KNOWLEDGE, TOOLS, UTILISATION AND SOURCES OF BRUCELLOSIS SURVEILLANCE DATA AMONG ANIMAL HEALTH WORKERS IN NAIROBI COUNTY, KENYA

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DECLARATION AND APPROVAL

This Research Project study is my original work and has not been presented for a degree in any other Institution.

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ii

DEDICATION

This Research proposal is dedicated to my beloved wife Lucy Wangechi Muriithi and my children: Zipporah Wangui Muriithi, Titus Muhari Muriithi, Moses Njoka Muriithi, Amos Koine Muriithi, for their motivating support and encouragement in this effort.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMSAND ABBREVIATIONS

APHRC	Africa Populations and Health Research Centre
AU-IBAR	African Union - Inter African Bureau for Animal Resources
CI	Confidence Interval
DHIS	District Health Information System 2
FAO:	Food and Agricultural Organization
GHOA	Greater Horn of Africa
HBM	Health Belief Model
HMIS	Health Management Information System
IDI:	In-Depth Interview.
KNBS:	Kenya National Bureau of Statistics
NACOSTI	National Commission for Science Technology and Innovation
OIE	World Organization for Animal Health
SMPs	Standard Methods and Procedures
URT	United Republic of Tanzania
WHO	World Health Organization
ZDU	Zoonotic Disease Unit, Kenya

ABSTRACT

Brucellosis is a neglected zoonosis considered as reemerging in several countries including Kenya. Globally Brucellosis affects over 500.000 humans and several thousands of livestock annually. Live animals and animal products are the key sources of human infection, which has been on the increase in urban populations. This is associated mainly with increasing raw milk trade and consumption in urban settings. The purpose of the study was to evaluate knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya. The specific objectives of the study were to determine data sources for brucellosis surveillance among animal health workers in Nairobi County, to assess tools available for brucellosis surveillance among animal health workers in Nairobi County, to determine levels of knowledge on brucellosis surveillance data management among animal health workers in Nairobi County and to establish utilization of brucellosis surveillance data among animal health workers in Nairobi County. This research was being guided by Health Belief Model, Knowledge Attitude Practice Theory and Epidemiological Triad Model. The study used applied cross-sectional study design to determine data sources knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya. Study area will be the administrative County of Nairobi. The approach used quantitative and qualitative study approach. Data was collected by the use of structured questionnaire, key informant interview and focus group discussions. Data was systematically entered and analyzed using SPPS software for analysis. The target population in this research was comprised of animal health workers in Nairobi County in Kenya. The study used a census survey procedure that included all the 101 animal health care workers in the County. Data was cleaned, entered, and analyzed using SPSS versus 20 packages. A bivariate logistic regression was used to determine factors associated with Brucellosis surveillance data management knowledge and practice. Quantitative data was presented in form of graphs, tables and pie charts. In addition, information collected from key informants interviews and focused group discussions was analyzed in terms of themes and sub -themes using quotes from the findings, data sources and data collection mechanism had significance effect on brucellosis surveillance data management practice among animal health workers in Nairobi County. Availability of tools, level of knowledge practice and data utilization has a significant effect on brucellosis surveillance data management practice among animal health workers in Nairobi County. The study recommended that animal health workers should be trained equipped supported with logistics and regularly supervised. The results of this study will be shared to both the veterinary and public health authorities and relevant stakeholders and it was expected to contribute towards an improved health information systems and an integrated human-animal brucellosis control strategy in urban settings of Kenya.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter covers background of the study, statement of the problem, study justification, objectives of the study, research questions, significance of the study, and scope of the study, limitations of the study, delimitation of the study, assumptions, and operational definitions of terms.

1.1 Background of the Study

The interface between human beings, animals, and the environment can be a source of many zoonotic diseases with adverse implications on the public health system as well as the social and economic aspects (WHO, 2018). Brucellosis is the most common zoonosis globally. Though endemic in developing countries, it is neglected in sub-Saharan Africa where it causes considerable suffering of human patients and heavy productivity loses in animals (Enzama *et al*., 2018). Brucellosis is one of the most prevalent bacterial zoonosis and is considered an economically important infection that affects humans and livestock. The infection is usually transmitted to humans through direct contact with infected materials such as the afterbirth or indirectly through the ingestion of animal products. In addition to that, the consumption of raw milk represents a major source of the infection (WHO, 2018).

In China, brucellosis was first reported in 1905 and historically was highly prevalent in both humans and domestic animals. During the 1950s to the 1970s, annual incidence was over 1 per 100,000 population in both humans and livestock. After application of strategic prevention and control measures (including vaccination), its prevalence decreased profoundly. In the 1980s and 1990s, annual incidence has dropped to 0.2 per 100,000 population, both in humans and livestock (Zhong *et al*,2018). However, annual

reported cases of human brucellosis have showed an upward trend since 2000 (Zhong et al, 2018). In 2009, 35,816 brucellosis cases were reported. The annual incidence was 2.7 per 100,000 populations (Zhong *et al,* 2018).

Sub-Saharan Africa is the most rapidly urbanizing region in the world. It is estimated that by 2030, 70% of the world population will be residing in the cities (Frayne *et al.,* 2018). However, assured urban advantage in developing countries; raise many challenges including infections and zoonotic diseases which cannot effectively be tackled due to poor access to health services including disease surveillance and control programs) (Menashe-Oren *et al.,* 2018). This is because of mismatch between rapid urban growth and government's inability to provide basic services including health for both human and animals.

In Tanzania's One Health strategic plan (2015–2020) highlights brucellosis as one of six high priority zoonotic diseases (URT, 2018). The strategic plan identifies knowledge gaps on the incidence, testing and surveillance of brucellosis among other priority zoonoses targeted for control and elimination (URT,2018). Previous hospital and community-based febrile studies have estimated that up to 7.7% of the population in the pastoralist communities of northern Tanzania are exposed to Brucella (Bodenham *et al,* 2020), while 6.1% and 3.5% of acute patients from rural pastoralist and peri-urban, agro-pastoral settings respectively have been identified as confirmed brucellosis cases (Bodenham *et al, 2020*). The use of standardized protocols for testing, use of internationally recognized diagnostic tests and use of a standard case definition to generate surveillance data on human brucellosis are not currently practiced in Tanzanian health facilities (URT, 2018).

In Tanzania, the guidelines for surveillance and reporting of prioritized diseases, recommend the use of the electronic, Integrated Disease Surveillance and Reporting system (IDSR) (URT, 2018b). The system, which is used by health facilities to report disease case data to national surveillance systems, is designed to identify cases of priority, notifiable diseases based on the 10th version of the WHO International Statistical Classification of Diseases and Related Health Problems (URT, 2018b). The IDSR guidelines were first incorporated into the Tanzanian health system in 2001 and included 13 priority diseases. In 2011, the national IDSR guidelines were revised to include surveillance of 34 priority diseases and conditions in its second phase (URT, 2018b). Although brucellosis is not a notifiable disease, it is a priority zoonosis in Tanzania that should be reported at health facilities (URT, 2018b). However, despite these goals, the IDSR system is not fully integrated into health facility information management systems, especially in rural, primary health facilities and brucellosis is currently not routinely included as a priority disease within the IDSR system (URT, 2018b). The second phase of the IDSR platform is currently used in most district and referral hospitals, but in the primary health facilities, paper-based facility logs are still widely used (Nonga & Mwakapeje, 2017). The variation in testing protocols at different health facilities for the diagnosis of brucellosis also complicates utilization of existing data. Current practices often lead to misdiagnosis of brucellosis as one of a range of other common causes of febrile illness (Crump et al, 2019)

In Kenya, disease burden remains undetermined or under-estimated due to scanty and unreliable data. The lack of reliable and appropriate quality data has led to neglect and low disease prioritization (Njeru *et al*., 2016). The unavailability of sound quality data in Nairobi County, Kenya and developing world is associated with poor performance of surveillance systems, underreporting of cases and poor data management by field health

workers. A systematic review of studies and publications in Kenya over the last century revealed huge gaps in disease metrics and data due to poor data management practices among professionals (Njeru *et al*., 2016). The practice of good data management among health workers is a key pillar in providing reliable quality data essential for decision making regarding brucellosis control both at local service delivery and at policy-planning levels. The first case of brucellosis was recognized in Kenya in 1916 but a systematic literature review study of 36 publications indicated that data on brucellosis disease burden estimates, prevalence, reporting frequencies and potential risk factors is not available, an indication that data management practice and data utilization is wanting (Njeru *et al*.,2016).

Nairobi, which has over 100 slum settlements, has 10% excess mortality and disease burden. The surge in disease burden is associated with zoonotic infections including brucellosis. The rise in Brucellosis infections is attributed to the increased trade and consumption of raw milk and milk products in urban settings and inadequate public health action arising from insufficient and unreliable health data. (Menashe-Oren et al., 2018),

A study done in Dagoretti area in Nairobi Kenya found 1.1% of raw milk tested positive for *Brucella abortus* (Henaux, 2017). The study found that Three thousand six hundred and ninety-six (3696) persons were treated for brucellosis in Nairobi Public Health facilities, in 2016, while only five (5) animal cases were recorded in the County Veterinary Department. Animal handlers. Moreover, the number of animal brucellosis cases is extremely small as compared to those of humans captured at various Health facilities (Henaux, 2017).

However, studies to assess levels of data management knowledge practice, data use among animal health workers, and associated factors have not been undertaken in Kenya or Nairobi. The aim of this study is to assess level of data management knowledge, practice and factors that are associated with brucellosis surveillance data management knowledge practice and data use among animal health workers in urban settings of Nairobi County. The study findings will be used to improve performance of surveillance system and provide quality data essential for effective public health action.

1.2 Statement of the Problem

Public health burden associated with brucellosis in Nairobi County in Kenya is huge though not officially quantified. Evidence-based literature and relevant data essential for estimating public health and economic impacts is missing in Kenya (WHO, 2018). According to WHO (2018) data, management practice among health professionals is poor due to lack of competencies such as data collection, analysis, interpretation and use. In developing counties only, a small proportion of health workers practice some form of data management further contributing to inadequacy of the much-needed data for public health action (Chaka *et al.,* 2018).

In Nairobi County data management practice remains weak especially among field animal health workers as indicated by the low number of animal case reports yet accompanied by a large number of human cases reported. In addition, there is no literature on brucellosis surveillance data management practice among animal health workers.

This study is intended to fill the gap on knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya. The findings of this study will inform county and national governments animal health

authorities to improve the design and performance of brucellosis data management for planning and implementing effective disease control and prevention strategies.

1.3 Study Justification

There is little published information and scanty data available regarding brucellosis in Nairobi County. Information on assessment conducted in Kenya or any other developing country on the existing surveillance data systems to determine if they are adequately meeting their objectives is not available. Participatory surveillance in animal health sector is weak and animal related cases reported in Nairobi County remains low as compared to human cases yet animals and animal products are the key sources of brucellosis infections. There is therefore limited surveillance data, which is a prerequisite for planning and implementing effective disease control measures and actions. Kenya has been participating in a regional brucellosis surveillance and control programme since 2011 yet only scanty data for performance monitoring is available at Nairobi county level.

The risk of re-emergence and transmission of brucellosis is greater with introduction of peri- urban dairy production and upsurge in raw milk trade and consumption activities (Seimenis & Battelli, 2018). Brucellosis control is most efficient and cost effective if directed at the animal host level (Prez-sancho *et al.*, 2015). The more reason why brucellosis surveillance data management, practice among animal health workers is important to generate essential data for public health action.

Lack of adequate and reliable data is attributed to the levels of data management practices of animal health workers responsible for disease surveillance and control at the field level. Generation and management of reliable quality data depends on data

management knowledge, practices and utilization competences in addition to institutional, technical and organizational support.

There has been a surveillance system in place since 2011 operated by animal health workers yet the amount of data available remains low. However, their performance has not been evaluated in terms of data management knowledge, practice and data use. This study will identify and assess factors that facilitate or hinder effective data management knowledge practice and use among animal health workers in Nairobi County and therefore give insights of improving existing data systems for appropriate early warning early action to reduce escalating burden of urban milk borne surveillance

The devolution of Animal and Human health services to the counties as per the Kenyan Constitution promulgated in 2010 has brought new dimensions and impact that should be considered in disease monitoring and management systems in both human and livestock sectors. This study will seek to assess the levels of brucellosis surveillance data management knowledge practice and data utilization among animal health workers in Nairobi County regarding brucellosis. Since there is no previous study conducted, the information obtained in this study will help to establish a base line and provide specific recommendations for designing reliable data management and brucellosis surveillance systems by both the County and National Governments.

1.4 Objectives of the Study

1.4.1 General Objective

To investigate knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya

1.4.2 Specific Objectives

i. To determine data sources for brucellosis surveillance among animal health workers in Nairobi County, Kenya.
ii. To assess tools available for brucellosis surveillance among animal health workers in Nairobi County, Kenya.
iii. To determine levels of knowledge on brucellosis surveillance data management among animal health workers in Nairobi County, Kenya.
iv. To establish utilization of brucellosis surveillance data among animal health workers in Nairobi County, Kenya.

1.4.3 Research Questions

1. What are the data sources for brucellosis surveillance among animal health workers in Nairobi County, Kenya?

2. What tools are available for brucellosis surveillance among animal health workers in Nairobi County, Kenya?

3. What is the level of knowledge on brucellosis surveillance data management among animal health workers in Nairobi County, Kenya?

4. How is brucellosis surveillance data utilized among animal health workers in Nairobi County, Kenya?

1.5 Significance of the Study:

The study forms the basis and enhances research-based policies on the adoption of data management knowledge and use in public health service especially in management of milk borne Brucellosis and other Zoonotic diseases in both national and county governments. The study will also provide a reference point for physical knowledge

management of data such as collection, analysis, dissemination and utilization data. It will also enhance adoption of efficient surveillance systems amongst animal health workers in urban settings in relation with associated factors. In addition, the study will be useful to the community as it might help in the reduction of brucellosis and other zoonotic diseases. The study contributed to the existing body of knowledge on brucellosis disease surveillance in Kenya. It also stimulated prospective researchers to replicate the study in the study of other zoonotic diseases.

1.6 Scope of the Study

This study will focus on knowledge, tools, utilisation and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya. The research will be carried out in Nairobi City County, which has seventeen administrative sub-Counties. This study focused on level of knowledge, tools, sources and utilization of brucellosis surveillance data. The study will be confined to public animal health workers in Nairobi County. The study lasted 12 months

1.7 Limitations of the Study

Like all other research work, this study is likely to face certain limitations. Research limitations are those characteristics that arise from designs or methodology used in study has and affect study findings and their interpretation (Price et al., 2004). The number of responses received and the accuracy of information volunteered will limit the study. Findings may not be generalized to other areas other than urban settings. To overcome these limitations, the researcher intends to recruit and carry out training of enumerators as well as pretesting of interviews. In addition, 10 percent more questionnaires will be administered and the researcher where possible will engage respondents to improve respondent understanding.

1.8 Delimitation of the Study.

Delimitation refers to deliberate choices or selections made by an investigator to describe boundaries set for the study. They are intended to guide practical achievement of research goals and are determined mainly by theories, objectives questions and variables adopted by the study. This is to describe the scope of interest in details (French, 2017). The study will be delimited to animal health workers in the civil service who have been trained on notifiable disease surveillance service in Nairobi County. The study was also delimited to officers‟ attributes of data management knowledge, use and practice gender and work experience. The study will also be delimited to a structured questionnaire as the only tool of data collection.

1.9 Assumptions

Assumptions in research refer to elements or factors outside the control of an investigator that are taken for granted or accepted as true in a study (LeVine, 2018). This revolve around the study theory or phenomenon and includes instruments, methodology, analysis, participants and results (LeVine, 2018). For the purpose of the study, the researchers assume that the training and educational background of the respondents to this study will enable them understand the terminologies used in the research instruments. It is also assumed that respondents would participate freely and honestly, because anonymity and confidentiality will be preserved and the sample taken will be generalizable to the entire population. In addition, the participants have access to surveillance material and supervision. The investigator assumes approvals by the necessary authorities and institutions such as the Nairobi City County government, Mount Kenya University Ethical committee and NACOSTI will be granted in good time.

