FACTORS INFLUENCING MULTISECTORAL COLLABORATION AMONG STAKEHOLDERS FOR ONE HEALTH APPROACH IN THE CONTROL OF ZOONOSES IN KISUMU COUNTY, KENYA

BY

NOBERT DENNIS ONYANGO

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Of

Jaramogi Oginga Odinga University of Science and Technology

DECLARATION

Declaration by the student

This thesis is my original work and has not been presented for an award of a Master's degree or diploma in any other university or institution.

Signature: _____ **Date: _____**

Nobert Dennis Onyango

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This thesis has been submitted for examination with our approval as supervisors.

1. **Dr. Daniel Onguru, PhD**
   School of Health Sciences
   Jaramogi Oginga Odinga University of Science and Technology

Signature: _____ **Date: _____**

2. **Dr. Angeline Ochung'-Orwa**
   School of Biological, Physical, Mathematics and Actuarial Sciences
   Jaramogi Oginga Odinga University of Science and Technology

Signature: _____ **Date: _____**

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ABSTRACT

One Health approach recognizes the intricate relationship between the health of man, animals, and their shared environment. It integrates efforts of multiple disciplines working locally, nationally, and globally to achieve optimal health for people, animals, and the environment. The changing interactions between people, animals, plants, and the environment have pushed the growth and expansion of human populations into new geographic areas, forcing people to live close to wild and domestic animals. The proximity, climate change, and land use have led to a disrupted environment that provides opportunities for zoonoses. About 60% of all human infectious diseases and approximately 75% of emerging infections are zoonoses. These diseases cause endemic health burdens in low-income settings, pressure on healthcare infrastructure, community tensions, and decreased economic prosperity. Control of zoonoses requires the multisectoral collaboration of experts in human, animal, and ecosystem services under a One Health approach. Information from this study can inform one health policy revision leading to the rational use of scarce resources and achieving health equity. However, such benefits cannot be achieved without a functional county-level One Health unit, as in Kisumu. A cross-sectional study generated information from 142 respondents regarding factors influencing multisectoral collaboration under a One Health approach in controlling zoonoses in Kisumu County. The nature, extent, and barriers to collaboration, captured on a semi-structured self-administered questionnaire, were determined and assessed using descriptive and inferential statistics. Multisectoral collaboration to control zoonoses in the area was average (51.4%) and driven mainly by public health officers. Conducting joint sensitizations [x^2 (5) = 25.329, p *<0.001)*], notifying other sectors whenever a zoonosis is encountered [x^2 (5) = 44.265, p *<0.000)*] and collaboration through professional associations [x^2(5) = 17.776, p *<0.001)*] were the significant nature of collaboration. Lack of communication [H (5) =23.055, $p < 0.001$)], Lack of transport facilities [H (5) = 23.588, $p < 0.001$)], lack of interest in zoonoses at work and during training [H (5) = 25.678, p *<0.001*)], insufficient funding [H (5) = 34.453, $p = 0.001$)], differences in emphasis on zoonoses at the across the sectors [H (5) = 21.068, $p < 0.001$)] were the significant factors affecting One Health collaboration. Respondents observed that communication among OHCs is can enhance cooperation, transport facilities are needed to enhance responses where collaboration is required, funding is needed to support one health operations and continued specialization increases focus area, thus hindering collaboration. Addressing staffing requirements, training needs, allocation of resources, and setting up a robust information management system for data sharing can improve multisectoral collaboration for the One Health approach.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AFENET	African Field Epidemiology Network
AFROHUN	Africa One Health University Network
AMR	Antimicrobial Resistance
COVID-19	Corona Virus Disease of the Year 2019
EO	Environment Officer
FAO	Food and Agriculture Organisation
HPAI	Highly Pathogenic Avian Influenza
KENFELTP	Kenya Field and Laboratory Training Programme
MERS	Middle East Respiratory Syndrome
MO	Medical Officer
OHC	One Health Collaborators
OHCEA	One Health Central and Eastern Africa
OIE	Office International des Epizooties (World Organisation for Animal Health)
PHO	Public Health Officer
SARS	Severe Acute Respiratory Syndrome
UNICEF	United Nations Children Fund
VO	Veterinary officer
VPP	Veterinary Paraprofessional
WHO	World Health Organisation
WPP	Wildlife Paraprofessional
ZDU	Zoonotic Disease Unit

CHAPTER ONE: INTRODUCTION

1.1 Background

One Health approach recognizes that people's health intricately connects to animals and their shared environment (CDC, 2015). The integrated, unifying approach sustainably balances and optimizes the health of people, animals, and ecosystems (Hamilton *et al*., 2015; OIE, 2021). The practice strives to design and implement programs, policies, legislation, and research where multiple sectors communicate and work together to achieve better health outcomes (WHO, 2017).

The concept of One Health has become necessary because of the changing interactions between people, animals, plants, and the environment (CDC, 2015). The changing interactions have led to the growth and expansion of human populations into new geographic areas forcing people to live close to wild and domestic animals. Together with climatic and land-use changes, the encroachment of people raises the risk of disruption in the environment, changes that provide opportunities for diseases to pass to humans (Wood *et al*., 2014; Worobey *et al*., 2014). These diseases can now spread quickly across borders and around the globe because of the movement of people, animals, and their products due to increased international travel and trade (World Bank, 2012).

According to available literature, around 60% of all human infectious diseases currently recognized, and approximately 75% of the emerging infectious diseases that have affected humankind over the past three decades were zoonoses (El Zowalaty *et al*., 2019). Infectious diseases are now emerging or re-emerging almost every year. The trend continues due to the increasing global population, aging, travel, urbanization, and climate change, which favor new pathogens' emergence, evolution, and spread (Bloom *et al*., 2017).

In Africa, the burden of zoonoses needs to be better established due to weak surveillance and health information systems, and some still need to be considered a high priority (ZDU Kenya, 2014). However, the WHO-Africa Region puts it at 25% of all public health emergencies of international concern. According to the *National Strategic Plan for the Implementation of One Health in Kenya*, a survey in Kiambu and Kajiado counties in Kenya indicated a prevalence of 1.5% and 3.4%, respectively, for brucellosis in the livestock population from a 2012 survey. The same study

reported a 2% prevalence of brucellosis in Kiambu and 14% for Kajiado in the Human population. In wildlife, the prevalence was 30%.

Epidemics have caused global societal and economic impacts related to unexpected illnesses and deaths and interference with travel, business, and everyday life activities (Morens & Fauci, 2013). Other emerging infections may be less catastrophic but take a significant human toll causing public fear, economic loss, and adverse outcomes (Morens & Fauci, 2013).

Some of the emergent diseases include SARS, West Nile, avian influenzas (H5N1 and H7N9), hantavirus, Rift Valley Fever, norovirus, Marburg, influenza A, MERS, Ebola, Zika, and recently, COVID-19 (Bloom *et al*., 2017; El Zowalaty & Järhult, 2020; Gebreyes *et al*., 2014; Morens & Fauci, 2013). Although most of the recently emerging infectious diseases have been viral, bacterial infections have also been a threat to human health, for example, the devastating cholera epidemic in Haiti, the foodborne Escherichia coli O104: H4 outbreak in Germany in 2011, and the invasive nontyphoidal Salmonella in Africa (Bloom *et al*., 2017).

When zoonotic pathogens cross over to human hosts, they fundamentally cause an endemic health burden. The diseases are prevalent among communities in low-income settings, which are often characterized by the high population growth rate, lack of capacity in a skilled workforce to tackle disease outbreaks, and further compounded by a high proportion of people with compromised immunity due to comorbidities like HIV/AIDS (Gebreyes *et al*., 2014; Munyua *et al*., 2019). The situation gets dire when the livelihood of those communities revolves around livestock keeping and shared housing. These practices include herding, milking, helping with birthing, and other cultural norms promoting the consumption of unprocessed livestock products such as unpasteurized milk and uninspected meat.

The threat of emerging and infectious diseases to human health, society, and the global economy appears to increase since they continue to evolve and spread. For example, in 2016 alone, over 1 million people died from HIV. The SARS outbreak of 2002 resulted in the deaths of 700 out of the 8000 infected patients within six months, with the survivors experiencing ill health and disability in certain circumstances (Antabe & Ziegler, 2020). In particular, SARS and COVID-19 placed pressure on

healthcare infrastructure, created community tensions, and decreased economic prosperity (El Zowalaty & Järhult, 2020; World Bank, 2012). Indeed, the World Bank estimated the financial burden due to six zoonoses in specific countries between 1997 and 2009 to be around U.S. dollars 80,000,000,000 (World Bank, 2012).

Recognizing the global threat of emerging and re-emerging zoonoses led to advocacy for adopting a One Health approach at the national level to strengthen the monitoring and response to zoonotic disease risks through a multisectoral, transdisciplinary collaboration (FAO, OIE, 2012).

One Health focuses mainly on antimicrobial resistance in Europe, leaving the zoonoses aspect to veterinary services (Sikkema & Koopmans, 2016). In Africa, the One Health approach is being spearheaded by a network of universities, mainly in central, western, and eastern Africa. They collaborate in building academic partnerships and One Health capacities in public health and veterinary medicine schools (AFROHUN, 2022; Amuguni *et al*., 2019).

