safety or risk. There is also a relationship between independent variables; proper waste management could help in infection prevention. Training and compliance practices could also help in proper waste management and infection prevention (CLSI, 2004).

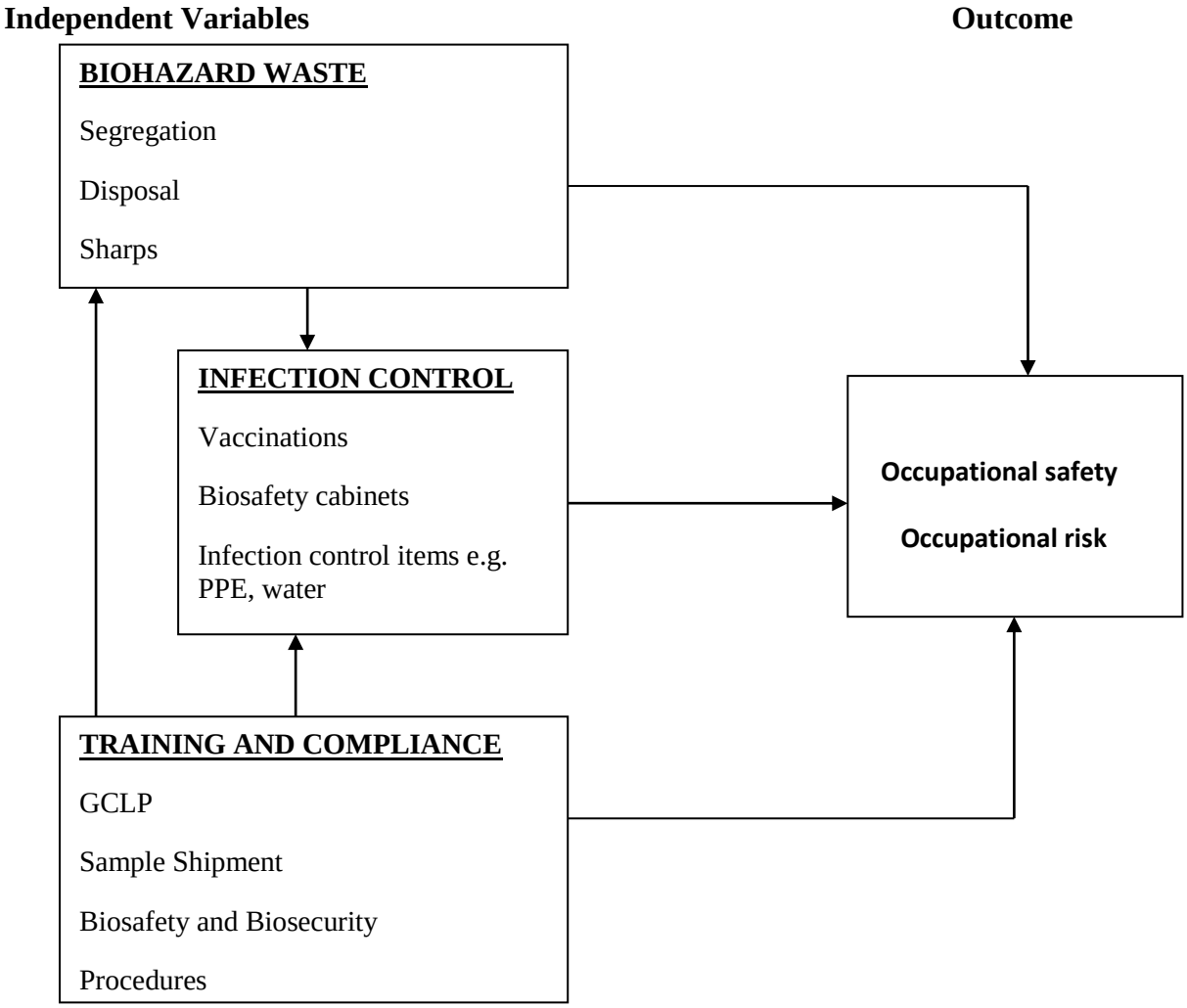

Fig 2.2. Conceptual Framework: Adapted from Structural equation model of Laboratory Quality Management (CLSI, 2004).

CHAPTER THREE

METHODOLOGY

3.1 Study Site

The study was conducted among laboratory workers in medical facilities in Kisumu East sub-County, Kenya. Kisumu East sub-County is one of the seven sub-Counties within Kisumu County. (Fig 3.1: Map of Kisumu East sub-County). Kisumu East sub-County has an area of about 135.90 Sq. Km, with a total population of 150,124 (KNBS, 2011) . It has 5 County assembly wards and borders Nyando sub-County to the East, Nandi East sub-County to the North East, Kisumu North sub-County to the North, Kisumu West sub-County to the West and Rachuonyo South sub-County to the South across the lake. It lies within longitude $34^0$10 E and 35^0 20 E and latitude 0^0 20 S and 0^0 50 S (G.O.K, 2009). The health care delivery system in Kisumu East Sub-County consists of public sector health facilities and facilities managed by faith-based organizations (FBOs), non-governmental organizations (NGOs) and private entities. As of February 2014, there were 42 health facilities in Kisumu East sub-County, including five hospitals, seven health centres and 21 dispensaries and 10 medical clinics. All these facilities had laboratory capacity of 121 staff (Moumie, 2011) . Waterborne diseases such as cholera, amoebas, e-coli and typhoid are among the leading causes of death in Kisumu East Sub-County, particularly among children. This high prevalence of communicable infections is a risk factor to occupationally-exposed laboratory personnel. Each year Kisumu County experiences cholera outbreaks and Kisumu East Sub-County is usually one of the worst affected (Moumie, 2011).