1.10 Operational Definitions of Terms

Clinical/ Syndromic Surveillance: Refers to health data of a clinical syndrome that has significant impact on community or population health. This is crucial in tracking the presence or absence of specific disease or condition in a certain population and can be useful in anticipating or predicting an outbreak (the webstars new world medical dictionary, 2004).

Data Collection Mechanisms: Surveillance system is a methodology involving one or more component of activities that generate information on disease status and health events for the purposes of informing public health actions and effectiveness of public health intervention. It involves deliberate search of information identifies relevant representatives reliable and timely data for policy planning, action planning and cost effective management of health events. There are various types of surveillance depending on the purpose of the information required namely:

Active Surveillance: involves a committed effort by veterinary professionals to collect information on specified disease. It is based on well-designed survey and it involves sampling of clinically normal animals in a population and is useful in detecting subclinical and carrier cases (Martin *et al., 2019*).

Data Sources: Sources of surveillance data; large farms, owners, veterinary practices, breeding stations, research institutions, veterinarians, para-veterinarians, community health workers, laboratories, abattoirs, commercial ranchers, medical personnel in public and private institutions and livestock markets among others

Data Use Practice: This refers to actual utilization of collected data and synthesized information in planning policies, programming interventions and following up the same to determine their success. This continuous use of generated information that develops into practical knowledge and skills and eventually enhances data management capacities of health practitioners and other data users. The ability to collect, process, interpret, use data: share data with other users. The individual ability to present findings, medium of communications, and evaluating routine activities (Shagake, 2017).

Definition of Public Health Surveillance: Public health surveillance is referred to as an on-going assessment of community health events and includes timely collection, collateral analysis, interpretation, dissemination and use of that data (Krieger, 2018). Data is important in describing, predicting, prioritizing, planning, monitoring and Evaluating Public Health Policies, Intervention and programs (Orenstein and Bernier, 1990)

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter will outline the review of literature carried out by the researcher. It is organized around knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya

2.1 Theoretical Literature review.

In this study, two theoretical models will be considered in guiding the researcher in achieving the research goals. These models are health belief model, Knowledge Attitude Practice Theory and the epidemiological triad model.

2.1.1 Health Belief Model

The model was first developed in the 1950s by social psychologists; Hochbaum, Rosenstock and Kegels working in the US Public Health Service Department. It was developed in reaction to the failures of public health preventive services at that time and more specifically for explaining and predicting health-related behaviours more so concerning uptake of health services (Janz & Becker, 1984).

The main argument of the HBM is that a person's belief about health related problems, perceived benefits of actions and barriers to actions as well as self- efficacy explain people's involvement or lack of involvement in health-promoting behaviours. In addition, a stimulus or cue to action is important in triggering health-promoting behaviours (Rosenstock, 1974).

The model at the personal level is useful in explaining change and maintenance of health related behaviors. This guiding framework is particularly useful in health education and extension behavior and related interventions. In the four concepts of the

model, it is assumed that taking action to prevent or control illness is important if one takes himself susceptible. Taking action will also depend on believe that the condition or illness will have potentially serious consequences for one i.e. perceived severity (Eracker *et al.*, 1984).

In addition, if one believes is beneficial in reducing both severity and susceptibility (perceived benefits). One needs to belief also that benefits (Perceived benefits) outweigh perceived barriers to action (Eracker *et al.*, 1984). From literature, we have learnt that animal health workers have very poor skills knowledge of managing Surveillance data if they had the right knowledge they would greatly improve the quality of surveillance data that is crucial to control of brucellosis among animals before it spreads to humans.

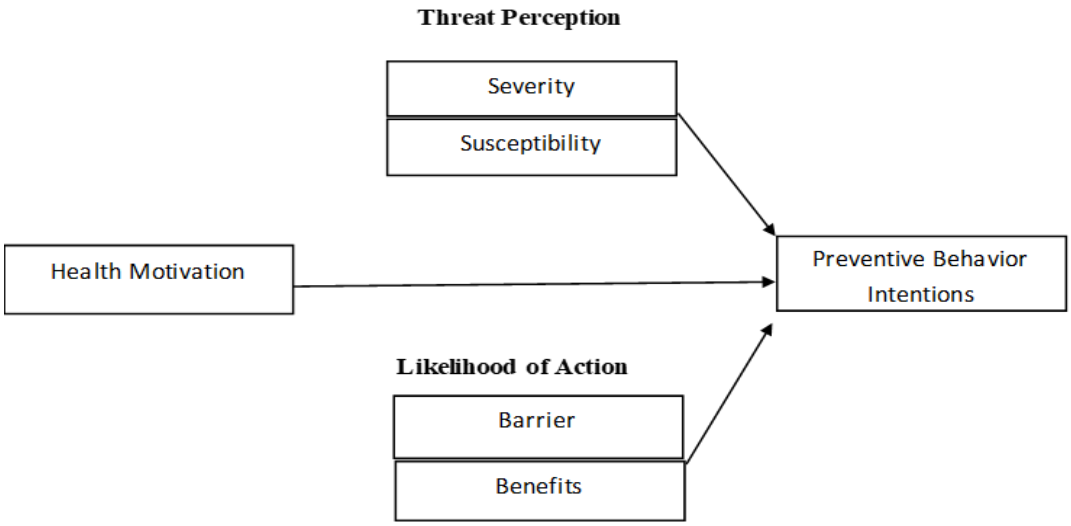


Figure 2.1:The health belief model adopted

(source: Beckel *et al*., 1984)

2.1.2 Epidemiologic Triad Model

A model that explains infectious disease causation process. It consists of the environment in which the susceptible host and the agent interact to cause a disease in the susceptible host. In this arrangement, some organism (vector) plays a role of

transmitting infectious process but vectors do not cause disease. In triad model, transmission will occur when disease agent moves from one host or reservoir through a portal of exit and enter into a susceptible host through an appropriate portal of entry. The mode of transmission is either direct contact of host to host or indirectly through inanimate vehicles or formites or animate one the vectors.

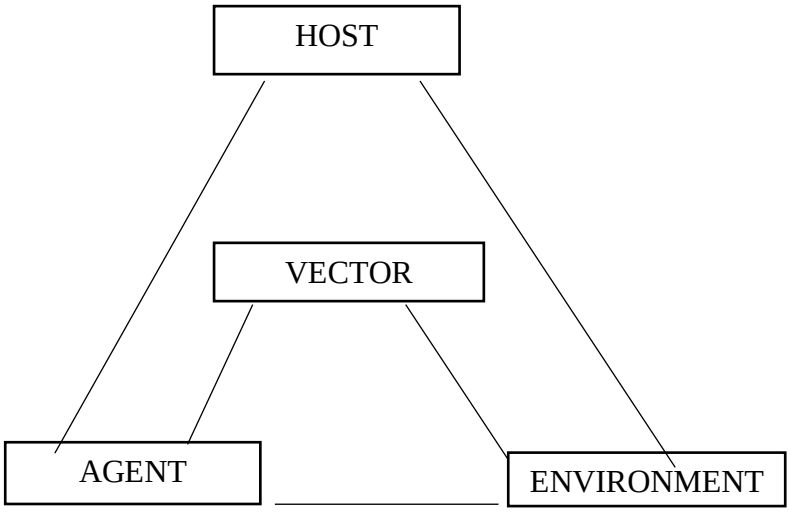


Figure 2.2 Epidemiologic Triad of Disease Causation

(Adopted from Egger et al., 2003)

This model is important for this study because it explains the conditions that has to be met for the spread of brucellosis. Knowledge on this theory will help in preventing or curing brucellosis and other zoonotic diseases in Nairobi County.

2.1.3 Knowledge Attitude Practice Theory

In this theory, Public Health surveillance practice diffusion of innovation is linked to skills and habits, which are shaped by variables of knowledge attitudes and practice (KAP). He also recognizes practical experience, self-motivation and work environment as factors that improve knowledge and attitude practice (Armstrong, 2019). Andrew and kandel (1979) recognises that behaviour change through attitude influence depends on the contingent factors or situational factors that impact on attitudes such as -

a) Socio-economic status -income, occupation, age, gender education and religion

b) Level of physical or psychological experience such as health.
c) Enabling means or availability of facilitating support items like logistics, materials, training supervision or Technical packages.
d) Level of attachment to a relevant group attitude towards desired target behaviour, such as behaviour of Public health workers, laboratory workers or animal health workers.

Therefore, the success of an organization depends on its knowledge, how knowledge is used what lessons can be progressively learnt and how it can a can generate and adopt new ideas consistently. (Prusak, 2017). This is because though generating knowledge is essential. Know how has to leverage on a contingent factor to be useful, this is how to make public health institutions more efficient in taking necessary actions promptly both at personal and organizational level. (Nonaka, 2017). Some studies have been conducted on how organizations share knowledge between groups or individuals but little research has concentrated on how knowledge is used by individuals who generate it (Mowery *et al.,* 2016). Technology is a useful tool to facilitate both knowledge generation and use an example where mobile phones are easy to use in collecting, analysing or transferring information to web sites or the computer aided systems (Goodman & Darr, 2016). This theory is important in this study because the effectiveness of data management by the animal health worker in Nairobi county depended on their knowledge, attitudes and practice on brucellosis disease.

2.2 Empirical Literature Review.

2.2.1 Data Sources for Brucellosis Surveillance

Timely and responsive public health surveillance for zoonotic diseases such as brucellosis heavily depends on integrated interventions from public health settings, hospitals, and animal-related organizations. These interventions necessitate a

consistent, reliable, and interoperable dataset across involved organizations (Idrovo, 2020) The absence of an effective health information management system (HMIS) hinders precise assessment of the actual frequency rate and distribution of brucellosis and delays control efforts (Keramat *et al,* 2021). Accordingly, the enhancement of data management strategies to improve the measurement of the real disease burden and affect the results of interventions has garnered global attention.

Traditionally, bio-surveillance systems rely on the reporting of identified diseases formally by field investigators, physicians, veterinarians, laboratories, and other healthcare providers to relevant health agencies. Although traditional surveillance produces accurate and high-quality data, these systems can be expensive and require a formal health structure to operate. Furthermore, these systems are hierarchical in organization, causing considerable lag in disease reporting. Many times, an outbreak is underreported or unreported due to these limitations, especially in resource-limited settings (O'Shea, 2017).

Digital health surveillance is a form of non-traditional, internet-based, surveillance that mines large volumes of electronic data, e.g., news articles, social media, blogs, and other internet sources, to identify and monitor health-related events (Morse, 2017). These digital surveillance methods act as a form of early warning systems, providing health alerts that are difficult to obtain through traditional health infrastructure. These systems utilize varying levels of automation and human scrutinization to screen large quantities of unstructured data present on the internet, filter out unnecessary data, and flag potential health threats (Keller *et al.,* 2019).

The filtered information is then further verified by qualified experts and useful information is extracted manually or using natural language processing techniques for further analysis (Milinovich *et al.,* 2016). Early warning systems have played a critical

role in informing the outbreaks of diseases, such as severe acute respiratory syndrome (SARS) and Ebola, to official health authorities (Milinovich *et al.,* 2016). Some of the examples of disease warning systems include ProMED-mail, HealthMap, the Global Public Health Intelligence Network (GPHIN), and the Early Warning, Alert and Response System (EWARS). Early warning systems are highly cost-effective, easily accessible, and provide spatial and temporal alerts of high resolution in near-real time (Guy *et al,* 2018).

In many low- and middle-income countries where the veterinary and public health infrastructure is rudimentary, declining, or non-existent, digital surveillance can inform official verification, timely response, and the mobilization of health resources during disease outbreaks. Digital surveillance has been utilized by international agencies, such as the World Health Organization (WHO), as a source of epidemic intelligence in investigations. In fact, the majority of infectious disease events investigated by WHO were first identified through these informal sources, including press reports and the internet. (Grein *et al* 2018).

In Africa countries are leveraging technology to create interoperable health information systems. Interoperability allows different branches of a health information system using different software to tap into each other's' databases to harvest useful information, improving quality and completeness of data in each sector (Aquil *et al,* 2019). Some countries are using District Health Information Software (DHIS), Electronic Medical Records (EMR) and Electronic Health Records (EHR) for collection, analysis, sharing information and knowledge for health information system strengthening throughout the region. Information system managers, decision-makers, developers of open source software for health information systems and other stakeholders are involved in strengthening health information systems (Aquil et al, 2019).

In Kenya, due to a continuous change in farming systems, preferred livestock breeds, and trading patterns, as well as close interactions between people and animals, there is a rising risk of zoonotic disease outbreaks. Though zoonotic disease surveillance is carried out by both human and animal health sectors, there is minimal integration of the surveillance systems between the two sectors, leading to underreporting of disease events (Falzon et al, 2019). Furthermore, Kenya is limited in disease surveillance infrastructure comprised of adequate diagnostic facilities across the country and appropriately trained personnel, disease reporting, and an early warning system. In this situation, a digital surveillance system has the potential to greatly advance country-wide bio-surveillance efforts through automated gathering, compiling, identifying, and reporting of information related to potential new or unknown disease events from a variety of sources. Our study examined the nature and extent of zoonotic disease reporting in Kenya, the potential of digital bio-surveillance in the early detection and warning of zoonotic disease events, and factors associated with the official reporting of such events (Falzon et al, 2019).

Kenya most health facilities are using paper based health information system. The Districts and referral hospitals are using District Health Information Software and some use Electronic Medical Records (EMR) and Electronic Health Records (EHR) (Ballou *et al*, 2019). Health Information System (HIS) is one of the most powerful investments one can make to improve your ability to show evidence of one's progress. Kenya faces greatest challenges in collecting, analyzing, evaluating and interpreting indicator data to guide evidence based policy-making (Canadian Health Services Research Foundation, 2016). In Gucha District, health information system uses District Health Information Software (DHIS) and Electronic Medical Records whereas health facilities (health

centres and dispensaries) use paper based and level four hospitals use EMR and DHIS (Canadian Health Services Research Foundation, 2016).

2.2.2 Tools for Brucellosis surveillance data.

Donors tend to take advantage of the government policies, which are perceived sometimes as weak, by taking lead to demand for extra and enhanced data to serve their own purposes of reporting because at the national level such data is considered not relevant (HMN, 2018). Because of such constraints found in the national government systems, some donors organize their own systems for monitoring their activities (HMN, 2018).

Physicians acceptance of hospital information systems: a case study revealed that top management support positively influences perceived usefulness and use of data (Chen & Hsiao, 2019). Top management support strongly, directly and positively affects perceived usefulness and use of data (Shih & Huang, 2020). Moreover, supported that top management support positively affects HIS user satisfaction (Cho, 2017). In addition, perceived adequacy of top management support has a significant impact on HIS user (Urbach*et al.*, 2021).

Keeping staff informed of metric results, benchmarks, and unit outcome measurements such as patient satisfaction scores and complaints is helpful for increasing staff buy-in to improve processes in the unit. But staff nurses also need to add data analysis and data-driven decision making skills as part of their direct-care competencies. Complex, unique, and ever-changing patient demands require rapid response and frequent adjustments. As a unit leader, she/he is the critical link for completing the circle of using outcome data to improve patient care (Carl Thompson, 2017). Thus, information and knowledge resulting from data assist healthcare personnel to develop strategies to improve performance and patient-care quality. Given that healthcare is ever-changing

and evolving, it's the responsibility of the leadership to familiarize themselves with data analysis and data-driven decision-making processes in order to make more informed decisions (Carl Thompson, 2017).

