ASSESSMENT OF THE LEVEL OF PREPAREDNESS FOR EBOLA VIRAL DISEASE IN TWO HEALTH FACILITIES IN BUSIA COUNTY, KENYA

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THESIS SUBMITTED TO THE COLLEGE OF HEALTH SCIENCES, SCHOOL OF PUBLIC HEALTH, DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS IN PUBLIC HEALTH (MPH)

DECLARATION

Declaration by the student

This thesis is my original work and has not been presented for a degree award in any other university. No part of this thesis may be reproduced without permission of the author and or the University.

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DEDICATION

To my parents Mr. John Chepkwony and Mrs. Sally Chepkwony for their inspiration and encouragement.

To my dear husband for his support throughout the study and children who always put a smile on my face.

ABSTRACT

RESEARCH TITLE: ASSESSMENT OF THE LEVEL OF PREPAREDNESS FOR EBOLA HEMORRHAGIC FEVER IN TWO HEALTH FACILITIES IN BUSIA COUNTY, KENYA

Background: Ebola viral disease is an emerging viral disease caused by Ebola virus of the Filoviridae family. It is an acute febrile disease of sudden onset and is usually associated with a high case fatality rate (50%-90%). Previous Ebola outbreaks have demonstrated weakness in hospital preparedness among other holistic control measures. A key Global Health Security Agenda is to strengthen health systems through preparedness. Health system preparedness is the capacity to detect protect and respond to disease outbreaks.

Objectives: - The objectives of this study were to: Assess knowledge of health care providers on detection of Ebola hemorrhagic fever, describe the infection prevention measures in place to protect health care providers from transmission of Ebola in health facilities and assess preparedness of health care providers with regard to response to suspected Ebola cases in health facilities in Busia County.

Methods

Study site was Busia County, study population were Health care providers in Busia county hospital and Kocholia Sub County Hospital, study design was descriptive cross-sectional study. 139 health providers were sampled. Stratified sampling was done on health care providers and purposive sampling was used to choose the two health facilities. Data collection was done using questionnaires and key informant interviews and data analysis was done using R software. For qualitative data thematic analysis was used.

Results: The average score for knowledge to handle suspected Ebola case was 78.0 (SD: 21.2) with similar averages for the two facilities, Busia: 79.6 (SD: 21.7), and Kocholia: 73.7 (SD: 19.6),. The score for infection prevention and control measures was 67.2 (SD: 21.3) . Analysis of this score by health facility showed that Busia County Hospital had a score of 71.3 (SD:20.8) and Kocholia Sub-County Hospital had a score of 56.8 (SD: 19.2). The average score for the preparedness to respond to suspected Ebola case was 32.0 (SD: 22.2). Analysis by health facilities showed that Busia County Hospital had a score of 37.2 (SD: 22.9) and Kocholia Sub-County Hospital a score of 19.0 (SD: 13.7).

Conclusion and recommendation: - Both facilities were not adequately prepared to manage a suspected case of EVD**.** Both facilities should ensure that health care providers are trained on management of Ebola viral disease. Infection prevention and control guidelines should be implemented. Each hospital should test their level of preparedness through drills

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ANOVA	Analysis of Variance
BEBOV	Bundibugyo Ebola Virus
BSL	Bio Safety Level
CDC	Centre for Disease Control and Prevention
CFR	Case Fatality Rate
CH	County Hospital
CHVs	Community Health Volunteers
CHW	Community Health Worker
CIEBOV	Cote d' ivore Ebola Virus
CMEs	Continuous Medical Education
CNS	Central Nervous System
CO	Clinical Officer
DR	Doctor
DRC	Democratic Republic Of Congo
EMS	Emergency Medical Services
EVD	Ebola Viral Disease
EVD	Ebola Viral Disease
FDA	Food and Drug Administration
FHF	Filovirus Hemorrhagic Fever

HCP	Health Care Providers
HCW	Health Care Worker
IDSR	Integrated Disease Surveillance and Response
IgM	Immune globulin M
IHR	International Health Regulations
IPC	Infection Prevention and Control
IQR	Inter-quartile Range
IREC	Institutional Research and Ethics Committee
KEMRI	Kenya Medical Research Institute
KII	Key Informant Interview
KNBS	Kenya National Bureau of Statistics
KSH	Kenyan Shilling
Lab Tech.	Laboratory Technologist
MHF	Marburg Hemorrhagic Disease
MPH	Masters in Public Health
MSF	*Medecins Sans Frontiers*
MTRH	Moi Teaching and Referral Hospital
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational safety and health administration
PCR	Polymerase Chain Reaction
PGH	Post Graduate in Health

PHO	Public Health Officer
POE	Point of Entry
PPE	Personal Protective Equipment
PPEs	Personal Protective Equipment's
REBOV	Reston Ebola Virus
R-EBOV	Reston Ebola Virus
REG.NO	Registration Number
RNA	Ribonucleic Acid
RRT	Rapid Response Teams
SCH	Sub County Hospital
SD	Standard Deviation
SEATINI	The Southern and Eastern Africa Trade Information and Negotiations Institute
SEBOV	Sudan Ebola Virus
S-EBOV	Sudan Ebola Virus
SOPs	Standard Operating Procedures
SPH	School of Public Health
TAFV	Tai Forest Ebola Virus
TARSC	Training and Research Support Centre
UNHCR	United Nations High Commissioner for Refugees
USA	United States of America

VHF	Viral Hemorrhagic Fever
WCC	WHO Collaborating Centre
WHO	World Health Organization
ZEBOV	Zaire Ebola Virus
Z-EBOV	Zaire Ebola Virus

DEFINITION OF TERMS

Assessment: It is the systematic examination of the health status indicators for a given population that is used to identify key problems or gaps and assets in a hospital.

Assess: It is the evaluation of the Hospital's level of preparedness for Ebola Hemorrhagic Fever.

Confirmed case: A suspected case with laboratory confirmation (positive IgM antibody, positive PCR or viral isolation), or epidemiologic link to confirmed cases.

Donning: The practice of putting on PPEs.

Doffing: The practice of taking off PPEs.

Ebola Viral Disease: is an emerging viral disease caused by Ebola virus and is characterized by fever of sudden onset and hemorrhage. The term Ebola Viral Disease is used interchangeably with Ebola Hemorrhagic fever It affects both human and non-human primates.

Health Care Providers: These are health workers who provide care to patients in this case; Doctors, Nurses, Clinical Officers, Laboratory Technologists and Public Health Officers.

Health Facilities: These are level three and level four hospitals providing care to patients.

Infection prevention measures: Means the procedures applied to prevent uninfected persons from getting the disease or halt the spread of disease or contamination among affected population..

Knowledge: Its facts, information, and skills acquired through experience or education.

Level of preparedness: Categorizing the capacity of health care system to respond to disease outbreak in percentages. The preparedness of a health system is measured in

terms of knowledge of health providers, infrastructure and capabilities to respond to disease outbreaks.

Outbreak: One single case of confirmed Ebola virus

Preparedness is defined as the capability of the public health and health care systems to detect, protect against, respond and recover from health emergencies whose impact, timing and unpredictability may overwhelm routine capabilities in a hospital.

Protect: It is the act of limiting transmission of diseases in Hospitals by using PPEs and observing basic hygiene.

Response: This is aggregate of measures to contain or reduce the effects of an epidemic to prevent any new infection or further loss of lives and to maintain functionality in the hospital.

Suspected case:

Any person presenting with an acute onset of fever with no response to usual causes of fever in the area and any of the following additional symptoms: severe headache, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Ebola Hemorrhagic Fever is an emerging infectious disease of public health importance. It was first discovered in 1976 following a concurrent outbreak of a febrile illness in Democratic Republic of Congo and Sudan (Heymann, 2008).

The family of Filoviridae has two genera, Ebola and Marburg virus. Outbreaks of Filoviruses have a characteristic feature of secondary transmission and associated high mortality rates (Fieldman, 2014).

The largest Ebola outbreak which started in December 2013 in west Africa was unprecedented and led to a declaration of public health emergency of international concern by World Health Organization. Factors which led to transmission of Ebola were; inadequate health care infrastructure, lack of training among health workers and inadequate PPEs. In addition, the three most affected countries had porous borders which facilitated movement of cases hence further transmitting the disease (Aylward *et al.*, 2014).

The 2014 Ebola outbreak in west Africa was attributed to lack of Ebola preparedness and capacity to respond to the outbreak in Guinea, Liberia and Sierra Leon .The spread of Ebola viral disease was intense in the region because its health systems had severely been affected by many years of conflict and political instability (WHO,2015).

By the time the outbreak was confirmed in March 2014, the transmission of the Ebola disease was beyond the scope of the affected countries. This was due to delay in confirmation of suspected cases which delayed the control interventions. (Gostin and

Friedman, 2015).

Hospital preparedness is the capacity of Health facilities to respond to disease outbreaks while reducing the negative consequences as well as the integrity and functioning of the health systems. Ebola virus disease highlight the importance of capacity to detect and respond to Public Health threats, (Marston *et al*., 2017).

The International Health Regulations (IHR 2005), require every country to develop its capacity to detect and respond to public health events of potential international spread before they become emergencies. There is need to train health workers on detection ,prevention and response to Ebola disease outbreak.

Global health security is dependent on the ability of all countries to rapidly detect and respond to public health threats at their source. It is ideal to strengthen public health capacity before the disease outbreak. Previous Ebola outbreaks shows the risks that emerging diseases pose to local and global health security in settings that have limited public Heath capacity, (Fauci, 2014).

Ebola disease is zoonotic and therefore, there should be inter-sectoral collaboration between Public Health surveillance team and animal health surveillance in early detection of the disease. High mortality rate among non human primates acts as an early warning sign of an outbreak. (Aylward *et al.,* 2014).

Despite the virulence of Ebola virus, its transmission can be interrupted in health facilities by practicing infection prevention and control. Providing an adequate supply of PPEs and training health workers on the process of donning and doffing will help in controlling infections during disease outbreaks and minimize mortality rates, (Sims *et al.,* 2016).

Early detection and isolation of cases is key in controlling Ebola outbreaks and minimizing the transmission of disease in the hospitals and community. Ebola outbreak results to a surge of patients and therefore require vigorous public health response and a functioning health care delivery system, (Hewlett *et al*., 2015).

Outbreaks of Ebola disease causes wide spread fear and anxiety in the community. Health education in the community and adequate preparedness in health facilities will improve management and control of the disease. Timely control of outbreaks is dependent on hospitals' ability to respond to the outbreak. (WHO, 2015).

According to (Marais *et al*., 2016), the gap in Ebola control may also be failure to apply the core principles of health promotion which are early, active and sustained engagement of affected communities so that the affected population have knowledge about the disease and how to prevent it.

Emergency preparedness measures include; planning and policies, surveillance system, equipment and infrastructure, knowledge and capabilities, training and skills, emergency response teams, stock piling and laboratory for confirmation of Ebola cases (Landesman and Cross, 2006).

World Health Organization recommends hospitals to prepare health care professionals on how to detect epidemics early in order to facilitate early response hence reducing morbidities and mortalities associated with the disease (WHO,2015).

An effective response therefore is crucial as its based in pre designated contingency plan, which maps resources and how operations will be carried out during an outbreak of disease (Hewlett et al,.2015)

1.2 Problem Statement

A key Global Health Security Agenda is to strengthen health systems through preparedness. It is dependent on ability of all countries to rapidly detect, prevent and respond to public health threats, (Fauci, 2014)

According to International Health Regulation (IHR, 2005), it's important that all countries have the capacity to detect, and rapidly respond to public health events. This will help in containing an Ebola disease outbreak and minimize the international spread of diseases. This has not been achieved in many countries and therefore action plans should be developed to improve countries capacities.

Nosocomial transmission of Ebola is a great challenge in health facilities. Delayed detection of the disease can lead to amplification of disease outbreak in hospitals and communities.. During the 2014 Ebola outbreak in west Africa, health systems disintegrated and hospitals became a source of infection ,(MSF,2014)

Currently there is an ongoing Ebola viral disease outbreak in DRC and it was declared a public health emergency of international concern in July 2019, (WHO, 2019).

Kenya is at a risk of Ebola outbreak due to human traffic and truck drivers from affected areas. Kenya - Uganda border is porous and people move between the two countries freely and this is a risk to disease transmission because Uganda has had several outbreaks of Ebola viral disease

Lack of capacity to detect and respond to Ebola outbreaks can lead to outbreaks becoming emergencies. Therefore hospitals should be prepared to detect, protect and respond to Ebola outbreaks .

1.3 Justification of the Study

Hospitals play an important role in reducing the morbidity and mortality. Transmission of Ebola Viral Disease in a hospital can be prevented through early diagnosis, isolation of cases, infection prevention and control measures and provision of adequate PPEs, (Frieden et al., 2014).