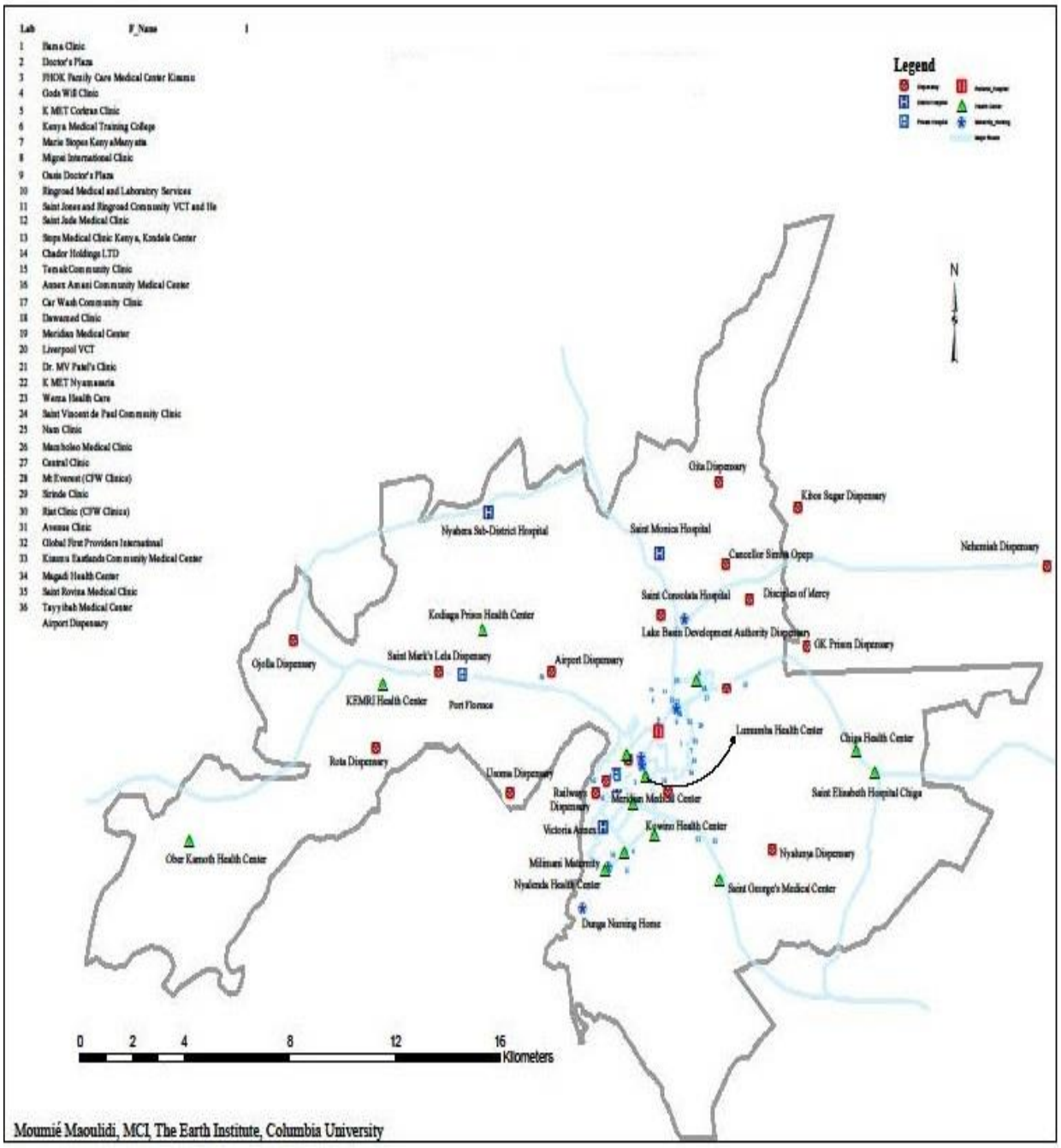

Fig 3.1 Map of Kisumu East Sub-County showing Laboratory Health Facilities in the study area.Source: Heath needs assessment report 2014

3.2. Study Design

A cross-sectional study of medical laboratories in Kisumu East sub-County was conducted during the month of December 2014 to determine the biohazard management practices by occupationally-exposed clinical laboratory personnel in medical facilities in Kisumu East Sub-County, Kenya. The study was conducted among all 121 Staff according to Kisumu Health Needs Assessment Report of 2014 (KNBS, 2014b). A cross-sectional study design was chosen because it maximised reliability of the data collected and economical on both time and funds hence relatively easy to manage.

3.3. Study population and Sampling

3.3.1 Study population

This study was conducted among laboratory workers in Kisumu East sub-County, Kenya. Laboratory staff were chosen because they are most vulnerable to occupational hazards (Collins, 1999). The study was conducted among laboratory personnel in both public and private medical facilities. It involved all 42 facilities in the sub-County. The target population consisted of all 121 laboratory personnel in Kisumu East sub-County (G.O.K, 2009).

3.3.2 Sampling technique

This study employed saturated sampling. Saturated sampling was preferred in this study because the study population was quite small (121) and all formed the sample population. This study sample was from all laboratory personnel in Kisumu East Sub-County including County hospitals, Dispensaries, Health centres, Clinics and stand alone laboratories.

3.3. Data Collection

The study employed questionnaires as the main tool for collecting data. Quantitative data on Waste management, Infection control items; training and compliance practices were collected for a period of one week. Participants who met the inclusion criteria were explained to the purpose of the study, possible risk and benefits (Appendix 2). Those who agreed to participate in the study were consented and questionnaires administered. The questionnaires were collected later in the day.