The efficiency with which a job is carried out may depend in part upon the technical apparatus available to do the job, and the extent to which the job provides satisfaction (Naeme, 2018). Some of these factors may be assessed by the use of formal techniques during the design stage of an information system, but in the main information relating to value, attitudes, and power is derived from the informal system (Naeme, 2018).

State of the art systems are critical for strengthening care delivery as it generates timely information for proper planning, monitoring and evaluation of service in health system. However, in sub-Saharan Africa, health reporting has been manual producing incomplete and flawed reports. Evidence shows that continued use of conventional systems contributes to poor data quality in terms of reliability, availability, timeliness and completeness of reporting, and compromises health service delivery. In Malawi, for instance, Kiberu found that the use of paper-based health facility reports to generate national synopses resulted in a 12% underreporting of persons on first-line antiretroviral treatment because many sites did not submit accurate data to the national level. (Kiberu et al 2016)

Study carried out in South Africa to discover and explains staff practices in managing data and/or information when utilizing (DHIS2) to support data quality improvement, strengths and weaknesses of current data management processes signified strengths, weaknesses and barriers that staff encounters. Data capturers was stated as a strength. Weaknesses included staff shortages of both clinical and corporate staff, shortage of computers and Internet access, poor feedback, training needs and data quality issues. Most of weaknesses and barriers meant proper implementation of DHMIS policy,

Standard Operating Procedures (SOPs), e-Health strategy and training staff, should be given attention (Garrib *et al.,* 2018).

In Tanzania, good health information systems are crucial for addressing health challenges and improving health service delivery in developing countries (Sherrod & Mumford, 2020).. However, the quality of the data produced by such systems is often poor and the data are not used effectively for decision-making. Although there has been increasing international attention to the need to develop strong health information systems, it has proved difficult to do so for several reasons, including fragmentation and lack of coordination of health programs (Sherrod & Mumford, 2020).

2.2.3 Level of Knowledge of Brucellosis Surveillance Data Management.

As healthcare organizations rapidly develop informatics and electronic systems, data become readily available hence operational and data analysis becomes a primary skill to encourage data use for decision making by clinical team managers in constant pursuit of process improvement and quality (Sherrod& Mumford, 2020). Motivating data collectors remains a challenge despite training on data-collection registers and questionnaires (Odhiambo, 2020). Staff attitude towards health information management determines their use of the data for improvement delivery at the point of collection. Common challenges with HIS in such nations is lack of ownership of data due to workers' perception that HIS submit reports to higher levels, meaning there is no enticement for health workers at lower levels to analyze, use and interpret health data (AbouZahr & Boerma, 2020).

Feedback of information to the providers of health data is essential. The success of any management information system depends on the feedback of data collected. It is the backbone of a sound information system and provides incentives ideally for providing accurate and up to date data (Ekwueme,2018). In order to collect valuable, relevant and

cost effective data, primary health care (PHC) workers should learn to appreciate the importance of statistical data and develop the skills needed to collect necessary and useful data (Ekwueme,2018). Training them on data management will motivate and empower them to recognize the importance of gathering accurate and reliable information. Studies in Nigeria have shown the need for training of primary health care workers on HMIS to improve data quality (Adindu & Babatunde, 2019).

Developing skills in analyzing, interpreting, and decision-making promote information use. A study in Zambia found that a well-designed Health Management Information System (HMIS) where health workers were trained in accord with internationally documented practices contributed to quality of data required to support good decisions (Simwanza and Church, 2018). Training in data use must be conducted to strengthen the capacity of health workers at the district and local levels to use health data for better management and health service delivery. Ability to interpret health information and apply it to the programmatic and policy context requires a skill set that is often never addressed in pre- or post-service training of health professionals. Training in data management and its importance at facility level may improve information use. In this way the system may become a promoter for good quality data to be used in decision making processes (Mohr & Batalden 2019).

Another study in India showed that inadequate analytic and data use skills were the most commonly reported constraints with a substantial number of respondents expressing a need for further training on data quality assurance, analysis and use. Interestingly, few respondents agreed that poor data quality was a serious impediment although duplication of data and inconsistencies in the data collection process were perceived barriers to data use (Harrison, 2019). Additionally, routine health information systems management should be decentralized to improve local use of health

information. This happens when local level managers and health service providers are involved in designing data collection and reporting tools. At district level one designated person or team should be responsible for information. In addition, information (including raw data), should be made available to all potential information users (RHINO, 2019) Furthermore, to improve sustainable demand for and use of data in decision making individual capacity in core competencies to demand and use data must exist at all levels of the health system. Competencies include skills in data analysis, interpretation, synthesis, and presentation, and the development of data informed programmatic recommendations. Data users often struggle with an underdeveloped ability to understand analyses and interpret them in the programmatic context.

2.2.4 Utilization of Brucellosis Surveillance Data

Employees' involvement refers to work structures and processes that allow employees to systematically give their input into decisions that affect their own work (Powell, 2011). It creates an environment in which people have an impact on decisions and actions that affect their jobs. (WebFinance, 2016) adds that it entails regular participation of employees in deciding how their work is done, making suggestions for improvement, goal setting, planning, and monitoring of their performance. Encouragement to employee involvement is based on the thinking that people involved in a process know it best, and on the observation that involved employees are more motivated to improve their performance (WebFinance, 2016). Despite training on the HIS, health care workers and managers do not always put the data collected to best use (Naeme, 2018). This has been described as a culture of reporting rather than a culture of using the information. There is little tradition of information use for decision making at the facility level in most developing countries, even among health managers. Health

care workers need to have sufficient knowledge and skills in order to have confidence to use information for decision-making.

Around the world, data are collected at health facilities about the populations they serve, their health needs and the services provided to meet those needs. These data are used to populate reports that are required by the varied national health programs. Often, once these data are sent to the higher level in the health system, they are not considered or used by the facilities themselves or their district or regional management to make decisions about future service delivery (Nutley & Reynolds, 2020). While providers may use data for individual patient management, health managers and providers rarely analyze the data they collect to monitor service delivery trends or to assess problems and identify new strategies for improving health services. As a result, many health systems fail to fully link evidence to decisions and suffer from a decreased ability to respond to the priority needs of the communities they serve (Nutley & Reynolds, 2020). System quality has a strong direct effect on perceived usefulness and actual use of data (Hwang, *et al*.,2018). In addition, Park, et al. (2019) supported that system quality has a positive influence on perceived usefulness of data which would influence its utilization. Moreover, Halawi, et al. (2018) supported that there is a positive relationship between system quality and user satisfaction and use. In addition, Ainin, *et al.* (2021) supported that system quality will have a significant, positive relationship with user satisfaction level and utilization of data.

Lack of involvement and motivation among health services personnel accounts for low quality of data collected and disseminated or discourage healthcare providers from submitting data collected. Since health services supervisors and peripheral health workers rarely receive feedbacks on data reported to higher level, they have little

incentive to ensure the quality of data collected and to comply with reporting requirements (Oranga, 2021).

Concern raised by HIS experts is lack an information culture in developing nations. There is need to focus on support command and feedback for HIS. Feedback keeps communication lines open and tenaciously solve problems leading to improvements in HIS. Health workers collating and transmitting data hardly get any feedback, and when such feedback is given it is negative, delayed and not very constructive (Chitama *et al.*, 2018).

The determinants of data utilization by grouping into three categorized such as behavioral, technical and organizational factors where by organizational factors played a crucial role in enhancing the behavioral and technical factors(Chorongo,2016). Researcher recognized that utilization of health information is determined by those three determinants by developed and strengthened of all determinants will make the best use of information to make decisions (Chorongo,2016).

Another study done in India explain that inadequate analytic and data use skills, repetition of information and inconsistencies in the data collection process were observed to be the most commonly an obstacle with a large number of respondents and recommends to have extra training on data quality assurance, analysis and use (Harrison et al, 2019). Furthermore, a study done in Tanzania on data management and came up with various factors that influence the use of health data such as knowledge, positive attitude, computer use, accessibility and friendliness of data collection tools, supervision, obtainability of fund and culture of information use (Chidi, 2017). Apart from that also the researcher reveals several challenges which hinder the effective data utilization which involves in adequate funding, data collection tools, supervision,

insufficient training, duplication and unfriendliness of data collection tools (Chidi, 2017).

In their study on the routine health information utilization showed that, more than half of the health workers working at government health institutions of East Gojjam Ethiopia were poor in using health information compared with the findings of others studies which is not good enough in health information system (Shiferaw*, et al.*, (2017). The study conveys that 45.8% of health providers had a good level of routine health information utilization. Thus, an inclusive training, supportive supervision, and regular response are extremely endorsed for improving routine health information use among health workforces at health facilities (Shiferaw, *et al*., (2017). Furthermore, the study indicates that HMIS training, data analysis skills, supervision, regular feedback, and positive attitude were factors associated to routine health information system utilization (Shiferaw, et al., (2017).

In Kenya there have been efforts to improve health care workers involvement in data driven decision making. An assessment by Health Metrics Network (HMN) identified various areas that need support to strengthen data use including among others; Lack of HIS policy guidelines and clear responsibilities of health workers at all levels; Weak linkages and data sharing; Inadequate feedback at all levels; Inadequate capacity building in data management; Inadequate health information scientists at all levels; lack of standard operating guidelines at all levels; Inadequate infrastructure at all levels i.e. email, computer services and databases; Inadequate use of HIS for planning and allocation of resources; inadequate allocation of resources to support HIS activities. Based on the recommendations from the findings efforts have been made through capacity building to upscale data driven decision making (HMN, 2018). The available literature is however scanty and is limited in focus particularly on how involving health

care workers promotes data use for decision making hence the focus of this study (HMN, 2018).

2.3 Critical Review

Data gaps are said to exist when available information is insufficient, inappropriate or incomprehensive to serve the purpose of which the surveillance system is designed. Data gaps arise from errors made during collection, entry, storage, processing and various data handling activities. This is partly due incompetence of data handlers and managers, inappropriate tools, lack of supervision and poor motivation of animal health workers. Motivation may be influenced by personal gains in terms of monetary incentives or social recognition and expected feedback response or utilization of the data (WHO, 2017).

In both World Health Organization (WHO) and World Organization for Animal Health (OIE), usually attach some monetary incentives to people who report cases of diseases or conditions identifications for eradication. In Kenya, a cash reward of Kshs. 100,000 (approximately US$1000) is given to a person who reports a confirmed case of Guinea worm, a neglected tropical disease like brucellosis (WHO, 2017). Public health practitioners are also influenced by their professional passion to diagnose and intervene in confronting, challenging public health events. Policy makers' and health program managers are motivated to follow up on data management since it would guide them in evaluating success and progress of various policies, programs interventions that enable them to take appropriate corrective measures.

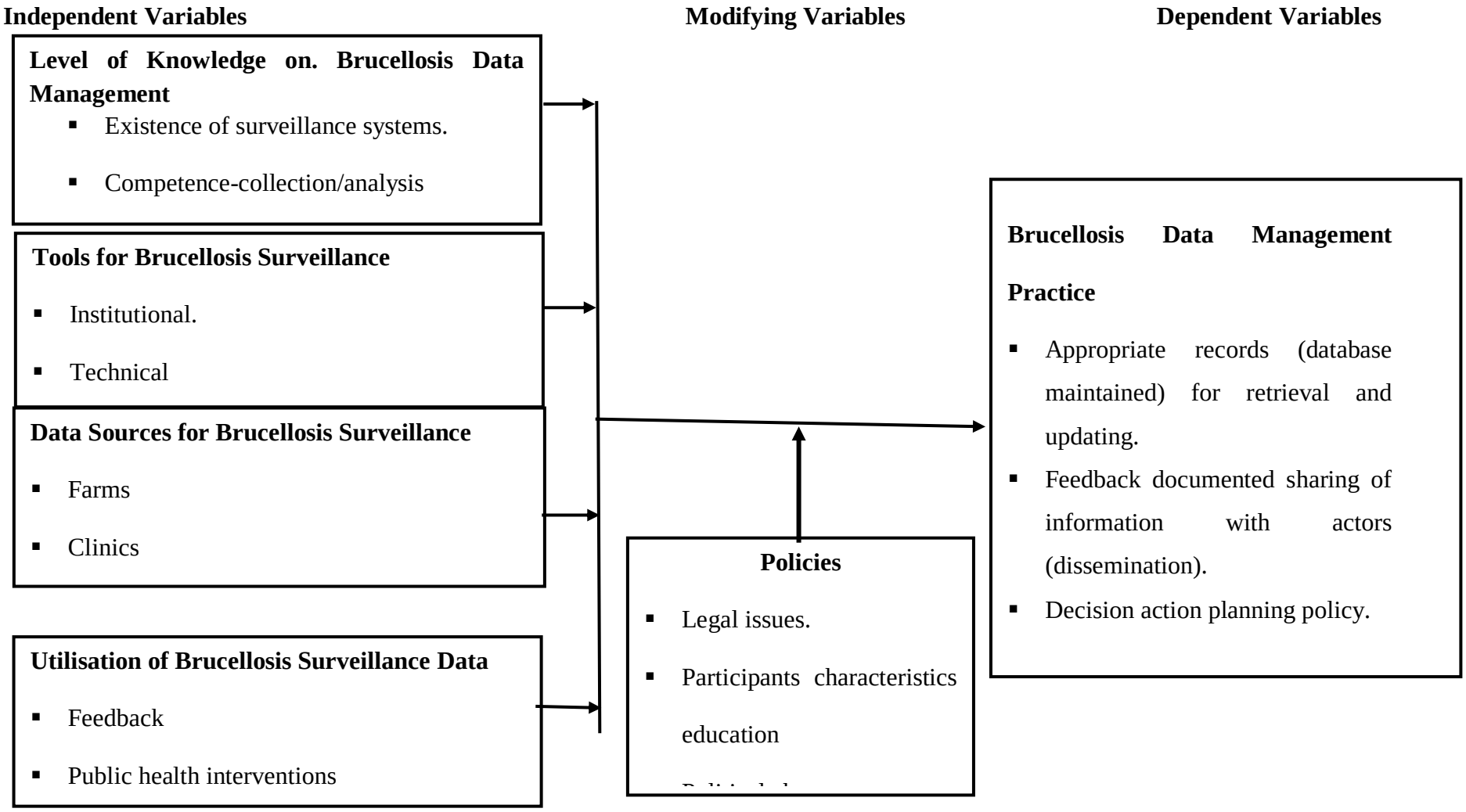
Training and practical experience are crucial to data collection skills. It has been recognized that without appropriate skills and knowledge, data enumerators and data analysts may fail to produce expected valuable information in their surveillance work. Capacity building of personnel implementing laboratory based surveillance and other

public health interventions is therefore vital to improve surveillance systems. WHO African region has adopted a course that provides competencies and skills to collect, collate, analyze, interpret and share laboratory surveillance data for early disease recognition and response. A similar initiative would assist animal health professionals to improve surveillance systems including that of brucellosis (WHO, 2017).

A systematic review of brucellosis literature within studies and publications carried out in the last century in Kenya gave no indications of such a study (Njeru *et al.*, 2016). This study is intended to generate knowledge and data about the level of brucellosis data management knowledge practice and use and associated factors among animal health workers in Nairobi County in Kenya.

2.4: The Conceptual Framework.

The conceptual framework intends to imagine factors that have a bearing on Brucellosis surveillance data management practice among animal health workers in Nairobi County in Kenya. In this study the independent variables are level of knowledge, tools, sources and utilization while dependent variable is brucellosis data management practice. The modifying variables in this study is policies.



Source: Literature review by the researcher.

Figure 2.3 Conceptual Framework

2.5 Summary of Conceptual Framework

Data management practice depends on independent variables which include the capacity of health workers to apply data management competencies, the sources of brucellosis surveillance data, available technical and institutional tools and utilization factors. Moderating factors include social demographics, factors, policy and Political environment

2.5.1 Independent Variables

2.5.1.1 Level of Brucellosis Surveillance Data Management among Animal Health Workers

This includes the individual competencies required to collect, analyze, disseminate and utilize brucellosis surveillance data

2.4.1.2 Tools for Brucellosis Surveillance

Availability of appropriate technical and institutional tools will determine the practice of brucellosis surveillance data management

2.5.1.3 Data Sources for Brucellosis Surveillance

Appropriate complete and reliable data is also dependent on relevant and articulate sources of data

2.5.1.4: Utilization of Brucellosis Surveillance Data

Data management practice is influenced by the value it adds in policy and public health interventions planning, implementation and evaluation..

