CULTURAL DRIVERS OF ZOONOTIC DISEASES AND IMPACT OF THE DISEASES ON POVERTY IN NGORONGORO DISTRICT, TANZANIA

NEEMA PRISCA ONESMO

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

There have been a lot of cultural practices which are risky for transmission of zoonotic diseases which are practised by pastoral societies despite efforts to combat such practices. The general objective of this study was to determine cultural drivers of zoonotic diseases and their impact on poverty, whereas the specific objectives were to: (a) assess cultural practices which are risky for transmission of zoonotic diseases, (b) identify the commonest animal and human infectious diseases and (c) determine the impact of zoonotic diseases on poverty. Purposive and random sampling methods were used to obtain a representative sample of 120 households. A questionnaire was used to obtain information in February 2013 from individuals representing the selected households in Orgosorok, Enduleni and Sale Wards of Ngorongoro District. SPSS was employed for data entry and analysis. The findings showed that risky cultural practices which are practised by the Masai community are drinking un-boiled milk, sleeping in the same houses with calves, eating raw or insufficiently cooked meat, drinking raw animal blood, and not cleaning the kraal for animals. The respondents were of the view that livestock infectious diseases such as anthrax, hydatid cyst, brucellosis and tuberculosis were among the leading diseases in the Masai community; they were mentioned by 21%, 18% 16% and 2% respectively of the respondents. Based on multiple linear regression analysis in which the dependent variable was poverty in terms household income and monetary value of assets owned, it was found that zoonotic diseases had negative impact on poverty ($\beta = -0.074$), albeit the impact was not significant ($p = 0.425$). On the basis of these findings, it is concluded that the occurrence of livestock infectious diseases is influenced by cultural practices and that the diseases in turn affect poverty negatively. In view of the conclusion, it is recommended that more education should be given on how to do away with cultural practices which are risky for transmission of zoonotic diseases, and knowledge should be imparted on how to prevent the occurrence of the diseases in order to alleviate poverty among pastoral societies.

DECLARATION

I, Neema P. Onesmo, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Neema Prisca Onesmo Date

(M.A.Rural Development student)

The above declaration is confirmed

_____ _____

Dr. Kim A. Kayunze Date

(Supervisor)

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DEDICATION

This dissertation is dedicated to my lovely father, Onesmo Francis Kiluvia, who laid down the foundation for my education and sacrificed much for the value of my education, shaped my career with his affection, diligence and love. Thus may the Almighty God give him long life on the days ahead.

This work is also dedicated to my beloved mother the late Norah Simion Butatondewe whose courage, compassion and love were the source of inspiration for this work.

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The preparation and accomplishment of this dissertation would not have been possible without the help of the Almighty God and of many people and some institutions. Therefore, in the first place, I thank the Almighty God for His inspiration upon me; otherwise, this work would not have been completed. God is the one who enabled me to perform this work successfully.

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I would like to extend my sincere thanks to extension workers, community leaders of Ngorongoro District, particularly those of Orgosorok, Digodigo and Enduleni wards for their assistance during the data collection process as they played a big role in mobilizing the pastoralists to show up for interviews. Also my regards go to all household heads who were interviewed for their commitment in providing me with the needed information.

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My unique regards go to my family members for their moral and material support they offered me during my study; I am deeply appreciative of the patience and understanding of

my fiancé, Nicholous and my daughter Nicole throughout the study period. I hope they will find their sacrifice made worthwhile.

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LIST OF ABBREVIATIONS

BCT	Bovine Cerebral Theleriosis
BSE	Bovine Spongiform Encephalitis
CBOs	Community Based Organizations
CBPP	Contagious Bovine Pleuro Pneumonia
ECF	East Coast Fever
HAT	Human African Trypanosomiasis
LGA	Local Government Authority
MCF	Malignant Catarrhal Fever
NCA	Ngorongoro Conservation Area
NCAA	Ngorongoro Conservation Area Authority
NDC	Ngorongoro District Council
NGOs	Non-Governmental Organizations
NSGR	National Strategy for Growth and Poverty Reduction
TADs	Trans-Boundary Animal Diseases
TB	Tuberculosis
URT	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Problem

The word culture refers to an appreciation of good literature, music, art, and food. However, for anthropologists and other behavioural scientists, culture is the full range of learned human behaviour patterns (Taylor, 2003). According to him, culture is "that complex whole which includes knowledge, beliefs, art, laws, morals, customs, and any other capabilities and habits acquired by man as a member of society through socialization processes though it is not limited to men since women possess and create it as well. Thus, culture is a powerful human tool for survival, but it is a fragile phenomenon. It is constantly changing and easily lost because it exists only in minds. Written languages, governments, buildings, and other man-made things are merely the products of culture, but they are not culture in themselves. For this reason, archaeologists cannot dig up culture directly in their excavations.

Furthermore, culture is the totality of socially transmitted behaviour patterns, arts, beliefs, institutions, and all other products of human work and thought. These patterns, traits, and products are considered as the expression of a particular period, class, community, or population. Also these patterns, traits, and products are considered with respect to a particular category, such as a field, subject, or mode of expression. Culture is also explained as the predominating attitudes and behaviour that characterize the functioning of a group or organization. It is the total of the inherited ideas, beliefs, values, and knowledge, which constitute the shared bases of social action, the total range of activities and ideas of a group of people with shared traditions, which are transmitted and reinforced by members of the group. Thus, it is a particular civilization at a particular period, the

attitudes, feelings, values, and behaviours characterize and inform society as a whole or any social group within it, and generally is a way of life of a group of people (Barnouw 1973).

An infectious disease is one that is caused by pathogenic micro-organisms, such as bacteria, viruses, parasites or fungi. Such diseases may be grouped into re-emerging (lingering) and emerging (relatively new) zoonoses that affect both animals and humans (the emerging zoonoses being those diseases which can be transmitted to people from animals) and re-emerging and emerging non-zoonotic diseases, which are specific either to animals or to humans (WHO, 2005).

Poverty has no generally accepted definition to date. Many researchers have attempted to define it in many ways basing on different contexts and with different purposes. Clack (2001) defines poverty as the concerns with income, assets, health, life expectancy, diet, shelter, education, security, access to vital resources, and other aspects of living standards. URT (1999) defines poverty as a state of deprivation and prohibitive of decent life that results from many mutually reinforcing factors including lack of productive resources to generate material wealth. According to Kiros (1995), poverty does not only mean lack of food or any assets or malnutrition, diseases, and illiteracy, but also powerlessness, isolation and vulnerability to irreversible ratchets of impoverishment.