3.3.1 Research procedure

Quantitative data was collected from 121 respondents among laboratory staff using questionnaires during the month of December, 2014. Self-administered questionnaires were then provided to the laboratory personnel by research assistants (Appendix 3). Research assistants who had received Hepatitis B vaccinations prior to their assignment were also provided with laboratory coats to protect them from hazardous laboratory environment during the interviews.

3.4. Inclusion and Exclusion criteria

3.4.1 Inclusion criteria

Medical laboratory workers within Kisumu East sub-County, Kisumu County, Kenya in both private, Government-owned and faith-based medical facilities.

3.4.2 Exclusion criteria

Those working in the medical laboratories but do not participate in daily routine laboratory procedures.

3.5. Data analysis

Both descriptive and inferential statistics were used for quantitative data analysis. Frequency tabulations and percentages were also used to determine socio-demographic characteristics of the respondents, laboratory management authority and laboratory tier systems. In order to evaluate harzadous wastes management frequency tabulation was used to determine the percentages and frequencies of waste management practices, infection control measures and training and compliance practices.

3.6. Study Assumptions and Limitations

It was assumed that participants agreed to participate and disclose their knowledge and practices on biohazard management in relation to occupational health and safety. There was limitations on the generalization of results in laboratory facilities.The study was also limited because in cross sectional studies,it is not easy to establish temporarity between exposure and outcome. However to control for confounding, research assistants recived the same training and used the same data collection tool.

3.7. Ethical Considerations

Participation was voluntary and informed consents by the respondents formed the basis of participation (Appendix 2). Confidentiality of the participants was assured by filling in of self-administered questionnaires. Data was stored in password-protected computers and only the PI was able to access it. Ethical approval was provided by Maseno University Ethical Review Committee (Appendix 4). Authority was also sought from the Kisumu East Medical Officer of Health and Kisumu East Sub-County Medical Laboratory Technologist (CMLT) (Appendix 5). The purpose of the study, benefits and risks were explained to the study participants.

CHAPTER FOUR

RESULTS

4.1. General Characteristics of the Study population

The health care tier system in Kisumu East sub-County consisted of referral hospitals, County hospitals, sub-County hospitals, health centres, dispensaries and clinics. The laboratory personnel in each tier system included National referral 14 (11.6%), sub county 7 (5.8%), clinics 10 (8.3%), health centres 47 (38.8%), dispensaries 16 (13.2%) and stand-alone laboratories 27(22.3%) of the respondents. The facility management authority consisted of Central government 21(17.4%), County government 43(35.5%), NGO/Private not for profit 25 (20.7%), Private for profit 25(20.7%), Mission/Faith-based 7(5.8%). Laboratory services included; diagnostic 86 (71.1%), research 25 (20.6), research and diagnostic 10(8.3%) (Table 4.1).

Table 4.1: Characteristics of health facilities sampled

Variable		Frequency (%)n=121
Managing authority	Central government	21(17.4)
	County government	43(35.5)
	NGO/private not for profit	25 (20.7)
	Private for profit	25 (20.7)
	Mission /Faith based	7 (5.8)
Laboratory Services	Diagnostic	86 (71.1)
	Research	25(20.6)
	Research & diagnostic	10 (8.3)
Type of Facility	National referral	14 (11.6)
	Sub county	7 (5.8)
	Clinic	10 (8.3)
	Health Centre	47 (38.8)
	Dispensary	16 (13.2)
	Stand-alone laboratories	27 (22.3)

4.2. Socio-demographic Characteristics of the Respondents

The study population consisted of 121 laboratory personnel in medical facilities in Kisumu East Sub-County. The study showed that 76 (62.8%) were males and 45 (37.2%) were females. Ages of personnel showed that 15-24 yrs 22(18.2%), 25-34yrs 68(56.2%), 35-44 yrs 21(17.4%), 45-54yrs 6(5.0%) and 55 and above 4(3.3%). Majority of lab personnel had a work experience of 5yrs and below 57 (47.1%);6-11yrs 37(30.6%),12-16yrs 17(14.0%),17-21yrs 4(3.3%),22 years and above 6(5.0%).Laboratory designation constituted laboratory technician 20(16.5%), laboratory technologists 84(69.4%),assistant research officers 12(9.9%) and research officers 5(4.1%), (Table 4.2).

Table 4.2: Socio-demographic characteristics of the respondents

Variable		Frequency (%)n=121
Gender	Male	76 (62.8)
	Female	45 (37.2)
Age of personnel	15-24yrs	22 (18.2)
	25-34yrs	68 (56.2)
	35-44yrs	21 (17.4)
	45-54yrs	6 (5.0)
	55&above	4 (3.3)
Years of experience	5yrs and bellow	57 (47.1)
	6-11yrs	37 (30.6)
	12-16yrs	17 (14.0)
	17-21yrs	4 (3.3)
	22 & above	6 (5.0)
Designation	Laboratory Technologist	20 (16.5)
	Laboratory Technician	84 (69.4)
	Assistant Research Officer	12 (9.9)
	Research Officer	5 (4.1)

4.3. Biological Waste Management Practices

Biological wastes were some of the potential threats occupationally-exposed clinical laboratory personnel in Kisumu East Sub-county experience. The assessment of hazardous waste management practices constituted sharps and bioharzadous wastes. Facility disposal of sharp waste showed; burn in incinerator 105(86.8%), open burning 2(1.7%), dumping without burning 5(4.1%), removal off-site 9(7.4%). Final disposal of medical waste after collection showed; incinerated 90(74.4%),burned and not buried 3(2.5%),burned and buried 25(20.7%),buried but not burned 3(2.5%).Waste segregation showed 118(97.5%) were segregating wastes while 3(2.5%) were not practicing waste segregation. SOP for reagents showed that 101(83.5%) has SOP for reagents while 20(16.5%) did not have. Disposal of used reagents showed that; incineration 51(42.1%), return to manufacturer 5(4.1%), as indicated in the MSDS 38(31.4%), as indicated in the COSHH 27(22.3%). (Table 4.3).