2.5.2: Dependent Variables. Brucellosis

2.5.2.1 Data Management Practice

Indications of good data management include well-kept and regularly updated records, information sharing and communication protocols3

2.5.3: Moderating Variables.

2.5.3.1: Government Policy

The government policy strategies and programmes are important in guiding surveillance systems. the moderating effect can shape data management

2.5.3.2: Individual Participants Characteristics.

Personal attributes of animal health workers such as the level of education ,technical and professional competencies affect efficiencies [n data management practice.

2.5.3.3: Political Situation of the Country.

Data management practice will also depend on the stability or other political environment in the country such as logistical support, institutional efficiency or political good will of government in place.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The section contains the study methods used in this research work. It comprised of the study design, research approach, target population, sample size determination and sampling process, data gathering tools and techniques. It also focused on methods of data analysis, data presentation techniques and ethical issues.

3.1 Study Design

The research work applied cross-sectional study design where data was collected in a systematic manner to establish factors that are associated with milk borne brucellosis data management knowledge practice and use among animal health in Nairobi County in Kenya. The design enabled the investigator to acquire important information at a point in time. It helped in examination and analysis of independent variables in relationship to dependent any other variable that affects the level of surveillance data management knowledge, practice and use, and associated factors among animal health workers in Nairobi County in Kenya (Shagake, 2014).

3.2 Site Study Approach.

The approach study used quantitative and qualitative study approach. Data was collected by the use of structured questionnaire, key informant interview and focus group discussion and systematically entered and analyzed using SPPS software for analysis. Quantitative information was grouped in themes and analyzed using it will be based on interviews of animal health workers in Nairobi County.

3.3 Study Site

Study area will be the administrative County of Nairobi. The County covers approximate area of 996sq. kilometer. This area includes seat of Kenya government as well as the county headquarters. The huge population, a fifth of the national population, reside here and consume milk mainly from other counties and its production only covers 10% of the total demand production is carried mainly in the pre-urban areas of Kasarani, Roysambu, Ruaraka, Westlands, Langata, Kamukunji, Makadara, Dagoretti, and Embakasi sub-Counties. However, all other areas have some limited level of production due to land scarcity. Many farmers keep their animals away from public due to the fear of county by-laws but report cases to veterinary service providers. (Refer to appendix II)

3.4 Target Population

The target population in this research was comprised of animal health workers in Nairobi County in Kenya providing animal and public health services including disease surveillance and have some level of knowledge of data management. Interviews were carried out for all the animal health care workers deployed in county administrative structures as well as in specific facilities such as laboratories, slaughter houses and markets handling fresh animal products. The animal health workers came from the following departments: Disease control, extension services, public health, food safety, laboratory services and clinical services. These animal health care workers are charged with responsibilities of disease reporting, sharing and management.

3.5 Sample Size determination

The study used Cochran formula to calculate the sample size, a prevalence rate of 5.6% derived from a brucellosis survey carried out by Kenya Zoonotic Disease Unit in

Kiambu County (ZDU, 2021), was considered most appropriate (Cochran 1977) formula used to calculate the sample size.

$$N = \frac{Z^2 P (1-P)}{d^2}$$

Where Z is the value of 95% confidence level, which is 1.96

P is the known prevalence, which is 5.6%

D is the margin of error (precision) which is 0.05

$$n = \frac{1.96^2 \times 0.056 \times 0.944}{0.05^2}$$

N= 81 samples minimum plus 10% to cover non-responses making a total of 90 samples.

3.6 Eligibility Criteria

3.6.1. Inclusion Criteria

Public animal health care service providers who have practiced for at least three years in the study area and are deployed in county administration stations, Veterinary laboratory and fresh animal products markets for at least 3years

3.6.2 Exclusion Criteria

None was excluded since a census survey was carried out in the study.

3.7 Sampling Procedures

The study used a census survey procedure that included all the 101 animal health care workers in the County. The staff deployment register was used to recruit the officers

who took partake in the study. The sample size calculated by the Cochran formula was 81. A further 9 samples representing ten percent of calculated sample size was added to cover for non-response and make the sample size 90. Where an officer was not present in the station during the interview day, a repeat visit was made

Table: 3.1: Sampling Frame

S/No.	Sub-County	No. in place	No. Selected
1	Starehe	5	All
2	Mathare	4	“
3	Kamukunji	5	“
4	Makadara	5	“
5	Embakasi East	5	“
6	Embakasi West	6	“
7	Embakasi Central	4	“
8	Embakasi South	4	“
9	Embakasi North	5	“
10	Kasarani	9	“
11	Roysambu	6	“
12	Ruaraka	6	“
13	Westlands	8	“
14	Langata	9	“
15	Dagoretti North	7	“
16	Dagoretti South	7	“
17	Kibra	6	“
	Total	101	101

Source: Department of Veterinary services

Conventionally, census design for entire population is difficult to carry out due to its cost and logistical implications especially for large populations. However, it is the method of choice where the population is small and there is adequate time to collect data. This method has the advantage providing on an intensive study, which also gives accurate data (Loxiton, 2016). In this study census, survey will be used since the entire population is 101.

3.7.1: Data Gathering Methods and Processes

In the study, a structured questionnaire was used to collect quantitative data regarding influencing factors influencing brucellosis surveillance data management practice among animal health workers in Nairobi County. According to Kothari, 2016), a questionnaire is mostly preferred in the field research due to its low cost and simplicity in application. The target population for the quantitative design include animal health workers in Nairobi County Questionnaires were used to collect data from these participants. Focus group discussions and Key informant interviews were used to collect qualitative data from these research subjects. Qualitative data was obtained and was integrated with the quantitative data obtained from the questionnaires. The key informant interview involved the 17 sub-county animal health officers. One focus group discussion was conducted at the county level. The effectiveness of this tool is improved through pilot tests. The process of data collection followed the following stages:

a) A pretested questionnaire (Appendix II) was administered among animal health workers in Nairobi County to collect data on knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers.
b) The factors included knowledge of brucellosis surveillance data management knowledge, competencies, socio-demographic, technical and organizational and factors of animal health workers.
c) The information regarding, levels of data management knowledge, practice and utilization.lt included skills and competence in the ability to collect, enter, analyze, interpret and disseminate data.

d) Information gathered in organizational factors of the animal health administrative service included provision or availability of reference materials, mobile phones, registers reporting formats, supervision, training and feedback

e) On technical factors of animal health workers, information focused on knowledge of existing surveillance systems surveillance for zoonotic diseases, tools and data sources. Data on types of reports, frequency of reporting and use of data in planning various public health interventions was gathered.

The questionnaire also collected socio demographic characteristic data of animal health workers.

3.7.2 Validity of Instrument

Validity is an indicator that the questionnaire tool correctly collects required data as intended in the design. It ensures accurate representation of study out comes anticipated. An indicator of the degree to which the sample represents the whole population, professional's information will be obtained and not restricted to that of managers. Study queries in the survey and interview protocol were modified to denote each factor in the study. The information gathered from the pre-test phase were subjected to variable scrutiny (Golafshani, 2019).

3.7.3 Reliability of Instrument

Reliability refers to the level of which study outcomes progressively show consistence over time. It also portrays how accurate the study population is represented in the research work. It is also a procedure of discovering out the level to which a measurement technique will reproduce the consistent outcome if done repeatedly under the same circumstances, Toke et al, (2017). A pretesting study was piloted in Kiambu town Sub-County with twenty animal health workers of similar professional bracket

and engaged in animal health work to verify reliability of the survey by use of SPSS analytical tool. A software-based computation of constant value greater than 0.7 in Cronbach alpha scale will show that the study measurement process is consistent while values smaller than 0.5 unreliable, Toke *et al*., (2017).

3.8 Data analysis tools.

3.8.1Quantitative data analysis

SPSS is software used in the analyses of collected data in research and aid in making conclusions based on the outcomes provided by the software in terms of graphs, correlation, regression and other functionalities. In this research, SPSS was used to analyze data collected from the questionnaires. In addition, information collected from key informants interviews and focused group discussions was analyzed in terms of themes and sub -themes

3. 8.2: Data Entry and Cleaning

Field data was collected on pretested paper questionnaires (Appendix II). The questionnaire was checked regularly for consistency. The data was then entered in MS excel sheet. All paper data was stored safely under lock and key, accessible only to authorized study staff. Electronic data was stored in a password-protected database and backed up daily for extra protection.

3.8.3: Quantitative data analysis.

MS Excel 2007 (Microsoft, Seattle, WA, USA) and Statistical package for social science (SPSS) versions 20 packages was used for data processing and analysis where summary statistics were computed to describe the variables. The results were presented in form of frequencies, proportions, tables and charts. Bivariate logistic regression was computed to show the effect of independent Variables on dependent Variables.

Bivariate analysis was done to determine the association between categorical variable and a P-value <0.05 will be statistically significant.

3.8.4: Qualitative data analysis

The qualitative data analysis from the study will use of themes and sub-themes, transcribing of data, presentation in tables with individual quotes from the respondents.

3.9. Ethical consideration.

3.9.1 Mount Kenya University Ethical Clearance

This is in reference to acceptable or unacceptable behavior or a standard for distinguishing right and wrong doing in the practice of generating new knowledge to exclude falsehood Ethical clearance and introductory letter were sought from Mount Kenya University, Ethical Committee before data collection work was undertaken in Nairobi County in Kenya.

3.9.2: National Commission for Science Technology and Innovation (NACOSTI) Clearance.

An approval letter was acquired from National Commission for Science Technology and Innovation (NACOSTI). The researcher obtained clearance letter from Nairobi County Government before starting the research. Informed consent from participants was granted and the participants were guaranteed of data confidentiality.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter will present the analysis of the study data. The broad objective is to investigate knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya. The specific objective of the study includes determination of data sources and data collection mechanism, available tools for Brucellosis events, level of Brucellosis surveillance data management practice and utilization of surveillance data among Animal health worker.

4.1 Study Response

All the 101 questionnaires administered to the respondents were completed giving a response rate of 100%. According to Mugenda and Mugenda (2017), any response above 70% is excellent for statistical analysis and reporting.

4.2 Demographic Characteristics

The statistical analysis in this section were informative, descriptive and was on demographic of animal health workers that included gender, age, marital status, level of education, years of service and department. As shown as in table 4.1 below. In terms of station of work 20% were stationed at the facility, 8% were at laboratory service, 46% were at ward level, 5% were stationed at the county headquarters while 21% were stationed at the Sub-counties. The animal health workers interviewed consisted of 52% Male consisted of and 48%females. In terms of age distribution, majority of the animal health workers were above 50 years (55%), those who were between 40 and 49 years were 37. Those who were between 30 and 39 years were 6%. The least group consisted of those who were between 20 and 29 years and they constituted 2% of the total respondents.

In terms of age distribution of animal health, workers among degree holders majority 12 out of 28 respondents representing 43 percent were above 50 years 13 (46%) respondents were between 40 and 49 years. Those between 30 and 39 years were two respondents. Only one respondent who had a degree was below 29 years. As shown in figure 4.1 below:

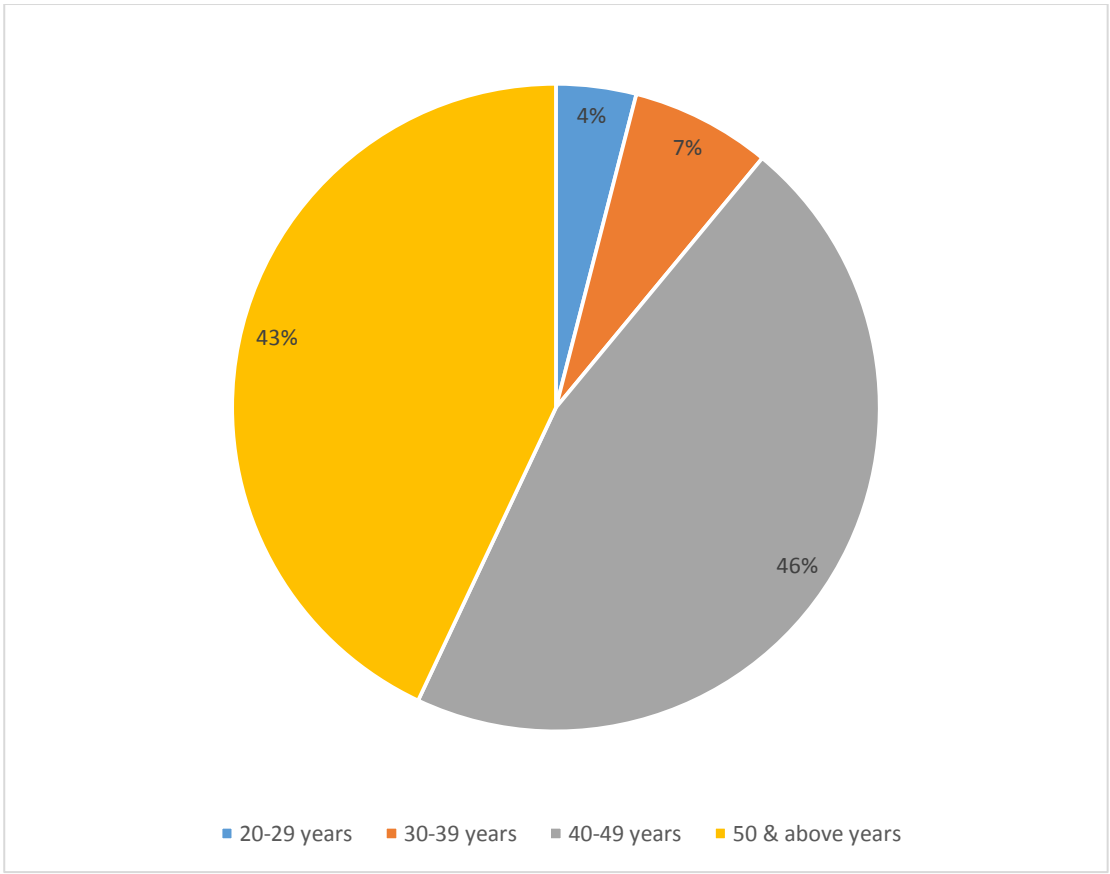


Figure 4.1: Age Distribution of Degree Holders

The respondents in the study consisted of singles (13%), married (71%), separated (15%) and divorced (1%).In terms of education level, all the respondents majority of the respondents held either certificate or diploma qualification (72%). Those who had reached university level of education constituted 28% of the respondents. Those who were in the range of 21-30 years constituted 43% and those who had worked for more than 30 years constituted 47. Those who had worked for less than 10 years constituted

5% of the sample while those who had worked between 11 years and 20 years constituted 6% of the respondents.

The departments that the respondents belonged were Disease control (66%), extension services (5%), and public Health (10%), food Safety (10%), laboratory services (8%), clinical services (1%).Social demographic characteristics associated with brucellosis surveillance is summarized in table 4.1 below.

Table 4.1 Demographic Characteristics Associated with Brucellosis Surveillance Data Management Practice.