Kenyan borders are porous and Uganda has had several outbreaks of Ebola virus disease, therefore it is important to assess the level of preparedness in the hospitals near the border point. The gaps identified will be used to help inform policy making in order to strengthen the capacity of the health facilities to detect and respond to disease outbreaks early.

Therefore it is important to undertake this study in order to assess the level of preparedness in the health facilities which receive referrals of suspected cases from . Busia and Malaba border posts. The study findings provide not only hospital levels of preparedness but also a measure of country's progress towards achieving core capacity requirements as per the international health regulations (WH0, 2008).

1.4 Research Question

What is the level of preparedness in the health facilities in case of an outbreak of Ebola hemorrhagic fever in Busia County?

1.5 Objectives

1.5.1 Broad Objective

To assess the level of preparedness for Ebola hemorrhagic fever in two health facilities in Busia County.

1.5.2 Specific Objectives

1. To assess the knowledge of health care providers on detection of Ebola hemorrhagic fever in two Health facilities in Busia County.
2. To describe measures in place to protect health care providers from potential transmission of Ebola in the two health care facilities in Busia County.
3. To determine capacity of the health facilities to respond to suspected Ebola cases in the two health facilities in Busia County.

CHAPTER TWO

LITERATURE REVIEW

Ebola hemorrhagic fever is caused by the highly virulent RNA virus of the filoviridae family, which has become one of the world's deadly virus due to its high case fatality rate. The known sub-types of the virus are; Bundibugyo Ebola virus (BEBOV), Sudan Ebola virus (SEBOV), Zaire Ebola virus (ZEBOV), Reston Ebola virus (REBOV) and Côte D'Ivoire Ebola virus (CIEBOV), also known as Tai Forest Ebola virus (TAFV). (Fauci, 2014).

Strains of Ebola virus differs in terms of case fatality rates. ZEBOV fatality rates ranges from 60% to 90%, SEBOV strain has a case fatality rates of 40–60%, while the BEBOV strain is associated with fatality rates of 25%. Ebola hemorrhagic fever is an important global public health concern because of its high mortality rates and spread of the virus across borders through air travel or land borders. (World Health Organization, 2014)

2.1 Epidemiology of Ebola Virus

Ebola Virus Disease (EVD) was first recognized in 1976 in 2 separate outbreaks, one in Nzara, Sudan, and the other in Yambuku, Democratic Republic of Congo. The outbreak in Democratic Republic of Congo occurred in a village near the Ebola River, from which the disease takes its name (Günther *et al.*, 2011).

Since its discovery in 1976, EVD has been occurring in Sub-Saharan Africa. The first cases of EVD were isolated in the Democratic Republic of Congo (DRC) and Sudan (1976) and EVD epidemics have occurred in DRC (1977, 1995, 2007, 2008, 2012), Sudan (1979, 2004), Gabon (1994, 1996, 2001, 2002), Uganda (2000, 2007, 2011, 2012), Republic of the Congo (2001, 2002, 2003, 2005), Guinea (2014), Liberia

(2014), Sierra Leone (2014) and Nigeria (2014).

According to report published by World Health Organization (2014), the previous outbreaks were confined to rural areas in Central and East African region. The recent epidemic in West Africa affected the densely populated urban areas causing high mortalities and affected the countries socio-economic activities and air travel which resulted in widespread fear and anxiety globally, (WHO, 2014).

Globally there was anxiety after Ebola virus was diagnosed among the travelers and volunteers from West Africa in other countries like United States, Spain, Italy, Belgium and United Kingdom (Matua *et al*., 2015).

The 2014 West African Ebola crisis represented the largest global outbreak of a high mortality, non-vaccine preventable contagious illness in recent history. The major affected countries, Guinea, Liberia and Sierra Leone, had fragile health systems, porous borders that allowed infected people to move to other countries, had inadequate trained health care professionals and poor infrastructure. These countries had also been affected by many years of war and conflicts (Aylward *et al.*, 2014).

2.1.1 Reservoir Hosts

There is evidence that fruit bats are associated with EVD, but they have not been confirmed to be the reservoirs. Research is still ongoing(Schountz, 2014).

2.1.2 Transmission

The index case of Ebola occurs through contact with infected wild animals which are usually hunted for food (bush meat) such as the monkeys, antelopes, porcupines.

The early warning sign of impending disease outbreaks is the unexplained deaths of non-human primates . Ebola is then transmitted from person to person through direct

contact with body fluids of an infected person or dead body or contaminated surfaces (Heymann, 2008).

Risk of Ebola transmission is interrupted by observing infection prevention and control practices. Nosocomial transmission is a great challenge in health facilities, and hospitals have often served as a source of disease amplification to health care workers and the community (Abebe *et al.*, 2016).

Asymptomatic patients have a low viral load hence do not transmit the disease, but the symptomatic patients have a high viral load hence contact with these patients increases the transmission of the disease. The incubation period of Ebola hemorrhagic fever ranges from 2-21 days with an average of 8-10 days.

The signs and symptoms of the disease are: acute fever, myalgia, body weakness, headache, nausea, vomiting, abdominal pain and diarrhoea are common. Dysphagia, hiccups, maculopapular rash and hemorrhagic manifestation such as epistaxis, gum hemorrhage, haematemesis, and melaena and conjuctival injection may further develop. As the disease progresses patients become dehydrated and wasted as a result of diarrhea and vomiting. Central Nervous System involvement is manifested by somnolence, delirium and coma. The case fatality rate ranges from 50% to 90% (Heymann, 2009)

2.3 Epidemic Preparedness

Preparedness to detect, respond and control outbreaks in time is crucial in every country. The IHR 2005, require every country to develop its capacity to detect, protect and respond to public health events of potential International concern. Previous Ebola outbreaks highlight the importance of the capacity to detect and respond to outbreaks. Emerging diseases are a risk to Global health security in settings with limited Public Health capacity, (Marston *et al*., 2017).

During epidemics of infectious diseases, isolation centers get overwhelmed, health providers who responded to the epidemic became infected and mortality rate was high among the infected. In West Africa their Health systems disintegrated, Ebola treatment centers were reduced to places where nosocomial spread of Ebola occurred (Baize *et al.*, 2014).

Epidemic preparedness is a challenge in many Countries because occurrence of Ebola viral disease is uncertain. Nobody knows the timing or the place that will be affected, hence a challenge for the hospitals to allocate its scarce resources for preparedness plans (Baize *et al.*, 2014).

The 2014 Ebola virus disease outbreak exposed the level of vulnerabilities of the Health care systems and also lack of preparedness in health facilities around the world,(Ogoina *et al*., 2015).

A study done in Ghana by Annan et al., 2017, revealed lack of preparedness in their Health facilities to respond to suspected case of Ebola disease. Health workers indicated that their Hospitals lacked the capacity to respond to Epidemic prone diseases. Majority of the Health workers (38/47) were not satisfied with their surveillance system and response preparedness.

In Epidemiological Surveillance, Early warning system is important in early detection of an epidemic. The strategy uses animal mortality surveillance as an early warning sign to alert prevention program aimed at reducing the risk of human outbreaks Surveillance systems should be in place to detect any unusual occurrence of disease that fit into case definition of Ebola hemorrhagic fever. Case definition for Ebola should be distributed in health facilities to enable health providers to report suspected cases (Hewlett *et al*.,2015).

However, surveillance for suspected cases of Ebola in human population is inadequate. During disease outbreaks unexplained deaths of non-human primates usually precede human cases, but they are not always detected. Collaboration with wildlife mortality surveillance systems is thus essential for early detection of zoonotic diseases. (Baize *et al.*, 2014).

Community based surveillance system should be implemented before outbreak of the disease. This serves as early warning sign in the community. Key personnel in the community like Community Health Workers (CHWs), community leaders and religious leaders should be trained on community surveillance to enable early reporting of suspected cases that fit into case definition of Ebola (World Health Organization, 2014).

Laboratory preparedness is crucial for early diagnosis and response to Ebola outbreak. Biosafety level 3 and 4 are used to process samples from suspected cases and also confirm the cause of the outbreak. Laboratory Bio-safety guidelines in handling, transportation and analysis of highly infectious waste should be followed by laboratory personnel. Patients present with nonspecific signs and symptoms and therefore, Health care providers should be trained on Ebola virus disease and be provided with case definition of the disease (WHO, 2014).

A study done in Ghana by (Adokiya *et al*., 2016) showed that the country had limited Laboratory capacity and there was a challenge in confirming suspected Ebola cases. Ghana had eight suspected Ebola cases and seven cases died without confirming the cause of death. This shows the delays in early detection and response to disease outbreaks due to limited capacities in most countries in Africa.

In a resource limited setting, it is possible to use existing structures to respond to disease outbreaks. The rapid response teams comprising of medical specialists in disease control and laboratory scientists who are trained in investigation and testing for Ebola Virus Disease should be formed. The effective control of Ebola in Nigeria in July 2014 was facilitated by using established Polio incident management system (Amdiouni and Rhaffouli, 2015).

Emergency preparedness plans should be in place in all points of entry (airports, seaports and major land crossing) as per the International Health Regulations (IHR 2005). It is WHO's recommendation that port health staff should be ready to identify suspected travelers with signs and symptoms or from high risk areas. This will ensure that people crossing the borders are screened for the disease hence minimize spread of the disease to another country.

Contact tracing is monitoring closely those who were in contact with Ebola cases in order to identify signs of disease early and minimize transmission of Ebola disease in the health facilities and the communities (WHO, 2014)

2.3.1 Knowledge of Health Providers on Detection of Ebola Hemorrhagic Fever

Knowledge of Ebola viral disease among health care providers is important in early diagnosis and treatment of the disease. According to Abebe *et al.,* 2016, poor knowledge of Ebola disease among health providers may increase transmission of the disease among health workers through contact with highly infectious body fluids.

Therefore training of health providers is important in order to control amplification of the disease outbreak in the hospital.

Early in the 2014 Ebola outbreak in West Africa, several clusters of EVD were reported in healthcare facilities throughout the country. These clusters occurred because of poor knowledge and poor adherence to basic infection prevention and control (IPC) practices, and contributed to EVD transmission among patients and healthcare workers (HCWs) within the healthcare facility and surrounding communities. By March 2015, 288 HCW infections had been reported in Liberia (Cooper *et al.,* 2016)

Ebola virus has an incubation period of 2-21 days, therefore, it is key in following up of contacts of suspected or confirmed cases. It is also important in making presumptive diagnosis of travelers from areas with disease outbreak.

A study done by Annan *et al*., 2017 showed that health care workers had poor knowledge of Ebola disease and its transmission. This showed how ill prepared the health workers were in the face of a life threatening epidemic. Poor knowledge of the disease may put the lives of Health care providers at risk because Ebola virus is highly infectious. Knowledge of health care workers can be improved through continuous training in case management and participation in drills to test their level of preparedness.

2.3.2 Infection prevention and control in health facilities

Basic infection prevention and control measures in hospitals are essential to avoid transmission of the disease to other patients, health workers and visitors. Unfortunately, under-resourced health facilities in Africa are faced with challenges of inadequate staff, lack of standard personal protective equipment's (for example,

gloves, gowns, face shields, respirators, gumboots). There is lack of capacity necessary to effectively trace Ebola contacts and isolate cases (Annan *et al.*, 2017).

The inadequate capacity to respond to Ebola outbreak enabled the disease to be amplified in health facilities. According to Annan *et al.*, 2017 health workers (5-6%) were affected by Ebola epidemic in three West African countries because infection prevention and control guidelines had not been put in place to guide them.

The greatest risk of Ebola transmission is not from patients with diagnosed infection but from delayed detection, confirmation and isolation of cases. The signs and symptoms of Ebola disease such as headache, acute fever, nausea, vomiting, diarrhea, and weakness are nonspecific and similar to other diseases that present with fever for example malaria. It may be difficult to suspect Ebola disease hence patients may transmit the disease to, health care workers, other patients and family members before the disease is diagnosed (Frieden *et al.*, 2014).

Health-care workers should always take standard precautions when caring for patients, regardless of their presumed diagnosis. The World Health Organization has provided standard guidelines on infection prevention in hospitals in order to reduce transmission of disease (WHO, 2014).

A report published by CDC in 2015 showed that among the 28,637 cases, 818 were health workers and 488 died from the disease, a CFR of 60%. Health systems were weak even before the outbreak but it disintegrated as some health professionals got infected and others left their work place. The health workers had inadequate PPEs which could have contributed to nosocomial infections (Aylward *et al.*, 2014).

Training on donning and doffing of personal protective equipment had not been done hence most of health personnel were at risk of getting the disease (WHO, 2015).

Early detection of Ebola disease and isolation of cases is key in controlling the outbreaks and minimizing transmission of the disease in the health facilities. Isolation facilities should have design features that ensure health workers provide care to patients with minimal risk of getting infected. To maintain staff safety, and minimize transmission of the disease the isolation unit should have a room where staff use for donning and doffing PPEs under supervision. The rooms should be constructed with seamless surfaces for walls and floors to facilitate disinfection (Hewlett *et al.*, 2015).