Table 4.3: Characteristics of bioharzadous waste management

Variable		Frequency (%)n=121
Facility Disposal of sharps waste	Burn in incinerator	105 (86.8)
	Open burning	2 (1.7)
	Dumping without burning	5(4.1)
	Remove offsite	9 (7.4)
Final disposal of medical waste after collection	Incinerated	90 (74.4)
	Burned and not buried	3 (2.5)
	Burned and buried	25 (20.7)
	Buried but not burned	3 (2.5)
Waste segregation	Yes	118 (97.5)
	No	3 (2.5)
Have SOP for reagents	Yes	101 (83.5)
	No	20 (16.5)
Disposal of used reagents	Incineration	51 (42.1)
	Return to manufacture	5 (4.1)
	As indicated in MSDS	38 (31.4)
	As indicated in COSHH	27 (22.3)

4.4. Infection control measures

The study found out that personnel using biosafety cabinet in their facilities were 56(46.3%) while those without biosafety cabinets were 65(53.7%). Special applications and practices in BSL2 showed that the presence of restricted access 71 (58.7%), Biosafety manual 57 (47.1%), HEPA filter BSC 39 (32.2%), Immunization Programs for Lab Personnel 47 (38.8%), Emergency procedures for spill cleanup 44 (36.4%), Specific training on pathogen handling 46 (38.0%).

Vaccinations received showed that; Hepatitis B 77(63.6%), Tetanus toxoid 69(57.0%), Seasonal Flu 21(17.4%), Anti rabies 10(8.3%), Yellow Fever 29(24.0), Typhoid 35(28.9%).

The study examined the presence of infection control items and found out that; Running water (piped) 104 (86.0%), Hand washing soap/liquid soap121 (100%), Hand disinfectant 103 (85.1%), Waste bin119 (98.3%), Sharps container 121(100%), PPE 116(95.5%), Eye wash 51(42.1%), First aid kit 76(62.8) and biological spill kit 39(32.2%). (Table 4.4).

Table 4.4: Infection control measures and items

Variable	Number(%) n=121	
	Yes	**No**
Biosafety Cabinet	56 (46.3)	65 (53.7)
Special applications and practices in BSL2		
Restricted access	71 (58.7)	50(41.3)
Biosafety manual	57 (47.1)	64(52.8)
HEPA filter BSC	39 (32.2)	82(67.7
Immunization Programs for Lab Personnel	47 (38.8)	74(61.2)
Presence of Signage(Biohazard sign) on infectious materials	55 (45.5)	66(54.5)
Emergency procedures for spill clean up	44 (36.4)	77(63.3)
Specific training on Pathogen handling	46 (38.0)	75(62)
Vaccines Received		
Hepatitis B	77 (63.6)	44 (36.4)
Tetanus toxoid	69 (57.0)	52(43)
Seasonal Flu	21 (17.4)	100(82.6)
Anti rabies	10 (8.3)	111(91.7)
Yellow Fever	29 (24.0)	92(76)
Typhoid	35 (28.9)	86(71.1)
Have the following infection control items		
Running water (piped)	104 (86.0)	17(14.0)
Hand washing soap/liquid soap	121 (100)	0(0.00)
Hand disinfectant	103 (85.1)	18(14.9)
Waste bin	119 (98.3)	2(1.7)
Sharps container	121 (100)	0(0.00)
PPE	116 (95.9)	5(4.1)
Disposable non latex gloves	66 (54.5)	55(45.5)
Eye wash	51 (42.1)	70(57.9)
First aid kit	76 (62.8)	45(37.2)
Disinfectant (bleach or alcohol)	119 (98.3)	2(1.7)
Have biological spill kit	39 (32.2)	80 (66.1)

4.5 Training and compliance practices

The study found out that 85 (70.2%) had received training on Good clinical and laboratory practice, 58(47.9) laboratory biosafety and biosecurity while specimen/sample shipment was 83(68.6%).

Compliance practices and guidelines showed that; National infection prevention and control guidelines for health care services in Kenya 103(85.1%), Guidelines for PEP for laboratory staff 99(81.8), Infection prevention guidelines 108(89.3), Blood safety guidelines 109(90.1), Laboratory safety guidelines 115(95.5%) and emergency evacuation plans (SOPs) 87(71.9). (Table 4.5).

Table 4.5: Information on training and compliance practices

Trainings received	**frequency (%) n=121**	
	Yes	**No**
Good clinical and laboratory practice	85 (70.2)	36(27.9)
Laboratory biosafety and biosecurity	58 (47.9)	63(52.1)
Trained specimen/sample shipment	83 (68.6)	38(31.4)
Laboratory has the following		
Emergency evacuation plan (SOPs)	87 (71.9)	34(28.1)
Laboratory safety guidelines	115 (95.0)	6(5)
Blood safety guidelines	109 (90.1)	12(9.9)
Infection prevention guidelines	108 (89.3)	13(10.7)
Guidelines for PEP for laboratory staff	99 (81.8)	22(18.2)
National infection prevention and control guidelines for health care services in Kenya	103 (85.1)	18(19.9)

CHAPTER FIVE

DISCUSSIONS

Studies have highlighted that ineffective management of infectoius laboratory waste in develpong country can compromise the qualty of patient and create occupapational and enviromental health risk (Collins, 1999; Moumie, 2011).