In Kenya, the introduction of One Health commenced in 2006 by establishing a multisectoral committee to coordinate preparedness efforts to prevent the spread of Highly Pathogenic Avian Influenza following the global reach of avian influenza (Munyua *et a*l., 2019). The initiative was immediately tested by a Rift Valley Fever outbreak, providing a valuable learning experience concerning the collaboration between health and veterinary services (Rwego *et a*l., 2016). The partnership led to creating a Zoonotic Disease Unit (ZDU) in 2012 to coordinate One Health activities in Kenya through collaboration between the ministries responsible for health and livestock through policy creation, advocacy, communication, and leadership on One Health matters within the government. It drew funding from the government and donor agencies. Its objectives were to create awareness about One Health, strengthen surveillance, detection, prevention, and control of zoonoses in humans and animals, and conduct research and training at the human-animal and ecosystem interfaces (Mbabu *et al*., 2014; ZDU, 2022).

Benefits of research in the One Health approach include global improvement of animal and human health through collaboration among all the health sciences, especially between the veterinary and human medical professions, to address critical

needs and development of centers of excellence for education and training in specific areas through enhanced collaboration among colleges and schools of veterinary medicine, human medicine, and public health (AFROHUN, 2022). One Health approach is particularly relevant in managing food safety, control of zoonoses, and combatting antimicrobial resistance, vector-borne diseases, environmental contamination, and other health threats shared by people, animals, and the environment (CDC, 2015; WHO, 2017).

1.2 Statement of the Problem

Zoonoses account for about 60% of the currently recognized human infectious diseases and 75% of the emerging infectious diseases that have been around for the last three decades (El Zowalaty *et al*., 2019). About 71% of these emerging infectious diseases originate from wildlife (Lytras *et al*., 2021; Winck *et al*., 2022). Infectious diseases are now emerging or re-emerging almost every year, and the trend is expected to continue due to the increasing global population, aging, travel, urbanization, and climate change, which favor the emergence, evolution, and spread of new pathogens (Bloom *et al*., 2017; El Zowalaty & Järhult, 2020). Kisumu County lies close to the Congo basin, which is a major zoonotic hotspot, has international air and sea ports, hosts wildlife reserves, and has a city with informal and rural settings, but without a functional County-level One Health Unit (COHU) to coordinate one health activities(ZDU, 2022). That is despite the growing recognition of One Health approach in the control and prevention of zoonoses (FAO-OIE-WHO, 2019). This study investigated the factors that influence multisectoral collaboration for the One Health approach in the management zoonoses in Kisumu County, Kenya

Objectives of the Study

1.3.1 Broad Objective

To investigate the factors influencing multisectoral collaboration for One Health approach among stakeholders in the control of zoonoses in Kisumu County

1.3.2 Specific Objectives

i. To determine the proportion of One Health practitioners that collaborating for control of zoonoses
ii. To establish the nature of multisectoral collaboration among One Health practitioners for the control of zoonoses

iii. To establish the barriers to multisectoral collaboration among One Health practitioners in the control of zoonoses

1.4 Research Questions

i. What is the proportion of One Health practitioners that collaborate for control of zoonoses?
ii. What is the nature of multisectoral collaboration among One Health practitioners in the control of zoonoses?
iii. What factors affect multisectoral collaboration among One Health practitioners in the control of zoonoses?

1.5 Study Justification

Zoonoses are increasingly becoming important owing to endemic health burdens and tensions they create within communities, the pressure exerted on healthcare infrastructure, and decreased economic prosperity due to morbidity(Gebreyes *et al*., 2014; Munyua *et al*., 2019). Research on the One Health approach is imperative since it is recognized as a cost-effective way of controlling zoonoses.

1.6 Significance of the Study

Information from the study can inform the need to review policy guiding the implementation of the One Health approach with a focus on the extent and nature of multisectoral collaboration, including mobilization and rational use of available resources for controlling zoonoses. Funders often need to be convinced on the need to allocate money for newer policies such as on the one health approach, and information from well-done research can be quite useful.

1.7 Scope of the Study

The study was conducted in Kisumu County and targeted serving medical and environmental health officers, veterinary officers and veterinary paraprofessionals, officers employed by the County government of Kisumu, and wildlife/ecosystem officers working with the national government of Kenya. It was conducted for two weeks, with timing dictated by the availability of the respondents at their workstations. The study focused on what having a functional county level one health

coordinating unit can achieve by determining the proportion of OHC collaborating without the unit in place, the nature and the barriers to search efforts.

1.8 Limitations

As with any other cross-sectional study, some level of nonresponse was expected. However, this was mitigated by increasing the sample size.

1.9 Definition of Terms

Ecosystem health: environmental conditions with the impacts of anthropogenic activities that affect the health of plants, animals, and human

Health workers: Medical officers and public health officers

Collaboration: Deliberate partnership for control of zoonoses

Multisectoral collaboration: the deliberate partnerships among health workers, veterinarians, and ecosystem experts for disease control purposes

One health: The interconnection in the health of man, animals, and their shared environment

One health approach: Wholistic way of controlling and preventing zoonoses through multisectoral collaboration

One Health practitioner: Medical officers, environmental health staff, veterinarians, and wildlife ecologists with some knowledge and experience of zoonoses and outbreaks among humans and animals, whose collaboration enhances One Health outcomes

One Health collaborators: Same as one health practitioners

Sectors: Animal Health, Human Health, and Wildlife or ecosystem sectors

Stakeholders: Same as one health collaborators

Veterinarians: Veterinary officers and veterinary paraprofessionals

Wildlife Officers: Wildlife ecologists, wildlife veterinarians, and any wildlife personnel with knowledge of zoonoses and outbreaks among humans and animals whose collaboration enhances One Health outcomes

Zoonoses: Diseases or infections naturally transmissible from vertebrate animals to humans.

CHAPTER TWO: LITERATURE REVIEW

2.1 The extent of collaboration among One Health practitioners

Implementing the One Health approach has had varying successes and challenges (Okello *et al*., 2014). Despite the overall interest in the One Health approach, application at the national, local levels still needs improvement due to the need for more practical and tested operational methods for implementation and evaluation (World Bank, 2010). Globally, the Food and Agriculture Organisation (FAO), the World Organisation for Animal Health (WOAH), and World Health Organisation (WHO) has a tripartite agreement that unites their efforts in the promotion of the One Health approach (FAO-OIE-WHO, 2019).In Africa, the African Field and Epidemiology Network (AFENET) coordinates the training of One Health fellows from biological science backgrounds and hosts conferences to provide platforms for sharing experiences concerning response to disease outbreaks (Rwego *et al*., 2016). In Kenya, The Zoonotic Disease Unit guides One Health approach efforts and county One Health Units, even though Kisumu County lacks a functional One Health unit (ZDU, 2022).

There is, however, a need for more data on the proportion of One Health partners collaborating to control zoonoses. In a study conducted in Tanzania, veterinarians initiated most collaboration with health and wildlife service experts, followed by health workers and wildlife experts (Kayunze *et al*., 2014). In Kenya, the ZDU was operationalized in March 2012 to coordinate One Health activities, with one medical epidemiologist from ministry responsible for health, one veterinary epidemiologist from the ministry responsible for veterinary services, and an ecologist from the environmental sector working at the secretariat (Mbabu *et al*., 2014; ZDU Kenya, 2014). The devolution of medical and veterinary services following the promulgation of the constitution of Kenya in 2010 necessitated the creation of County One Health Units to coordinate the implementation of the One Health approach at the county level (ZDU, 2022; ZDU Kenya, 2014). One Health practitioner's training is conducted in Kenya under the Kenya Field Epidemiology and Laboratory Training Programme (KENFELTP) for officers from health and veterinary directorates at national and County governments (Rwego *et al*., 2016). However, the proportion of the officers selected from other sectors remains vague.

2.2. Nature of multisectoral collaboration for One Health approach

According to the WHO, multisectoral action is essential for health and well-being since, with such collaboration, efforts to address the complex challenges we face to improve health and well-being and reduce inequalities and inequities may be enhanced (WHO, 2018). One Health approach is driven mainly, by veterinarians, with limited involvement by the human medical personnel because most physicians are convinced that emerging and zoonotic diseases do not significantly impact human health compared to major infectious diseases such as HIV/AIDS, tuberculosis, and malaria (Marcotty *et al*., 2013). By the second half of the 20th century, there was an understanding that increased collaboration between the human health sector and the veterinary sector was necessary to prevent and control zoonotic diseases and antimicrobial resistance (Sikkema & Koopmans, 2016).

Collaboration strategies are generally level-based, solution-based, or third-party-based (Yasobant *et al*., 2019). In a level-based approach, the collaboration takes the form of practice of human and veterinary medicine, such as in Tanzania and the USA, or the integration of the two professions through combined training as a way of strengthening their competencies, as in the USA, Europe, and East African countries (Eussen *et al*., 2017; Kayunze *et al*., 2014; Sweeney *et al*., 2018). The integration of the two professions ultimately leads to enhanced surveillance. In a solution-based strategy, the collaboration enhances the control of specific diseases and the management of sleeping sickness or outbreaks, as has been the case in the control of bird flu in Uganda and China, respectively (Zheng *et al*., 2019). The third-party strategy is where a secretariat leads One Health activities, such as the Zoonotic Disease Unit of Kenya. In Kenya, senior epidemiologists are deployed from directorates of health and veterinary services to drive multisectoral collaboration to control zoonoses (Mbabu *et al*., 2014). India had solution-based collaborations for managing outbreaks and a level-based approach for research purposes (Asokan *et al.*, 2011; Chatterjee *et al*., 2016; Sekar *et al*., 2011; Yasobant *et al*., 2019).