Most of the people of Ngorongoro District, particularly the Maasai and the Sonjo, are well known for sticking to some cultural elements and livestock keeping practices that are not practised elsewhere among other pastoralists and in other places of Tanzania. These elements and practices include not boiling milk before drinking it; herding livestock in the same areas where wild animals do graze or are grazing at the same time; watering

livestock in the same areas where wild animal drink water; sleeping in the same houses with livestock, especially calves, goats and sheep; drinking raw blood of livestock; cooking meat insufficiently, and roasting meat insufficiently. These practices heighten risks of wild animals transmitting zoonotic diseases to livestock and livestock transmitting such diseases to people.

Animal diseases have multiple impacts, which have been highlighted from different perspectives. The impacts of the diseases are mainly felt at farm level, while broader economic impacts can occur with diseases that restrict trade in livestock and livestock products. The occurrence of such diseases impacts heavily on the poor livestock producers by marginalizing them from higher-price livestock markets and restricting their capacity for value-added trade. When considering pro poor livestock development, it is necessary to highlight the impacts on the poor of epidemic diseases and their control, which include direct effects and potential trade benefits. With regard to the latter, benefits and costs vary according to the different livestock sectors. For poor livestock keepers, who pays and who benefits is a crucial question when it comes to planning and targeting control and eradication efforts (Coleman, 2002).

Although the disease risks are not evenly distributed in the Ngorongoro district, the frequent migration of livestock in search of good pasture, water, salts, and markets and in avoidance of specific diseases invariably leads to livestock being at risk of exposure to all the wildlife and livestock diseases. The situation is worsened by the concurrent migration of various wildlife species in search of pastures, water, and salts. However, the risk of transmission of some diseases including MCF, trypanosomosis, anthrax and black quarter is confined to geographically defined areas where risk can be mitigated by avoidance, albeit at the expense of availability of good grazing (Shaw, 2009).

1.2 Problem Statement

Efforts have been in place to stop emerging and re-emerging (lingering) infectious diseases in Ngorongoro District to prevent the diseases from going on causing burden of disease in humans and animals and constraining socio-economic well being, among other unpleasant effects. However, in spite of these efforts, incidences of occurrence of the diseases and their impact in humans, livestock, and wild animals are persistently high. For example**,** efforts were made by the Ngorongoro Livestock Department from 2010 to 2011 to vaccinate over 450,000 cattle against CBPP and 250,000 goats and sheep were vaccinated against East Coast Fever (ECF) but yet, the rate of the diseases transmission is still high and affects to about 70% of the pastoralists in Ngorongoro District (Ole-neselle,2008). Moreover zoonotic diseases such as anthrax, brucellosis, tuberculosis is still a threat to the pastoralists of East Africa and endeavor to control them should be crucial (Coast, 2002).

On the other hand, cultural practices like sleeping in the same house with livestock especially calves, drinking un-boiled milk, consuming animal blood, eating raw/insufficiently cooked meat which is done by pastoral societies specifically the pastoralists of Ngorongoro District have been pointed out to be major drivers that are risky for transmission of the said infectious diseases (Ole-neselle,2008). However, the extent to which cultural factors are associated with occurrence and persistence of the diseases as well as the extent to which the diseases impact on poverty among the pastoralists is not known. Therefore, the aim of this research was to determine those extents.

1.3 Study Justification

The implementation of MKUKUTA I interventions in Cluster II focused on achieving two broad outcomes, namely: (i) improved quality of life and social wellbeing, particularly of

the poorest and most vulnerable groups in the population; and (ii) reduced inequities e.g., in education, survival, and health across geographic areas, income, age, gender and other attributes. The National Livestock Policy of 2006 stipulates that; “remote areas which are still under serviced modalities will be worked out in collaboration with Local Government Authorities to improve livestock services in those areas of the country” (URT, 2006)

The findings of the study will be used to increase awareness within the members of the society especially on the cultural factors contributing to the livestock and human infectious diseases among the pastoralists in the respective society together with the awareness of the impact of such diseases on poverty. Moreover, the results will help to create and raise curiosity among society members on how to do away with bad cultural practices which contribute to the occurrence and persistence of the infectious diseases. The findings of the study will also inform both governmental and non-governmental institutions to find a way out to fight better against the bad cultural practises in pastoral societies and promoting good practices aimed at reducing the infection rates so as to reduce poverty more effectively at the district level and the national level at large.

1.4 Objectives and Hypotheses of the Study

1.4.1General objective

The general objective of the study was to determine the cultural drivers of zoonotic diseases and their impact on poverty.

1.4.2 Specific objectives

The study aimed at achieving the following specific objectives:

(i) To assess cultural practices which are risky for transmission of zoonotic diseases

(ii) To identify the commonest animal and human infectious diseases

(iii) To determine the impact of zoonotic diseases on poverty.

1.4.3 Null hypotheses of the study

(i) There is no significant association between some cultural practices and occurrence of some infectious diseases.

(ii) Costs incurred on infectious diseases do not have significant impact on overall income.

1.5 Conceptual Framework

In order to meet the objectives of the research and identify the variables for data collection, a conceptual framework has been developed. Katani (1999) argues that such a framework can bind facts together and provide guidance towards realistic collection of appropriate data and information.

A research performed without a conceptual framework is usually sterile for reasons that the researcher does not know quite well what data to collect, and when he/she has to collect them more he/she will not know how to put them into use (Kajembe, 1994). The conceptual framework in Fig. 1 outlines variables to be studied. Then hypothetical relationships between and among the variables are explained. The framework groups the variables into background, independent and dependent variables. The types of variables shown in the conceptual framework are: background variables, which include age, sex, marital status, religion, and occupation, family size and level of education attained by the heads of household. The independent variables are the cultural drivers which mainly include the cultural elements practised in the respective households and various infectious diseases which can be transmitted. The dependent variable is poverty; it will be measured in terms of assets owned. It is hypothesised that variations in the dependent variable

mainly depend on differences in the extents to which household members and their livestock succumb to various infectious diseases.