Airborne transmission of Ebola virus has not been demonstrated in studies that have described human-to-human transmission, although hypothetical concerns about aerosol transmission of Ebola virus when performing procedures that generate droplets in the hospital have been raised (Dowell *et al.*, 1999). However, Standard precautions should be observed to prevent direct contact with blood and/or body fluids (Chevalier *et al.*, 2014)

2.3.2.1 Case Management

During Ebola outbreak clinical team should be strengthened through provision of adequate medical supplies in order to manage the cases well and hence reduce the transmission of Ebola Viral Disease in health facilities.

Lack of Ebola Treatment Centers can lead to small outbreaks getting out of control. Therefore, treatment centers should be identified prior to the outbreaks to contain epidemics early enough (MSF, 2014). Ebola outbreaks have been associated with increased mortality rates and if burials are not conducted by trained burial teams it may amplify an epidemic.

Dead bodies have high viral load and infectious if handled without protective clothing hence can lead to transmission of the disease among the contacts (Gray, 2015).

2.3.3 Preparedness to Respond to Suspected Case of Ebola Hemorrhagic Fever

2.3.3.1 Rapid Response Team

The Ebola outbreak in West Africa exposed deep vulnerabilities and disparities in health care systems of affected countries. Health care facilities should appoint rapid response team and train them on how to respond to Ebola outbreaks so that upon detection of suspected Ebola case they are able to put control measures in place including quarantine measures, isolation and contact tracing. This helps to stabilize outbreaks early and hence minimize transmission (Fauci, 2014)

Availability of resources directly affects response activities and therefore it's necessary to mobilize resources and manage them before an outbreak occurs. An inventory of resources should be part of preparedness plan in order to mobilize them in a coordinated manner (Matua *et al*., 2014).

2.3.3.2 Coordination

Coordination is the integration of activities, responsibilities and command structures to ensure resources of an institution are used effectively. International Health Regulations (IHR, 2005) emphasizes that every member country should have coordination structures in place to enhance preparedness for emergencies. This ensures that duplication of effort are minimized and achieve maximum output from resources available (WHO, 2015).

Communities should be involved when planning for response activities since they are the first responders in case of disease outbreaks therefore educating them on how to identify signs and symptoms of Ebola virus and prevent transmission of infectious disease is mandatory (Marais *et al*.,2016).

2.4 Conceptual Framework for Assessing Preparedness for Ebola in Health Facilities

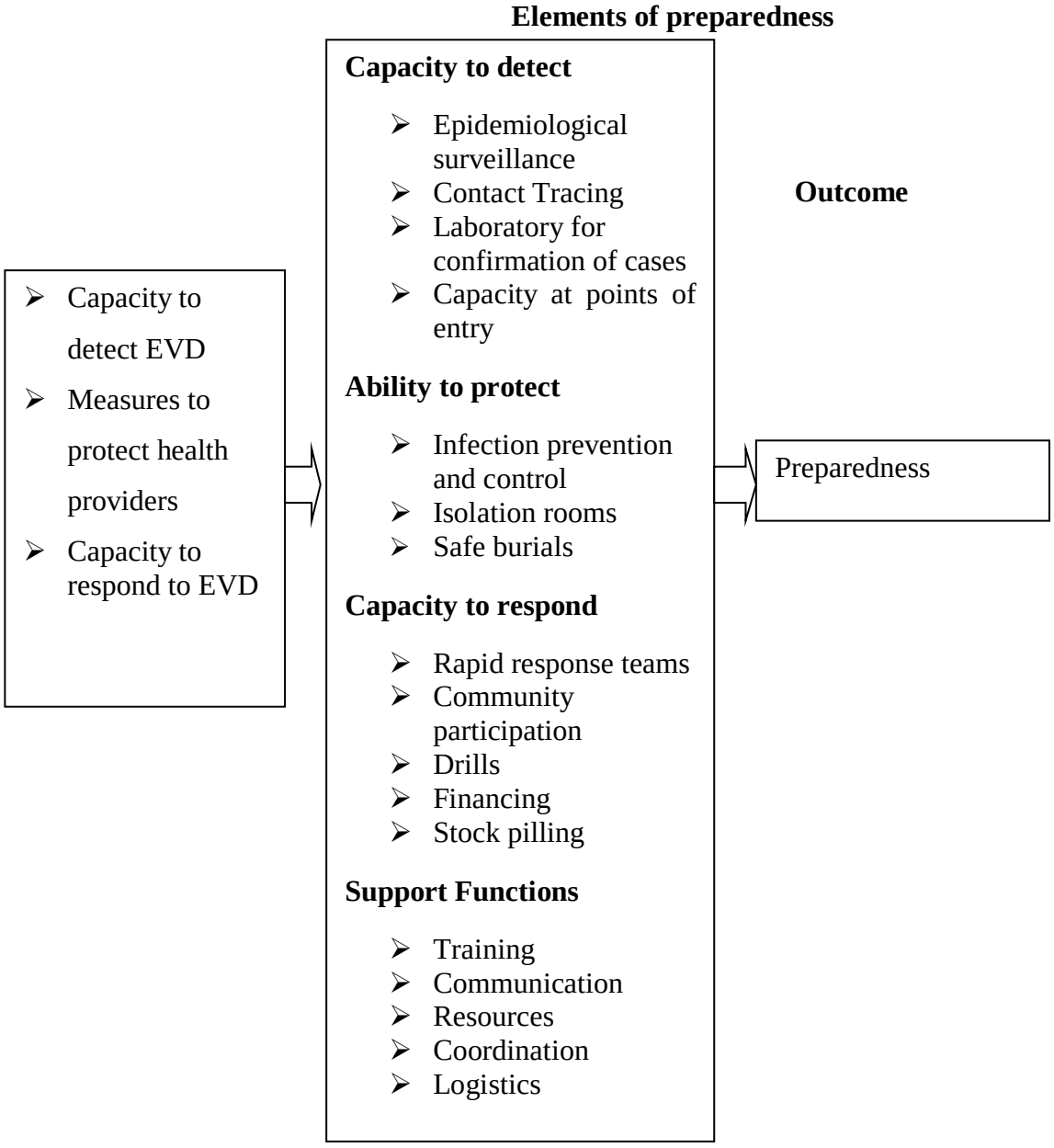

Figure 2: Conceptual Framework for Assessing Preparedness for Ebola in Health Facilities

Source: World Health Organization, (2014)

It is the recommendation of WHO, 2014 that every health facility to have the capacity to detect disease outbreaks, protect health providers and respond to disease outbreaks. The outcome of this framework is preparedness.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

Busia County is situated in the Western part of Kenya. It borders Uganda to the West, and the following counties on the Kenyan side; Kakamega to the East, Bungoma to the North and Siaya to the south. The main entry to Uganda is through Busia and Malaba border points although there are many porous crossing points along the border. The total population in the county was 743,946 according to (KNBS, 2010). The health facilities in the county are ; 1 County Referral Hospital , 4 Sub-County Hospitals, 12 Health Centers, 3 Nursing Homes, 49 Dispensaries , 10 Medical Clinics. Busia county has two main ports of entry to Uganda i.e. Malaba border in Teso North Sub County and Busia border in Matayos Sub County.

3.2 Study Population

Health care providers (medical officers, clinical officers, Nurses, public health officers and laboratory technicians) in the health facilities. These are the cadres that are in the frontline to respond in case of a suspected case of Ebola viral disease.

3.3 Study Design

Descriptive cross sectional study. Both quantitative and qualitative methods were used to collect data at that point in time.

3.4 Sample Size Determination

Sample size was obtained using Joskow and Yamane's formula for a given population size for a cross sectional study (Joskow and Yamane, 1965) .This is used for calculating proportions where the size of population is known .In this case population of health care providers in the two facilities were 212.

$$n = \frac{N}{[(1+N(e)^2]}$$

Where n=sample size

N=Population size

e=Accepted level of error: alpha is 0.05

$$n = \frac{212}{[1+212(0.05)^2]}$$

= 139 Persons

3.5 Sampling Technique

Busia County Referral Hospital and Kocholia Sub County Hospital were purposively sampled because they were the main health facilities along the Kenya Uganda border and serves larger population in the Kenyan Uganda border in Busia County. A stratified sampling method was used and health providers were stratified based on their cadres.

They were stratified into Doctors, Clinical Officers, Nurses, Laboratory technicians and Public Health Officers. The total number of health care providers was 212; Busia County Hospital had 153 health care providers while Kocholia Sub County Hospital had 59 health care providers therefore the calculated sample was distributed as per the hospital population of health care providers. The samples were distributed proportionately among the health providers as indicated in table 3.1 below.

Table 3.1: Proportionate sampling of HCP in the Health Facilities

Total HCP in the two hospitals were 212. 153 HCP in Busia County Hospital and 59 in Kocholia Sub County Hospital

BUSIA COUNTY HOSPITAL	KOCHOLIA SUB COUNTY HOSPITAL
No. of HCP=153	No of HCP=59
Doctors (11/212) *139=7	Doctors (4/212)*139=2
Clinical Officers (20/212)*139= 13	Clinical Officers (15/212)*139=10
Nurses (98/212)*139=64	Nurses (33/212)*139= 22
Laboratory technologists (23/212)*139= 15	Laboratory technologists (6/212)*139= 4
Public Health Officer (1/212)*139= 1	Public Health Officers (1/212)*139= 1

The health providers were sampled proportionately as per their cadre
HCP- Health Care Provider, * multiplication sign

Purposive sampling was used to select 16 key informants who were the heads of departments in the hospital. 10 health care providers from Busia County Hospital and 6 Health care providers from Kocholia Sub County Hospital.

3.6 Eligibility Criteria

3.6.1 Inclusion Criteria

- Health facilities- 2 Hospitals were sampled at the two border points.
- Health care providers working in the two facilities (Doctors, Clinical Officers, Nurses, Laboratory Technologists and Public Health Officers) who consented to participate in the study.

3.6.2 Exclusion criteria

- Health care providers who were on leave at the time of study

3.7 Data Collection Procedures

Training of research assistants on data collection techniques was done prior to the actual study. The training involved: understanding the objectives of the study, obtaining consent from study participants, administering questionnaires. I used quantitative, qualitative methods. Questionnaires were used to collect quantitative data on knowledge, measures in place to protect health providers and response activities in place. Key informant interviews was used for qualitative data. Checklist was used for confirming whether preparedness activities were in place.

Qualitative methods were used to collect data which could not be measured quantitatively and were important for the study. Data was collected from participants who consented to participate in the study. Consent was obtained by ensuring that the participants read the consent form and signed it.

Key informant guide was used in the hospital in order to get more information on preparedness. This was done by the researcher. Pilot study and actual data collection was done after IREC approved the proposed study.

3.8 Reliability and Validity

For reliability and validity of the data collected, training of research assistants was done by the investigator on both the study objectives and tools that were used for data collection. Pre-testing of questionnaires and key informant interview guide was done in Bungoma County Hospital to test reliability and validity of data collection tools. Bungoma County Hospital was chosen because of its proximity to border point and has same staffing with Busia County Hospital. Patients from Kocholia Sub County Hospital are also referred to this facility.

3.8.1 Data Handling and Cleaning

Data collection tools were submitted to the investigator at the end of each working day to check for completeness. A database was developed using excel where data entry was done at the end of each working day. Data cleaning was done to ensure that there were no errors arising from data entry.

Both hard and soft copies were safely stored under lock and key for the purpose of maintaining confidentiality.

3.8.2 Data Analysis Plan

The outcome for this study was level of preparedness to respond to Ebola cases. This was measured using a set of questions assessing knowledge, infection prevention measures, and preparedness of the facility to respond to suspected Ebola case. The questions were scored and summed up together to derive scores assessing three attributes: knowledge, infection prevention measures, and preparedness to respond to suspected Ebola case. They were done as follows: following criteria used in Nigeria by (Oladimeji *et al.*, 2015) to assess gaps in knowledge and practices among health workers.

The knowledge scores were derived by scoring all the knowledge questions (knowledge on the cause of Ebola, knowledge on transmission of Ebola, knowledge on the persons at risk of contracting Ebola, knowledge of signs and symptoms of Ebola, knowledge on the case definition of Ebola disease, knowledge on the incubation period of Ebola disease, and if they had familiarity with protocols and procedures for notifying designated points of contact regarding patients under investigations for Ebola) and summing them up to get a score. The correct response received a score of one (1) and incorrect response received a score of zero (0). One score was awarded if a responded was able to answer the correct cause of Ebola

hemorrhagic fever, one score was awarded if the respondent was able to correctly answer more than three means of transmission of the Ebola disease, one score was awarded if the responded was able to correctly answer more than 3 correct persons at risk of contracting the Ebola disease, and one score was awarded if the respondent was able to correctly answer more than six signs and symptoms of Ebola hemorrhagic fever. Therefore the maximum score was eight (8) and minimum score was zero (0).