In Australia, diseases affecting man and animals, including matters relating to the environment, are managed by separate agencies with limited data sharing, compromising timely and effective communication within collaborating sectors (Johnson *et al*., 2018). However, there were multisectoral detection and response

procedures, targeted surveillance and notification systems, joint meetings and exercises, and communication (Adamson *et al*., 2011). In Tanzania, the nature of collaboration in the prevention, control, and treatment of rabies is such that veterinary and medical personnel share resources, for example, refrigerators for storage of vaccines and vehicles when carrying out vaccination campaigns (Karimuribo *et al.*, 2012). In Kenya, multisectoral collaboration is seen in training where under the KENFELTP, officers with basic training in health and biological sciences get selected from directorates of health and veterinary at national and county levels of government. The selected students get facilitation for either short courses or a two-year program leading to a Master of Science in Field Epidemiology at AFROHUN-affiliated universities in Kenya (Rwego *et al*., 2016).

2.3. Factors affecting collaboration among One Health practitioners

The challenges experienced during the operationalization of the One Health approach include the failure of information sharing among concerned disciplines and agencies, inequitable funding for multisectoral engagement, and imbalanced participation among professionals in human, animal, environmental, and ecosystem health sectors (Bardosh *et al*., 2017; Schurer *et al*., 2016).

In the U.S., lack of crucial leadership to enhance buy-in among One Health collaborators, difficulty in changing the mindset of healthcare providers from a clinical to a preventive approach, differences in organizational cultures, competing priorities, and lack of resources and appropriate models to guide the national One Health program were identified as a threat to the implementation and success of One Health (Courtenay *et al*., 2015). Additionally, the report notes the need for a communication plan to effectively influence public awareness and motivate a campaign to help influence decision-makers to support the One Health approach.

A "silo mentality" among professionals across different sectors in Australia contributed to the lack of multisectoral collaboration (Johnson *et al*., 2018). Commercial interest, lack of communication, lack of inter-sectoral trust, silos in education, and siloed funding were identified. Commercial interest was a barrier when, for instance, the surveillance served one sector, specifically the agriculture industry, owing to its contribution to the country's GDP. In such a scenario, the

veterinary department may not value sharing data if it does not consider safeguarding human health a priority (Johnson *et al*., 2018). There were poorly defined unifying One Health efforts in the Arctic region, including advocacy and partners, limited resources, and inadequate policy (Gebreyes *et al*., 2014; Lee & Brumme, 2013). Studies found that priorities differed whenever departmental objectives and requirements were at variance, leading to limited multisectoral collaboration (Young *et al*., 2019).

Professional tensions and distrust across sectors hampered communication in most African countries. For instance, antimicrobial resistance is blamed on veterinarians when antibiotics are used as growth promoters, over-prescribed, or rivalry exists due to institutional separation and poor linkages between health and veterinary agencies (Jeggo & Mackenzie, 2014; Uchtmann *et al*., 2015). Without training in One Health, veterinarians, human doctors, and environmental scientists tend to restrict their thinking within their professions, limiting their scope of interest and making it harder to integrate their views into an interdisciplinary approach (Johnson *et al*., 2018).

In Nepal, the absence of a separate institutional setup to lead One Health activities, limited coordinated efforts among stakeholders, and a lack of policy framework to guide multisectoral collaboration frustrated the implementation of One Health. In addition, low awareness among the public, poor laboratory networks, and limited technical know-how impeded the implementation of One Health in Nepal (OIE, 2011). In Tanzania, collaboration stagnated due to a lack of clear policies to guide the cooperation among One Health partners, limited knowledge of animal health, poor networking among health experts, and a dearth of plans for collaboration (Kayunze *et al*., 2014).

In Kenya, surveillance and disease reporting in the animal health sector were underfunded. Yet, they are the critical elements of multisectoral collaboration that generate data on the burden of zoonoses that can convince policymakers to allocate more resources to One Health activities (Munyua *et al.*, 2019).

2.4. Conceptual Framework

The study was guided by the conceptual framework shown in Fig. 2.1, where the independent variables were the extent of multisectoral collaboration among the One Health partners with particular emphasis on which sector initiates the collaboration, the different nature of multisectoral collaboration assumed, and the barriers to multisectoral collaboration. The intervening variables were government policies related to staff employment, deployment and retention in the various sectors, and the occurrence of natural disasters such as extremes of weather, epidemics, and pandemics. The dependent variable was the control of zoonoses.

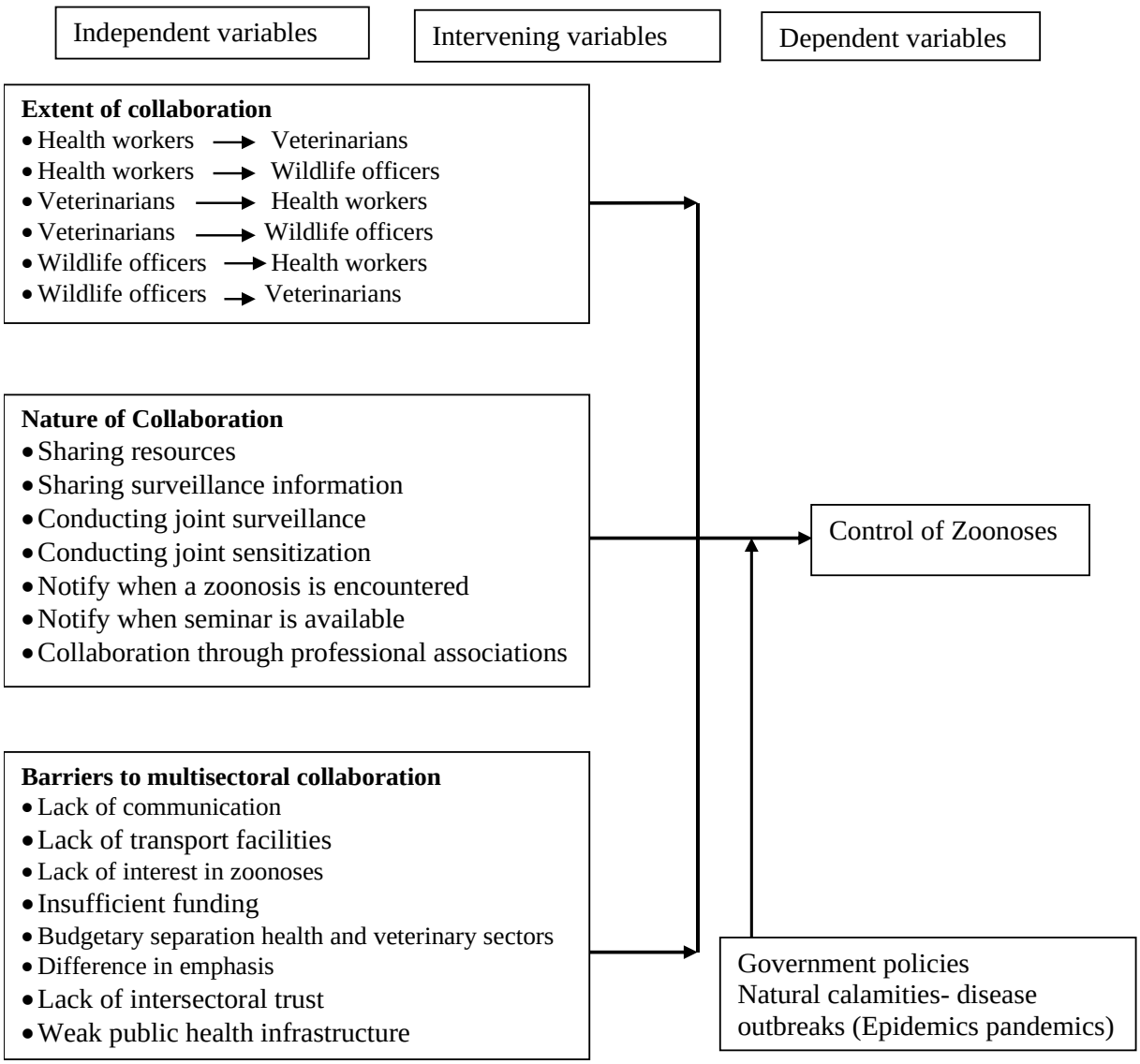

Figure 2.1: *Conceptual Framework* **(author)**

CHAPTER THREE: METHODOLOGY

3.1. Study Area

The study was conducted in Kisumu County. The area measures about 2,085.4 sq. Km, within longitudes 33° 20'E and 35° 20'E and latitudes 0°20'South and 0°50'South. The County covers a total area of 2009.5 km^2; another 567 km^2 is covered by water. The population of Kisumu County is 1,155,574 (560,942 males and 594,609 females), with 300,745 households and an average household size of 3.8. The population density is 554 per sq. Km. The County has a diverse economic potential, including fishing, agriculture, manufacturing, and wholesale trade. Most of the water for irrigation comes from River Nyando, whose annual floods displace vast numbers of people. The County also hosts Ndere Island National Park and Impala Park (County Government of Kisumu, 2019). Kisumu has a seaport, airport, game reserves, and rural and urban settings, and is a major transit point to one of the three global zoonotic hotspots, the Congo Basin (ZDU, 2022). The study was conducted in public hospitals, veterinary offices and at the Kenya Wildlife Service, Lake region office and Impala Park in Kisumu.