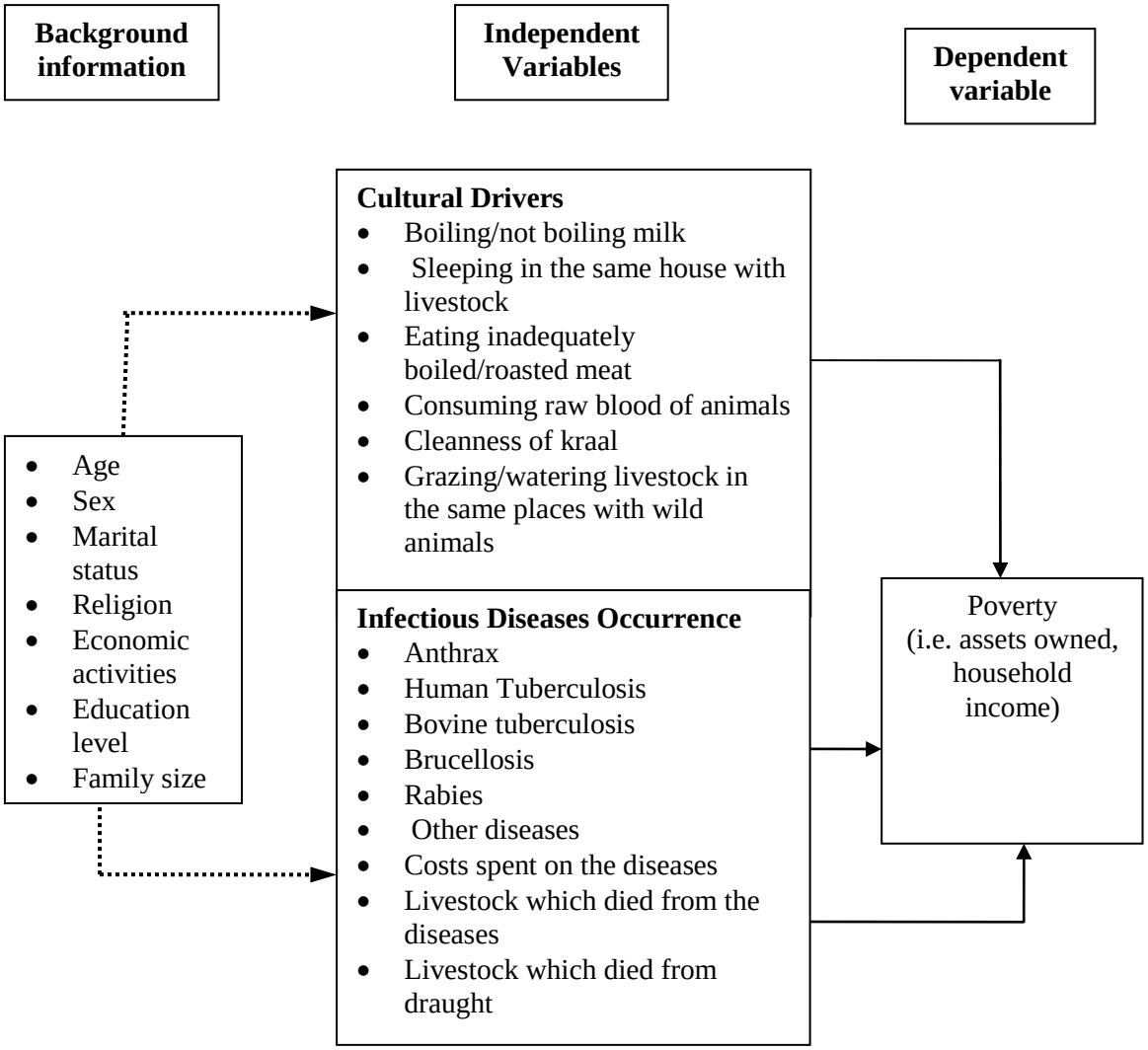

Figure 1: Conceptual Framework

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents in detail variables of the research conceptual framework. The variables include, culture, poverty and its meaning, infectious diseases, and drivers of livestock infectious.

2.1 Culture

The word culture has many different meanings, and different writers describe it in different ways but bringing the same meaning. It refers to an appreciation of good literature, music, art, and food. However, for anthropologists and other behavioural scientists, culture is the full range of learned human behaviour patterns (Taylor, 2003). According to him, culture is "that complex whole which includes knowledge, beliefs, art, laws, morals, customs, and any other capabilities and habits acquired by man as a member of society through socialization processes though it is not limited to men since women possess and create it as well.

Culture is a powerful human tool for survival, but it is a fragile phenomenon. It is constantly changing and easily lost because it exists only in minds. Written languages, governments, buildings, and other man-made things are merely the products of culture, but they are not culture in themselves. For this reason, archaeologists cannot dig up culture directly in their excavations. Furthermore, culture is the totality of socially transmitted behaviour patterns, arts, beliefs, institutions, and all other products of human work and thought. These patterns, traits, and products are considered as the expression of a particular period, class, community, or population. Also these patterns, traits, and products are considered with respect to a particular category, such as a field, subject, or mode of

expression. Culture is also explained as the predominating attitudes and behaviour that characterize the functioning of a group or organization. It is the total of the inherited ideas, beliefs, values, and knowledge, which constitute the shared bases of social action, the total range of activities and ideas of a group of people with shared traditions, which are transmitted and reinforced by members of the group. Thus, it is a particular civilization at a particular period, the attitudes, feelings, values, and behaviours characterize and inform society as a whole or any social group within it, and generally is a way of life of a group of people (Barnouw, 1973).

2.2 Cultural Drivers of Livestock Infectious Diseases

These include elements and practices which may cause the occurrence and persistence of the livestock infectious diseases. Some of the culture practiced by the pastoralists include not boiling milk before drinking it; herding livestock in the same areas where wild animals do graze or are grazing at the same time; watering livestock in the same areas where wild animal drink water; sleeping in the same houses with livestock, especially calves, goats and sheep; drinking raw blood of livestock; cooking meat insufficiently, and roasting meat insufficiently. These practices heighten risks of wild animals transmitting zoonotic diseases to livestock and livestock transmitting such diseases to people. The diseases contribute to impoverishing people through costs incurred to treat the diseases and losses of livestock and their products due to morbidity and mortality of the livestock.

2.3 Infectious Disease

It is well known that an infectious disease is one that is caused by pathogenic micro-organisms, such as bacteria, viruses, parasites or fungi. Infectious diseases may be grouped into re-emerging (lingering) and emerging (relatively new) zoonoses that affect both animals and humans, and re-emerging and emerging non-zoonotic diseases, which

are specific either to animals or to humans. According to WHO/FAO/OIE (2004), an emerging zoonosis is as "a zoonosis that is newly recognized or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range". Some examples of emerging zoonoses are avian influenza, Bovine Spongiform Encephalitis (BSE) and the Nipah virus.