The situation of poor waste management is still common in developng countries like Nigeria,Mozambigue,Kenya and Tanzania (CDC, 2014a). Proper management of the multiple waste streams generated by medical laboratories requires an in depth knowledge of all laboratory practices and procedures in terms of the type of waste generated (WHO, 2014). Results showed that bioharzadous waste management practices in most facilities were in line with prescribed standards expected however, few facilities still needed improvement.

Vaccination as a way of infection prevention and control is necessary for occupationally-exposed laboratory personnel. Some of these vaccines for communicable diseases include hepatitis B, seasonal influenza, typhoid fever vaccine and tetanus (CDC, 2014a). Most Laboratory associated infection rates range from 15% to 40% and occupational transmission is usually associated with violation of one or more of three basic principles of infection control: hand washing, vaccination of health care workers, and prompt placement of infectious patients into appropriate isolation (Kent, 1996). A survey carried out by KNBS found out that only thirty six percent of facilities in Kenya have infection control items available (KNBS, 2011). This is consistent with the current study since in Kisumu East Sub-County, Only a smaller percentage have infection control items like eyewash, biological spill kit, immunization program and biosafety cabinets. Most laboratories in Kisumu East Sub-County do not have vaccination programs for their personnel.

The training of the staff constitutes the main component of WHO laboratory biosafety standard. The staff must be trained and knowledgeable of what procedures they are undertaking in the laboratory. These qualities are crucial for efficient biohazard management practice and for evaluating and managing risk (OECD, 1998). In Kisumu East Sub-County, only a few personnel have participated in Sample shipment, laboratory biosafety and GCLP Trainings. Compliance practices as a tool of Laboratory Quality Management system showed that a number of laboratories are still bellow the stipulated WHO laboratory biosafety standards. Poor personnel training may result to incompetency hence increases the risk of a LAI or other biological accident in the laboratory, and may also contribute to improper pathogen accounting, storage and transportation, which in turn could contribute to the illicit acquisition of biological agents by terrorists or would-be bio-criminals.

A WHO investigation attributed laboratory infections to negligent program management (e.g., poor laboratory practices, insufficient training). According to National Policy on Injection Safety and Health Care Waste Management, the limiting factors in proper management of laboratory hazards include; inadequate training and lack of standards and guidelines (NASCOP, 2007). Compliance with this standard provides public assurance that the rights, safety and well-being of trial subjects are protected, consistent with the set principles that have their origin in the Declaration of Helsinki (Knight, 1998). This concurs with the current study that compliance practices are a component of WHO laboratory Safety standards among Laboratory personnel in Kisumu East Sub-County.

CHAPTER SIX

SUMMARY OF FINDINGS,CONCLUSION AND RECOMENDATIONS

6.1 Summary of Findings

The general waste management and segregation system in Kisumu East Sub-County is considered inadequate as per the WHO laboratory Biosafety Standards and the implementation of overall bio-waste regulation is still unsatisfactory as few laboratories are still disposing of waste in a haphazard, improper and indiscriminate manner.

Majority of Laboratory facilities in Kisumu East Sub-County did have infection control items, measures and guidelines. Only 38.8% of those working in BSL2 have immunization programme for lab personnel, while majority (61.2%) did not have. Most facilities did not have spill kit with only 39% having biological spill kit, thus pointing to a compromise to biosafety. Accordingly,103(85.1%) had National infection prevention and control guidelines for health care services in Kenya, Guidelines for PEP for laboratory staff was in 99(81.8%), Blood safety guidelines was observed in 109(90.1%), and Laboratory safety guidelines in 109(90.1%). These were still below the WHO Laboratory biosafety standards.

According to the study, only 36.4% had been trained on Good Clinical Practice while 63.6% had not been trained. Additionally, 41.9% had been trained on Laboratory Biosafety and Biosecurity while 52.1% had not been trained. Only 83(52.1%) had been trained on specimen shipment. Therefore there was need for training of all laboratory personnel to minimize laboratory biorisk.

6.2 Conclusions

Conclusions were as follows:

1) Hazardous waste management and segregation practices in few facilities were not totally in line with the prescribed expected standards in WHO laboratory biosafety Manual.

2) Most facilities lacked infection control items such as biosafety cabinets, immunization programs, eye wash, spill kits and first aid kits. These were below the stipulated standards in the WHO laboratory Safety Manual Checklist.

3) Some staff had not been regularly updated on procedures and specialized training which provides knowledge about Sample shipment, biosafety, GCLP and Standard Operating procedures. These were not in line with the prescribed Standards in the WHO Laboratory Biosafety Manual.

6.3 Recommendations from current study

1) All laboratories in Kisumu East Sub-County should have appropriate disposal of hazardous waste and develop infrastructure for segregation and safe disposal of hazardous materials since this is important aspect of improving occupational health.
2) To prevent, identify, monitor, and control the spread of infections in laboratory facilities in the region, comprehensive infection prevention and control (IPC) practices should be implemented. All laboratory staff should be vaccinated against hepatitis B, typhoid, yellow fever and tetanus especially those handling blood specimens.
3) All laboratory staff in Kisumu East sub-County should be trained on Good clinical and Laboratory practice, Laboratory Biosafety and sample shipment. Additionally, each laboratory must have written Standard procedures and adhere to them as these are some of the pillars of Laboratory Quality Management System.

6.4 Recommendations for future studies

Poor or lack of personnel training among Laboratory personnel in Kisumu East Sub-County is a biohazard in the laboratory, and may also contribute to improper pathogen accounting, storage and transportation, which in turn could contribute to the illicit acquisition of biological agents by terrorists or would-be bio-criminal. As such, there is need for further studies on laboratory Biosecurity in Kisumu East Sub- County as some of the laboratories handle pathogens that can be used in bioterrorism if appropriate biosafety measures are not put in place.