	Details	Frequency	Percent	Significance (P-value)
Station	Facility	25	25	p<0.001
	Laboratory Service	11	11	p<0.001
	Ward	41	41	p<0.001
	County Headquarters	4	4	p<0.001
	S/County	21	21	p<0.001
Gender	Male	53	52	p<0.001
	Female	48	48	p<0.001
Age	20-29	2	2	p<0.001
	30 -39	6	6	p<0.001
	40- 49	37	37	p<0.001
	50 & above	56	55	p<0.001
Marital Status	Single	13	13	p<0.001
	Married	72	71	p<0.001
	Separated	15	15	p<0.001
	Divorced	1	1	p<0.001
Education Level	Primary	0	0	p<0.001
	Secondary	0	0	p<0.001
	Cert/dip	73	72	p<0.001
	University	28	28	p<0.001
Years of Service	10 and below	5	5	p<0.001
	11-20	6	6	p<0.001
	21-30	43	43	p<0.001
	Above 30	47	47	p<0.001
Department	Disease control	67	66	p<0.001
	Extension services	5	5	p<0.001
	public Health	10	10	p<0.001
	Food Safety	10	10	p<0.001
	Laboratory services	8	8	p<0.001
	Clinical services	1	1	p<0.001
	Others	0	0	p<0.001

Source: Research Findings (2019)

4.3 Data Sources for Brucellosis Surveillance

From the study, the main sources of data for animal health workers interviewed was as follows livestock markets visits (77%), slaughter house visits (46%), Reports from farmers (79%), Laboratories (40%), Veterinary clinics (56%) public health workers (48%). The respondents also cited other sources of data such as: community barazas, artificial inseminators, border posts, ward administrators, chiefs, community leaders,

agro vet shops, agricultural extension workers, transporters, meat traders, county disease reports, director of veterinary services, eateries, Kenya Wildlife Service, and veterinary information system as some source of data. Knowledge on data reporting including the type of report frequency and method of reporting was sought.

From the findings, 84 out of 101 respondents send surveillance reports using mobile telephone. Eighty-one (81) respondents used SMS (Text message) to send surveillance report. The other methods of sending surveillance report were scarcely cited by the respondents. For instance, out of the 101 respondents, 27% used email, 11% used postal services, 2% used website, and 1% used other computerized tools. No respondents used radio, land telephone, fax nor flash drive to send surveillance reports. Hand delivery and digital pen were cited as other methods that was used to send surveillance reports by the respondents.

According to the findings 21 % of the respondents, used paper registers to track specimen while 15% of the respondents cited electronic tool. Excel spread sheet was not used by the respondents to track specimen. Electronic tools used by the respondents to track specimen included Laboratory Information Management System (LIMS) and SLAB.

According to the study findings, 19% of the respondents received their lab test orders through standardized (national) paper form while 17% received through a computerized tool (LIMS). Non-standard form was not cited by the respondents. When asked whether lab test results were transmitted directly from the lab equipment to the central laboratory or to those who requested, only 20 out of 101 respondents were affirmative. Data Sources and data collection Mechanism is summarized in the table 4.2 below.

Table 4.2 Data Sources and data collection Mechanism

	Variables	Frequency	Percent
Source of Data	Livestock market visits	78	77

	Slaughter houses visits	46	46
	Farm visits	80	79
	Farmer reports	75	74
	Laboratories	40	40
	Clinics	56	56
	Public health workers	48	48
Lab Specimen Tracking	Paper registers	21	21
	Electronic tool	15	15
	Excel spreadsheet	0	0
	Others	0	0
	Unknown	0	0
Receiving of Laboratory	Non-standard paper form	0	0
Test orders by the	Standardized (national) paper form	19	19
laboratory.	Through a computerized tool (LIMS)	17	17
Knowledge of direct	Yes	20	20
results transmission	No	0	0
	Don't Know	4	4

Furthermore, key informant interview and focus group discussions were conducted to establish data sources for brucellosis surveillance. The research questions made up the main themes for the analysis of qualitative data. The interviewees responded well and some of their responses are provided as follows:

"Livestock markets visits and reports from farmers are the main source of data for brucellosis surveillance in my department."

"Community barazas especially those that are led by chiefs and community forms a vital source of data for brucellosis surveillance."

"We usually collaborate with different stakeholders such as Kenya Wildlife Service and agro-vet shops to get information on brucellosis."

4.4 Tools Available for Brucellosis Surveillance

4.4.1 Organizational (Institutional) Tools

According to their response pen and paper was available to 99 (98%) of the respondents. Mobile phone was available to 93(92%) of the respondents. Protective clothing was available to 90(89%) of the respondents. Materials that were available to less than 60% of the respondents included registers (55%), reporting formats (59%),

computer (35%) and thermometer/Stethoscope (18%).When asked whether they needed or lacked any other additional critical working tools the respondents cited that they needed tools such as: internet, field test kits/diagnostic kits, airtime, transport, allowance, reference materials, soft wares, printers, digital pens. The findings on organizational(institutional) tools are summarized table 4.3 below:

Table 4.3 Organizational (Institutional) factors

	Variables	**Frequency**	**Percent**
Availability of materials	Paper/ Pen	99	98
	Computer	35	35
	mobile phone	93	92
	Registers	56	55
	Protective clothing	90	89
	Reporting formats	60	59
	Thermometers, stethoscopes	18	18

Source: Research Findings (2019)

In furthermore, key informant interview and focus group discussions were conducted to establish available institutional tools for brucellosis surveillance. The research questions made up the main themes for the analysis of qualitative data. The interviewees responded well and some of their responses are provided as follows:

"There is low budgeting allocation for tools used in data collection and analysis thus we are forced to use our own mobile phones to collect and send data tour supervisors. Computers that are available in our workstation are inadequate and there is a need for procurement more computers."

"When sending data to our supervisors we usually use out own gadget despite lack of provision for internet allowance. This makes the business of reporting to be costly on our part."

4.4.2 Technical Tools for Brucellosis Surveillance

When asked on the availability of documents for brucellosis disease surveillance systems 69 of the 101 respondents, representing 68% were affirmative while 32 respondents said the materials were not available. Those who said there were available documents for brucellosis disease surveillance systems material cited both paper and electronic materials. Documents that were in paper form included ND1, PP1, sanitary reports and daily sheet. Electronic documents included EPI Collect, digital pen, Excel, sanitary reports, Sero-epidiological survey and Kenya Animal Bio-surveillance System.

When asked what type of documents were sent to the country veterinary officer/surveillance officer majority of the respondents cited summary report as the most sent type (75%).58% cited case based reports, rumor reports (56%) and ad-hoc reports (49%)**.**

When asked whether laboratory test results were sent with the surveillance reports, (46%) of the respondents were affirmative, 14% said no, while 40% were not aware.

When asked frequency of sending surveillance reports the most cited were the monthly reports, which constituted 82% of the respondents. Those who send weekly reports were 57%.55% said that in the course of their work they send reports that were required immediately. The least cited types of reports were quarterly (28%), Annual (19%) and daily reports, which was cited by only 5% of the respondents.

When asked how test results were reported from the laboratory to the public health disease surveillance officers the respondents cited the following: mail non-standard paper form (2%), mail standard (national) paper form (9%), electronic (1%), direct-

integrated computerized tools(0%), electronic message to computerized surveillance tool (2%), phone (12%), email (10%), web-based results sharing tool (0%).The respondents also cited hand delivery as other methods of transmitting laboratory results. Technical Tools for brucellosis surveillance are summarized in table 4.4 below.

Table 4.4 Technical Tools for Brucellosis Surveillance

	Variables		Frequency	Percent
Availability of Documents for Brucellosis Disease Surveillance Systems	Yes		69	68
	No		32	32
Reports Sent to County Veterinary Officer / Surveillance Officer	Case-based reports		59	58
	Summary (weekly, monthly, quarterly		76	75
	Rumor reports) reports		57	56
	Ad-hoc reports (formal and informal)		49	49
	Case-based reports		59	58
	Summary (weekly, monthly, quarterly		76	75
	Rumor reports) reports		57	56
	Ad-hoc reports (formal and informal)		49	49
	Case-based reports		59	58
	Summary (weekly, monthly, quarterly		76	75
Whether Laboratory Test Result were Sent with Surveillance Reports	Yes		47	46
	No		14	14
	Don’t Know		40	40
Frequency of Sending Disease Surveillance Reports	Immediately		56	55
	Daily		5	5
	Weekly		58	57
	Monthly		83	82
	Quarterly		28	28
	Annually		19	19
Method of Sending Surveillance Report	Electronic	Email or email attachment	27	27
		SMS (Text message)	81	80
		Website	2	2
		Flash drive	0	0

		Other computerized tools	1	1
	Paper	Fax	0	0
		Postal service	11	11
	Verbal	Land telephone	0	0
		Mobile telephone	85	84
		Radio phone	0	0
Reporting of laboratory test results to surveillance officer.	Mail non-standard paper form		2	2
	Mail standard (national) paper form		9	9
	Electronic		1	1
	Direct-integrated computerized tools		0	0
	Electronic message to computerized surveillance tool		2	2
	Phone		12	12
	Email		10	10
	Web-based results sharing tool		0	0

Source: Research Findings (2019)

In addition, key informant interview and focus group discussions were conducted to establish available technical tools for brucellosis surveillance. The research questions made up the main themes for the analysis of qualitative data. The interviewees responded well and some of their responses are provided as follows:

"In our office we usually send different types of surveillance reports. However, the most common types of reports are the monthly reports."

"Sometimes we are required to send reports when they are required by our supervisors. This is especially so when there are cases of emergencies."

4.5 Level of Knowledge for Brucellosis Surveillance Data Management

4.5.1 Overall Knowledge of Data Management Competency

The object of the study was to determine specifically the level of data management competences including training and technological skills of animal health workers. When asked whether there exists a surveillance system for zoonotic diseases 69% of the respondents were affirmative, 7% said no while 24% did not know.

When asked about the surveillance roles that they performed in the course of their work majority of the respondents cited data collection (88%) and data entry (83%). Other roles cited included data editing (34%), data management (33%), data analysis (22%) and data administration (4%).There were no roles cited by the respondents in the ICT support and system architecture. Out of the 28 graduates 22 performed roles in data collection, 18 performed data entry roles, 11 had data management roles, 2 performed data editing roles while only one person performed data entry role. No graduate had a role in both system architecture and ICT Support.

When the respondents were asked to identify priority zoonotic diseases in Nairobi county they identified following: Rabies, anthrax, rift valley fever, Hydatidiosis, brucellosis, avian influenza, salmonellosis, sleeping sickness, Rinderpest, mastitis,

CBPP, tape worm, black quarter, Cyticencosis, Echnoccocus, lumpy skin disease, leptospirosis, tuberculosis, *Trichella spiralis,* Leishmaniasis.

According to their response 89 (88%) of the respondents had not been trained on data management in the last three years. Of the 12 (12%) of the respondents who had been trained, 7(58%) were trained on basic skills while 5 (42%) had received refresher course.

Interviewed animal health workers had the following technological skills: 95 workers out of 101 interviewed were knowledgeable on Data collection skills, which was 95% of the respondents. Ninety-six (96) respondents were knowledgeable on data entry skills (96%), Thirty-seven (37) respondents were able to do data analysis constituted. Data interpretation skills was known by 25 respondents while those who knew data dissemination constituted 72 out of 101 respondents. On technological skills possessed by the 28 respondents holding degree certification, data collection and data entry skills were possessed by 22 respondents 18 out of 28 respondents had data dissemination skills. Seven (7) and five (5) respondents respectively possessed data analysis and data interpretation skills. Factors associated with level of knowledge on data management competencies is summarized in the table 4.5 below.

In addition, key informant interview and focus group discussions were conducted to establish available level of knowledge on brucellosis surveillance data management. The research questions made up the main themes for the analysis of qualitative data. The interviewees responded well and some of their responses are provided as follows:

"I am conversant in data collection and data entry but data analysis is difficult for me"

"Training on data management has not been conducted in our department for quite a long time now."

"In order to perform my work effectively I need refresher courses on data management especially on the analysis and interpretation part."

"From my side I can perform data entry and collection but I have difficulties in handling the data analysis. Because data analysis is done at the headquarter level workers at the branch level are un able to learn the skill."

Table 4.5: Level of knowledge on data management competencies

	Variables	Frequency	Percent
Availability of surveillance system for zoonotic diseases	Yes	70	69%
	No	7	7%
	Don't Know	24	24%
Surveillance Roles Performed	Data collection	89	88
	Data entry	84	83
	Data editing	34	34
	Data management	33	33
	Data analysis	22	22
	Database administration	4	4
	ICT Support	0	0
	Systems architecture	0	0
Training on data management	Yes	12	12
	No	89	88
Type of Training	Basic training	7	58
	Refresher training	5	42
Technological skills	Data collection	95	95
	Data entry	96	96
	Data analysis	37	37
	Data interpretation	25	25
	Data dissemination	72	72

Source: Research Findings (2019)

4.5.2 Association between Knowledge and Data Management Practice

In the table Chi-Square Tests result, SPSS also tells us 22 cells have expected count less than 5 and the minimum expected count is 0. 016.This means the sample size requirement for the chi-square test of independence is satisfied. The probability of the chi-square test statistic (chi-square= 307.581) was $p<0.001$, less than or equal to the alpha level of significance of 0.05. The analysis shows that there is a significant relationship between knowledge and data management practice of animal health workers. Association between Knowledge and Data Management Practice is summarized in table 4.6 below.

Table 4.6 Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	307.581[a]	16	.000
Likelihood Ratio	36.395	16	.003
N of Valid Cases	102		

a. 22 cells (88.0%) have expected count less than 5. The minimum expected count is .01.

4.6 Utilization of Brucellosis Surveillance Data

4.6.1 Overall Data utilization

The study inquired about utilization of data animal health worker collected in planning and implementing public health measures routine activities. According to the findings only 53% of the respondents reported to have used data they had personally collected while 47 % of the respondents did not use data that they collected personally.

According to the findings about three quarter of the animal health, workers either rarely use (34%) or do not make use (42%) of data or feedback in their routine work. Only 16 % and 9% of the respondents often and seldom use data or feedback in their routine work respectively.

According to the findings majority of the activities or measures routinely planned and implemented by animal health workers involved data dissemination/information sharing (68%), collection of samples (68%) and vaccination of animals (65%). The study also found that animal health workers played a minimal role in planning and implementation of disease surveillance (18%), public education (32%), outbreak investigation (35%) and imposing quarantine/closure of premises (26%). When asked about what they needed to improve data utilization in their routine work, majority of the respondents cited training (98%), materials (92%), feedback (77%) and lab facilities (75%).Only 50% of the respondents considered technical supervision (50%) vital in their routine work.

According to the study, their technical supervisor visited very few animal health workers in the last three years. For instance, only 28% of the respondents were visited monthly. Out of 101 respondents 21 said they were visited quarterly and 15 were, visited annually. Those not visited at all constituted 27% of the respondents.

When asked whom they share their surveillance data 63 out of 101 respondents shared their data with farmers, sixty-four percent (64%) shared their data with veterinary public health office. Sixty-nine (69%) shared their data with County veterinary centers while 59% percent of the respondents shared their data with animal clinicians (59%).The respondents scarcely shared their data with human public health office (44%), national surveillance center (14%) and ZDU (11%). Cited in the data sharing included: Livestock/ meat traders, KEBS, OIE, and AUIBUR, universities, research institution, FAO, community barazas and colleagues. Data utilization is summarized in table 4.7 below.

Table 4.7 Data utilization

	Variables	Frequency	Percent
Use of personally collected data	Yes	54	53
	No	47	47
Frequency of use of data or Feedback	Often	16	16
	Seldom	9	9
	Rarely	34	34
	Not at all	42	42
Public Health Measures/ Activities Routinely Planned and Implemented.	Disease surveillance	18	18
	Data dissemination/ information sharing	69	68
	Vaccination	66	65
	Public education	32	32
	Collect samples	69	68
	Outbreak investigation	35	35
	Impose quarantine/closure of premises	26	26
What's needed to improve data utilization in routine work	Training	99	98
	Materials	93	92
	Supervision	51	50
	Lab facilities	76	75
	Feedback	78	77
Frequency of visits by technical supervisor	Monthly	28	28
	Quarterly	21	21
	Annually	15	15
	Not at all	27	27
Sharing of Surveillance Data	Famers	63	63
	Laboratories	39	39
	Animal clinicians'	60	59
	Human Public health office	44	44
	Veterinary public health office	65	64
	County veterinary centers	70	69
	National surveillance centers	14	14
	ZDU	11	11

Moreover, key informant interview and focus group discussions were conducted to establish the level of data utilization for brucellosis surveillance. The research questions made up the main themes for the analysis of qualitative data. The interviewees responded well and some of their responses are provided as follows:

"Most of the surveillance data from our office are shared with county veterinary officers and farmers and are scantly shared with the Zoonotic Disease Unit(ZDU)."