3.2. Study Design

The study adopted a cross-sectional design to unravel the drivers of One Health, specifically, the factors influencing multisectoral collaboration in the One Health approach to control zoonotic diseases in Kisumu County.

3.3. Study Population

The study covered the 193 health workers, animal health paraprofessionals, environment officers, and wildlife professionals stationed within Kisumu County.

3.4. Target Population

The study targeted medical officers, public health officers, veterinary doctors, veterinary paraprofessionals, and wildlife officers (veterinarians and wildlife ecologists) within Kisumu County. as proposed in the One Health Strategic Plan for the Prevention and Control of Zoonotic Diseases in Kenya (ZDU, 2022)

3.4.1. Inclusion Criteria

Only medical doctors, public health officers, veterinary doctors, veterinary paraprofessionals employed by the County government of Kisumu, and wildlife officers (veterinarians and ecologists) working in the national government but stationed within Kisumu County and present at their workstations were included.

3.4.2. Exclusion Criteria

Medical officers, public health officers, veterinary doctors, veterinary paraprofessionals in private practice, and wildlife officers working in national and those wishing to stop midway did not form part of this study.

3.5. Sample Size Determination

The minimum sample required was estimated using the Cochran formula (Cochran, 1977),

$$n = Z^2pq/e^2$$

Where:

n = minimum sample required; e = the margin of error (5%),

p = proportion of OHC with knowledge of zoonoses (unknown; set at 50%)

q is 1 – p.

Z = standard normal deviate at 95% CI (1.96)

Therefore, $$n = \frac{1.96 * 1.96 * 0.5 * 0.5}{0.05 * 0.05}$$

$$= 384$$

The population of OHC was established to be 193. Using the finite population correction factor (Cochran, 1977), the adjusted sample size was,

$$(n_0) = n \times N/n + (N - 1)$$

Where: n = Cochran's sample size recommendation (384)

N = population of OHC (193)

Substituting,

$$n_0 = 384 \times 193/384 + (193 - 1)$$

= 128.7 (129) participants

The sample size was increased by 10% (12.9) to 142 participants to accommodate non-response.

3.6. Sampling Procedure

A list of 193 One Health collaborators (OHC) from the county directorates of health and veterinary services and Kenya wildlife service Lake Region constituted the primary unit for sampling purpose. Owing to the diverse nature population, stratified random sampling was used proportionately recruit the 142 targeted respondents by sub county and professions from the primary unit. Stratification of the respondents by Sub-County and profession was necessary to give to give everyone in the study population equal chance of participating in the study. The researcher had no control on the availability of the respondents at their work stations, therefore only those available in their offices at the time of interview and willing to participate were conveniently located and interviewed.

Table 3.1 : *Selection of OHC by profession and Sub County*

Sub-county	**OHC**	**No. of employees**	**%**	**No. of participants**
Kisumu East	MO	1	1/193×142	0.74 (1)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	10	10/193×142	7.36 (7)
Nyakach	MO	3	3/193×142	2.21 (2)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	14	14/193×142	10.3 (10)
Kisumu Central	MO	62	62/193×142	45.62 (46)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	18	18/193×142	13.24 (13)
	WO	3	3/193×142	2.21 (2)
Kisumu West	MO	2	2/193×142	1.47 (2)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	11	11/193×142	8.09 (8)
Seme	MO	3	3/193×142	2.21 (2)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	15	15/193×142	11.04 (11)
Nyando	MO	3	3/193×142	2.21 (2)
	VO	1	1/193×142	0.74 (1)
	VP	3	3/193×142	2.21 (2)
	PHO	12	12/193×142	8.83 (9)
Muhoroni	MO	2	2/193×142	1.47 (2)
	VO	1	1/193×142	0.74 (1)
	VP	2	2/193×142	1.47 (2)
	PHO	12	12/193×142	8.83 (9)
TOTAL		**193**		**142**

3.7 Data Collection Instruments

A semi structured questionnaire was used to collect quantitative and qualitative data.

3.8 Validity and Reliability of the Research Instruments

3.8.1 Validity

The validity of the research tool was achieved by seeking expert opinions from other lecturers who critically examined it and suggested modifications that improved it. The questionnaire was simplified, arranging items from more straightforward to relatively complex.

3.8.2 Reliability

The instrument was tested in Sigowet sub-county, Kericho County, because of its similarity to the study area. The questionnaire was pretested on 12 (2 MOs, 4PHOs, 1 EO, 1VO, and 2 VPPs) conveniently selected OHC. Reliability was then estimated using Cronbach's reliability coefficient. The SPSS indicated a Cronbach's Alpha of 0.89 which is greater than average (0.6) and was therefore adequate (George & Mallery, 2003)

3.9. Data Collection

Participants were interviewed using a semi-structured self-administered questionnaire. After formal introductions and a brief explanation of the study, including its objectives, the study participants were given the consent forms to read and sign if in agreement. The questionnaire was then issued and filled in the researcher's presence, whose role was only to make any clarification if such a need arose. Data was collected for a period of two weeks

3.10. Data Analysis

Data were cleaned, validated manually, and analyzed using Statistical Package for Social Sciences (SPSS IBM) version 26. Socio-demographic characteristics of the study population were described using descriptive statistics (frequencies, percentages, averages, mean and standard deviation). Proportion of respondents collaborating for one health approach was described using frequencies. Kruskal-Wallis was used to test

the differences on the barriers to multisectoral collaboration since the variable was categorical in nature and had more than two possible expressions. Chi-Square test was used to test the differences between nature of collaboration. In both cases, the p-value set at 0.05 significant level. Qualitative data collected in the semi-structured questionnaire was analysed thematically.

3.11. Ethical Considerations

The study was conducted after authorization from the Board of Postgraduate Studies of Jaramogi Oginga Odinga University of Science and Technology (Appendix ix). The protocols were reviewed by the Ethics Review Committee of Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu (Appendix xi). A research license was obtained from the national commission for science and technology and innovation (Appendix xiii). The study's objective was clearly explained to the respondents, and participation was voluntary. Those not willing to participate or wished to quit at any point were granted their wish without any preconditions. Potential loss of confidentiality was minimized using survey identification numbers only, while access to data was by codes and passwords. Hard copies of questionnaires remained in the sole custody of the principal investigator. Participants were interviewed individually and privately. No risks or discomforts were anticipated. Participants were required to sign the same consent forms, one retained by the interviewer and the other given to the participant.

CHAPTER FOUR: RESULTS

4.1. Characteristics of the Study Participants

A total of 142 One Health collaborators within Kisumu County participated in the study. From the results in Table 4.1, a majority (70.4%) of the respondents were below 45 years old, and the participants' mean±sd age was 39.7 ± 9.5, with a range of 24 – 58 years. Most (58.4%) of the participants were male, with a majority (83.8%) coming from the human health sector.

Distribution in terms of professional background was as shown in Table 4.1, where (45.1%)) were public health officers. About half of the respondents (54.2%) had bachelor-level education, followed by diploma-level (28.2%), with master's and certificate holders at (9.9%) and (7.7%), respectively (Table 4.1).

Table 4.1 *Characteristic of Study Participants*

Characteristics, N=142	**Frequency (n)**	**Percentage (%)**
Age group in years		
< 45	100	70.4
45+	42	29.6
Range 24 – 58		
Mean±sd 39.7 ± 9.5		
Gender		
Male	83	58.4
Female	59	41.6
Sector		
Human Health	119	83.8
Veterinary	20	14.1
Wildlife	3	2.1
Professional background		
Medical officer	55	38.7
Public health officer	64	45.1
Veterinary officer	6	4.2
Veterinary paraprofessional	14	9.9
Wildlife paraprofessional	1	0.7
Environment officer	2	1.4
Highest level of education		
Certificate	11	7.7
Diploma	40	28.2
Bachelor	77	54.2
Masters	14	9.9

Table 4.2 shows that 54.93% of respondents needed to be made aware of the Zoonotic Disease Unit in Kenya (ZDU), with medical officers having the lowest level of awareness. However, all veterinary officers and wildlife paraprofessionals were aware of the unit. In the human health sector, public health officers had the highest (54.69%) awareness regarding the existence of the ZDU.

Table 4.2 *Distribution of respondents according to awareness of the existence of a Zoonotic Disease Unit in Kenya*

	Awareness of the Zoonotic Disease Unit in Kenya	
Professional background	**Yes, n (%)**	**No, n (%)**
Medical officer	12(21.82)	43(78.18)
Public health officer	35(54.69)	29(45.31)
Veterinary officer	6(100.0)	0(0.0)
Veterinary paraprofessional	9(64.29)	5(35.71)
Wildlife paraprofessional	1(100.0)	0(0.0)
Environment officer	1(50.0)	1(50.0)
Total	**64(45.07)**	**78(54.93)**

Table 4.3 shows that most (84.5%) respondents have not attended any One-Health-related course besides their primary pre-service courses. All medical officers in the study had not benefitted from any One Health-related course. Some veterinary (33.3%) officers and public health officers (9.4%) had some training in disease surveillance.