Table 3.2: Scores for Knowledge

Cause of Ebola disease	1 correct response	1 mark
Mode of transmission	≥ 3 correct responses	1 mark
Persons at risk	≥ 3 correct responses	1 mark
Signs and symptoms	≥ 6 correct responses	1 mark
Case definition	Correct response	1 mark
Incubation period	Correct response	1 mark
Notification of authorities	Correct response	1 mark
Laboratory	Correct response	1 mark

Total score = 8

The score to assess the infection prevention and control measures put in place to protect the health provider were derived by scoring and summing up the questions assessing the measures put in place by the investigator. I summed and scored total of seven questions. The correct response received a score of one (1) and incorrect response received a score of zero (0). Thus the maximum score was seven (7) and minimum was zero (0).

Table3.3: Infection Prevention and Control Measures

Training on infection prevention	Correct response	1 mark
Use of PPEs	Correct response	1 mark
Training on donning and doffing	Correct response	1 mark
PPEs	State all standard PPEs for Ebola outbreak	1 mark
Safe transport of patients	Correct response	1 mark
Hand hygiene	Correct response	1 mark
Waste management	Correct response	1 mark

Total score = 7

The score assessing the preparedness of the health facility to respond to suspected Ebola cases was derived by scoring and summing up the ten preparedness questions with the correct response receiving a score of one (1) and incorrect response received a score of zero (0). The maximum and minimum scores were ten (10) and zero(0) respectively.

Table 3.4 : Preparedness to Respond

	Score for 'yes' response
Ebola response team	1 mark
Training on Ebola	1 mark
Preparedness plan	1 mark
Disaster planning committee	1 mark
Isolation rooms	1 mark
Exposed health providers	1 mark
Stock pile	1 mark
Adequate staff	1 mark
Communication	1 mark
Drills	1 mark

Total = 10

The three scores derived above (score assessing knowledge, assessing whether the health measures to protect the health provider are in place, and the score assessing preparedness of the facility to respond to suspected Ebola cases) were summed up and

divided by three to derive an overall preparedness score. The total number of questions that were evaluated were 25.

The scores derived above were converted to a scale of 0% – 100% using the following formula (Vreeman *et al*., 2015)

$$\frac{\textbf{Actual score- minimum possible score}}{\textbf{Maximum possible score- minimum possible score}} \times \textbf{100}$$

The scores for each attribute were categorized as poor (<50%), fair (50%-60%), Good (61%-80%), and very good > 80% (Vailaya *et al*., 2014).

Descriptive statistics for measuring the central tendency such as the mean and the median were used to describe normally distributed and skewed continuous variables respectively. Gaussian assumptions were assessed using Shapiro-Wilk test and using histograms. Frequencies and the corresponding percentages were used to summarize categorical variables.

The proportions, means, and medians were compared using Pearson's Chi Square test, independent samples t-test, and two sample Wilcoxon rank-sum test, respectively. We conducted Fisher's exact test whenever the Chi Square assumptions were violated.

Data analysis was stratified by the type of facility (County or sub-County hospital).

Data analysis was done using R: A language and environment for statistical computing (Team, 2016)

In the checklist, the framework for the assessment were the key components and tasks proposed as indicators in WHO consolidated Ebola preparedness checklist issued in January 2015 (WHO, 2015). Functionality of the tasks were scored using a scoring system used for assessing level of Ebola preparedness in South East Asia region (Vong *et al*., 2016).

Functionality of tasks were scored as follows

- ✓ No structure in place or activities not addressed (score 0)
- ✓ activities planned but not implemented (score 1)
- ✓ Activities in place but low evidence of functionality (score 2)
- ✓ Evidence of fully functional activities (score 3)

3.8.3 Data Presentation

Data was presented in tables and charts. Information generated was discussed in the report. For qualitative data, a summary of information was generated by constructs and illustrative quotes and presented in the results.

Table 1.5: Data Collection, Management and Analysis

	Quantitative	**Qualitative**
Tools	Interviewer administered Questionnaires	Key Informant Interviews in the health facilities
Data collection	Data was collected by the researcher and research assistants	Was collected by researcher and research assistants
Data management	-Training of research assistants -Pre testing the tools	-Training of research assistants -Pre testing the tools -Recording the data using recorders
Data analysis	Data entry done using excel and analysis using R soft ware	-Thematic analysis
Data presentation	Using tables and charts	Use of constructs and illustrative quotes

A summary table of data collection tools, data management, analysis and presentation of findings

3.9 Ethical Consideration

Approval was sought from Institutional Research And Ethics Committee (IREC) to carry out the study Permission was obtained from county governments of Busia County to conduct the study .

3.9.1 Respect of Persons

The participants were given an explanation on the purpose of the study. Those who agreed to participate in the study were given a consent form to read and sign.
The nature of participation was voluntary. No names were produced in analyzed information. Raw data was kept under lock and key.

3.9.2 Feedback

The report generated is to be presented for defense and then to the two Hospitals to enable them address the gaps that were identified in the study. I will also publish the study findings.

CHAPTER FOUR: RESULTS

4.1 Socio-demographic characteristics

Table 4.1: Socio-demographic characteristics

Characteristic	n 139	Mean (SD) or Median (IQR) or (%)
Age (Years), Mean (SD)		36.7 (8.5)
Range (Min., Max.)		23.0 – 59.0
Male, n (%)		46.0
Marital status, n (%)		
Single		29.5
Married		66.2
Widowed		4.3
Religion, n (%)		
Christians		92.1
Muslims		17.9
Profession, n (%)		
Nurse		61.8
Clinical officer		16.5
Laboratory technologist		13.6
Doctor		6.5
Public Health officer		1.4
Years of work in the health facility, Median (IQR)		5.0 (2.0, 9.0)
Range (Min., Max.)		0.1 – 30.0

A total of 139 participants aged 23.0 – 59.0 years were included in the study. The mean age was 36.7 (SD: 8.5). Up to 46.0% were male, 66.2% were married, and 92.1% were Christians.

The median duration of working in the health facility was 5.0 (IQR: 2.0, 9.0) years with a range of 0.1 – 30.0 years.

4.2 knowledge of HCPs on Ebola disease

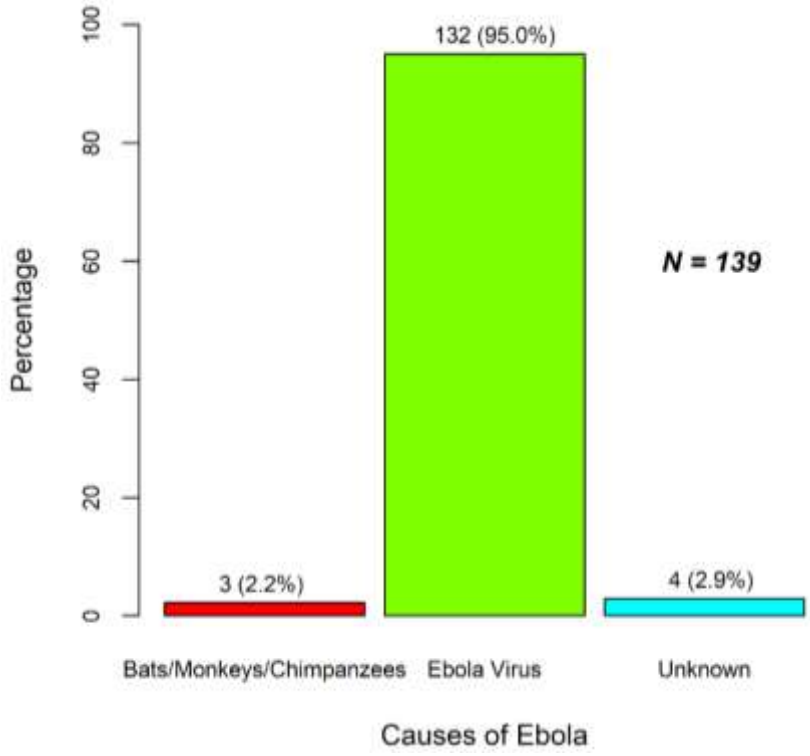

Figure 4.1: Knowledge on the causes of Ebola

Up to 95.0% of the participants knew that Ebola hemorrhagic fever was caused by the Ebola virus.

Table 4.2: Knowledge on the transmission of Ebola hemorrhagic fever

Mode of transmission	**Total** **n= 139** **%**	**Busia CH** **n=100** **%**	**Kocholia SCH** **n=39** **%**
Contact with body fluids	99.3	99.0	100
Contact with dead body	97.1	99.0	100
Contaminated equipments	89.2	88.0	92.3
Infected bush meat	73.4	75.0	69.2
Sexual intercourse	71.2	72.0	69.2
Knowledge on transmission	**81.3**	**83.0**	**76.9**

Respondents who knew three or more modes of transmission of Ebola were considered knowledgeable about the mode of transmission of Ebola. Based on this criteria 81.3% of the respondents understood the mode of transmission of the Ebola disease.

Table 4.3: Knowledge of persons at increased risk of contracting Ebola hemorrhagic Fever

Persons at risk of Ebola	**Total** **N=139** **%**	**Busia CH** **N=100** **%**	**Kocholia SCH** **N=39** **%**
Health workers	99.3	100	97.4
Hunters	68.6	74.5	53.8
Vetinary officers	71.4	75.3	61.1
Relatives in contact with patient	97.1	97.0	97.4
Travelers to endemic areas	93.2	95.7	87.2
Knowledge of at risk population	**72.7**	**75.0**	**66.7**

Health workers, any person who has been in contact with Ebola patients and travelers to Ebola epidemic areas were perceived to be the most at risk persons by 99.3%, 97.1% and 93.2% of the respondents respectively. The respondents who correctly specified at least three persons at increased risk of the Ebola hemorrhagic fever were considered knowledgeable. Based on this criteria, 72.7% of the respondents knew the persons who were at risk of contracting Ebola disease. When analysed by facility 75% of HCP were knowledgeable in Nusia County Hospital and 66.7% in Busia Sub-County Hospital

Table 4.4: Knowledge of Signs and symptoms of Ebola hemorrhagic fever

Signs and Symptoms	Total n=139 %	Busia CH n=100 %	Kocholia SCH n=39 %
Fever	95.0	94.0	97.4
Headache	86.2	81.8	97.4
Vomiting	77.0	73.0	87.2
Diarrhea	77.0	79.8	71.8
Sore throat	51.5	54.8	43.6
Cough	47.0	51.6	35.9
Intense fatigue/general weakness	94.9	95.0	94.7
Abdominal pain	61.6	62.6	59.0
Bleeding	98.6	99.0	97.4
Rash	56.5	65.7	59.0
Had knowledge on the symptoms of Ebola hemorrhagic fever	**64.7**	**67.0**	**59.0**

Knowledge on the signs and symptoms of Ebola hemorrhagic fever was assessed. The responses were as shown in Table 4.4.

The most common signs and symptoms that participants knew were; fever (95%), intense fatigue (94.9%), bleeding (98.6%), headache (86.2%), diarrhea (77.5%) and vomiting (77.0%). The respondents who were able to correctly specify more than six signs and symptoms of Ebola hemorrhagic fever were considered to be knowledgeable about the signs and symptoms of Ebola disease. The findings show that up to 64.7% of the respondents were able to correctly state more than six correct signs and symptoms of Ebola hemorrhagic fever.

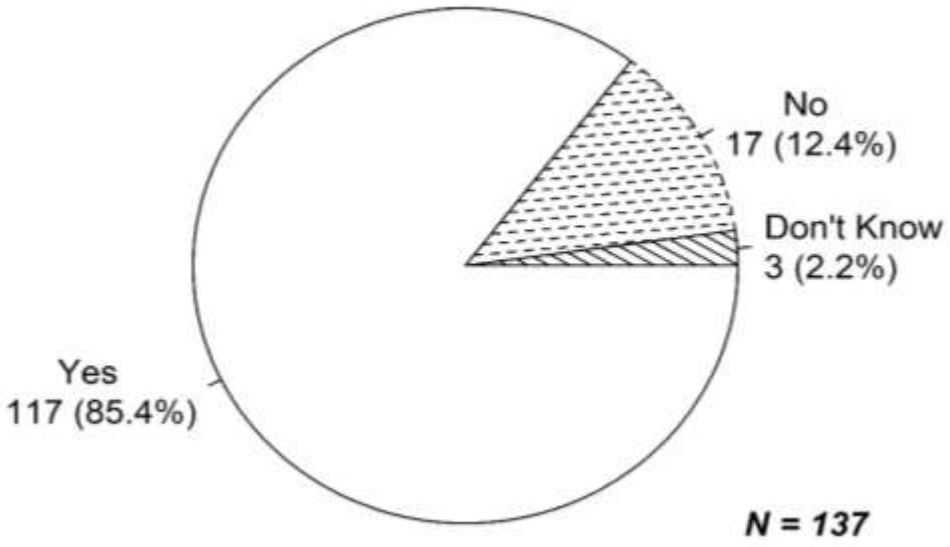

Figure 4.2: Knowledge on case definition for guidance on who meets the criteria as a person under investigation for Ebola hemorrhagic fever

Up to 85.4% had knowledge on how to define a case that meets the criteria as person under investigation for Ebola hemorrhagic fever. One of the key informant from Kocholia Sub County Hospital said, "*.....Ministry of Health has a list of notifiable diseases which can be of help in case of an outbreak of disease. Under the IDSR there is a list of notifiable diseases including Ebola with a case definition.....*" (HCP 10).