"I personally use data that I collect to plan and implement public health activities in my department."

"We need more training so as to improve data utilization in routine work."

"The level of supervision in our department is very low and as a result making our work difficult."

"Feedback from our seniors is very rare and sometimes one can stay for long period without getting any feedback."

4.6.2 Association between Data Utilization and Data Management Practice

In the table Chi-Square Tests result, SPSS also tells us 27 cells have expected count less than 5 and the minimum expected count is 0.01.This means the sample size requirement for the chi-square test of independence is satisfied. The probability of the chi-square test statistic (chi-square= 307.184) was $p<0.001$, less than or equal to the alpha level of significance of 0.05. The analysis shows that there is a significant relationship between data utilization and data management practice of animal health workers. Association between Data Utilization and Data Management Practice is summarized in table 4.8 below.

Table 4.8 Association between Data Utilization and Data Management Practice

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	307.184[a]	20	.000
Likelihood Ratio	34.897	20	.021
N of Valid Cases	102		

a. 27 cells (90.0%) have expected count less than 5. The minimum expected count is .01.

4.6.3 Characteristics Associated with Brucellosis Data Management Practice

When asked about the activities that they carry out as part of data management practice. Compiling reports was cited by 98% of the respondents 94 percent cited record keeping and 82% cited writing minutes of meetings. Auditing of reports, data storage and data updating was cited by 24%, 27% and 21% of the respondents respectively. When asked whether they routinely use data gathering and management tools majority of the respondents were affirmative (90%) the remaining 10% were not using data gathering and management tools. Characteristics associated with Brucellosis Data Management Practice is summarized in table 4.9 below.

Table 4.9 Characteristics associated with Brucellosis Data Management Practice

	Variables	Frequency	Percent
Data management practice	Compile reports	99	98
	audit reports	24	24
	keep data records	95	94
	data storage	27	27
	data updating	21	21
Use of Data Gathering and Management Tools	Yes	90	90
	No	11	10

4.7 Bivariate regression analysis

4.7.1 Association between graduate level staff and whether they were trained on data management

Bivariate regression was carried out to check whether there exists any statistically significant association between respondents at graduate level staff and training on data management. The association was found to be statistically significant. The result is summarized in the table 4.10 below.

Table 4.10 Association between graduate level staff and training on data management

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.247	.047		5.246	.000
	Been Trained On Data Management	.253	.137	.183	1.849	.067

a. Dependent Variable: University

4.7.2 Association between Staff above 50 Years of Age and whether they were Trained on Data Management

Bivariate regression was carried out to check whether there exists any statistically significant association between respondents at graduate level staff and training on data management. The association was found to be statistically significant. The result is summarized in the table 4.11 below

Table 4.11 Association between Staff above 50 Years of age and Training on Data Management

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.562	.053		10.584	.000
	Been Trained on Data Management	.022	.154	.014	.140	.889

a. Dependent Variable: @50ampabove

4.7.3 Association between Availability of Tools, Frequency of Use of Data or Feedback and Frequency of Visit with Data Management.

Bivariate regression was carried out to check whether there exists any statistically significant association between respondent's availability of tools, frequency of use of data or feedback and frequency of visit. The association was found to be statistically significant. The result is summarized in the table 4.12 below

Table 4.12 Association between Availability of Tools, Frequency of Use of Data or Feedback and Frequency of Visit with Data Management.

	Significance	95% Confidence Interval	
		Lower Bond	Upper Bond
AVAILABILITY OF TOOLS			
Pen and paper	0.662	-0.814	0.520
Computer	0.162	-0.460	0.274
Mobile phone	0.415	-0.160	0.385
Register	0.277	-0.198	0.057
Protective clothing	0.754	-0.180	0.248
Reporting format	0.958	-0.132	0.125
Thermometer/Stethoscope	0.458	-0.263	0.120
FREQUENCY OF USE OF DATA OR FEEDBACK			
Often	0.450	-0.263	0.117
Seldom	0.663	-0.280	0.179
Rarely	0.351	-0.068	0.189
Not at all	0.396	-0.204	0.081
FREQUENCY OF VISIT			
Monthly	0.707	-0.133	0.196
Quarterly	0.175	-0.051	0.279
Annually	0.049	0.001	0.357

4.8 Discussions

From the findings, most of the staff in animal health department were of advanced age with very few holding university qualification. This is an indication that in near future most of the workers would have retired from work. The study found that the only a very few members were trained on data management 3 years before the study was done (12%).This low level of knowledge on data management among animal health workers is an impediment to brucellosis surveillance. This is because the same workers are required to collect, process, analyze, interpret, disseminate and utilize data yet they were not regularly trained. Therefore, the level of data management competencies is major factor influencing data management knowledge practice and data utilization. As most of animal health workers had inadequate competencies in data analysis and interpretation, they could not make use of data or manage it as desired. Therefore, the

scarcity data and information on brucellosis that most of animal health workers relied on their level of education. This agrees with the study carried out by Gichuki (2017) who was studying health care practice of smoking cessation intervention with their level of knowledge. As compared to our findings he found that only 11% of the health workers were trained on smoking cessation intervention. Gichuki (2017) found out that there was a significant relationship between having received training on smoking cessation intervention with the health care providers level of knowledge and confidence in provision of smoking cessation interventions.

The study established that the frequency of visitation by the technical supervisor was generally low despite its importance. In this study, most of the surveillance data was shared within the department but sharing with external stakeholders was rare. This disconnect affects the efficiency of tackling zoonotic disease. This agrees with the findings by Shagake *et al* (2017) who found out that those Health Extension Workers (HEW) who were supervised every three months were 4 times [(AOR=4.204, 95% CI: (1.372-12.885)] more likely to have good knowledge compared to those who were not supervised. Other supervision frequencies such as every month, every six months and every one year were not significantly associated. That means those HEWs who were supervised once in every month, 6 months and every year had no significant difference in their data management knowledge compared with no supervision at all. The findings also concur with Dorah (2018) who concluded that organizational and management structures in the areas of support of review meetings, feedbacks and supervision were found to be a very effective strategy of enhancing information utilization to make decisions and also the level of culture of information use in a health facility also influenced the utilization of health information by the health facility. In addition, Dorah (2018) noted that support from the higher level was very important to provide a mutual

agreement between the behavioral and the technical factors to achieve a common ground for information use.

This study found animal health workers rarely use data or feedback in their routine work. that they were involved in collecting. From our finding, only 16% often use the data that they personally collected. Animal health workers stationed at County level used were the greatest users of data they personally collected (25%).This was followed by Sub-County (14%), facility (13%), ward (10%) and service (9%).This percentage show that senior management who are concentrated at the county level are the main users of the data collected as compared to the lower level staffs who are located outside the county headquarters. This low use might affect the motivation for collecting accurate information. This study reveals that the main roles of the animal health workers involved data collection and dissemination with minimal roles in other activities. This finding relates to a study done by Kuyo, *et al* (2018), who reported that utilization of data within the District Health Information System 2 (DHIS2) system was affected by the hierarchical arrangement, which hindered access to the system in favor of senior officers in the organization. The study by Kuyo, *et al* (2018) also found that utilization of data and DHIS2 varied with levels top sub-county and county level managers who used the data more than the lower level staff. The study established that in order to assist them improve data utilization in their routine work what most animal health needed was training, materials, feedback and lab facilities and to some extent Supervision This agrees with a study by Kuyo, *et al*.(2018) who found out that the main challenges inhibiting the use of information in the District Health Information System 2 for evidenced based decision-making included lack of management support, poor skills among the users, lack of adequate computers, unreliable internet connectivity, lack of power backup and resistance to change.

The study observed that there were organizational related challenges that hindered brucellosis surveillance data management among animal health workers in Nairobi County. The availability of tools such as reporting formats, registers, computers lack of testing kits and other laboratory diagnostic tools affected the practice of data management among many animal health workers resulting to scanty data records. Lack of these tools made it difficult to collect reliable and accurate data. For instance, majority of animal health workers rarely use data in planning and implementing routine public health measures except, vaccination data collection and information sharing. This was attributed by shortage of essential materials and required logistic support.

This concurs with a study by Shagake *et al* (2017) showed the importance of the availability of data registration books and reference materials for good data management tradition. Health Extension Workers who had registration book were about six times [AOR=5.66, 95% CI: (2.019-15.874)] more likely to perform good data practice. In addition, those HEWs who reported they had reference material on how to manage data were almost two times [AOR=1.897, 95% CI: (1.178-2.968)] more likely to have good data management tradition compared with those who had not reference materials. This might be due to continuous supply of data management recourses to the health extension program, which may result in increased utilization of the resources. This agrees with another study carried out by Dorah (2018) who found out that technical factors like staff competence and skills, computer software, IT complexity, complexity of data management and data collection tools were vital instruments for making data available, data analysis and decision making. Dorah (2018) found evidence that lack of technical and analytical skills created a barrier to producing high quality, reliable data and information.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The chapter present the summary, conclusion and recommendations of the study. The study sought to investigate knowledge, tools, utilization and sources of brucellosis surveillance data among animal health workers in Nairobi County, Kenya.

5.1 Summary of Findings

5.1.1Background Characteristics of Respondents

The study established that male and female were nearly equally distributed in the animal health department. In addition, most workers were above 50 years of age and very few were below 39 years. Most of the animal health workers were married and very few were either single, divorced or separated. In terms of level of education majority were diploma or certificate holders. Very few were degree holders. In terms of duration of service majority of the respondents were had worked for more than 20 years. The study revealed that the bulk of the workers belonged to the disease control department with very few representations of other departments. The analysis shows that there is a significant relationship between social demographic factors of the respondents and data management practice of animal health workers.

5.1.2 Data Sources for Brucellosis Surveillance

The study also established that there were many sources of data for animal health workers. The study established that mobile phones was the most preferred way of sending surveillance reports in comparison with the other methods. This may be due to its convenience and low cost compared to other methods.

From the study, the main sources of data for animal health workers interviewed was as follows livestock markets visits (77%), slaughter house visits (46%), Reports from farmers (79%), Laboratories (40%), Veterinary clinics (56%) public health workers (48%). Other sources included community barazas, artificial inseminators, border posts, ward administrators, chiefs, community leaders, agro vet shops, agricultural extension workers, transporters, meat traders, county disease reports, director of veterinary services, eateries, Kenya Wildlife Service, and veterinary information system as some source of data. Knowledge on data reporting including the type of report frequency and method of reporting was sought.

From the findings, majority of the respondents send surveillance reports using mobile telephone and SMS (Text message). Other methods of sending surveillance report included used email, postal services hand delivery, digital pen and website.

In addition, only 21 % of the respondents, used paper registers to track specimen while 15% of the respondents cited electronic tool. Electronic tools used by the respondents to track specimen included Laboratory Information Management System (LIMS) and SLAB. According to the study findings, very few respondents received their lab test orders through standardized (national) paper form and computerized tool (LIMS).

5.1.3 Tools Available for Brucellosis Surveillance

The study established that pen and paper was the most common data management and gathering tool (98%). This was followed by mobile phone (92%) and protective clothing. (89%) Stethoscopes/ thermometer (18%) and computers (35%) were not adequate. Registers and reporting formats were established to be moderately available to animal health workers.

When asked whether they needed or lacked any other additional critical working tools the respondents cited that they needed tools such as: internet, field test kits/diagnostic kits, airtime, transport, allowance, reference materials, soft wares, printers, digital pens. When asked on the availability of documents for brucellosis disease surveillance systems the respondents said that it was available but not to all animal health workers. The available documents for brucellosis disease surveillance systems material cited both paper and electronic materials. Documents that were in paper form included ND1, PP1, sanitary reports and daily sheet. Electronic documents included EPI Collect, digital pen, Excel, sanitary reports, Sero-epidiological survey and Kenya Animal Bio-Surveillance System. In addition, the majority of documents sent to the country veterinary officer/surveillance officer were summary report (75%), case based reports (58%), rumor reports (56%) and ad-hoc reports (49%)**.** Most respondents were not aware whether laboratory test results were sent with the surveillance reports.

When asked frequency of sending surveillance reports the most cited were the monthly reports, which constituted 82% of the respondents. The least cited type of reports was quarterly (28%), Annual (19%) and daily reports, which was cited by only 5% of the respondents. When asked how test results were reported from the laboratory to the public health disease surveillance officers the respondents cited the following: mail non-standard paper form (2%), mail standard (national) paper form (9%), electronic (1%), direct-integrated computerized tools (0%), electronic message to computerized surveillance tool (2%), phone (12%), email (10%), web-based results sharing tool (0%).The respondents also cited hand delivery as other methods of transmitting laboratory results.

5.1.4 Level of Knowledge on for Brucellosis Surveillance Data Management

The study established that the availability of surveillance system in place, but nearly a third either do not know or cannot access the facility. The major surveillance roles performed by animal health workers mainly revolves around data collection and entry. Roles in ICT support and system architecture in non-existence while data administration roles is minimal. The study established that training on data management is nearly non-existence in that only 12% are trained on data management skills. The study also indicated that the knowledge priority zoonosis was good. It was low for brucellosis surveillance (69%).

The study also indicated the knowledge of data management competences as very low especially analytical, and interpretation competencies. Thus, making it difficult for the majority of animal health workers to benefit from collected data in terms of information generation and subsequently using the same. This is especially those who had tertiary level of education. Most of the animal health workers had little or no training the last three years only had some form of training.

The study reveals that majority of reports sent from field to county are summary report, while case based report where brucellosis is important is done by 58% of the respondents. Laboratory report sent together with surveillance reports were sent by forty-seven percent of (47%) of the respondents are aware (understand) the need to include laboratory results in surveillance system. These will affect accuracy of reports and therefore overall surveillance system. The study also found out that only 12% of animal health workers were trained on Data management within a period of 3 years were not trained (88%). Therefore, competency on data management on were quite low especially data analysis (37%) data interpretation. (25%).The analysis shows that there

is a significant relationship between knowledge and data management practice of animal health workers.

5.1.5 Utilization of Brucellosis Surveillance Data

According to the findings only 54% of the respondents reported to have used data, they had personally collected while 47 % of the respondents did not use data that they collected personally. In addition, about three quarter of the animal health, workers either rarely use (34%) or do not make use (42%) of data or feedback in their routine work. Only 16 % and 9% of the respondents often and seldom use data or feedback in their routine work respectively.

The study also found that animal health workers played a minimal role in planning and implementation of disease surveillance (18%), public education (32%), outbreak investigation (35%) and imposing quarantine/closure of premises (26%). When asked about what they needed to improve data utilization in their routine work, majority of the respondents cited training (98%), materials (92%), feedback (77%) and lab facilities (75%).Only 50% of the respondents considered technical supervision (50%) vital in their routine work. According to the study, their technical supervisor visited very few animal health workers in the last three years.

The study found that respondents scarcely shared their data with human public health office (44%), national surveillance center (14%) and ZDU (11%). Cited in the data sharing included: Livestock/ meat traders, KEBS, OIE, and AUIBUR, universities, research institution, FAO, community barazas and colleagues.

5.2 Conclusion

In terms of sources of data used for brucellosis surveillance by animal health workers the study concluded that the main sources of data are livestock markets visits and

reports from farmers. Other sources of data for brucellosis surveillance for animal health workers included slaughter house visits, laboratories, veterinary clinics and public health workers. It was also concluded that use of technologies like mobile phones to source data is non-existent and thus data collection involves a lot to physical movement by the data collector. The use of Information and Communication technology(ICT) is in the reporting and not sourcing stage.