Table 4.3 *Attendance of One Health - related course by One Health collaborators*

Professional background	Course attended				
	None n (%)	Environmental health (meat inspection) n (%)	Disease surveillance n (%)	Animal welfare n (%)	Bio-surveillance of zoonoses n (%)
M.O	55(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
PHO	58(90.6)	0(0.0)	6(9.4)	0(0.0)	0(0.0)
VO	4(66.7)	0(0.0)	2(33.3)	0(0.0)	0(0.0)
VPP	2(14.3)	12(85.7)	0(0.0)	0(0.0)	0(0.0)
WPP	0(0.0)	0(0.0)	0(0.0)	1(100.0)	0(0.0)
EO	1(50.0)	0(0.0)	0(0.0)	0(0.0)	1(50.0)
Total	**120(84.5)**	**12(8.5)**	**8(5.6)**	**1(0.7)**	**1(0.7)**

About half (57.0%) of respondents did not attend any One Health-related seminar. All veterinarians attended only AMR seminars. However, a majority (98.2%) of the medical officers did not participate in any One Health-related forum, as Table 4.4 shows.

Table 4.4 *Attendance of One Health - related seminars by respondents*

Professional background	Seminar attended							
	None n (%)	AMR n (%)	Zoonoses n (%)	Climate change n (%)	COVID-19 disease n (%)	Response & surveillance for rabies n (%)	Food safety n (%)	Disease surveillance n (%)
M.O	54(98.2)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(1.8)
PHO	18(28.1)	0(0.0)	4(6.3)	0(0.0)	7(10.9)	1(1.6)	1(1.6)	33(51.6)
VO	0(0.0)	6(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
VPP	7(50.0)	0(0.0)	0(0.0)	1(7.1)	0(0.0)	0(0.0)	6(42.9)	0(0.0)
WPP	1(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
EO	1(50.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(50.0)
Total	**81(57.0)**	**6(4.2)**	**4(2.8)**	**1(0.7)**	**7(4.9)**	**1(0.7)**	**7(4.9)**	**35(24.6)**

About half (54.5%) of respondents needed to be made aware of the objectives of the ZDU. A majority (76.8%) of the medical officers who were aware of the existence of the Zoonotic Disease Unit could not list any of its objectives. However, veterinary officers and veterinary paraprofessionals who reported having an awareness of the same were able to list at least two objectives of the unit, as shown in Table 4.5

Table 4.5 *Respondents' knowledge of the objectives of the Zoonotic Disease Unit of Kenya*

Professional background	Objectives of the Zoonotic Disease Unit			
	Did not know n (%)	**Listed 1 objective n (%)**	**Listed 2 objectives n (%)**	**Listed 3 objectives n (%)**
MO	42(76.8)	8(14.3)	5(8.9)	0(0.0)
PHO	29(45.3)	29(45.3)	6(9.4)	0(0.0)
VO	0(0.0)	0(0.0)	5(83.3)	1(16.7)
VPP	5(35.7)	6(42.9)	3(21.4)	0(0.0)
WPP	0(0.0)	1(100.0)	0(0.0)	0(0.0)
EO	1(50.0)	0(0.0)	1(50.0)	0(0.0)
Total	**77(54.5)**	**44(30.8)**	**20(14.0)**	**1(0.7)**

4.2. Proportion of collaborating One Health practitioners

The proportion of one health practitioner collaborating to control zoonoses in Kisumu County was 51.4% (Figure 4.1). The proportions of collaboration across the different sectors are shown in Table 4.6, with 47.9% of the health workers collaborating with veterinarians, health workers, and the wildlife sector at 1.4%. Collaboration between the veterinary and health sectors was at 44.5%), and veterinarians and the wildlife/environmental sector were at 2.1%). (Table 4.6).

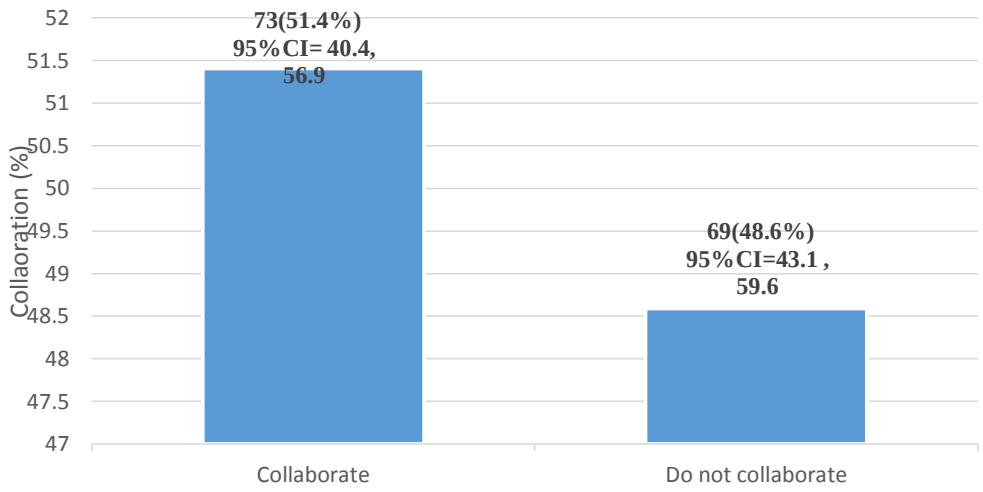

Figure 4.1 *Overall proportion of One Health practitioners collaborating for control of zoonoses*

Table 4.6 *Extent of multisectoral collaboration among One Health practitioners*

	Responses	
Collaboration by sector	**n**	**%**
Health workers collaborating with veterinarians	70	47.9
Health workers collaborating with wildlife/ecosystem experts	2	1.4
Veterinarians collaborating with health workers	65	44.5
Veterinarians collaborating with wildlife/ecosystem experts	3	2.1
Wildlife/ecosystem experts collaborating with health workers	3	2.1
Wildlife/ecosystem experts collaborating with veterinarians	3	2.1

4.3. Nature of collaboration among One Health practitioners

A majority (86.3%) of the One Health partners who participated in the collaboration notified their counterparts whenever a zoonosis was encountered, with public health officers initiating most instances of the collaboration (Table 4.7). Veterinary officers, veterinary paraprofessionals, wildlife paraprofessionals, and the environment officer did not share refrigerators or vehicles during vaccination campaigns. Joint surveillance was only conducted by medical officers, public health officers, and the environment officer. Running joint sensitizations [$\square^2$ (5) = 25.329, p *<0.001)*], notifying other sectors whenever a zoonosis is encountered [$\square^2$ (5) = 44.265, p *<0.001)*], and collaboration through professional associations [$\square^2$ (5) = 17.776, p *<0.001)*] were the significant nature of collaboration for control of zoonoses in Kisumu County (Table. 7).

Table 4.7. *Nature of multisectoral collaboration among One Health partners*

Nature of collaboration	Professional background									
	MO n (%)	PHO n (%)	VO n (%)	VPP n (%)	WPP n (%)	EO n (%)	Total n (%)	□2	df	p-value
Sharing refrigerators	0(0.0)	1(1.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.6)	1.227	5	0.942
Sharing vehicles during vaccination	3(4.1)	4(5.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	6(3.6)	1.710	5	0.888
Sharing surveillance information	9(12.3)	20(27.4)	3(4.1)	5(6.8)	0(0.0)	2(2.7)	38(22.8)	12.910	5	0.024
Conducting surveillance together	6(8.2)	13(17.8)	0(0.0)	0(0.0)	0(0.0)	1(1.4)	19(11.4)	9.085	5	0.106
Conducting joint sensitizations/advocacy	4(5.5)	14(19.2)	0(0.0)	1(1.4)	1(1.4)	2(2.7)	21(12.6)	25.329	5	<0.001
Notifying other sectors when a zoonosis is encountered	11(15.1)	29(39.7)	6(8.2)	14(19.2)	1(1.4)	2(2.7)	62(37.1)	44.265	5	<0.001
Notifying other sectors when training opportunities arise	0(0.0)	4(5.5)	0(0.0)	1(1.4)	0(0.0)	0(0.0)	5(3.0)	4.279	5	0.510
Collaboration through professional associations	7(9.6)	2(2.7)	1(1.4)	3(4.1)	1(1.4)	1(1.4)	15(9.0)	17.766	5	0.003

Key: MO = medical officer; PHO = public health officer; VO = veterinary officer; VPP = veterinary paraprofessional; WPP = wildlife paraprofessional; EO = environment officer

4.3.1. Factors that prompt multisectoral collaboration

Medical officers, veterinary paraprofessionals, and wildlife paraprofessionals were prompted to collaborate with other counterparts by needing particular expertise outside their sector. Veterinary officers and public health officers were led to collaborate by the desire to promote One Health. The need for specific expertise from other sectors [$\square^2$ (5) = 27.873, p <0.001)], the need to promote One Health [(5) $\square^2$ = 40.877, p <0.001)], and the desire to mainstream One Health as government policy [($\square^2$ 5) = 26.310, p <0.001)] were the significant factors that prompted collaboration for control of zoonoses in Kisumu County (Table 4.8).