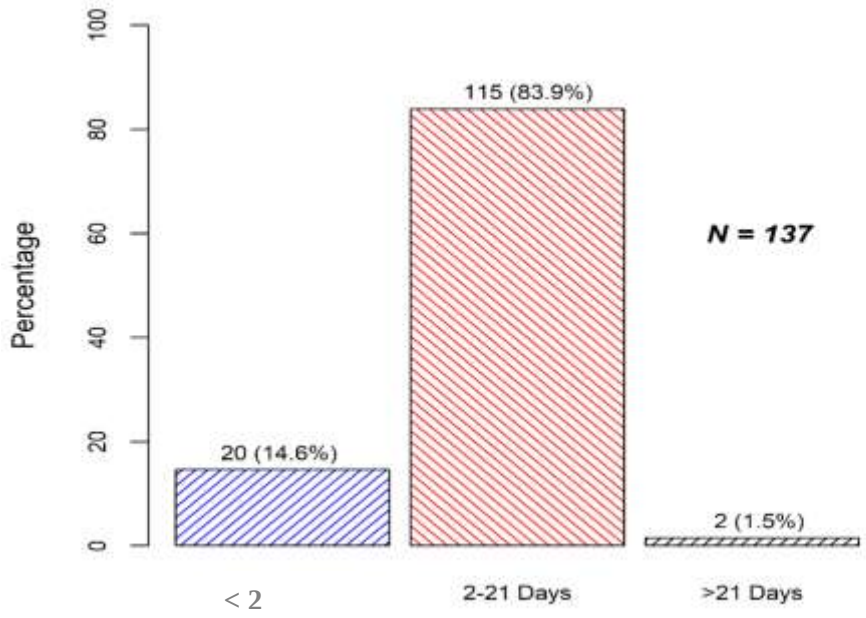

Figure 4.3: Knowledge of the incubation period of Ebola hemorrhagic fever

Majority of the participants (83.9%) correctly specified the incubation period for Ebola hemorrhagic fever. Knowledge about incubation period is important in early diagnosis of EVD and follow up of contact cases. HCPs who were knew the incubation period of EVD as 2-21 days were 82.7% in Busia County Hospital and 87.2% in Kocholia Sub County Hospital.

4. 2 Results on infection prevention and control Measures

IPC measures were assessed and results presented in table below.

Table 4.5- Measures to protect health care providers

Measures to protect health care providers	**Total n=139 %**	**Busia CH n=100 %**	**Kocholia SCH n=39 %**
Training on IPC	61.6	66.7	48.7
Training on donning and doffing of PPEs	35.6	43.5	18.8
Use of PPEs	96.4	97.0	94.9
PPEs in the hospital	0	0	0
IPC committee	50.0	61.6	20.5
SOPs on safe transport	57.2	53.5	66.7
Supplies for hand hygiene	75.4	67.7	94.9
SOPs on management of waste	53.6	54.5	51.3
Total score	**67.2**	**71.3**	**56.8**

Up to 61.6% of the respondents acknowledged that they have undergone training on infection prevention and control measures. Use of protective equipment when attending to patients was confirmed by 96.4% of the respondents.

Up to 35.6% of those who use protective equipment when attending to patients acknowledged that they have been trained on donning and doffing of the personal protective equipment. None of the respondents was able to correctly state all the required personal protective equipment.

Infection prevention committee was reported to be available by 50% of the participants but from the key informant interviews it was evident that there is no functional infection prevention committee though guidelines are there.

4.3 Results from KII on infection prevention and control

From the key informant interviews, it was clear that patients are not routinely screened for Hemorrhagic fevers. One key informant from Busia County Hospital said, " *we don't actively screen all patients but if the clinical officer suspects Ebola through history taking they can alert the team*". (HCP 8).

From the key informant interviews 3 staff from Kocholia sub County Hospital and 4 health providers from Busia County Hospital attended training and the rest were sensitized by the trained team through CMEs. One of the key informant from Busia County Hospital said, "*We have four health providers who have underwent training that consist of a consultant, medical officer, clinical officer and a nurse. They came and sensitized us.....*" (HCP 1)

Concerning infection prevention and control guidelines, one of the key informant from Busia County Hospital said, "*We use infection prevention guidelines from the national government but the issue is implementation because at the moment we have many challenges .....*". (HCP 7).

From the key informant interviews it was clear that there were no standard PPEs for Ebola and one key informant from Busia County Hospital said, "*.....we have the general PPEs like gloves and masks but we don't have standard PPEs for Ebola*". (HCP 7) Another key informant from Kocholia Sub County Hospital said "*... the few PPEs that we have are not in the hospital, they are kept at the disease surveillance office in the sub county.....*"(HCP 9)

4.4 Results on preparedness to respond to suspected Ebola cases

Table 4.6: Preparedness to respond to suspected Ebola cases

Preparedness to respond	**Total n=139 %**	**Busia CH n=100 %**	**Kocholia SCH n=39 %**
Ebola response team	36.2	49.5	2.6
Training on management of Ebola case	18.1	20.2	12.8
Preparedness plan for EVD	31.2	41.4	5.1
Disaster planning committee	58.1	64.3	42.1
SOPs on management of HCP who may accidentally get exposed	20.3	24.2	10.3
Essential drugs and non pharmaceuticals	25.4	20.2	38.5
Adequate staff to respond to epidemics	7.2	8.1	5.1
Communication	63.8	61.6	69.2
Drills done	13.0	16.2	5.1
Total score	**32**	**37.2**	**19.0**

The table presents the results on the capacity of the hospitals to respond to suspected Ebola cases. This was the perception of Health Providers on the capacity of the hospitals to respond to EVD.

Health care providers who reported to have been trained in management of Ebola case were 20.2% in Busia County Hospital and 12.8% in Kocholia Sub County Hospital.

In Busia County Hospital 41.4% of the HCPs and 5.1% of the HCPs in Kocholia Sub County Hospital reported that they had preparedness plan in the hospital. The reason for the low scores in both facilities was attributed to the fact that the disaster

preparedness committee was not active and they had not met to prepare a plan for Ebola virus disease.

Adequate staff is crucial to responding to disease outbreaks. In Busia County Hospital 91.9% of the HCPS reported that they have inadequate staff to respond in case of Ebola outbreak and in Kocholia Sub County Hospital 94.9% of the HCPs reported that they had inadequate staff.

Communication during disease outbreaks is important part of response. The HCPs who reported that they have mechanism in place for rapid communication incase of Ebola outbreak were 61.6% in Busia County Hospital and 69.2% in Kocholia Sub County Hospital.

Drills with simulated patients helps to test the preparedness of health care providers and the capacity of the hospital in responding to disease outbreaks. The health care providers who reported that they have had drills in the hospital were 16.2% in Busia County Hospital and 5.1% in Kocholia Sub County Hospital.

4.5 Results from KII on preparedness to respond to EVD

Most of the respondents said that Ebola response team was available in the hospital though from the key informant interviews and the checklist, it was Evident that the team is not active. one of the key informant from Busia county hospital said, " *The team was formed but it's not active....*" (HCP 7). Another key informant from Kocholia Sub County Hospital said " *No we don't have Ebola response team. I don't want to be part of that team because Ebola is highly infectious disease and we are not prepared to handle the disease".* (HCP 6).

A few of the respondents said that they had been trained on the management of a person under investigation for Ebola. From the two hospitals few health workers were

trained. One Key informant from Busia County Hospital reported that "*We have inadequate staff that have not been trained but have been sensitized about Ebola through CMEs. We have 4 who have undergone training who consist of a consultant, Medical Officer, clinical officer and nurse. They came and sensitized us.*"(HCP 1).

Some of the participants acknowledged that the facility had a preparedness plan for Ebola hemorrhagic fever. One of the key informant from Kocholia Sub County Hospital said, "*In Kenya just like it could happen elsewhere, I think plans are made once we're faced with the outbreak itself. Maybe there are funds at the county level for such emergencies."* (HCP 6). This concurs with the findings on the checklist that there was no preparedness plan for EVD.

According to some of the respondents, the hospital had isolation rooms for suspected Ebola cases. From the checklist, it was evident that Busia County Hospital had a tent that had been constructed during Ebola outbreak in West Africa in 2014 but it was incomplete with no beds, no water, and no electricity while Kocholia sub- County Hospital had no isolation room.

Some of the respondents reported that there were guidelines for monitoring and management of health care providers who may accidentally get exposed to Ebola case. But from key informant interviews most health providers were not willing to work in the hospital in case of Ebola disease outbreak. One of the key informant from Busia County Hospital said, " *We have only three staff who trained on management of Ebola..... If a patient came to this hospital with suspected Ebola, honestly I will not come to work and risk my life.*" (HCP 7)

One of the key informant from Busia County Hospital said "*There are challenges with essential drugs and PPEs. It's during the outbreaks that from Afya House we are given stock. We have inadequate supplies.*" (HCP 3).

From the key informant interviews it was evident that drills had not been done in the hospital. One of the key informant from Busia County Hospital said "*No, I have not participated in any drill in the hospital. You know Ebola is an emerging highly infectious disease but has never occurred in Kenya, so we have never prioritized it.*" (HCP 2)

Concerning referral of patients, the hospitals have referral guidelines but the challenge is that these health facilities have not trained their ambulance drivers as it was evident from the checklist. One key informant from Kocholia Sub County Hospital said, "*Yes we have guidelines on how referrals should be done but I don't think the drivers are trained on specific disease so that in case they are transporting suspected cases they would be at risk.*" (HCP 10)

According to key informant from Busia County hospital HCP 1 " *We have inadequate staff who have not been trained but have been sensitized about Ebola through CMEs. We have 4 who have underwent training who consist of a consultant, Medical Officer, clinical officer and nurse. They came and sensitized us*".

EBOLA PREPAREDNESS CHECKLIST

The check list was used to confirm whether the minimum requirements of a hospital had been implemented by the two hospitals and the table below shows the findings. The check list was adopted from consolidated Ebola preparedness checklist, (WHO 2015)

Table 4.7 Ebola preparedness checklist

Elements	Minimum requirements	Busia	Kocholia
1. Coordination	a. plans for coordination	2	2
	b .coordination tested through drills	0	0
	c. contingency plans available	0	0
	d. policy in place	1	0
2.Rapid response teams	a. Team leader identified	1	1
	b. Team has an ambulance	0	0
	c. Responsibilities assigned to members	0	0
	d. Training of RRT		
	➢ Case management	2	2
	➢ Specimen collection	1	1
	➢ Contact tracing	2	2
	➢ Outbreak investigation	2	2
	➢ Decontamination	2	2
3.Public awareness and community engagement	a. Plan for engaging with media and public	1	1
	b. Functional communication mechanism for engaging all stakeholders	0	1
	c. Risk communication plan	0	0
	d. Targeted messages for health workers	2	2
4. Infection prevention and control	a. IPC guidelines and SOPs	2	2
	b. Health facility provided with	3	1
	➢ Running water	3	2
	➢ Hygiene and sanitation supplies	3	3
	➢ Disinfectants	0	0
	➢ PPEs		
	c. Training on IPC	2	1
	➢ Health providers		
	➢ Cleaners	0	0
	d. Isolation units	1	0
5a. Case	a. Adequate PPEs	1	1

management	b. Training on EVD management	2	2
	c. Training of ambulance drivers	0	0
	d. Resources for isolation unit	3	0
5b. safe and dignified burials	a. SOPs for safe burials	0	0
	b. Trained burial team	0	0
	c.Appropriate burial ground	0	0
6. Epidemiological surveillance	a. 24/7 hotline or emergency numbers	1	1
	b. Guidance on surveillance	3	3
	c. Case definition for EVD	3	3
	d. Investigation forms	2	2
	e. Surveillance system in place	3	3
	f. Lines of reporting for EVD	3	3
7. Laboratory	a. National referral laboratory for handling specimens and analysis. b. Protocol for specimen collection and shipment to designated reference laboratory.	3 3	3 3
	c. Laboratory personnel are trained on safety procedures d. IPC for specimen collection.	2	1
	e. Packaging labeling.	2	2
	f. Certificate for handling infectious substances.	3	0
8. Logistics	a. Storage capacities evaluated (Stock pile in place). b. Efficient stock pile management. c. Transport requirements for personnel and goods : d. Reliable sample transport mechanism. e. Isolation structures. f. Training of human resources (Drivers, safe burial teams, security, administration, procurement, store keeper). g. Mapping of all available resources including locations. h. Suppliers of standard essential items	1 0 0 0 1 0 0 2	1 0 0 0 0 0 0 1

	identified.	0	0
	TOTAL SCORE	61	48

Actual score- minimum possible score × 100

Maximum possible score- minimum possible score

Busia County Hospital

61/150*100 = 41%

Kocholia Sub County Hospital

48/150* 100 = 32%

The observational checklist was used to confirm whether the minimum requirements proposed by WHO had been implemented. There was a gap between the response of health providers and what was in place in the two health facilities. The scores of preparedness according to health providers perception was 37.2% for Busia County hospital and 19% for Kocholia Sub County hospital. In the checklist the scores were 41% for Busia CH and 32% for Kocholia SCH.