It was also concluded that tools that helped the animal health workers perform their work effectively were not enough. For example, thermometer, stethoscope and computers were not sufficient. It was also concluded that animal health workers were not facilitated with tools such as: internet, field test kits/diagnostic kits, airtime, transport, allowance, reference materials, software, printers, digital pens.

In conclusion, documents for brucellosis disease surveillance systems was available in both electronic and paper form. Documents that were in paper form included ND1, PP1, sanitary reports and daily sheet. Electronic documents included EPI Collect, digital pen, Excel, sanitary reports, Sero-epidiological survey and Kenya Animal Bio-surveillance System. It was also concluded that summary report was the most sent type report and were mostly sent on a monthly basis using mobile phone.

It terms of level of knowledge of data management competences the study concluded that most workers were conversant with data collection and data entry. Contrary data editing, data management, data analysis, database administration, ICT Support and systems architecture were either rare or non-existent. This lack of relevant skills might be due to lack of training and refresher courses. Form the study only 12% of the respondents had been trained on basic data management skills in the last three years before this study.

The study concluded that animal health workers rarely use data or feedback in their routine work that they were involved in collecting. From our findings, only 16% often use the data that they personally collected. Additionally, animal health workers stationed at headquarters were the greatest users of data they personally collected as opposed to those in the branches level. This information leads us to the conclusion that senior management who are concentrated at the headquarters are the main users of the data collected as compared to the lower level staffs who are located outside the county headquarters. This low use might affect the motivation for collecting accurate information by those at the branches level. More over the study concluded that most of the surveillance data was shared within the department but sharing with external stakeholders was rare.

The study concluded that the frequency of visitation by the technical supervisor was generally low despite its importance and as a result this disconnect affected the efficiency of brucellosis disease surveillance.

5.3 Recommendations

i. Since most of the reporting is done in using mobile phones the study recommended that the county need to facilitate the animal health workers with airtime and data collecting and processing software so as to make data collection efficient.

ii. The study recommended that there is need for Nairobi County health department to invest in Internet and Communication Technologies (ICTs) so as to ensure speedy and up-to-date reporting and sharing of brucellosis disease information.

iii. The study recommended that animal health workers needed to be trained on data editing, data management, data analysis, database administration, ICT Support and systems architecture which are currently rare or non-existent in the animal health department. Focus needs to be directed towards strengthening health information systems. This will require ICT connectivity, systems redesigning and capacity building of health care workers critical in data generation and management.

iv. To improve data utilization in public health action the national government and County government should provide training, materials and lab facilities to animal health workers. In addition, they should be regularly supervised and given timely feedback.

v. There was need to strengthen the utilization of information at all levels of the system, through enhancing the culture and practice of "Data and Information use for decision-Making" and capacity building at national, county and facility levels.

vi. The study recommend that County and Sub-county veterinary management teams should develop and implement monitoring tools to support supervision of animal health workers in delivering of brucellosis surveillance data management.

5.4 Areas for Further Study

From the findings the study makes the following suggestions for further studies:

i. Further researches are needed using tools having greater observational components to ascertain timeliness and accuracy of brucellosis surveillance data.

ii. Our study used a cross sectional method using only self-administered questionnaire. There is a need to use other method such as mixed method which

uses more than one research instrument thus improving quality of data collection and assist in triangulation of vital information.

iii. Similar studies need to be carried out in other counties of Kenya so as to enable comparison with our findings.

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APPENDICES

Appendix I: Questionnaire

Title of Research: Knowledge, Tools, Utilisation and Sources of Brucellosis Surveillance Data among Animal Health Workers in Nairobi County, Kenya.

Name of Student: Peter Muriithi Muhari:

Name of University: Mount Kenya University.

Note: Kindly the information/ data collected is purely for academic purposes, but can be used to improve Brucellosis surveillance systems in Kenya and there is no direct benefit to you as a respondent.

CONSENT FORM

Please Tick

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4. Agree to the interview / focus group / consultation being audio recorded. ☐

5. Agree to the interview / focus group consultation being video recorded. ☐

6. Agree to the use of anonymized quotes in publications. ☐

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐

3. I agree to take part in the above study. ☐

4. Agree to the interview / focus group / consultation being audio recorded. ☐

5. Agree to the interview / focus group consultation being video recorded. ☐

6. Agree to the use of anonymised quotes in publications. ☐

Name of Researcher: Peter Muriithi Muhari

Signature……...…Date……...

Respondent

Signature…….....Date……..…

SECTION A: DEMOGRAPHIC CHARACTERISTICS OF ANIMAL HEALTH WORKERS.

Data Management Knowledge & Practice Questionnaire for Health-Care Workers

Questionnaire No. ……

Date: …….

- ❖ The knowledge required for this test is specifically for those who have participated in surveillance training and field practice or laboratory workers
- ❖ Tick only **one answer** to each question
- ❖ Please read the questions carefully before answering. Your answers will be kept confidential

1. Name …….
2. Date…….
3. Facility…….
4. Service …….
5. Ward ……
6. City ……..
7. S/County ……..…...

Gender.

(i) Male ☐
(ii) Female ☐

Age.

(i) 20-29 ☐
(ii) 30 -39 ☐
(iii) 40- 49 ☐
(iv) 50 AND ABOVE ☐

3. Marital status

(i) Single ☐
(ii) Married ☐
(iii)Separated ☐
(iv)Divorced ☐

4. Education level of the youth.

(i) Primary ☐
(ii) Secondary ☐
(iii)Certificate/diploma ☐
(iv)University ☐
(v) Years of service ☐

1. **Department (please select the department which best represents yours)**

(i) Disease control ☐
(ii) Extension services ☐
(iii)public Health ☐
(iv)Food Safety ☐
(v) Laboratory services ☐
(vi)Clinical services ☐
(vii) Others ☐

2. **Are there surveillance systems for zoonotic diseases in your Department?**

Yes ☐

No ☐

3. **What surveillance roles doyou perform in course of your work? Select all that apply.**

(i) Data collection ☐
(ii) Data entry ☐

(iii)Data editing ☐

(iv)Data management ☐

(v) Data analysis ☐

(vi)Database administration ☐

(vii) ICT Support ☐

(viii) Systems architecture ☐

(ix)Other: _____

4. **What are the priority zoonotic diseases in your Country/County?**

Disease

(i) **……**

(ii) **……..**

(iii)**……..**

(iv)**……..**

(v) **……**

5. **Is there a document available describing Brucellosis disease surveillance systems?**

Yes ☐ No ☐

If yes what type of document(s)*:

Electronic ☐

Paper ☐

Document name: _____

Electronic ☐ Paper ☐

Document name: _____

Electronic ☐ Paper ☐

Document name: _____

6. **What are your regular sources of data?**

(i) Market visits ☐

(ii) Slaughter houses visits ☐

(iii) Farm visits ☐

(iv) Farmer reports ☐

(v) Laboratories ☐

(vi) Clinics a ☐

(vii) Public health workers ☐

(vii) Others ☐

7. **What reports do you send to the county veterinary officer/surveillance officer?**

(i) Case-based reports ☐

(ii) Summary (weekly, monthly, quarterly) reports ☐

(iii) Rumor reports ☐

(iv) Ad-hoc reports (formal and informal) ☐

(v) Others ☐

8. **Are laboratory test results sent with the surveillance reports?**

Yes ☐ No ☐ Don't known ☐

9. **What is the frequency of sending disease surveillance reports? Select all that apply.**

Immediately ☐ Daily ☐

Weekly ☐ Monthly ☐

Quarterly ☐ Annually ☐

10. **What is the method for sending surveillance reports? Select all that apply.**

Electronic

Email or email attachment ☐ SMS (Text message) ☐

Website ☐ Flash drive ☐

From another computerized tool ☐

Paper

Fax ☐ Postal service ☐

Verbal

Land telephone ☐ Mobile telephone ☐

Radio phone ☐

Others – please specify: _____

Laboratory Reporting

[If no laboratory is available, please skip this section]

11. **How is lab specimen tracking done?**

Paper registers ☐

Electronic tool – name: _____

Excel spreadsheet ☐

Others – please specify: _____

Unknown ☐

How are lab test orders received by the laboratory?

Non-standard paper form ☐

Standardized (national) paper form ☐

Through a computerized, tool (LIMS) ☐

Others – please specify: _____

12. **Are lab test results transmitted directly from the lab equipment to the Central laboratory or to those who requested?**

Yes☐ No☐ Don't known☐

13. **How are laboratory test results reported from the laboratory to public health disease surveillance officer?**

Mail non-standard paper form

Mail standard (national) paper form ☐

Electronic ☐

Direct integrated computerized tools ☐

Electronic message to computerized surveillance tool ☐

Phone ☐

Email ☐

Web-based results sharing tool ☐

Others – please specify: _____

SECTION B: KNOWLEDGE OF DATA MANAGEMENT

14. **Have you been trained on data management for the last three years?**

(i) Yes. ☐

(ii) No. ☐

15. **What type of training?**

(i) Basic training ☐

(ii) Refresher training ☐

16. **Do you have any technological skills in?**

(i) Data collection ☐

(ii) Data entry ☐

(iii) Data analysis ☐

(iv) Data interpretation ☐

(v) Data dissemination ☐

17. **How do you rate your knowledge on data management competences on a scale of 1 to 5?**

NB. 1. Being the lowest 5. Being the highest.

Competence	**1**	**2**	**3**	**4**	**5**
1.Data Collection					
2.Data Entry					
3.Data Analysis					
4.Data Interpretation					
5.Data Dissemination					

DATA MANAGEMENT PRACTICE SECTION

18. **As part of data management practice, which of the following activities do you carry out?**

(i) Compile reports ☐

(ii) audit reports ☐

(iii) keep data records ☐

(iv) data storage ☐

(v) data updating ☐

(vi) Minutes of meetings ☐

19. **Do you routinely use data gathering and Management tools?**

(i) Yes ☐

(ii) No ☐

20. **Which of the following working materials are available to you?**

(i) Paper/ Pen ☐

(ii) Computer ☐

(iii) mobile phone ☐

(iv) Registers ☐

(v) Protective clothing ☐

(vi) Reporting formats ☐

(vii) Thermometers, stethoscopes ☐

21. **Which additional critical working tools do you lack?**

(i) ----------

(ii) ----------

(iii)----------

(iv)----------

DATA UTILIZATION SECTION

22. **In your routine work have you used any data that you personally collected?**

(i) Yes. ☐ (ii) No. ☐

23. **In your routine work, how often do you use data or Feedback.?**

(i) Often ☐

(ii) Seldom ☐

(iii)Rarely ☐

(iv)Not at all ☐

24. **Which of the following do you need to improve data /Feed- back use?**

(i) Training ☐

(ii) Materials ☐

(iii)Supervision ☐

(iv)Lab facilities ☐

(v) Feedback ☐

25. **Which of the following public health measures/ activities do you routinely plan and implement?**

(i) Disease surveillance ☐

(ii) Data dissemination/ information sharing ☐

(iii)Vaccination ☐

(iv) Public education ☐

(v) Collect samples ☐

(vi)Outbreak investigation ☐

(vii) Impose quarantine/closure of premises ☐

26. **Are you regularly visited by your technical supervisor?**

(i) Yes. ☐ (ii) No. ☐

27. **What is the frequency of the visits?**

(i) Monthly ☐

(ii) Quarterly ☐

(iii)Annually ☐

28. **With whom do you share surveillance data with?**

(i) Famers ☐

(ii) Laboratories ☐

(iii)Animal clinicians ’☐

(iv) Human Public health office ☐

(v) Veterinary public health office ☐

(vi)County veterinary centers ☐

vii) National surveillance centers ☐

(viii)ZDU ☐

(viii) Others ☐

Appendix II: Focus Group Discussion And Key Informant Interview Questions

1. What are the main sources of data for brucellosis surveillance in your department?
2. what are the other sources of brucellosis data in your department?
3. Is brucellosis common in Nairobi County?
4. Is there a surveillance system in place for brucellosis in Nairobi County?
5. Is there a training program for brucellosis surveillance data management in your department?
6. How competent are you in data analysis and interpretation?
7. What tools are available in your department for brucellosis surveillance?
8. How often are you visited by your supervisors?
9. With whom do you share brucellosis surveillance data?
10. How do you utilize surveillance data to prevent and control of brucellosis?

Appendix III: Introduction Letter from School

Mount Kenya University

SCHOOL OF POSTGRADUATE STUDIES

MPH/2016/58406

25th July, 2019

The Director, Research Coordination Division
National Commission for Science, Technology & Innovation
Utalii House, 8th & 9th Floor
P.O Box 30623- 00100
NAIROBI

Dear Sir/Madam,

RE: PETER MURIITHI - REGISTRATION NO. MPH/2016/58406

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the **Department of Epidemiology & Biostatistics** in the **School of Public Health.**

The title of his research is *"Factors Associated with Brucellosis Surveillance Data Management among Animal Health Workers in Nairobi County, Kenya."*

He has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for his research between **July and September, 2019.**

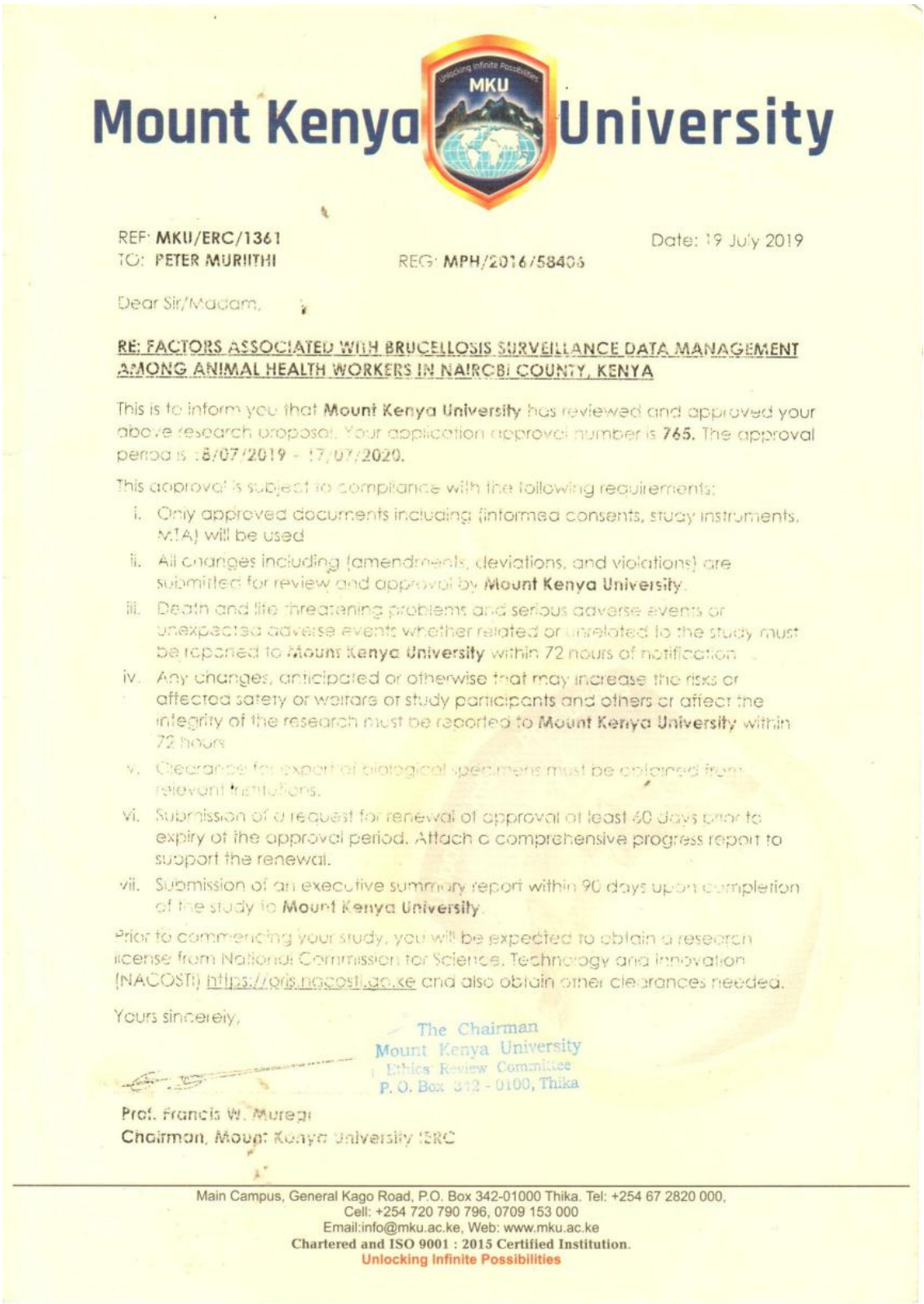
Any assistance accorded to him will be highly appreciated.