Table 4. 8 *Factors that prompt collaboration among One Health partners*

Cues to OH collaboration	Professional background								
	MO n (%)	PHO n (%)	VO n (%)	VPP n (%)	WPP n (%)	EO n (%)	□2	df	p-value
There was adequate transport	0(0.0)	5(6.9)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	6.272	5	0.281
There was a need for that expertise	13(18.1)	27(37.5)	4(5.6)	13(18.1)	1(1.4)	2(2.8)	27.873	5	<0.001
There was sufficient funding	0(0.0)	1(1.4)	1(1.4)	0(0.0)	0(0.0)	0(0.0)	11.021	5	0.051

There was a need to promote One Health	8(11.1)	30(41.7)	6(8.3)	12(16.7)	1(1.4)	2(2.8)	40.877	5	<0.001
It was government policy	12(16.7)	27(37.5)	4(5.6)	13(18.1)	0(0.0)	1(1.4)	26.310	5	<0.001

Key: MO = medical officer; PHO = public health officer; VO = veterinary officer; VPP = veterinary paraprofessional; WPP = wildlife paraprofessional; EO = environment officer

4.4. Factors that affect multisectoral collaboration among One Health practitioners

According to the study participants, lack of communication [$H(5) = 23.055$, $p<0.001$)], lack of transport facilities [$H(5) = 23.588$, $p <0.001$)], lack of interest in zoonoses at work and during training [$H(5) = 25.678$, $p <0.001$)], insufficient funding[$H(5) = 34.453$, $p <0.001$)], differences in emphasis on zoonoses at work [$H(5) = 21.068$, $p <0.001$)] were the significant factors affecting One Health collaboration (Table 4.9).

Table 4. 9 *Factors that affect collaboration among One Health partners*

Factors	**□2**	**df**	**p-value**
Lack of communication	23.055	5	<0.001
Lack of transport facilities	23.588	5	<0.001
Lack of interest in zoonoses at work and during training	25.678	5	<0.001
Insufficient funding	34.453	5	<0.001
Budgetary separation of health and veterinary departments	5.191	5	0.393
Differences in emphasis on zoonoses at work	21.068	5	<0.001
Lack of intersectoral trust	6.323	5	0.276
Weak public health infrastructure	5.644	5	0.342
Institutional separation of health and veterinary departments	15.131	5	0.010

Table 4. 10 *Summary of how multisectoral collaboration is affected*

Factor	Effect	n	%
Lack of communication	It does not affect One Health	22	15.5
	Communication enhances cooperation	69	48.6
	Uncertain	3	2.1
	This leads to disjointed efforts	5	3.5
	Facilitates engagement at departmental levels	43	30.3
Lack of transport	It does not hinder collaboration	26	18.3
	Enhances responses where collaboration is needed	101	71.1
	Uncertain	15	10.6
Lack of interest in zoonoses at work and during training	It does not hinder collaboration	22	15.5
	Some health workers do not understand the impact of zoonoses	13	9.2
	Uncertain	27	19.0
	Interest drives One Health	15	10.6
	Departments promote their core mandates only	12	8.5
	Viewed as a concern for veterinarians	26	18.3
	It is only a public health concern during outbreaks	11	7.7
	Zoonoses are not common in urban settings	10	7.0
	Capacity building is inadequate	6	4.2
Insufficient funding	It does not hinder collaboration	7	4.9
	Funding supports One Health operations	76	53.5
	Limits research on emerging and infectious diseases	3	2.1
	Uncertain	12	8.5
	Limit development of One Health Infrastructure	2	1.4
	Supports training opportunities	26	18.3
	Supports advocacy	16	11.3

Lack of emphasis on zoonoses at work and during training	It does not hinder collaboration	12	8.5
	Hampers multisectoral communication	22	15.5
	Uncertain	28	19.7
	Need to deliver on core mandates	25	17.6
	No clear policy to guide collaboration	18	12.7
	Specialization increases focus on one area	31	21.8
	Insufficient staff	6	4.2
Lack of multisectoral trust	It does not hinder collaboration	38	26.8
	Hampers communication	17	12.0
	Uncertain	44	31.0
	Affects coordination	21	14.8
	Some departments feel superior to others	14	9.9
	Blame game over perceived failure/inaction of a department	8	5.6

Regarding how the various factors affect collaboration, respondents expressed varied sentients, as summarized in Table 4.10. However, some of the dominant sentiments were as stated below:

On lack of communication:

"Communication enhances cooperation" Participant No. 1 Medical officer

"*Lack of communication leads to disjointed efforts"* Participant No. 67 Medical officer

"Communication facilitates engagement at departmental levels" Participant No. 47 Veterinary paraprofessional

On lack of transport facilities;

"*Enhances responses where collaboration is needed"* Participant No. 56 Public health officer

On insufficient funding;

"*Funding supports One Health operations"* Participant No. 41 Environment officer

"Funding supports training opportunities" Participant No. 116 Public health officer

On Lack of interest in zoonoses at work and during training;

"Zoonoses are a concern for veterinarians" Participant No. 89 Medical officer

On lack of emphasis on zoonoses at work and during training; "*Specialization increases focus on one area"* Participant No. 66 Medical officer

CHAPTER FIVE: DISCUSSION

5.1. The extent of multisectoral collaboration among One Health practitioners

In this study, the level of multisectoral collaboration was average. Most instances of collaboration were initiated by the health sector and conducted with the livestock sector. It was primarily driven by the efforts of public health officers, unlike in Tanzania and elsewhere, where the animal health sector initiated the collaboration (Kayunze *et al*., 2014). The better performance of the human health sector over the animal health sector is attributed to the low staffing, which increased the workload, leading to a concentration on perceived core mandates of livestock disease control. The number of health staff of any sub-counties in Kisumu County was more than the entire staff complement of the county directorate of veterinary services (Table 3.1). The low staffing level also explains the need for more collaboration from the wildlife/ecosystem sector since only three experts were deployed in the area. The lone wildlife veterinary officer serving the study area was based in Nairobi.

The national government retained policy formulation functions in the human and animal health sectors in Kenya. However, the policy guiding One Health needed to be revised to sustain multisectoral collaboration by assuming that the available staff would adequately take up the new roles in the One Health approach (ZDU Kenya, 2014). This observation compares well with a Tanzanian study where a lack of clear policy statements on human resources contributed to the low level of collaboration between medical officers and veterinarians (Kayunze *et al*., 2014).

Medical officers make critical decisions regarding the control of diseases in hospitals and human populations. Their participation in multisectoral collaboration should complement efforts from the livestock and wildlife sectors. As such, their low awareness of the existence of the Zoonotic Unit and its objectives can seriously undermine the control of zoonoses.

Post-basic training in the One Health approach, either as a course or seminar, could have been better among health workers. The few staff that benefited from the Kenya Field and Epidemiology Training program needed to be appropriately deployed to drive the One Health agenda. Indeed, all medical officers sampled did not attend any One Health-related course, and a paltry 1.8% participated in One Health-oriented

seminar. Medical officers appeared to focus on curative services at the expense of prevention, where One Health focuses.

The average level of collaboration between the livestock and wildlife sectors should concern disease control experts since most zoonotic disease pathogens originate from the wildlife before crossing into the livestock populations and then into humans (Zheng *et al*., 2019). The livestock sector is a buffer between the origin of zoonoses and the human health sector(Wood *et al*., 2014).

5.2. Nature of collaboration among One Health practitioners in Kisumu County

The capacity of one health (OH) partners to collaborate is primarily determined by the available human resources and other resources, especially funds (Courtenay *et al*., 2015). Although sharing vehicles and refrigerators during vaccinations ought to have been easier for partners to collaborate, the lack of such facilities made it impossible to achieve. Joint activities such as conducting surveillance and sensitizations on zoonoses were equally easier to achieve. Still, they were impeded by the need for adequate staff from the animal health and wildlife sectors. The notification was relatively easier to complete owing to the little material input required and was frequently used by the collaborating partners.

Partners were prompted to collaborate by the need for particular expertise outside their work sector to complement their disease prevention and control efforts. However, the need for knowledge in disease detection and response, targeted surveillance and notification systems, joint meetings, and activities provided the cue for partners to collaborate, as noted elsewhere (Adamson *et al*., 2011). The need for such expertise explains why public health officers initiated most of the joint One Health activities, more so by their role in health education in the human health sector and the appreciable level of the workforce, unlike other areas where the animal sectors took the lead (Kayunze *et al*., 2014).

5.3. Factors affecting One Health collaboration

Multisectoral collaboration for control of zoonoses requires regular communication among the stakeholders, and this explains why lack of communication was a significant factor that hampered collaboration in the area. Collaborating sectors

exchange surveillance information regarding zoonoses and other diseases, including their outbreaks. A robust communication system enhances information sharing among One Health collaborators and community education about disease outbreaks and management, as noted elsewhere (Mwangi *et al*., 2016). Communication among the collaborating partners enhances knowledge integration and cooperation through engagement at different departmental levels (FAO-OIE-WHO, 2019; Hitziger *et al*., 2018). Communication across the collaborating sectors allows for planning and sharing the surveillance data and planning.