Unlike such relatively new diseases, some ancient diseases are re-emerging as public problems for a number of reasons. They are known as lingering or neglected zoonoses. WHO (2006) lists seven of them and is concerned about the tendency that they seem to attract less public awareness. The seven diseases in the list are Anthrax, Bovine tuberculosis, Brucellosis, Cysticercosis and neurocysticercosis, Cystic echinococcosis or hydatid disease, Rabies, Zoonotic sleeping sickness or Human African Trypanosomiasis (HAT), and food-born zoonoses including *Salmonella* (Salmonellosis), *Campylobacter* (Campylobacteriosis), and *Escherichia coli* infections of animal origin affecting millions of people annually.

About 60% of human pathogens are zoonotic in the sense that they are a species infectious to, and capable of causing disease in, humans under natural transmission conditions (Woolhouse and Gowtage-Sequeria, 2005, cited by Shaw, 2009). The same authors also report that nearly three-quarters of zoonoses are emerging and re-emerging diseases, including avian influenza, severe acute respiratory syndrome (SARS), West Nile virus, and Nipah virus.

Infectious diseases can spread directly or indirectly from one person to another, one animal to another, or from animals to persons and vice versa. Wild animals are known to be reservoirs of pathogens some of which may not affect them due to their genetic make-

up and adaptation to wild conditions, albeit some of the pathogens can cause disease in livestock and in humans. However, infectious diseases can also cross from either human to wild animals (e.g. human TB) or from livestock to wildlife (e.g. bovine TB). A major transboundary animal disease of cattle that used to cause heavy mortality in wild ungulates, whose elimination from the Maasai eco-system of Tanzania and Kenya resulted in a progressive increase in the population of wildlife, notably the wildebeest in the Serengeti (Kock, 2003) and whose global eradication depended on concerted action only in the cattle population, was rinderpest (FAO and OIE, 2011).

Interactions among wildlife, livestock and humans can favour the spread of the pathogens either directly to people through contact with wild animals harbouring the pathogens, contact with contaminated wild products, or consuming wildlife products, including bush-meat. Interactions among the members of the natural ecosystems (e.g. human encroachment and land use, etc); food and agriculture systems (e.g. expanding agricultural production, etc.); and human living environments (including increasing population density and growth, etc.) can lead to disease occurrence or infection spread. In their analysis of trends, Jones *et al.* (2008) concluded that the majority of emerging infectious diseases of humans (71.8%) originate from wildlife.

Interactions among wildlife, livestock, and humans are also explained by two theories: the Island biogeography theory (MacArthur and Wilson, 1967) and the parasite-stress theory of human sociality (Reperant, 2010). The former states that pathogens that lead to disease occurrence are identified at three levels of: interactions within species sources of pathogens, interactions between recipient host species and species sources of pathogens, and interactions within recipient host species (MacArthur and Wilson 1967). The latter states that humans' ontogenetic experiences with infectious diseases as well as their

evolutionary historical interactions with these diseases exert causal influences on human psychology and social behaviour (Thornhill, 2010). This theory emphasizes the causal role of non-zoonotic parasites, which are characteristic of disease transmission from one person to another one, rather than zoonotic parasites which transmit diseases from vertebrate animals to humans.

2.4 Concept of Poverty

Poverty has no generally accepted definition to date. Many researchers have attempted to define it in many ways basing on different contexts and with different purposes. According to World Bank, Poverty is pronounced deprivation in well being (World Bank 2001). Moreover, Clack (1991) defines poverty as the concerns with income, assets, health, life expectancy, diet, shelter, education, security, access to vital resources, and other aspects of living standards. URT (2001) defines it as a state of deprivation and prohibitive of decent life that results from many mutually reinforcing factors including lack of productive resources to generate material wealth. According to Kiros (1995), poverty does not only mean lack of food or any assets or malnutrition, diseases, and illiteracy, but also powerlessness, isolation and vulnerability to irreversible ratchets of impoverishment.

Nevertheless, terminologies “poor” and “poverty” have been described as a monolithic group and issue (World Bank. 2002). Sections on poverty profile still differentiate between subgroups of poor as rural, urban, women or minorities. However, strategies directions rarely pick this variance up consider the poor into one homogeneous group if mentioned at all requiring uniform policy treatment. The phenomenon refers to a condition of living below a defined poverty line or standard of living (Bagachwa, 1994, Mtafikolo, 1994). The line is subject to variation by socio political-economic cultural setup. Poverty

manifests itself through hunger, illness and inability to get medical treatment, attend school or read and write.

Furthermore, the phenomenon results from many mutually reinforcing factors, including lack of productive resources, to generate material wealth, illiteracy prevalence of diseases, discriminative socio-economic and political systems and natural calamities such as drought, floods, and wars (URT, 1998).

There are various ways of measuring poverty, but they are avoided in this short paper. However, at least it is worth mentioning that income is a poor indicator of well being since it is volatile and some people having much income may not use it to obtain important needs. This view is supported by Sen (1999) who argues that resources are imperfect indicators of well-being and Alkire *et al.* (2010) who contend that income is a fuzzy measure of poverty. Therefore, non-monetary indicators are preferable to monetary ones, either to supplement the latter or alone. The preference for using non-monetary indicators grew in the 1990s after Amartya Sen came up with the capability approach to poverty measurement, which is linked with the human development perspective and is now fashionable in measuring poverty.

2.5 Linkages between Zoonoses and Poverty

The poor in every society, and particularly in developing countries, bear an excessively high share of the burden of disease. However, in the case of zoonoses, there are a number of reasons why their burden falls especially heavily on poor people which go beyond the usual reasons of access, affordability and vulnerability.

Firstly, poor people are more at risk of contracting many zoonoses. There is a strong association between poverty and living in close contact with animals, the reservoirs of disease. For some diseases the risk factors are very clear, bovine tuberculosis, anthrax and brucellosis are primarily occupational diseases, affecting livestock keepers and, in the case of anthrax, those who process animal products, such as tanners. For those diseases which affect consumers of livestock products, again the risks are skewed towards the poor (FAO 2005).

Pork which cannot be marketed because it contains cysts can be sold off cheaply, unpasteurized milk sold in non-sterile conditions, meat from dying animals slaughtered near the farm or in backyards are all bought or eaten by the poorest consumers. Pigs living in areas with poor sanitation are those which get cysticercosis. Recent research into the risk factors for TB in United Republic of Tanzania has clearly shown that for all forms of human extra pulmonary TB, the risk of disease was greatest among remote, marginalized and impoverished households.