Thank you.

Mount Kenya University
Dean, School of Postgraduate Studies
P. O. Box 342 - 01000
Thika

Dr. Samuel M. Karenga, Ph.D
Dean, School of Postgraduate Studies
Enc.

Appendix IV: ERC Certificate



Mount Kenya University

REF: MKU/ERC/1361 Date: 19 July 2019
TO: PETER MURIITHI REG: MPH/2016/58406

Dear Sir/Madam,

RE: FACTORS ASSOCIATED WITH BRUCELLOSIS SURVEILLANCE DATA MANAGEMENT AMONG ANIMAL HEALTH WORKERS IN NAIROBI COUNTY, KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **765.** The approval period is :8/07/2019 - 17/07/2020.

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 **Mount Kenya University**.
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 **Mount Kenya University** 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 **Mount Kenya University** 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 **Mount Kenya University**

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.

Yours sincerely,

The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

Prof. Francis W. Muregi
Chairman, Mount Kenya University ERC

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000,
Cell: +254 720 790 796, 0709 153 000
Email:info@mku.ac.ke, Web: www.mku.ac.ke
Chartered and ISO 9001 : 2015 Certified Institution.
Unlocking Infinite Possibilities

Appendix V: Authorization Letter from Nairobi City County

NAIROBI CITY COUNTY

Telephone: 020 3536843
Fax 020 3523948

County Director of Veterinary Services,
Nyayo House (14th floor)
P. O. Box 40851-00100
NAIROBI, KENYA

11th September, 2019.

AGRICULTURE, LIVESTOCK AND FISHERIES

Ref: NBI/EDUC/VOL.I/18/164

Dr. Peter Muriithi
Mt. Kenya University.

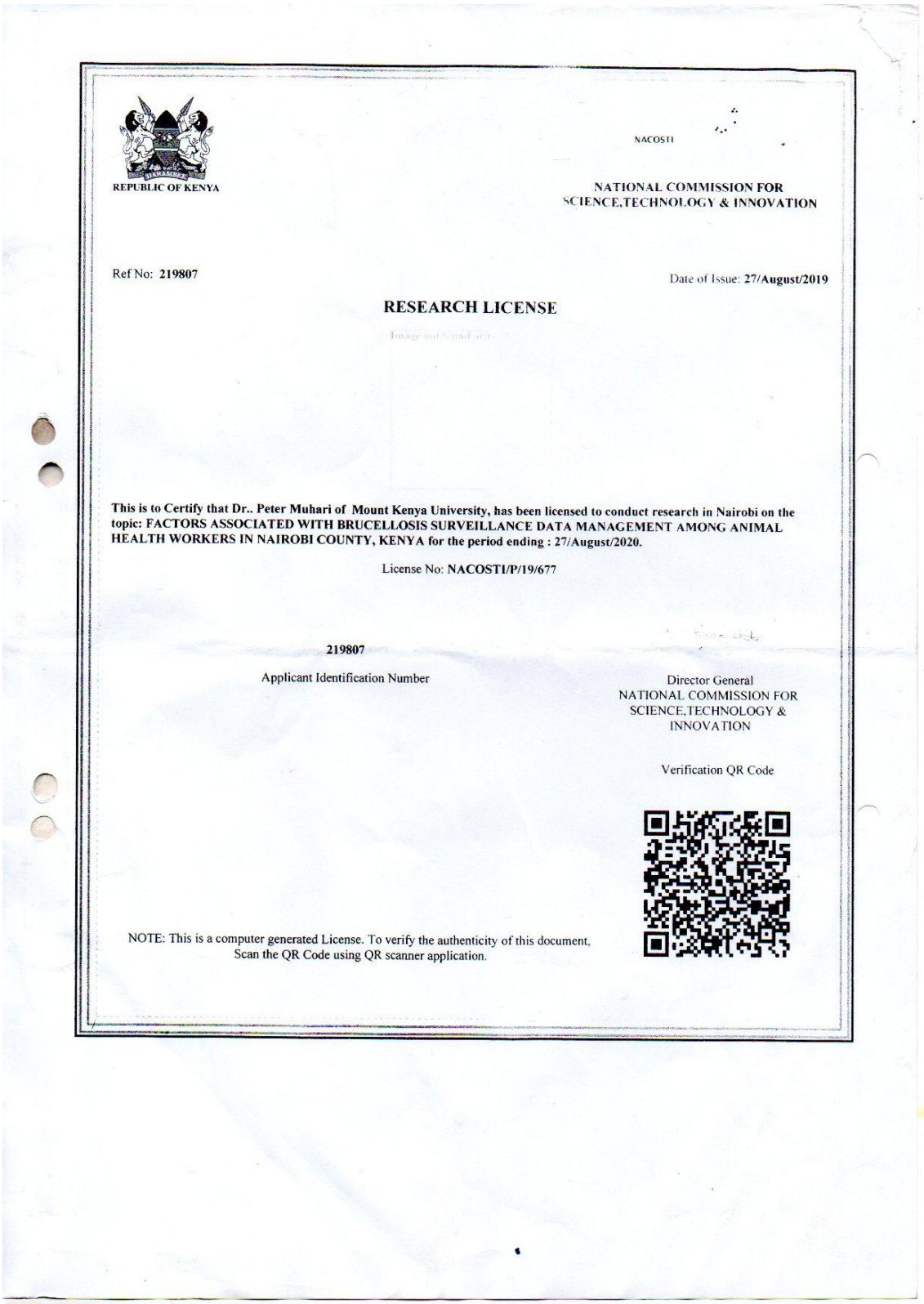
RE: AUTHORITY TO CARRY OUT RESEARCH WORK IN NAIROBI COUNTY.

Your letter dated 2/9/2019 refers. The department of Veterinary Services has accepted your request to conduct research on Factors associated with Brucellosis Surveillance Data Management among Animal Health Workers in Nairobi as per the research licence from NACOSTI dated 27/8/2019. This authority allows you to do your work within two (2) months from the date of this letter.

The result of your work is expected to be shared with the department afterwards.

Dr. Kabatha J.M.M.
For: COUNTY DIRECTOR OF VETERINARY SERVICES
NAIROBI CITY COUNTY

Appendix VI: Research Permit from NACOSTI



REPUBLIC OF KENYA

NACOSTI

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **219807**

Date of Issue: **27/August/2019**

RESEARCH LICENSE

Image not Found or type unknown

This is to Certify that Dr.. Peter Muhari of Mount Kenya University, has been licensed to conduct research in Nairobi on the topic: FACTORS ASSOCIATED WITH BRUCELLOSIS SURVEILLANCE DATA MANAGEMENT AMONG ANIMAL HEALTH WORKERS IN NAIROBI COUNTY, KENYA for the period ending : 27/August/2020.

License No: **NACOSTI/P/19/677**

219807

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix VII: Map Of Nairobi County

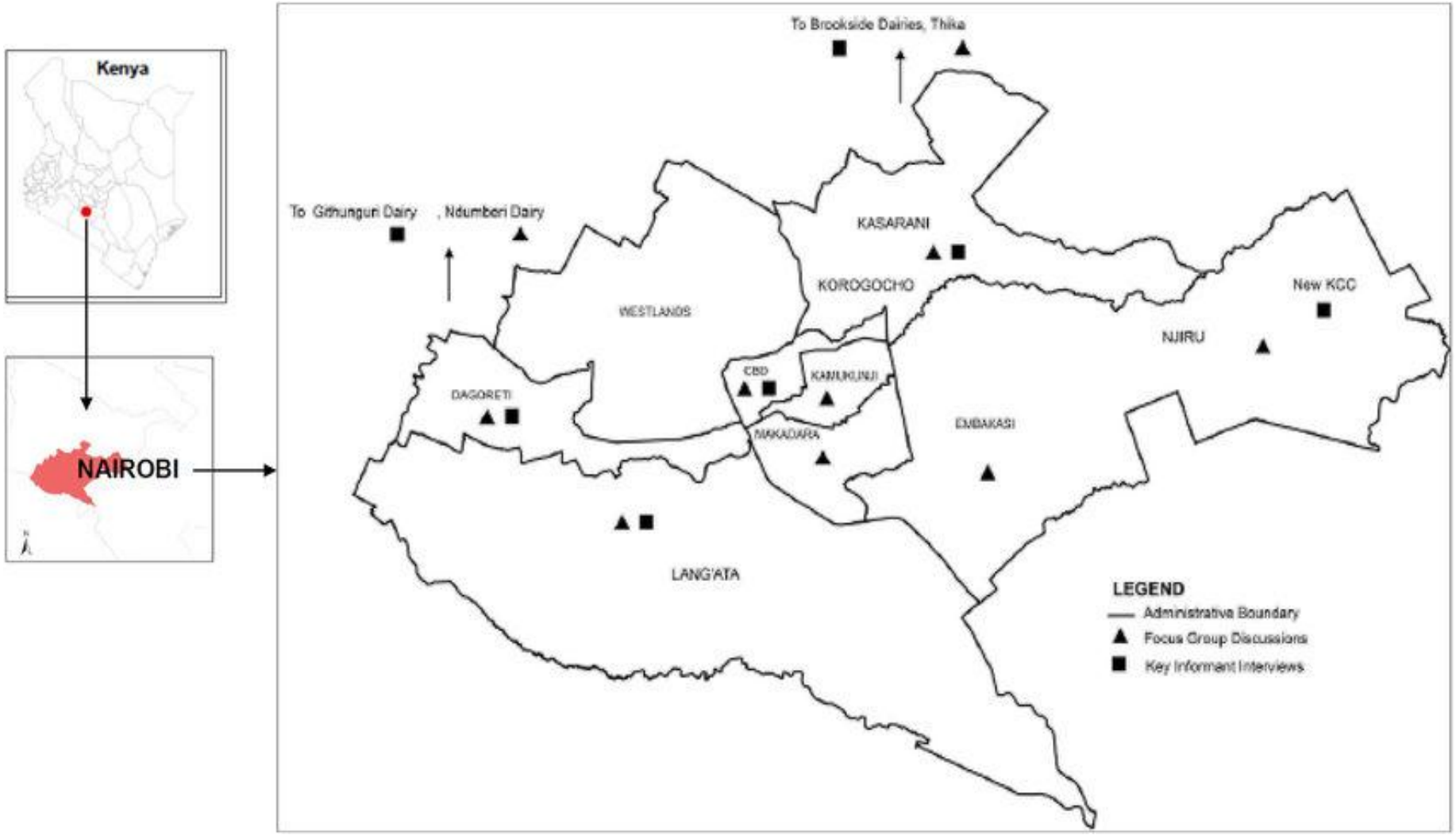
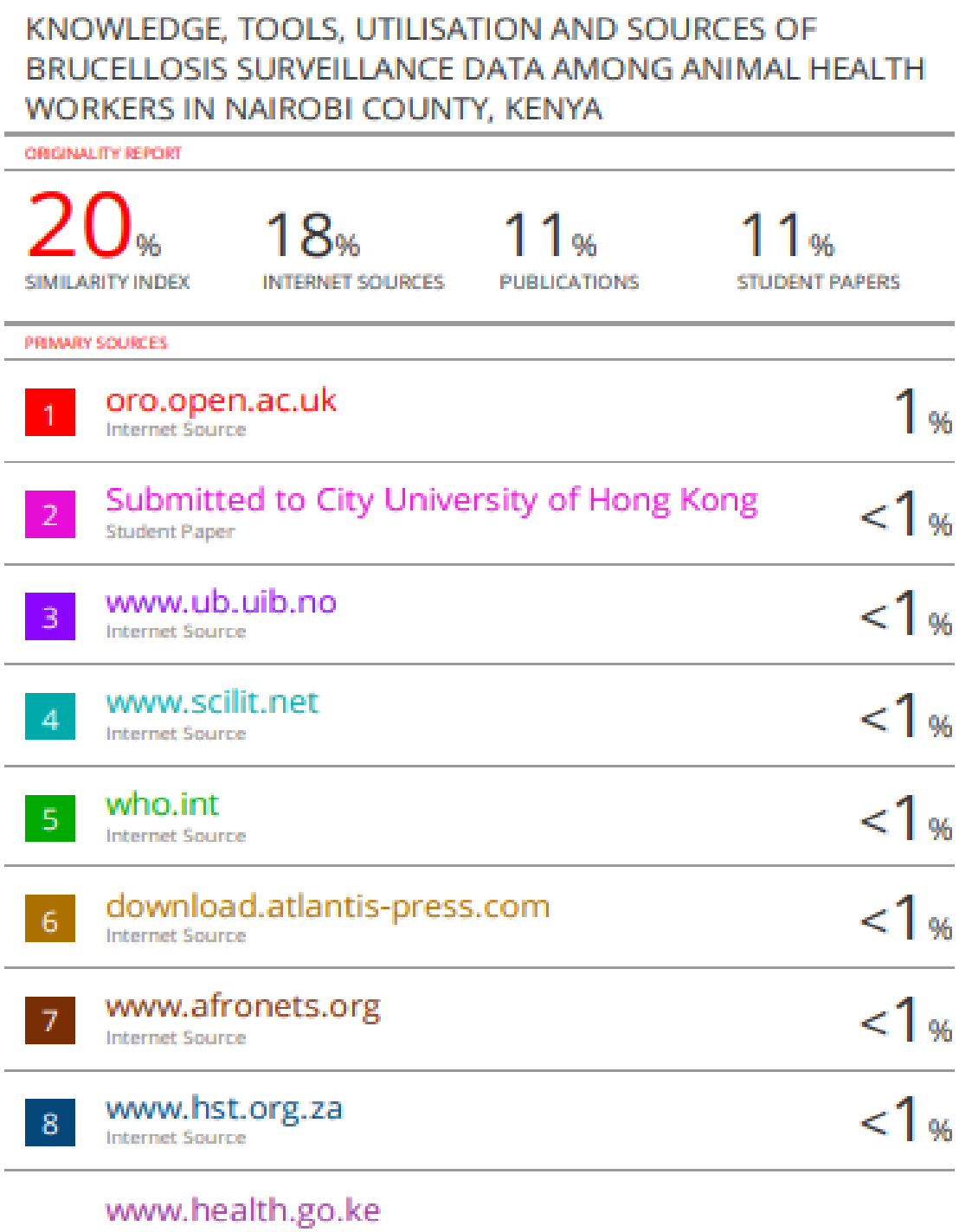


Figure 3.1 Map of Nairobi County (Kibetu, 2018)

Appendix VIII: Similarity Index



KNOWLEDGE, TOOLS, UTILISATION AND SOURCES OF BRUCELLOSIS SURVEILLANCE DATA AMONG ANIMAL HEALTH WORKERS IN NAIROBI COUNTY, KENYA

ORIGINALITY REPORT

20%	18%	11%	11%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	oro.open.ac.uk Internet Source	1%
2	Submitted to City University of Hong Kong Student Paper	<1%
3	www.ub.uib.no Internet Source	<1%
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