One health approach requires the deliberate mobilization of material and human resources. Funding is crucial in acquiring communication systems, office infrastructure, hiring, training, and retaining adequate staff, transport facilities, and other materials. Activities such as sensitizations of communities on zoonoses require funding. Collaborating partners also need to build their capacities through seminars, short refresher courses, or postgraduate training in field epidemiology, all of which require a reliable source of funding. One Health collaboration would ideally succeed with an adequately trained, appropriately deployed, motivated workforce equipped for tasks. Enhancing funding can positively impact multisectoral collaboration for controlling zoonoses (AFROHUN, 2022; Courtenay *et al*., 2015; Kayunze *et al*., 2014).

Multisectoral collaboration for control of zoonoses requires a substantial interest in the same during training and the workplace, including their emphasis across all collaborating sectors, yet this needs to be improved. According to this study, some health workers need to understand the impact of zoonoses fully and wrongly believe that zoonoses are only important during outbreaks. Indeed, some health workers still view zoonoses as a problem in rural areas and a concern for veterinarians. However, a closer look at zoonotic disease dynamics indicates that every sector has a stake in control and prevention since most zoonoses have their origins in the wild and need to be prevented from crossing into domestic animals, from where the risk of infection in human population significantly increases (Marcotty *et al*., 2013; Marty & Jones, 2020).

Lack of interest in zoonoses, especially among health workers, compares well with other studies where low interest was attributed to continued specialization and inadequate post-basic course training, including a lack of opportunities for acquiring new knowledge on zoonoses (Mwangi *et al*., 2016). The solution to the lack of interest in zoonoses lies in, among other factors, entrenching zoonosis as a core unit of all health-related courses, organizing joint activities, including refresher seminars, and prioritizing the zoonoses (ZDU, 2022).

Placing too much focus on perceived critical departmental objectives hampers collaboration such that veterinarians consider animal health an economic venture leaving out the public health perspective. Human health experts are concerned with curative services rather than the potential of a preventive approach to zoonoses (Courtenay *et al*., 2015). Where curative health services are prioritized, the need to consult among collaborating partners diminishes. Overemphasis on curative services negatively impacts interest in zoonoses, mainly where zoonotic diseases are primarily associated with veterinary work but without relevant support structures (AFROHUN, 2022; Marcotty *et al*., 2013).

The distrust among the collaborating partners emanates from the assumption that the animal health sector abets the increasing problem of antimicrobial resistance, especially where antibiotics are clinically overprescribed or used as growth promoters (Jeggo & Mackenzie, 2014; Nathan & Cars, 2014). The mistrust leads to a lack of coordination due to professional tensions, further limiting communication and, therefore, collaboration (AFROHUN, 2022; Johnson *et al*., 2018)

Multisectoral collaboration, as part and parcel of the health system, requires clearly defined unifying One Health efforts, One Health champions and partners, policy direction, and allocation of adequate resources to expand its capacity for better preparedness and resilience (AFROHUN, 2022; Ruscio *et al*., 2015).

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CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Multisectoral collaboration for One Health in controlling zoonoses in Kisumu County was average and primarily initiated by the human health sector, specifically public health officers. Conducting joint sensitizations, notifying other sectors whenever a zoonosis is encountered, and collaborating through professional associations were the significant nature of multisectoral collaboration and were driven by the need for particular expertise outside one sector, the desire to promote One Health and mainstream One Health as a government policy. Lack of communication and transport facilities, insufficient funding, and lack of interest in zoonoses at work and during training, including the differences in the level of emphasis across the participating sectors, were barriers to multisectoral collaboration for the One Health approach in Kisumu County.

6.2 Recommendations

The study recommends addressing the deficiencies in the implementation of the One Health approach as follows:

1. The delivery unit of the County Government of Kisumu, in partnership with the Kenya Wildlife Service and the Zoonotic Disease Unit, should spearhead the formation and activation of a County level One Health coordination unit that is adequately staffed by appropriately trained and well-motivated individuals from human health service, veterinary directorate and wildlife and environmental sector, to drive the One Health agenda.

2. The county government of Kisumu, in consultation with the Zoonotic Disease Unit of Kenya and working together with other national and international agencies with interest in One Health, including but not limited to WHO, WOAH, and FAO, should mobilize the resources required for staffing, training, and facilitate learning from best practices.

3. The county government of Kisumu should allocate funds to procure transport facilities, train, and set up an automated real-time alert system that enhances data collection, processing, and dissemination among One Health collaborators to address communication challenges. This system needs to be accessible to all One

Health collaborators but with different user privileges. The Commission for higher education and the ministries responsible for health, agriculture, wildlife, and environment should review all health and ecosystem-related courses to entrench One Health perspectives to enhance interest in zoonoses and level the differences in their emphasis during training in the workplace.

6.3 Suggestions for Further Research

There is a need to investigate the low interest in the One Health approach, particularly among the medical officers since their participation is critical to multisectoral collaboration in control zoonoses. During such a study, consideration should be made to expand the area covered, and more cadres of healthcare providers and community leaders included as participants. The study should equally have a more robust qualitative arm, using several approaches for data collection.

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APPENDICES

Appendix I: Participant consent form

Dear Sir/Madam,

Informed Consent

Study number……

A. Introduction

My name is Nobert Dennis Onyango. I am a student at Jaramogi Oginga Odinga University of Science and Technology, pursuing a Master of Public Health degree. I wish to ask for your support during a study I am doing, where I want to find out important facts on **"Effectiveness of Collaboration in the Implementation of One Health Approach for The Control of Zoonotic Diseases in Kisumu County."** I shall explain the project to you in detail should the information contained here be insufficient.

I am making this request to you and some other people, and I hope to get a response from you. You will find a copy of the consent form that you may sign to acknowledge participating in the study. This is enclosed herein, and if you could be kind enough, please read them both. I am optimistic that you will be of great help to this cause, which will, in turn, inform policies and approaches to enhance one health approach in the study community and elsewhere.

This study will not interfere with much of your work activities since it will be a passive investigation of the activities revolving around One Health. What you will share with me will be highly appreciated. I present herewith a copy of the consent form for you to sign. I will be most grateful for your help.

B. Information about the study

Description of the study

You have been asked to take part in the project seeking to find out the **Effectiveness of collaboration in the implementation of One Health Approach for The Control of Zoonotic Diseases in Kisumu County**

What is the study about?

One Health approach is a relatively new concept in which sectors dealing with human, animal, and wildlife health collaborate in various ways to achieve better health outcomes through the control of zoonoses, managing food safety, controlling antimicrobial resistance, mitigating effects of climate change, among others. This study will focus on using the approach to control zoonoses in both man and animals.

What will be done

If you decide to participate in the project, you will be involved in answering a self-administered questionnaire. The questionnaire will take not more than 15 minutes to answer, and my presence is to make any clarification merely should the need arise. Your name will not be on the questionnaire.

Potential Risks

There are no possible significant risks during this study. You may, however, feel some discomfort with some questions, as is usual, in case you are anxious. If that is the case, and if you feel the need to stop answering, you shall do so voluntarily because the decision to be part of the study is entirely up to you. Whatever you decide will not be held against you. You understand that the Principal Investigator (Nobert Dennis Onyango), responsible for the study, is not a member of any health regulatory board or employment bureau. Your participation will not impact your job security or any other matter.

Expected Benefits

There are no guaranteed direct benefits to you immediately on account of this research. However, the study's findings will go a long way in improving the implementation of the One Health approach, especially in the control of zoonoses and other emerging diseases. The overall impact will be sustainable health outcomes, food security, and improved public health.

Confidentiality

Your participation in the project is confidential to the extent permitted by law. None of the information will identify you by name or any other identifiable feature. All information you provide will be kept confidential, and any materials involved will be

under lock, with only limited access. No information that will be traceable to you will be on the transcript. No publication or resulting communication will bear your details, and where need be, you shall be notified, and your express written authorization is requested. This guarantees you that no other person will have information related to you.

Decision to Quit

The decision of whether to take part or not is entirely up to you. If you decide to take part in the study, you can quit at any time. You are free to refuse to participate or withdraw at any time without affecting or jeopardizing your future job prospects. You are also free to decline to answer questions you do not feel comfortable answering. This will not have any consequence on your access to any benefits that should reach all community members.

Questions

If you have any further questions, you can call Nobert Dennis Onyango (Principal Researcher, on 0722492568). Should you have questions regarding how the study is being conducted, please contact the University Supervisor (Dr. Dan Onguru: 0721818368).

Declaration by Participant

I have read the consent information form (or it has been read and explained to me in the language I am most comfortable in [_____], and I fully understood what is stated. Any questions I have about the research have been answered.

By signing this form, I unconditionally indicate my willingness to participate in this good cause. The consent form will be kept in the locker for safety and will not be attached to any transcripts or other materials.

……

Participant's signature Date

……

Witness signature Date

.....