Secondly, once infected, it is the poor who are least likely to get proper treatment. Again, there are a number of reasons why this is particularly so for zoonotic diseases. Most have to do with the sheer difficulty of obtaining a correct diagnosis reflecting not just the lack of diagnostic facilities or cheap and effective tests but also the fact that zoonoses are mostly contracted by remote rural populations for whom the cost of repeated trips to health centers in search of treatment or diagnosis eventually becomes prohibitive.

For example, those who were successfully diagnosed as suffering from zoonotic trypanosomiasis in Uganda had, on average, made three prior trips to a health facility and these already represented the more affluent subgroup, those most likely to be able to insist

on getting a correct diagnosis. In the case of rabies, where the key to survival from an infected dog bite is rapid administration of a good quality post exposure treatment, their availability is almost entirely a function of national and individual income poor countries are unable to stock sufficient supplies, they are seldom available in rural locations and often, where they are available, quality human cell-culture vaccine which costs about US$75 is only available to paying customers, others have to make do with cheaper alternatives which are less effective and can cause unpleasant and/or serious side effects (Budke *et al.,* 2006).

Thirdly, the impact of disease is worst in poor households where a dual burden is borne since it affects both people and animals. In humans, some zoonotic diseases are clustered in certain age groups for example sleeping sickness tends to be diagnosed in active adults as do diseases like anthrax, tuberculosis and brucellosis which are linked to livestock-keeping occupations. Illness or death of a breadwinner has a devastating impact on rural households. Other zoonoses primarily affect children, who are those most likely to suffer a fatal bite from a rabid dog. Dealing with these diseases places a big strain on the other adults in the household, either as carers or accompanying the patient while seeking or receiving treatment. In poor households, spare labour and spare funds do not exist so that the burden of looking after a seriously ill family member will push the household further into poverty or extreme poverty.

Furthermore, in communities where people are suffering from zoonoses the livestock are sure to be affected as well. Animal trypanosomiasis, caused by trypanosomes which are not pathogenic to humans, coexists in the same herds and flocks which harbour the trypanosome causing sleeping sickness, and is a major cause of low productivity and mortality in African livestock. Cysticercosis causes major losses to pig producers through

carcass condemnations and cystic echinococcosis through liver condemnations (Coleman, 2002).

Anthrax outbreaks are accompanied by high mortality in livestock. Tuberculosis and brucellosis depress livestock productivity and rabies, while mainly affecting carnivores, does cause deaths in livestock usually cattle.

The number of poor livestock-keepers worldwide is estimated at somewhere between 500 and 900 million by various sources (Thornton *et al.,* 2002) For these people livestock are a vital component of their survival strategy and, if healthy and well managed, can offer a route out of poverty. Livestock, especially smaller animals, are sold to meet emergency expenditures such as treatment and hospitalization of family members or food in times of shortage and thus form a vital component of poor households' coping strategies. Small-stock tend to be kept by women and provide a modest regular income in the form of egg or milk sales which goes directly to women and children, the latter sometimes benefiting from the extra protein available in the household.

Because poor people keep fewer animals, they are far more vulnerable to an animal's illness or death. And for animals too, the scenario is worse if they are kept by a poor household when an animal does fall ill, the livestock keepers are unlikely to be able to afford to treat it or to have good access to veterinary services and healthcare information.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

Ngorongoro is one of the five districts of the Arusha Region of Tanzania. It is bordered to the North by Kenya, to the East by Monduli District, to the South by Karatu and to the West by the Mara Region; it covers an area of about 14,036 km²; and it lies between Longitude 35 and 36E and latitude 2 and 4S. The district is divided in three divisions Loliondo, Sale and Ngorongoro. According to the 2002 Tanzania National Census, the population of the Ngorongoro district was 129,776. Within the district are the famous Ngorongoro Crater and active volcano Oldonyo Lengai. It plays host to parts of the wildebeest migration, as such, much of the district is considered part of the Serengeti-Mara Ecosystem, which is defined by the limits of the annual wildlife migration. The District Headquarters, including the office of the District Commissioner which is located in Loliondo village.

The major ethnic group in the district is the Maasai people who are almost entirely pastoralists; while the second big ethnic group is of the Sonjo people who practise pastoralism and crop production almost equally. The District is further divided administratively into 14 wards which are Arash, , Digodigo Kakesio, Malambo, Nainokanoka, Nayobi, Olbalbal, Oldonyo-Sambu, Ngorongoro, Pinyinyi, Soitisambu, Enduleni, Orgosorok, and Sale.