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APPENDICES

Appendix 1: WHO Laboratory Biosafety manual checklist

22. SAFETY CHECKLIST

Personal protection

1. Is protective clothing of approved design and fabric provided for all staff for normal work, e.g. gowns, coveralls, aprons, gloves?
2. Is additional protective clothing provided for work with hazardous chemicals and radioactive and carcinogenic substances, e.g. rubber aprons and gloves for chemicals and for dealing with spillages; heat-resistant gloves for unloading autoclaves and ovens?
3. Are safety glasses, goggles and shields (visors) provided?
4. Are there eye-wash stations?
5. Are there emergency showers (drench facilities)?
6. Is radiation protection in accordance with national and international standards, including provision of dosimeters?
7. Are respirators available, regularly cleaned, disinfected, inspected and stored in a clean and sanitary condition?
8. Are appropriate filters provided for the correct types of respirators, e.g. HEPA filters for microorganisms, appropriate filters for gases or particulates?
9. Are respirators fit-tested?

Health and safety of staff

1. Is there an occupational health service?
2. Are first-aid boxes provided at strategic locations?
3. Are qualified first-aiders available?
4. Are such first-aiders trained to deal with emergencies peculiar to the laboratory, e.g. contact with corrosive chemicals, accidental ingestion of poisons and infectious materials?
5. Are non-laboratory workers, e.g. domestic and clerical staff, instructed on the potential hazards of the laboratory and the material it handles?
6. Are notices prominently posted giving clear information about the location of first-aiders, telephone numbers of emergency services, etc.?
7. Are women of childbearing age warned of the consequences of work with certain microorganisms, carcinogens, mutagens and teratogens?
8. Are women of childbearing age told that if they are, or suspect that they are, pregnant they should inform the appropriate member of the medical/scientific staff so that alternative working arrangements may be made for them if necessary?
9. Is there an immunization programme relevant to the work of the laboratory?
10. Are skin tests and/or radiological facilities available for staff who work with tuberculous materials or other materials requiring such measures?
11. Are proper records maintained of illnesses and accidents?
12. Are warning and accident prevention signs used to minimize work hazards?
13. Are personnel trained to follow appropriate biosafety practices?
14. Are laboratory staff encouraged to report potential exposures?

Laboratory equipment

1. Is all equipment certified safe for use?
2. Are procedures available for decontaminating equipment prior to maintenance?
3. Are biological safety cabinets and fume cupboards regularly tested and serviced?
4. Are autoclaves and other pressure vessels regularly inspected?
5. Are centrifuge buckets and rotors regularly inspected?
6. Are HEPA filters regularly changed?
7. Are pipettes used instead of hypodermic needles?
8. Is cracked and chipped glassware always discarded and not reused?
9. Are there safe receptacles for broken glass?
10. Are plastics used instead of glass where feasible?
11. Are sharps disposal containers available and being used?

Infectious materials

1. Are specimens received in a safe condition?
2. Are records kept of incoming materials?
3. Are specimens unpacked in biological safety cabinets with care and attention to possible breakage and leakage?
4. Are gloves and other protective clothing worn for unpacking specimens?
5. Are personnel trained to ship infectious substances according to current national and/or international regulations?
6. Are work benches kept clean and tidy?
7. Are discarded infectious materials removed daily or more often and disposed of safely?
8. Are all members of the staff aware of procedures for dealing with breakage and spillage of cultures and infectious materials?
9. Is the performance of sterilizers checked by the appropriate chemical, physical and biological indicators?
10. Is there a procedure for decontaminating centrifuges regularly?
11. Are sealed buckets provided for centrifuges?
12. Are appropriate disinfectants being used? Are they used correctly?
13. Is there special training for staff who work in containment laboratories – Biosafety Level 3 and maximum containment laboratories – Biosafety Level 4?

Chemicals and radioactive substances

1. Are incompatible chemicals effectively separated when stored or handled?
2. Are all chemicals correctly labelled with names and warnings?
3. Are chemical hazard warning charts prominently displayed?
4. Are spill kits provided?
5. Are staff trained to deal with spills?
6. Are flammable substances correctly and safely stored in minimal amounts in approved cabinets?

7. Are bottle carriers provided?
8. Is a radiation protection officer or appropriate reference manual available for consultation?
9. Are staff appropriately trained to safely work with radioactive materials?
10. Are proper records of stocks and use of radioactive substances maintained?
11. Are radioactivity screens provided?
12. Are personal radiation exposures monitored?

Appendix 2: Informed consent

INFORMED CONSENT FORM FOR ALL THE RESPONDENTS

Biohazards management practices by occupationally-exposed clinical laboratory personnel in medical facilities in Kisumu East Sub-County, Kenya

Identification

Consent code…… Date …….....

Laboratory unique Number…… Interviewer Name…….....

I am a principal Investigator at Maseno University conducting a study to determine biohazard management practices among occupationally-exposed clinical laboratory personnel in medical facilities in Kisumu East Sub-County.

The study is done both public and private laboratory facilities. It is for academic purposes and the findings will also of help to the ministry of health, policy makers and other stake holders in their effort to improve laboratory occupational health and safety.

If you accept to respond to our questions, any information you give to us will be kept confidential. The information you give to us together with the others we receive from other facilities will not be identified as having come from you. Your participation is voluntary, and even if you decide to take part; you can withdraw your consent any time. If you agree to participate, then we will ask you a few questions. Do you agree to participate in the study?