The scores for each attribute were categorized as poor (<50%), fair (50%-60%), Good (61%-80%), and very good > 80% (Vailaya *et al*., 2014). Using this criteria on preparedness, both facilities had poor level of preparedness with regard to response to EVD. Both facilities scored less than 50%.

Table 4.8: Preparedness for Ebola disease

		Mean (SD)		
	N	Total (n=139)	Busia (n=100)	Kocholia n=39)
Knowledge of Ebola disease	139	78.0 (21.2)	79.6 (21.7)	73.7 (19.6)
Range (Min. – Max.)		0.0 – 100.0	0.0 – 100.0	25.0 – 100.0
Poor (< 50%)		8 (5.8%)	5 (5.0%)	3 (7.7%)
Average (50% – 60%)		12 (8.6%)	8 (8.0%)	4 (10.3%)
Good (60% – 80%)		49 (35.3%)	32 (32.0%)	17 (43.6%)
Very Good (> 80%)		70 (50.4%)	55 (55.0%)	15 (38.5%)
Health Measures to protect healthcare providers	139	67.2 (21.3)	†71.3 (20.8)	56.8 (19.2)
Range (Min. – Max.)		14.3 – 100.0	14.3 – 100.0	14.3 – 100.0
Poor (< 50%)		28 (20.3%)	16 (16.2%)	12 (30.8%)
Average (50% – 60%)		29 (21.0%)	17 (17.2%)	12 (30.8%)
Good (60% – 80%)		36 (26.1%)	24 (24.2%)	12 (30.8%)
Very Good (> 80%)		45 (32.6%)	42 (42.4%)	3 (7.7%)
Preparedness to handle suspected Ebola case	139	32.0 (22.2)	†37.2 (22.9)	19.0 (13.7)
Range (Min. – Max.)		0.0 – 100.0	0.0 – 100.0	0.0 – 50.0
Poor (< 50%)		97 (70.3%)	59 (59.6%)	38 (97.4%)
Average (50% – 60%)		19 (13.8%)	18 (18.2%)	1 (2.6%)
Good (60% – 80%)		20 (14.5%)	20 (20.2%)	0 (0.0%)
Very Good (> 80%)		2 (1.4%)	2 (2.0%)	0 (0.0%)

*** Based on knowledge, health measures to protect the health care providers, and preparedness to respond to suspected Ebola cases**

Overall, the average score for knowledge to handle suspected Ebola case was 78.0 (SD: 21.2) with similar averages for the two facilities, Busia: 79.6 (SD: 21.7), and Kocholia: 73.7 (SD: 19.6).

The overall mean for the score of infection prevention and control measures for the protection of healthcare providers was 67.2 (SD: 21.3). Analysis of this score by

health facility showed that Busia County Hospital had a score of 71.3 (SD:20.8) and Kocholia Sub-County Hospital had a score of 56.8 (SD: 19.2).

Overall, the average score for the preparedness to respond to suspected Ebola case was 32.0 (SD: 22.2) . Analysis of the score by the health facilities showed that Busia County Hospital had a score of 37.2 (SD: 22.9), and Kocholia sub-County Hospital had a mean (SD): 19.0 (SD: 13.7).

The level of preparedness stratified by the cadre was assessed as shown in Table 14.

Table 4.9 : Level of preparedness by profession

	Nurse n = 88	CO n = 23	Lab Tech. n = 18	Doctor n= 8	PHO n = 2
Knowledge of Ebola disease					
a Mean (SD)	74.9 (21.1)	84.2 (19.7)	85.4 (20.2)	84.4 (16.0)	50.0 (35.4)
Poor (< 50%)	5 (5.7%)	1 (4.3%)	1 (5.6%)	0 (0.0%)	1 (50.0%)
Average (50% – 60%)	9 (10.2%)	2 (8.7%)	0 (0.0%)	1 (12.5%)	0 (0.0%)
Good (60% – 80%)	36 (40.9%)	5 (21.7%)	6 (33.3%)	1 (12.5%)	1 (50.0%)
Very Good (> 80%)	38 (43.2%)	15 (65.2%)	11 (61.1%)	6 (75.0%)	0 (0.0%)
Health measures to protect healthcare providers₮					
a Mean (SD)	†65.5 (21.7)	64.6 (14.2)	78.6 (23.1)	69.6 (26.6)	57.1 (0.0)
Poor (< 50%)	20 (23.0%)	4 (17.4%)	2(11.1%)	2 (25.0%)	0 (0.0%)
*Average (50% – 60%)	16 (18.4%)	7 (30.4%)	4 (22.2%)	0 (0.0%)	2 (100.0%)
Good (60% – 80%)	25 (28.7%)	8 (34.8%)	1 (5.6%)	2 (25.0%)	0 (0.0%)
*Very Good (> 80%)	26 (29.9%)	4 (17.4%)	11 (61.1%)	4 (50.0%)	0 (0.0%)
Preparedness to respond to suspected Ebola cases₮					
a Mean (SD)	†34.7 (24.1)	26.1 (14.4)	33.9 (21.2)	20.0 (17.7)	15.0 (7.1)
*Poor (< 50%)	56 (64.4%)	21 (91.3%)	11 (61.1%)	7 (87.5%)	2 (100.0%)
Average (50% – 60%)	13 (14.9%)	2 (8.7%)	4 (22.2%)	0 (0.0%)	0 (0.0%)
Good (60% – 80%)	16 (18.4%)	0 (0.0%)	3 (16.7%)	1 (12.5%)	0 (0.0%)
Very Good (> 80%)	2 (2.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Overall preparedness					
a Mean (SD)	58.0 (17.9)	58.3 (10.5)	66.0 (16.6)	58.0 (13.6)	40.7 (9.4)
Poor (< 50%)	26 (29.5%)	5 (21.7%)	5 (27.8%)	2 (25.0%)	2 (100.0%)
*Average (50% – 60%)	18 (20.5%)	9 (39.1%)	0 (0.0%)	1 (12.5%)	0 (0.0%)
Good (60% – 80%)	35 (39.8%)	9 (39.1%)	9 (50.0%)	5 (62.5%)	0 (0.0%)
Very Good (> 80%)	9 (10.2%)	0 (0.0%)	4 (22.2%)	0 (0.0%)	0 (0.0%)

CO – Clinical Officer; Lab Tech. – Laboratory Technologist. PHO – Public Health Officer;

Fisher's exact test was used to compare categorical variables There was no evidence of difference in the average knowledge on Ebola disease scores, health measures to

protect healthcare providers scores, preparedness to respond to suspected Ebola cases scores, and overall preparedness scores by cadre (p-value>0.05).

The average knowledge score for the nurses, clinical officers, lab technologists, and doctors were good (>60%). More than 80% of the nurses, 86.9% of the clinical officers, 94.4% of the lab technologists, and 87.5% of the doctors had very good level of knowledge (knowledge score more than 80%). The overall preparedness scores were similar across the cadres (p>0.05).

Table 4.10: Level of preparedness by gender

	Male n = 64	Female n = 75	p-value
Knowledge of Ebola disease			
Mean (SD)	81.1 (18.9)	75.3 (22.8)	0.108t
Poor (< 50%)	3 (4.7%)	5 (6.7%)	0.726f
Average (50% – 60%)	4 (6.2%)	8 (10.7%)	0.385f
Good (60% – 80%)	20 (31.2%)	29 (38.7%)	0.379f
Very Good (> 80%)	37 (57.8%)	33 (44.0%)	0.126f
Health measures to protect healthcare providers			
Mean (SD)	70.3 (19.9)	†64.5 (22.2)	0.106t
Poor (< 50%)	9 (14.1%)	19 (25.7%)	0.136f
Average (50% – 60%)	15 (23.4%)	14 (18.9%)	0.537f
Good (60% – 80%)	17 (26.6%)	19 (25.7%)	>0.999f
Very Good (> 80%)	23 (35.9%)	22 (29.7%)	0.470f
Preparedness to respond to suspected Ebola cases			
Mean (SD)	29.5 (20.7)	†34.2 (23.4)	0.217t
Poor (< 50%)	46 (71.9%)	51 (68.9%)	0.714f
Average (50% – 60%)	10 (15.6%)	9 (12.2%)	0.625f
Good (60% – 80%)	8 (12.5%)	12 (16.2%)	0.631f
Very Good (> 80%)	0 (0.0%)	2 (2.7%)	0.499f
Overall preparedness			
Mean (SD)	60.3 (14.5)	57.6 (18.2)	0.326t
Poor (< 50%)	18 (28.1%)	22 (29.3%)	>0.999f
Average (50% – 60%)	10 (15.6%)	18 (24.0%)	0.289f
Good (60% – 80%)	29 (45.3%)	29 (38.7%)	0.491f
Very Good (> 80%)	7 (10.9%)	6 (8.0%)	0.574f

† N = 74; t Independent samples t-test; f Fisher's Exact test

There was no evidence of a difference in the average score for knowledge on the Ebola disease between the male and the female respondents, Male: 81.1 (SD: 18.9) vs. Female: 75.3 (SD: 22.8), p-value = 0.108.

There was no evidence either for a difference in the proportion of male and female respondents who had scores <50%, 50-60%, 60-80%, and >80% for knowledge (p-value>0.05), health measures to protect the healthcare providers (p-value>0.05), for the preparedness to respond to suspected Ebola cases (p-value>0.05), and for overall preparedness (p-value>0.05).

Table 4.11 : Level of preparedness by years of service

	Level of experience		
	≤ 5 years N = 79	> 5 years N = 60	p-value
Knowledge of Ebola disease			
Mean (SD)	73.4 (23.2)	84.0 (16.6)	0.002t
Poor (< 50%)	7 (8.9%)	1 (1.7%)	0.138f
Average (50% – 60%)	9 (11.4%)	3 (5.0%)	0.232f
Good (60% – 80%)	30 (38.0%)	19 (31.7%)	0.477f
Very Good (> 80%)	33 (41.8%)	37 (61.7%)	0.026f
Health measures to protect healthcare providers			
Mean (SD)	†63.0 (23.1)	72.5 (17.5)	0.006t
Poor (< 50%)	23 (29.5%)	5 (8.3%)	0.002f
Average (50% – 60%)	16 (20.5%)	13 (21.7%)	>0.999f
Good (60% – 80%)	16 (20.5%)	20 (33.3%)	0.118f
Very Good (> 80%)	23 (29.5%)	22 (36.7%)	0.464f
Preparedness to respond to suspected Ebola cases			
Mean (SD)	†24.6 (16.9)	41.7 (24.6)	<0.001t
Poor (< 50%)	67 (85.9%)	30 (50.0%)	<0.001f
Average (50% – 60%)	9 (11.5%)	10 (16.7%)	0.458f
Good (60% – 80%)	2 (2.6%)	18 (30.0%)	<0.001f
Very Good (> 80%)	0 (0.0%)	2 (3.3%)	0.187f
Overall preparedness			
Mean (SD)	53.3 (15.4)	66.1 (15.4)	<0.001t
Poor (< 50%)	30 (38.0%)	10 (16.7%)	0.008f
Average (50% – 60%)	18 (22.8%)	10 (16.7%)	0.402f
Good (60% – 80%)	30 (38.0%)	28 (46.7%)	0.385f
Very Good (> 80%)	1 (1.3%)	12 (20.0%)	<0.001f

† N = 78; t Independent samples t-test; f Fisher's Exact test

The average score for knowledge of Ebola disease was significantly high among the respondents with more than 5 years of experience, 26.9 (SD: 5.3) compared to those who had five years or less work experience, 23.5 (SD: 7.4), p-value = 0.002. The findings further show that A significantly higher proportion of the respondents with

>5 years of experience had very good knowledge compared to those ≤5 years, 61.7% vs. 41.8%, p = 0.026.

The average score for the health measures to protect the healthcare providers from Ebola disease was significantly high among the respondents with >5 years of work experience, 72.5(SD: 17.5) compared to those who had ≤5 years of work experience, 63.0 (SD: 23.1), p-value = 0.006. The results further show that the proportion of the respondents who had the health measures score that was < 50% among those with ≤5 years of work experience was significantly high (29.5%) compared to those with >5 years of work experience (8.3%), p-value = 0.002.