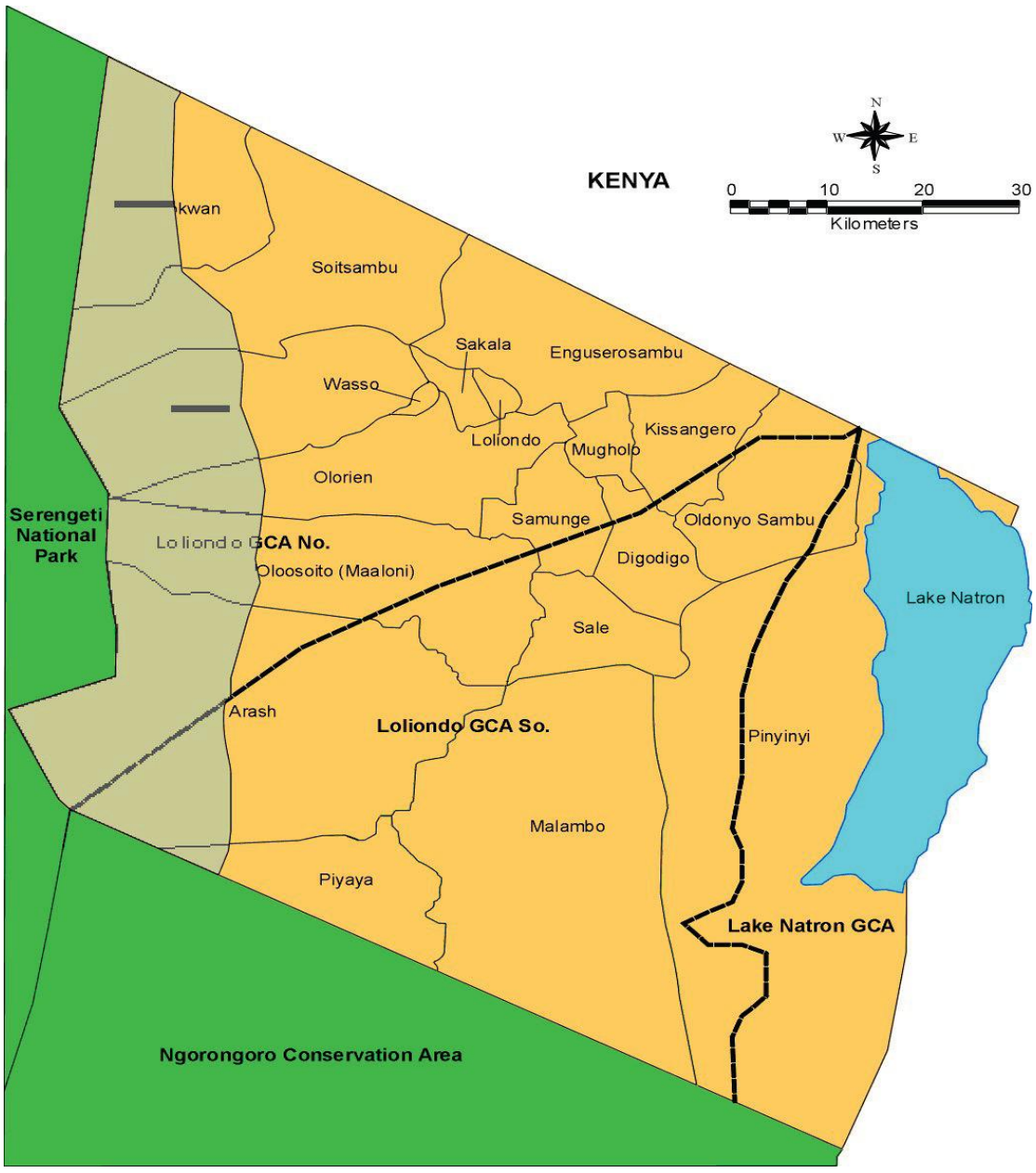

Figure 2: The map of Ngorongoro District showing the study area

3.2 Research Design

The study was a cross-sectional explanatory study in which data were collected at one point in a time. This design has been chosen for the research heeding arguments by Bernard (1994) and Babbie (1990), which the author agrees with, because data were collected once and considered for a single year. Therefore, the design is economical of financial, time and manpower resources. Thus Cross sectional research design was employed during data collection. Data were collected at a single point in time. The cross-sectional research design was employed for data collection both qualitative and quantitative due to resource limitation in order to reduce costs (Bryman, 2004; Saunders *et al.,* 2003). Instruments used for collecting information and data were structured questionnaire (Appendix 1). This method involved collection of information by asking questions to a representative sample of the population at a single point in time. The design was found to be more appropriate for this study taking into consideration the mobility and spatial arrangement of the pastoralists in the area.

3.3 Sample Size and Sampling Procedures

3.3.1 Population

The target population for this research was households in Ngorongoro District that keep and graze animals. According to the 2002 Tanzania National Population and Housing Census, the population of Ngorongoro District was 129,776, as stated above.

3.3.2 Sample size

Regardless of the population size, 30 cases is the minimum allowed sample size for a research in which statistical data analysis is to be done, and if a sample is to be subdivided the smallest sub-sample should have at least 30 cases/respondents. In most cases a sample of 100 is optimum (Bailey 1994). In view of this literature, a sample of 120 households

was selected, 40 in Enduleni ward, 40 in Orgosorok ward, and 40 in Sale ward. The sample size of this research, which is 120, is even bigger than the minimum sample size recommended by Bailey (1994). The wards have been selected purposively because Enduleni has the highest wildlife-livestock-humans interactions; Orgosorok is one of the areas with high livestock population thus chances of zoonotic is high; and Sale is a place with most crop production in Ngorongoro District.

3.3.3 Sampling procedures

Villages which were involved in the study were selected purposively as well because Digodigo (Enduleni) has the highest wildlife-livestock-humans interactions; Magaiduru (Orgosorok) is one of the areas with high livestock population; Enduleni (Sale) is a place with most crop production in Ngorongoro District. Households were selected through simple random sampling using a table of random number where household heads were subjected to the interview.

3.4 Data Collection

Consent of interviewees was requested before beginning the interviews. Privacy and confidentiality of collected data was maintained. Both primary and secondary data were collected using respective methods.

3.4.1 Secondary data

The secondary data especially on infectious diseases, culture, and poverty were obtained from different sources of information so as to improve the primary data source, and these data were obtained from existing published and unpublished information/literature. These were accessed from Livestock Officers, Community Development Department, Health

Department, ward and village offices, Sokoine National Agricultural Library (SNAL), and Worldwide websites.

3.4.2 Primary data

Primary data collection was mainly based on interview schedules, whereby heads of households or their representatives were subjected to questionnaire based interviews in which the researcher asked the questions and filled in answers in the appropriate spaces in the questionnaire copies. The questionnaire (Appendix 1) comprises open ended and close ended questions. The questions were derived from the specific objectives and the conceptual framework of the research, and they were designed in such a way that they were able to capture both quantitative and qualitative information on cultural factors contributing to livestock infectious diseases as well as the impact of the diseases on poverty.

3.5 Data Collection Tools

(i) **Questionnaire**

A structured questionnaire was designed (Appendix 1); pre-tested to check its validity and reliability, and it was improved again taking into account the experiences gained through the pre-testing exercise, thus the final version was used for actual data collection.

(ii) Checklist

A checklist of items for discussion was used to discuss with Livestock and Agricultural Officers, Health Officers and Community Development Officers so as to capture pertinent information on the commonest diseases in the district.

3.6 Data Processing and Analysis

Qualitative data from key informant interviewees were summarized, coded and analysed by comparing their similarities and differences with some answers that were given by the respondents on the cultural factors contributing to livestock infectious diseases and the impact of the diseases on poverty. Quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) to compute descriptive statistics of individual variables. The statistics included frequencies, percentages, averages, minimum and maximum values of individual variables. Moreover, inferential analysis was done to test the hypotheses of the research. The first hypothesis, which states that there is no significant association between some cultural practices and occurrence of some infectious diseases, was tested using chi-square.

Chi-square model

$$X^2 = \sum \frac{(obs - \exp)^2}{\exp}$$

Where χ^2 = Chi-Square value

Obs = Observed Frequency in each category

This model is best used for variables recorded at the categorical level. It is appropriate for this analysis since the independent variables for this model (cultural elements and practices) and the dependent variable (infectious diseases) was recorded at the categorical level.

The second hypothesis, which states that costs incurred on infectious diseases do not have significant impact on overall income, was tested using multiple linear regression since

both the independent (costs and other variables) and the dependent variables (overall income) were recorded at the ratio level as continuous variables.

Formally, the model for multiple linear regressions, given *n* observations, is:

$$Y= a + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \ldots \beta_nX_n + e_t$$

Y= The dependent variable poverty measured in terms of assets owned

a= Intercept (constant) term.