Yes ☐ No ☐

I.....hereby give consent to be interviewed by the investigator.

If you have any questions related to the study, you can contact the investigators; Fredrick Ogumbo on mobile number: +254 - 725849376 or Prof.Collins Ouma of African Population Health Research Cente on: +254 -722381214 or Prof James Ombaka of Maseno university on +254 - 721260 279, or the Maseno University Ethical Review on: 057 35 15 88.

Appendix 3: Questionnaire

Administered to Laboratory personnel in various health facilities in Kisumu East District

1.0 Identification

Questionnaire Code…… Date of Interview……

Laboratory unique Number……

1.1 Introduction

My name is Fredrick Ogumbo I am a postgraduate student undertaking Masters in Public Health (Epidemiology and population Health) at Maseno University. I am are carrying out a study whose aim is to determine biohazard management practices by occupationally-exposed clinical laboratory personnel in medical facilities in Kisumu East Sub-County.

1.2 Benefits

The information from this study will be strictly for learning purposes. It may also be used by the Ministry of Health and other stakeholders to promote Laboratory occupational health and safety

1.3 Basis of participation

Your participation will purely be voluntary. You will need approximately 20 minutes to fill in the questionnaires. The information will be given to the researcher and it will be treated with confidentiality. Your sincere and true response will contribute to the achievement of the aim of this study.

Would you like any more information before making your decision to participate or not?

BIOHAZARDS MANAGEMENT PRACTICES BY OCCUPATIONALY EXPOSED CLINICAL LABORATORY PERSONNEL IN MEDICAL FACILITIES IN KISUMU EAST SUB-COUNTY, KENYA

A) FACILITY IDENTIFICATION

Serial Number: ..... **Interview Date: .....**

1.	**Name of facility** _____	
2.	**Location of facility:** 1) Division _____ 2) Location _____	
3.	**Facility Number** _____	
4.	**Laboratory Services** 1)Diagnostic 2)Research 3) Research & diagnostic	☐
5.	**Type of facility** 1)National referral 2)District 3)Clinic 4) Health Centre 5) Dispensary 6)Stand-alone Lab	☐
6.	**Managing Authority** 1) Central government 2)County government 3)NGO/Private not for profit 4)Private for profit 5)Mission/Faith based	☐
	B) SOCIO-DEMOGRAPHIC CHARACTERISTIC	
7.	**What is your gender** 1)Male 2)Female	☐
8.	**How old are you** 1) 15-24yrs 2) 25-34yrs 3) 35-44yrs 4) 45-54yrs 5) 55& above	☐
9.	**How long have you been working in the lab** 1) >5yr 2)6-11yrs 3)12-16yrs 4)17-21yrs 5) 22 & above	☐
10.	**What is your speciality**1)Laboratory assistant 2)Laboratory Tech 5) Assistant Research Officer 6) Research Officer	☐
	C) BIOHARZADOUS WASTE MANAGEMENT	

11.	**a)How does this facility finally dispose of sharps waste**	1.Burn in incinerator	
		2.Open burning	
		3.Dumping without burning	
		4.Remove offsite	
		5.Never have sharps waste	
	b) How are medical wastes that are collected and removed off site finally disposed?	1.Incinerated	
		2.Burned and not buried	
		3.Burned and buried	
		4.Buried but not burned	
		5. Autoclaved	
	c) Do you segregate your waste	1)Yes 2)No	
	d) Do you have SOP for reagents management	1)Yes 2)No	
	e) If Yes in (d): How do you dispose used reagents	a. Incineration	
		b. Return to manufacture	
		c. As indicated in MSDS	
		d. As indicated in COSHH	
		e. Other (*Specify*)……	
12.	**a) What procedure is used for decontaminating and cleaning equipment before its final processing for reuse?**	1. Soaked in disinfectant solution/bleach	
		2. Cleaned with soap and water	
		3. Soaked in ethanol	
		4. No equipment reused	
		5. Don't decontaminate in facility	
	b)Have you experienced any of the following falling hazards ;slips, trips and falls	1.Yes 2.No	
	c)Have you experienced cuts from any of the following: glassware, capillary tubes and criavials	1.Yes 2.No	

	d) Have you experienced burns related to contact with hot surfaces(oven, heating plate, burner etc)	1.Yes 2.No	☐
	e)Have you been exposed to UV used in germicidal lamps such as Biosafety Cabinet	1.Yes 2.No	☐
D) INFORMATION ON INFECTION CONTROL AND BIOSAFETY			
13.	**a) Which Biosafety level is your Laboratory** 1)BSL 1 2) BSL2 3)BSL3		☐
14.	**Which of the following Biosafety level practices applies to your Laboratory** *(If yes mark 1, No Mark 2)* a)Limited access b)Sharps precaution c)Biohazard warning sign e)Negative air flow into laboratory f)Eyewash readily available in lab h)Hands free hand washing sink h)Self closing double door access		☐ ☐ ☐ ☐ ☐ ☐ ☐
15.	**Do you have and use Biosafety cabinet** 1)Yes 2)No		☐