CHAPTER FIVE: DISCUSSION

5.1 Discussion

This chapter is about discussion of study findings and comparing them with other studies that have been done.

5.1.1 Knowledge of HCPs on Ebola disease

In this study, 95% of the health care providers knew the cause of Ebola disease to be Ebola virus. This corresponds to a study done in Ghana which demonstrated that 83.2% of Health care providers knew that Ebola Virus was the cause of Ebola Viral disease (Annan *et al.*, 2017). A similar study done in Lahore Medical School in India showed that 78.4% of participants correctly identified the cause of Ebola disease (Rabiah *et al.*, 2015). Knowledge on the cause of Ebola viral disease is vital in early diagnosis of the disease and timely response to the outbreak.

A study in Gondar University Hospital in Ethiopia showed that 86.2% of health care providers were aware about mode of Ebola transmission (Abebe et al., 2016). This is consistent with findings from this study in which 81.3% of the health care providers understood mode of transmission of Ebola disease.

In this study, majority of the respondents (99.3%) were aware that health workers were the most at risk population. Travelers to endemic areas were also at risk (97.1%). The overall score for at risk population was (72.7%). Previous studies have demonstrated that hospitals have amplified Ebola outbreaks due to inadequate infection prevention and control and this affects health seeking behavior of affected communities. A study done in Sierra Leone on social and emotional impact of delivering health services during Ebola epidemic, respondents described how community members attacked health providers because they thought they were

injecting them with Ebola virus and selling their bodies for financial gain (Abebe *et al.,* 2016).

The study findings show that 64.7% of the respondents were able to correctly state signs and symptoms of Ebola. The commonest symptom known by the respondents were fever, general body weakness and hemorrhage (98.6%), though recent studies shows that not all Ebola cases end up with Hemorrhage (Baize *et al.,* 2014) therefore clinicians should use high index of suspicion if there are more cases presenting with similar symptoms and not responding to usual treatment of illnesses associated with fever in the area.

Ebola Virus has an incubation period of 2 to 21 days. This study findings show that (83.9%) of all health care providers correctly stated the incubation period. A similar study done in Nigeria in 2014 to assess gaps in knowledge and practice among health care providers show that (77.7%) of the respondents were aware of the incubation period of Ebola disease. Knowledge on incubation period is important in early diagnosis of Ebola through contact tracing and follow up of the contacts for the specified time frame (Oladimeji *et al.,* 2015). Due to the incubation period of 2-21 days a person can contract Ebola virus and move to other regions or countries without showing signs and symptoms of the disease hence many people may be at risk of the disease through contact with the case.

Ebola hemorrhagic fever is one of the notifiable diseases under Integrated Disease Surveillance and Response (IDSR). Notification of the local, regional and national authorities should be done once Ebola is suspected in the country. Once the epidemic is confirmed WHO should be notified concerning the disease outbreak. This is a requirement under International Health Regulation (WHO, 2008). In this study,

(80.4%) of the health care providers were familiar with protocols for notifying designated points of contact regarding patients under investigation for Ebola viral disease. This is similar to study by (Fauci , 2014).

5.1.2 Infection Prevention and Control Measures

The role of infection prevention and control is to reduce transmission of nosocomial infections and therefore, enhance safety to health care workers and patients. EVD constitutes a major occupational risk to health workers especially in hospitals with inadequate infection prevention coupled with low index of suspicion among clinicians (Oladimeji *et al.*, 2015).

A study done by (Cooper *et al*., 2016) showed that during EVD outbreak in 2013-2014 in west Africa, infection prevention and control was not practiced and this led to amplification of the disease outbreak in the health facilities. From this study, (61.6%) of the health care providers had been trained on infection prevention and control mainly through continuous medical education. In the era of emerging infectious diseases hospitals should focus on training all health providers on infection prevention and control in order to minimize transmission of diseases in health facilities.

Personal protective equipments are important when attending to patients suspected with highly infectious diseases like Ebola. CDC gave PPEs guidelines in 2014 to be used when attending to suspected Ebola cases which were: Surgical hoods (to cover head and neck), Face shield / Goggles, Respirators (N95 or Powered air purifying respirator), Double gloves, Disposable impermeable gown, Boot covers and water proof aprons. In this study, none of the participants correctly stated all the PPEs required. This could be attributed to the fact that the hospital has never experienced Ebola outbreak. In addition the required PPE's were not available in the hospital at the

time of study. A study done in Liberia showed that practicing infection prevention in the absence of adequate PPE is very difficult. This contributes to Ebola transmission in health care setting (Cooper *et al.*, 2016).

In this study, (35.6%) of the health care providers reported to have been trained on Donning and Doffing of PPE's. Donning and Doffing of PPE's is a complex procedure and self-contamination of exposed areas is common during Doffing. The training of health providers emphasizes the 'buddy' system where a supervisor ensures that health workers Donn and doff PPEs correctly to avoid self-contamination (Sims *et al.*, 2016). Regular training of health care providers is important to reduce infection rate among health care providers.

Community involvement is an important aspect of interrupting disease transmission in the community. A study done by Marais *et al.*, 2016, showed that the gap in Ebola control was due to failure to apply the principles of health promotion that is; early and active community engagement through community focal persons to help inform them about the disease and how to control. Adherence to standard infection prevention and control is important in infectious disease prevention but in a community set up more success can be achieved by combining their knowledge and experience with the medical aspect of disease control, (Gray *et al*., 2015). In this study community health workers act as an important link between the hospitals and communities and they have the responsibility to sensitize them about diseases. One of the key informant said " The community health workers act as a linkage between the hospital and community. They go up to the household level and they sensitize the communities about the disease outbreaks". HCP 5

5.1.3 Preparedness to respond to suspected Ebola cases

A study done in Ghana by (Annan *et al.*, 2017) showed that (92%) of the health care providers had not been adequately trained to handle a suspected case of Ebola disease. This is similar to this study which showed that (81.9%) of the health workers in two hospitals had not been trained to manage suspected Ebola case. Training of hospital staff is an important requirement to ensure an effective medical response to an epidemic, as shown in Nigeria where Ebola was contained in a short period of time. This was attributed to trained health providers and robust surveillance system and contact tracing (Oladimeji *et al.*, 2015).

To be prepared for any disease outbreak, a hospital should have emergency preparedness committee responsible for developing hospital preparedness and response plan. In this study, (58.1%) of health workers reported that they had disaster planning committee though one of the key informant from Busia County Hospital said, "..... *we have heard about the disaster planning committee but it is not active* ...." (HCP 7) and from my checklist it was evident that there was no emergency preparedness committee in both hospitals at the time of this study. This is contrary to a study by (Hewlett *et al.*, 2015)

Isolation is a key public health measure in control and prevention of transmission of highly infectious diseases. Although (47.8%) of health care providers reported that there were isolation rooms for suspected Ebola cases, none of the isolation facilities was functional. This is because they did not meet the minimum requirement of an isolation unit in which patient care rooms have specific features to enable health care providers to deliver standard care. Kocholia Sub County Hospital did not have an isolation unit while Busia County Hospital had a temporary tent designated for isolation of suspected cases but did not meet the minimum requirements of an

isolation unit. The isolation unit was incomplete with no water, electricity and beds. This is contrary to (Hewlett *et al.*, 2015), where by the isolation unit is required to have staff changing rooms and PPE's storage rooms. Patient care rooms are also constructed with seamless surfaces to facilitate surface disinfection. They should be located in secured areas separate from normal patient care areas in order to maintain safety of staff and other patients.

A survey of Arizona Emergency Department Hospital on preparedness for possible introduction of Ebola, (40%) of health care providers reported that they had protocol for exposed health providers, (Deluca *et al*., 2015). This is higher than the response of health providers in Busia county where (20%) of health care providers reported that there were protocols in place for monitoring and management of health workers who may accidentally get exposed to Ebola

According to WHO 2014, hospitals should ensure that epidemic management committees and rapid response teams are functional during pre-epidemic phase. This advice has not been adopted in the hospitals under this study. 36.2% of the respondents reported that they had Ebola response team but in my checklist there was no evidence that this response team had been formed. This is contrary to a study done by Marston *et al*., 2017.

According to Sims *et al*., 2016, prior to Ebola outbreak, hospitals should have stock piles of essential medicine and PPEs required for patient care and Epidemiological investigation but in this study only 25.4% of the respondents reported that the hospital had adequate supply of essential drugs but there was no stock pile of PPEs.

Community participation in preparedness for Ebola viral disease is important. A study done by (Marais *et al.*, 2016) showed that; although adherence to standard infection

prevention and control precautions and safety standards is critical, more success can be achieved by combining knowledge and experience of community members with that of IPC teams. In this study it was evident that community sensitization is done through chief's barazas and also through community health workers.

5.2 Limitation of the study

- Reliable on information from health care providers and they may have exaggerated/underreported
- The study was a cross-sectional study and correctly the preparedness level may have changed
- The study was hospital based and the assessment of points of entry was not included

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study provided levels of preparedness for Ebola virus disease in Busia County Hospital and Kocholia Sub County Hospital.

6.1.1 Knowledge of HCPs on Ebola disease

The average score for knowledge to handle suspected Ebola case was good, 78.0% (SD: 21.2) with similar averages for the two facilities, Busia: 79.6% (SD: 21.7), and Kocholia: 73.7% (SD: 19.6).

6.1.2 Infection prevention and control measures

The overall score of healthcare measures for infection prevention and control was good at 67.2% (SD: 21.3). The level of preparedness in Busia County Hospital was good at 71.3% while Kocholia Sub County hospital was fair at 56.8%

6.1.3 Preparedness to respond to Ebola

The score for the preparedness to respond to suspected Ebola case was poor at 32.0 % (SD: 22.2). Analysis of the score stratified by the health facility showed that the level of preparedness in Busia County hospital was poor at 37.2% and Kocholia Sub County Hospital was at 19.0%. Using the checklist on the capacity of the hospitals the scores were poor at 41% and 32% respectively for the two health facilities

There were gaps identified in the Ebola preparedness checklist which need to be addressed to ensure functionality of key components.

6.2 Recommendation

6.2.1Knowledge of HCPs on Ebola disease

- The Ministry of Health in the County Government should coordinate the training of health care workers on Ebola disease.
- Continuous Medical Education should be organized by Ebola Response Teams in order to update Health workers on early detection and management of EVD.

6.2.2 Infection prevention and control measures

- Infection prevention committee should organize for training of Health Care Providers on infection prevention and control.
- Both hospitals should have infection prevention committee to oversee the implementation of infection prevention and control guidelines.
- The Ministry of Health in collaboration with the County government should ensure that both hospitals have adequate supply of standard PPEs as recommended by CDC.
- Training of all health providers on donning and doffing of PPEs should be organized by the Ministry of Health in the County government.

6.2.3 Preparedness to respond to suspected Ebola cases

- Both facilities should have Ebola response teams which will help in preparing a preparedness plan for the hospital.
- The hospital management should ensure that they have functional isolation rooms to ensure that suspected Ebola cases are isolated to avoid amplification of the disease.
- Drills should be done at least yearly to test the preparedness plans.

6.3 Further Research

- There is need for more research on the level of preparedness for EVD in other hospitals in the rest of the country.

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APPENDICES

Appendix 1: Consent Form

ASSESSMENT OF THE LEVEL OF PREPAREDNESS FOR EBOLA HEMORRHAGIC FEVER IN BUSIA COUNTY.

You are requested to participate in a research study on assessment of the level of preparedness towards Ebola Hemorrhagic Fever in Busia County. This is a study conducted by a master's student in Moi University, College of Health Sciences, School of Public Health, Department of Epidemiology and Disease Control.

The purpose of this study is to assess whether the health facilities are prepared in case of an outbreak of Ebola.

Procedures of the study

if you agree to participate in this study, you will be given a questionnaire to fill information needed or participate in key informant interviews.

Voluntary nature of participation

Participation in this study is voluntary. You shall not be penalized if you do not participate in the study, your decision will be respected.

Confidentiality of the information

Information given will be treated as confidential and will be used for the purpose of this study. Your names will not be used on the questionnaires.

Benefits associated with participating in the study

The study findings will help the health facilities to know their level of preparedness in how to detect, protect and to respond to suspected case of Ebola Hemorrhagic Fever in Busia County

Participant's consent

I have read and understood the information above and by signing below, I consent to participate in the study

Participant's name..... signature..... Date.....

Name of the staff obtaining the consent..... signature..... Date.....

Appendix 2: Questionnaire

"ASSESSMENT OF THE LEVEL OF PREPAREDNESS FOR EBOLA HEMORRHAGIC FEVER IN HEALTH FACILITIES IN BUSIA COUNTY"

Melly Jepkosgei is a student from Moi University, School of Public Health, and College of Health Sciences pursuing master's in public health and am conducting a study on Assessment of the Level of Preparedness for Ebola Hemorrhagic Fever.