Researcher/Research Assistant signature Date

Appendix II: Questionnaire

SECTION A: GENERAL INFORMATION

Participant's No…… Interviewer's No……

1. Age (in years) ……
2. Sex ☐ Male ☐ Female
3. In which sector do you work?

   ☐ Health ☐ Veterinary ☐ Wildlife ☐ Other

   ……

4. What is your profession? (Please tick where appropriate)

Profession	Tick where appropriate
Medical officer	
Environmental health officer	
Veterinary officer	
Veterinary paraprofessional	
Wildlife veterinary officer	
Wildlife veterinary paraprofessional	
Wildlife officer	
Environment officer	
Other (please specify)	

5. Highest Level of Education (formal)

   ☐ Certificate ☐ Diploma ☐ Bachelor ☐ Masters ☐ PhD

6. Have you attended any in-service training and/or seminar on One Health-related courses?

   ☐ **Yes** ☐ **No**

   If **Yes**, please specify the course or nature of the seminar attended

   Course ……

   Seminar …….

SECTION B: COLLABORATION WITH OTHER PROFESSIONALS

1. Please indicate the department (other than your own) that you have collaborated with (past or present) for purposes of disease control

Department	Tick where appropriate	How often do you collaborate? (Never, Rarely, Often, Always)
Human health		
Veterinary services		
Wildlife services		

2. Please state the nature of collaboration regarding the control of diseases

	Area of collaboration	Tick where appropriate
i.	Sharing refrigerators for vaccine storage	
ii.	Sharing vehicles during vaccination/immunization campaigns	
iii.	Sharing surveillance information	
iv.	Conducting joint surveillance	
v.	Conducting joint sensitization/advocacy	
vi.	Notify when a zoonosis is encountered/suspected	
vii.	Notify when a training seminar is available	
viii.	Collaboration through professional associations	
	Others (please list them below)	
ix.		
x.		
xi.		

3. What prompted the kind of collaboration noted above?

	Cue for collaboration	Tick where appropriate
i.	There was adequate transport	
ii.	Need for expertise from veterinary, health, and wildlife	
iii.	There was sufficient funding	

iv.	Need to promote One Health	
v.	It was government policy	
	Others (please list below)	
vi.		
vii.		
viii		
ix.		
x.		

SECTION C: FACTORS AFFECTING COLLABORATION

1. Do you agree that the following can hinder the successful implementation of One Health at your place of work?

Lack of communication among health, veterinarians, and wildlife expert

Agree Uncertain Disagree

If you agree, please state why

……

……

……

Lack of transport facilities

Agree Uncertain Disagree

If you agree, please state why

……

……

Lack of interest in zoonoses at work and during training

Agree Uncertain Disagree

If you agree, please state why

……

……

Insufficient funding

Agree Uncertain Disagree

If you agree, please state why

……

……

……

Budgetary separation (health and veterinary expenses cannot be pooled)

☐ Agree ☐ Uncertain ☐ Disagree

The difference in the emphasis (medics focus on patients, vets on livestock, and wildlife experts on wildlife only)

☐ Agree ☐ Uncertain ☐ Disagree

If you agree, please state why

……

……

Lack of multisectoral trust

☐ Agree ☐ Uncertain ☐ Disagree

If you agree, please state why

……

……

Weak public health infrastructure

☐ Agree ☐ Uncertain ☐ Disagree

Institutional separation especially in health and veterinary departments

☐ Agree ☐ Uncertain ☐ Disagree

2. Are you aware of the existence of a zoonotic disease unit in Kenya?

☐ Yes ☐ No

3. If No. 2 is **Yes**, can you list at least two objectives of the unit?

……

THANK YOU

Appendix III: Authorisation from Board of Postgraduate Studies

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

BOARD OF POSTGRADUATE STUDIES
Office of the Director

Tel. 057-2501804
Email: bps@jooust.ac.ke

P.O. BOX 210 - 40601
BONDO

Our Ref: H152/4064/2018

Date: 20th November 2020

TO WHOM IT MAY CONCERN

RE: NOBERT DENNIS ONYANGO– H152/4064/2018

The above person is a bonafide postgraduate student of Jaramogi Oginga Odinga University of Science and Technology in the School of Health Sciences pursuing Master of Public Health. He has been authorized by the University to undertake research on the topic: ***"Effectiveness of Multisectoral Collaboration in the Implementation of one Health Approach for the Control of Zoonoses in Kisumu County".***

Any assistance accorded him shall be appreciated.

Thank you.

JARAMOGI OGINGA ODINGA
DIRECTOR BOARD OF
POST GRADUATE STUDIES
DATE .....
P. O. BOX 210 - 40601, BONDO
UNIVERSITY OF SCIENCE & TECHNOLOGY

Prof. Dennis Ochuodho
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

Appendix IX: Approval from the Department of Health and Sanitation

REPUBLIC OF KENYA

COUNTY GOVERNMENT OF KISUMU

Telegrams: "PRO (MED)"
Tel: 254-057-2020105
Fax: 254-057-2023176
E-mail: kisumucdh@gmail.com

Director of Public Health, Preventive/
Promotion and Environmental Health
P.O. Box 721 – 40100,
Kisumu.

DEPARTMENT OF HEALTH &SANITATION

Our Ref: GN 133 VOL.VII/(117) **Date:** 29th March, 2021

To:

CHMTs, SCMOHs, Facility In-charges and Medical Superintendents

RE: APPROVAL TO CONDUCT RESEARCH IN KISUMU COUNTY

The Department has reviewed and approved this research titled '***effectiveness of multi-sectoral collaboration in the implementation of one health approach for the control of zoonoses in Kisumu County.***'

This principal investigator for this research activity is Norbert Denis Onyango.

Kindly accord him all the necessary support

COUNTY DIRECTOR
OF HEALTH
KISUMU

Fredrick Oluoch
County Director Public Health & Sanitation
Kisumu County

CC. Norbert Onyango

From the office of Director of Public Health, Preventive/Promotion and Environmental Health

Appendix X: Approval from independent ethics review committee

COUNTY GOVERNMENT OF KISUMU
DEPARTMENT OF HEALTH

Telephone: 057-2020801/2020803/2020321
Fax: 057-2024337
E-mail: ercjoorth@gmail.com

When replying please quote

IERC/JOOTRH/347/20
Ref: .....

JARAMOGI OGINGA ODINGA TEACHING & REFERRAL HOSPITAL
P.O. BOX 849
KISUMU

5th February, 2021
Date.....

To: Nobert Dennis Onyango

Dear Nobert,

RE: STUDY TITLE:-
EFFECTIVINESS OF MULTISECTORAL COLLABORATION IN THE IMPLEMENTATION OF ONE HEALTH APPROACH FOR THE CONTROL OF ZOONOSES IN KISUMU COUNTY

This is to inform you that ***JOOTRH IERC*** has reviewed and approved your above research proposal. Your application approval number is ***IERC/JOOTRH/347/20.***The approval period is ***5th February, 2021 – 5th February, 2022.***
This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***JOOTRH - IERC***.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***JOOTRH - IERC*** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***JOOTRH - IERC*** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to JOOTRH - ***IERC***.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

In case the study site is JOOTRH, kindly report to Chief Executive Officer before commencement of data collection.

Yours sincerely,

SECRETARY, IERC

Appendix XI: Approval from the Kenya wildlife service

KENYA WILDLIFE SERVICE

KWS/BRP/5001

12th March 2021

Norbert D Onyango
Jaramogi Oginga Odinga University of Science & Technology
P. O. Box 210-40601
Bondo, Kenya
Email: nobertonyango@yahoo.com

Dear Norbert,

Wildlife Research Permission

We acknowledge your application for a permit to conduct an MPH Research approved by Jaramogi Oginga Odinga University of Science & Technology titled '***Effectiveness of multi-sectoral collaboration in the implementation of One Health approach for the control of Zoonoses in Kisumu County***'. We hope your study will generate useful data that will enhance One Health approach in Kenya.

You are therefore granted permit ref No. **KWS-0036-03-21** to conduct your research **from March 2021 to March 2022** upon payment of KWS research fee of **Ksh 6,000.** You will comply with the KWS regulations and guidelines on Wildlife Research within and outside protected areas during your study. Before commencing your fieldwork, you will obtain a NACOSTI permit and discuss the research work plan and reporting with our Senior Scientist In-Charge of the Western Conservation Area (WCA).

Upon completion of the study, you will submit a copy of your research findings to the undersigned.

Yours Sincerely

DR. PATRICK OMONDI, OGW
DIRECTOR
BIODIVERSITY, RESEARCH AND PLANNING/
AG. DIRECTOR - WILDLIFE RESEARCH & TRAINING INSTITUTE

Copy to:
- Assistant Director, WCA
- Senior Scientist, WCA
- W/SW, Kisumu Impala Sanctuary
- W/SW, Kisumu Station

Appendix XII: Approval from National Commission for Science and Technology and Innovation

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **883195**

Date of Issue: **09/March/2021**

RESEARCH LICENSE

This is to Certify that Mr.. NOBERT DENNIS ONYANGO of Jaramogi Oginga Odinga University of Science and Technology, has been licensed to conduct research in Kisumu on the topic: EFFECTIVENESS OF MULTISECTORAL COLLABORATION IN THE IMPLEMENTATION OF ONE HEALTH APPROACH FOR THE CONTROL OF ZOONOTIC DISEASES IN KISUMU COUNTY for the period ending : 09/March/2022.

License No: **NACOSTI/P/21/9340**

883195

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
INNOVATION

Verification QR Code

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