16.	**Special applications and practices in BSL2** **(*Specific to BSL2 Labs only if BSL3Skip to Item 12b)*** **Which of the following applies to your laboratory** a) Restricted access b) Biosafety manual c) HEPA filter BSC d) Immunization Programs for Lab Personnel e) Presence of signage(Biohazard Sign) on infectious materials f) Emergency procedures for spill clean up g) Specific training on pathogen handling	☐ ☐ ☐ ☐ ☐ ☐ ☐
17.	**Special applications and practices in BSL3** **(*Specific to BSL3 Labs only if BSL2 Skip to Item 13)*** **Which of the following applies to your laboratory** a) Policies on safe handling of sharps b) Containment lab kept Locked c) Staff proficient in microbiological practices and procedures d) Centrifugation of infectious substances carried out in BSC e) Presence of protocols specific to operation of the lab f) Availability of a method for decontaminating all laboratory wastes in the facility e.g. autoclaves g) Presence of eye wash station h) All windows sealed and emergency exits clearly marked	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
18.	**What kind of biological samples do you handle** ***(If yes mark 1 and No mark 2)***	a) CSF ☐ b) Blood ☐ c. Urine ☐ d. Sputum ☐ e. Swabs ☐ f. Stool ☐

		g.Semen	☐
19.	**Do you handle the following pathogens** ***(If yes mark 1 and No mark 2)***	a. Bacteria	☐
		b. Viruses	☐
		c. Parasites	☐
20.	**Have you received the following vaccines** ***(If yes mark 1 and No mark 2)***	a. Hepatitis B	☐
		b. Tetanus toxoid	☐
		c.Seasonal Flu	☐
		d. Anti rabies	☐
		e. Yellow fever	☐
		f. Typhoid	☐
21.	**Do you have biohazard bags**	1. Yes 2. No	☐
22.	**How do you decontaminate used specimen**	1. Autoclave	☐
		2. Using disinfectants/bleach	☐
		3. Using Ethanol	☐
		4. Other (*Specify*)……	☐
23.	**Have you ever suffered from the following diseases in the last 6 months** ***(If yes mark 1 and No mark 2)***	a. Respiratory	☐
		b. Diarrhoegenic	☐
		c. Fungal	☐
		d.Zoonotic	☐
		e. Blood-borne diseases	☐
24.	**Do you have the following infection control items** **(*If yes mark 1 and No mark 2)***	a. Running water (piped)	☐
		b. Water in bucket or basin	☐
		c. Hand washing soap/liquid soap	☐
		d. Hand disinfectant	☐
		e. Hand drying towels	☐
		f. Waste bin	☐
		g. Sharps container	☐

		h. Disposable latex gloves	
		i. Disposable non latex gloves	
		j. Eye wash	
		k. First aid kit	
		l. Disinfectant(bleach or alcohol)	
25.	**a)Do you have fire extinguishers**	1. Present and in use 2. spoilt	
		3.None	
	b) Do you have biological spill kit	1.Yes 2.No	

E) INFORMATION ON RESPONDENT KNOWLEDGE AND

26.	**Which of the following trainings have you received**	Good Clinical practice	
		Good clinical and laboratory practice	
		Laboratory Biosafety and biosecurity	
27.	**Have you been trained on specimen/sample shipment**	1.Yes 2.No	
28.	**Do you participate in Laboratory External Quality Assurance**	1. Yes	
		2. No	
29.	**Do you participate in proficiency testing**	1.Yes 2.No	

F) INFORMATION ON GUIDELINES AND PROTOCOLS

30.Do your lab has the following (*If yes mark 1 and No mark 2)*		
	a. Emergency evacuation plan (SOPs)	
	b. Laboratory safety guidelines	
	c. Blood safety guidelines	
	d. Infection prevention guidelines	
	e. Guidelines for PEP for Laboratory staff	
	f. National infection prevention and control guidelines for health care services in Kenya	
	g. Written guidelines on confidentiality	

Appendix 4:Ethical approval from Maseno University Ethics Review Committee

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221
Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 24th September, 2014

TO: Fredrick Abonyo Ogumbo
PG/MPH/00115/2011
School of Public Health and Community Development
Maseno University, Maseno, Kenya

REF: MSU/DRPC/MUERC/00100/14

RE: Biohazard Management Practices by Occupationally Exposed Clinical Laboratory Personnel in Medical Facilities in Kisumu East Sub County, Kenya. PROPOSAL REFERENCE No: MSU/DRPC/MUERC/000100/14

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 24th day of September, 2014 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 23rd September, 2015. If you plan to continue with the study beyond this date, please submit an application for continuation approval to MUERC Secretariat by 22nd August, 2015.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach MUERC Secretariat by 22nd August, 2015.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Yours faithfully,

Dr. Bonuke Anyona
Secretary,
Maseno University Ethics Review Committee.

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES
24 SEP 2014
MASENO UNIVERSITY

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

Appendix 5:Authorization Letter from Kisumu East Sub-county Medical Officer of Health

MINISTRY HEALTH

Telegrams: "Health" Kisumu
Tel: 057-23369
When Replying please quote:

Medical Officer of Health
Kisumu East Sub-County
P. O. Box 486
KISUMU

REF.No.: ST-GN/13/VOL.2/360

21st November, 2014

Fredrick Abonyo Ogumbo
SCHOOL OF PUBLIC HEALTH AND COMMUNITY DEVELOPMENT

RE: BIOHAZARD MANAGEMENT PRACTICES BY OCCUPATIONALLY EXPOSED CLINICAL LABORATORY PERSONNEL IN MEDICAL FACILITIES IN KISUMU EAST SUB-COUNTY, KENYA. PROPOSAL REFERENCE NO.MSU/DRPC/MUERC/000100/14

The Sub-County Health Management Team for Kisumu East hereby grants permission to collect data on the above mentioned topic in Kisumu East Health facilities.

Please take note that the study will last two weeks ending on 5th December, 2015. Continuation of study will be subject to fresh request through the above HMT.

Thank you.

MEDICAL OFFICER OF HEALTH
KISUMU EAST DISTRICT
Date:.....
P.O. Box 486-40100, KISUMU

DR. TITUS K. KWAMBAI
MEDICAL OFFICER OF HEALTH
KISUMU EAST SUB-COUNTY