Information provided will be confidential and will be used for academic purposes. The questionnaire may be completed by the respondents alone or with assistance of the researcher or research assistant

No.

Sub-County Busia County Hospital / Kocholia Sub-County Hospital

Name of health facility Busia County Hospital

SECTION A. SOCIO DEMOGRAPHICS

1. Age (in years) .....
2. Gender Male [ ] Female [ ]
3. Marital status

   Single [ ] Married [ ] Widowed [ ]
   Divorced [ ]
4. Religion

   Christian [ ] Muslim [ ] other, (specify).....
5. Profession

   Doctor [ ] Clinical Officer [ ] Nurse [ ]

   Public Health Officer [ ] Laboratory Technologist [ ]

Department .....

6. Number of years you have worked in the health facility.....

SECTION B. KNOWLEDGE ON DETECTION OF EBOLA HEMORRHAGIC FEVER

This section is designed to explore knowledge related to early detection of Ebola Hemorrhagic Fever. **Please tick the appropriate answer**

1. What causes Ebola Hemorrhagic Fever? (**Tick (√) One**)
    a. Ebola Virus [ ]
    b. Bats / Monkeys / Chimpanzees [ ]
    c. Unknown [ ]

2. How is Ebola transmitted? **(Tick (√) the appropriate answers)**
    a. Contact with body fluids of infected person [ ]
    b. Contact with dead Ebola patient [ ]
    c. Contaminated medical equipment [ ]
    d. Eating bush meat infected with Ebola [ ]
    e. Through sexual intercourse [ ]
    f. Don't know [ ]

3. Who are at risk of getting Ebola Hemorrhagic Fever? **(Tick (√) the appropriate answers)**
    a. Health workers.....Yes [ ] No [ ] Don't Know [ ]
    b. Hunters Yes [ ] No [ ] Don't Know [ ]
    c. Veterinarians Yes [ ] No [ ] Don't Know [ ]
    d. Any person who has been in contact with Ebola patients? Yes [ ] No [ ] Don't Know [ ]
    e. Travelers to epidemic areas Yes [ ] No [ ] Don't Know [ ]

4. What are the signs and Symptoms of Ebola Hemorrhagic Fever? **(Tick (√) the appropriate answers).**

   a. Fever Yes [ ] No [ ] Don't Know [ ]
   b. Headache Yes [ ] No [ ] Don't Know [ ]
   c. Vomiting Yes [ ] No [ ] Don't Know [ ]
   d. Diarrhea Yes [ ] No [ ] Don't Know [ ]
   e. Sore throat Yes [ ] No [ ] Don't Know [ ]
   f. Cough Yes [ ] No [ ] Don't Know [ ]
   g. Intense fatigue/general weakness Yes [ ] No [ ] Don't Know [ ]
   h. Abdominal Pain Yes [ ] No [ ] Don't Know [ ]
   i. Bleeding Yes [ ] No [ ] Don't Know [ ]
   j. Rash Yes [ ] No [ ] Don't Know [ ]

5. Do you know case definition for guidance on who meets the criteria as a person under investigation for Ebola?

   Yes [ ] No [ ] Don't Know [ ]

6. What is the incubation period of Ebola Hemorrhagic Fever?

   < 2 days [ ] between 2 - 21 days [ ] above 21 days [ ]

7. Are you familiar with protocols and procedures for notifying designated points of contact regarding patients under investigations for Ebola?

   Yes [ ] No [ ] Don't Know [ ]

8. Do you have an equipped laboratory where samples can be taken for confirmation?

   Yes [ ] No [ ] Don't Know [ ]

SECTION C. HEALTH MEASURES TO PROTECT HEALTHCARE PROVIDERS

This section seeks to explore measures that are in place to protect health care providers from getting Ebola Hemorrhagic Fever in a hospital set up. **(Tick (√) the appropriate answers)**

1. Have you had training on infection prevention and control

   Yes [ ] No [ ]

2. Do you use personal protective equipment when attending to patients?

   Yes [ ] No [ ]

IF YES, have you been trained on donning and doffing of Personal Protective Equipment (PPES)? Yes [ ] No [ ]

List the PPES that you have in the facility

.....

3. Do you have infection prevention committee?

   Yes [ ] No [ ] Don't Know [ ]

4 Are there isolation facilities for confirmed, suspected and probable cases?

   Yes [ ] No [ ] Don't Know [ ]

5. Does the hospital have standard operating procedures on safe transportation of patients? Yes [ ] No [ ] Don't Know [ ]

6. Do you have adequate supplies for performing hand hygiene in the hospital?

   Yes [ ] No [ ]

   If yes which of the following do you use?

   Soap and water [ ] Alcohol based hand rub [ ]

   Others (specify).....

7. Do you have a protocol showing how hospital waste is managed in case of disease outbreak Yes [ ] No [ ] Don't Know [ ]

SECTION D. PREPAREDNESS TO RESPOND TO SUSPECTED EBOLA CASES.

This section seeks to find out the capacity of the health facilities to respond to an outbreak of Ebola Hemorrhagic fever. **(Tick (√) the appropriate answers)**

1. Do you have Ebola Response Team in the hospital?

   Yes [ ] No [ ] Don't Know [ ]

2. Have you been trained on management of a person under investigation for Ebola?

   Yes [ ] No [ ] Don't Know [ ]

3. Does the facility have a preparedness plan for Ebola Hemorrhagic Fever

   Yes [ ] No [ ] Don't Know [ ]

4. Is there a disaster planning committee?

   Yes [ ] No [ ] Don't Know [ ]

5. Does the hospital have isolation rooms for suspected Ebola cases?

   Yes [ ] No [ ] Don't Know [ ]

6. Do you have policies for monitoring and management of health care providers who may accidentally get exposed to Ebola case?
   Yes [ ] No [ ] Don't Know [ ]
7. Does the hospital have adequate supply of essential drugs and non-pharmaceutical items in case of an outbreak of disease?
   Yes [ ] No [ ] Don't Know [ ]
8. Does the facility have adequate staff to respond in case of Ebola outbreak.
   Yes [ ] No [ ] Don't Know [ ]
9. Is there a mechanism in place for rapid communication in the hospital during disease outbreaks?
   Yes [ ] No [ ] Don't Know [ ]
10. Has the hospital response team conducted drills with simulated patients?
    Yes [ ] No [ ] Don't Know [ ]

Appendix 3: Interview Guide for Key Informant on Preparedness
The interview guide will be used to get information about preparedness in the hospital.

Section A

1. Name of the Sub County
2. Name of the health facility
3. Bed capacity
4. Name of key informant
5. Designation
6. Department

Section B

1. How is hospital activities coordinated in case of Ebola disease outbreak?
2. How is the surveillance system effective in early detection of Ebola disease outbreak?
3. Do you have trained Ebola Response Team? What are their responsibilities with regard to preparedness?
4. How are the laboratory personnel prepared in sample collection and transport to reference laboratory?
5. What is the capacity of your hospitals pharmacy with regard to sufficient and ready availability PPEs and essential medicines?
6. Do you have adequate staffs who have trained on management of suspected Ebola cases?
7. How often does the hospital organize for drills to assess the preparedness of health workers
8. Do you have documented guidelines on infection prevention?

9. Does the hospital have guidelines on how referrals are conducted from border point and other health facilities?
10. How does the hospital link up with veterinary department surveillance team in order to get early warning of disease outbreak?
11. How are communities involved in preparedness for Ebola?
12. Does the hospital have finances and other logistics planned for disease outbreaks?

Appendix 4: IREC Approval

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2016/61
Approval Number: 0001673

30th June, 2016

Ms. Melly Jepkosgei,
Moi University,
School of Public Health,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
30 JUN 2016
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Ms. Jepkosgei,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Assessment of the Level of Preparedness for Ebola Hemorrhagic Fever in Health Facilities in Busia County, Kenya".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1673*** on 30th June, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 29th June, 2016. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

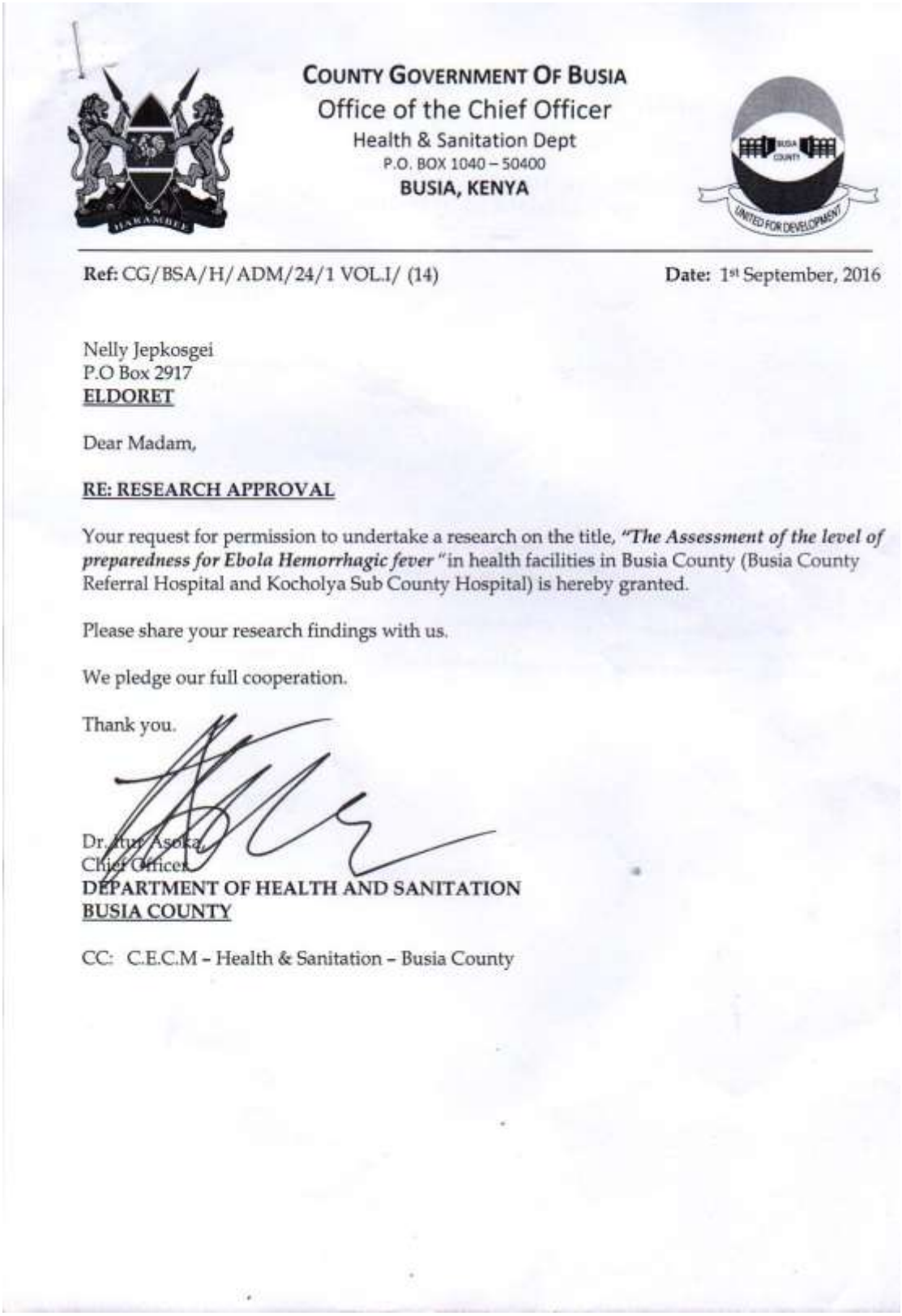
You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc	CEO	-	MTRH	Dean	-	SOP	Dean	- SOM
	Principal	-	CHS	Dean	-	SON	Dean	- SOD

Appendix 5: Approval from Busia County Government



COUNTY GOVERNMENT OF BUSIA
Office of the Chief Officer
Health & Sanitation Dept
P.O. BOX 1040 – 50400
BUSIA, KENYA

Ref: CG/BSA/H/ADM/24/1 VOL.I/ (14) **Date:** 1st September, 2016

Nelly Jepkosgei
P.O Box 2917
ELDORET

Dear Madam,

RE: RESEARCH APPROVAL

Your request for permission to undertake a research on the title, ***"The Assessment of the level of preparedness for Ebola Hemorrhagic fever "*** in health facilities in Busia County (Busia County Referral Hospital and Kocholya Sub County Hospital) is hereby granted.

Please share your research findings with us.

We pledge our full cooperation.

Thank you.

Dr. Atur Asoka
Chief Officer
DEPARTMENT OF HEALTH AND SANITATION
BUSIA COUNTY

CC: C.E.C.M – Health & Sanitation – Busia County

Appendix 6: MAP of Busia

Source: Kenya National Bureau of Statistics, 2010