X_1 to X_n=Independent variables.

e_t= Random error term.

$\beta_1$to β_n=Standardized partial regression coefficients for independent variables.

3.7 Limitation of the Study

Responses of interviewees mostly depended on individuals' memory whereby respondents rarely kept written records of their activities. Therefore, there were notable difficulties for respondents to give answers, especially on the questions which demanded them to mention costs incurred, expenditures made as well as households income. It has to be borne in mind that the confidential syndrome is not only prevalent in pastoral societies but also to the whole spectrum of the society especially when it comes to asking someone's level of income. Because of such limitations, some of the household incomes, costs and expenditures reported by the respondents might not be the exact figures/amounts; they were rather estimated figures. There were also language barriers whereby most of the respondents were not familiar with the Kiswahili language which was used for the interview.

3.8 Delimitation

When it was suspected that respondents gave insufficient information, careful probing enabled them to disclose and remember more accurate information about the study. The interviewer was responsible for watching for inconsistence in answers given by respondents. Also, in order to understand the language used by the respondents as well as interviewer s language, a translator was used to bring a common understanding.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter summarizes the findings on the cultural drivers of zoonotic diseases and impact of the diseases on poverty in Ngorongoro District. The results presented in this chapter include demographic characteristics of respondents and background variables, the cultural practices which are done by the Maasai in the study area, the humans and livestock infectious diseases which are caused as a result of cultural practices, impact of the diseases on poverty in terms of household income and assets owned and inferential analysis (hypotheses testing results).

4.1 Socio-Demographic Characteristics of the Respondents

The summarized demographic characteristics of respondents that were involved in the study include: sex, marital status, age, years of schooling (education levels of the respondents), household size, house quality, household annual income, diseases affecting households and general information on cultural practices.

4.1.1 Sex of the respondents

A total of 120 respondents were involved in the study. Out of these, 65.8% were males and 34.2% were females (Table. 1). The proportion of male and female turnout shows that there was a low female's proportion as this could be due to the participation of Masai women in other activities that give economic returns for their households. Also females were engaged in other daily household tasks. Moreover, low female representation during the interview could be because of a patrilineal system practised by the Masai communities whereby a man is the head of household, thus he has to represent the household in all

matters, especially when livestock's are involved thus women remain to have no say regarding livestock.

Table 1: Sex of the respondents

Sex of respondent	Frequency	Percent (%)
Male	79	65.8
Female	41	34.2
Total	**120**	**100.0**

4.1.2 Marital status

Marital status among the 120 respondents presented in Table 2 below shows that 75.0% were married and some were never married, widower, widow, divorced, separated and some who represented household heads (4.2%) were still young to be married This indicates that the majority of the interviewed respondents were in marriage.

Table 2: Marital status of the respondents

Marital status	Frequency	Percent (%)
Married	90	75.0
Never married	6	5.0
Widower	1	0.8
Widow	8	6.7
Divorced	6	5.0
Separated	4	3.3
Too young to be married	5	4.2
Total	**120**	**100.0**

4.1.3 Age of the respondents

As seen in Fig. 4, two-third (66.7%) of the respondents was at the age ranging between 30 and 45years. During the interview it was revealed that most of the youths (mainly boys) at the age 15 to 30 years shifted to towns to seek employment, like plaiting hair, guarding

and some other income generating activities compared to those who are at the age group of 30years and above most of whom have cattle thus are occupied with livestock responsibilities as well as other family responsibilities instead of moving to town or other places searching for employment. However, the minimum, maximum and the mean age for the interviewed respondents were 16, 85, and 38.67 respectively.

Table 3: Age of respondents

Age	Frequency	Percent (%)
15-30 years	16	13.3
30-45 years	80	66.7
45-60 years	24	20.0
Total	**120**	**100.0**

4.1.4 Education level of the respondents

The respondents were asked about their levels of education. This was done so as to come up with a real picture on education status of the entire community in the study area. The results in Fig 5 show that about two-thirds (46.7%) of the respondents in the households surveyed had no formal education, 27.5% of the respondents had primary education whereas people who attended secondary education as well as colleges were 18.3% and 7.5% respectively These results indicated that there was a high rate of illiteracy in the study area. This situation may be attributed to the pastoralists' culture whereby they are normally mobile and put more emphasis on their children engaging in livestock herding rather than going to school (priority is given to livestock rather than to education).

Moreover, the situation might also be due to the fact that most pastoralists are marginalized and distance of the Maasai households from the schools is very long thus

discouraging attendance of those who are enrolled and also increases drop out of school among those enrolled.

Also, most of girls who are at the age of school going are forced into early marriages before completion of school, thus this also increases the dropout rate and at the end the number of people with formal education in this community tends to be low.

Table 4: Education level of the respondents

Education level	Frequency	Percent (%)
Primary education	33	27.5
Secondary education	22	18.3
College/University	9	7.5
No formal education	56	46.7
Total	**120**	**100.0**

4.1.5 Household size

It was found that the sizes of the households surveyed ranged between member and 20 members with the minimum of 3 members and maximum of 17 members. However, it was observed that there was no relationship between household size and cattle ownership as it was thought (i.e. those households with many family members 10 to 20) were not necessary having large number of cattle. Instead, it was observed that there was a bit relationship between age of the household head and the household size, i.e. those household heads with high ages seem to have large household sizes compared to heads with young ages. On average it was found the average household size to be 7.47 members.

Table 5: Household size

Household size	Frequency	Percent (%)
1-5	31	25.8
6-10	73	60.8
11-15	13	10.8
16-20	3	2.6
Total	**120**	**100.0**

4.1.6 Types of the Houses of the Respondents

The type of the houses in which the majority of the respondents (Maasai) live is mainly traditional houses which are known as Engaji with soil floor, having walls made of wood and soil with no windows. The roof is mainly timber, soil/thatch. They use firewood being the main source of light as well as source of power.

4.2 Cultural Practices that are Risky for Transmission of Infectious Diseases

The first objective of the research was to assess cultural practices which are risky for transmission of infectious diseases. The results presented in this section meet this objective. In assessing cultural practices in the community, the respondents were asked to mention practices done in their households and in the entire community as a whole. It was observed that the households tended to drink un-boiled milk, eat raw and insufficiently cooked meat, drink raw animal blood, sleep in the same houses with livestock especially calves, and also have a habit of not cleaning the livestock's kraals often. These cultural practices have acted as drivers for livestock infectious diseases because they are risky for the transmission of such diseases. The major reasons mentioned for practicing such cultures varied from one household to the other, although in most cases they were almost the same among all the surveyed households.

4.2.1 Reasons for drinking un-boiled milk

The major reason mentioned as to why the Maasai drink un-boiled milk is that of local belief as 23.1% believed that un-boiled milk is safer to drink than boiled milk because the milk comes direct from cow and it's safe to drink when the milk is still hot. However, the issue of laziness in boiling milk appeared to be another reason as the respondents mentioned the boiling process to consume time in case one is in hurry of doing some other activities, thus they can't bare waiting to the boiling point that's why 23.1% of the surveyed households were found to consume un-boiled or insufficient boiled milk.

4.2.2 Reasons for eating raw/insufficient cooked meat and drinking raw animal blood

Drinking raw animal blood or eating raw/insufficient cooked meat is believed to be as medicine for treatment of some diseases. Whenever one is sick is given raw animal blood since Maasi believe the content in the blood can act as medicine for treatment and sometimes it is used for prevention of some diseases. Because of this, 13.0% and 26.4% eat raw or insufficient cooked meat and consume raw animal blood respectively.

4.2.3 Reasons for sleeping in the same house with livestock

It was observed that, the majority (33.7%) of the respondents tended to sleep in the same houses with livestock especially calves and the reasons behind this were mentioned to be protection that's they protect young animals (especially calves) from being harmed by wild animals. Therefore, sleeping with calves acted as a protection to the calves from wild animals.

On the other hand, the findings showed that, Maasai tend to sleep in the same house with animals because of their habit, that's they are used to it as a part and parcel of their lives. They consider animals to be the same as human, thus treat they treat them as fellows. However, the majority (51%) do not know the consequences of sleeping in the same house

with livestock, especially on the impact of the practice and its risks to human health as well as animal health.

Table 6: Respondents' responses on Cultural Practices (n=120)

Cultural practices	Responses	
	n	**Percent**
Drinking un boiled milk	48	23.1
Eating raw/insufficient cooked meat	27	13.0
Drinking raw animal blood	55	26.4
Sleeping in the same house with livestock especially calves	8	3.8
Cleanness of kraal	70	33.7
Total	**208**	**100.0**

4.3 Commonest Animal and Human Infectious Diseases

The household heads interviewed were asked about their health status and that of their family members so as to get the real situation of the entire community on the transmission and on prevalence rate of infectious diseases aim being meeting the second objective of the research which was to identify commonest animal and human infectious diseases. The health statuses were considered whether one was very healthy, moderately healthy, moderately ill and very ill. The considerations were based on the answers given by the respondents.

Table 7: Health status of the respondents

Health status	Frequency	Percent
Very healthy	25	20.8
Moderately healthy	61	50.8
Moderately ill	32	26.7
Very ill	2	1.7
Total	**120**	**100.0**

The table 9 above shows the general health status of the interviewed households which were the representatives of an entire community.

4.3.1 Commonest Human Diseases

Basing on the four health status categories, the respondents were further asked during the household survey to mention the commonest diseases that affected their households. It was observed that livestock infectious diseases such as hydatid cyst and brucellosis were among the leading diseases among the surveyed households with 18% and 16% respectively preceded by Anthrax with 21%. Anthrax is mainly transmitted from livestock to humans due to the use of animal skins and hides, which are not well dried by the household members as a mattress for sleeping. The high rate of hydatid cyst and brucellosis diseases could be due to the fact that the Masai people have a tendency of eating raw/insufficient animal meat as well as drinking raw animal blood cultural practices which are risky for the transmission of such diseases. Human Tuberculosis was reported at the rate of 2%. Other diseases mentioned by the respondents as a problem in their households included stomach problems and swollen feet.

Table 8: Commonest human diseases

Human Infections Diseases	Respondent Response			
	Yes		No	
	N	%	N	%
TB	8	2.0	112	20.0
Anthrax	85	21.0	35	6.0
Swollen feet	46	12.0	74	13.0
Brucellosis	62	16.0	58	10.0
Hydatid cyst	70	18.0	50	9.0
Stomach problems	39	10.0	81	14.0
Others	49	21.0	71	28.0

4.3.2 Commonest livestock diseases

Basing on the findings, it was again noted that the commonest diseases that affected livestock in the study area include Tuberculosis, East Coast Fever, Anaplasmosis, Contagious Bovine Pleuro Pneumonia, and Anthrax. Twenty two per cent (22%) of the respondents mentioned Anthrax as a major problem among the mentioned diseases, followed by East Coast Fever to have high prevalence since 20% of the respondents mentioned it to be a problem facing their livestock. The high prevalence could be due to high cost of vaccination as well as high cost of treating the diseases thus pastoralists fail to afford such cosst hence the transmission rate tends to remain high among the livestock. Contagious Bovine Pleural Pneumonia (CBPP) and Anaplasmosis were also reported as problems facing livestock with 17% and 15% respectively. About Tuberculosis in livestock, the respondents were not aware of the signs of the disease in livestock mainly because it was difficult to observe Tuberculosis cases in livestock.

Table 9: Commonest livestock diseases

Livestock Infections Diseases	Respondent Response			
	Yes		No	
	N	%	N	%
TB	0	0	120	31
East cost fever	69	20	51	13
Anaplasmosis	52	15	68	18
Cont. Bov (CBPP)	57	17	63	16
Anthrax	73	22	47	12
Others	87	26	33	9

4.4 Impacts of Infectious Diseases on Poverty

The findings presented in this section meet the third objective of the research which was to determine the impact of infectious diseases on poverty.

4.4.1 Household Poverty and Well Being Levels

In order to capture the household well being situation, 8 well being indicators were used to measure well being situation. The indicators used were (1) being able to eat at least 3 meals per day, which means whether there is food for the household members and whether the household members are able to get at least three meals per day (2) being well sheltered, (3) being able to escape avoidable morbidity and premature mortality, which imply that whether the household is able to run away from preventable morbidity and premature mortality (4) households having at least any household members having a good self-employment or a salaried employment; (5) being able to sell livestock and crop products in nearby towns; that's whether the household is able or is free to sell its products any time and at any price when there is a need to do so (6) being able to pay school fees for secondary school children belonging to the households, (7) having been able to buy new (not second-hand) clothes during the previous 12 months; and (8) having freedom to live the way they would value so long as they do not break the laws.

Basing on the indicators, the findings showed that, as one of the indicators of well being, out of 120 respondents interviewed; only 13.1% were able to eat at least 3 meals per day. Only 11.4% of the households surveyed were well sheltered. It was only 17.3% of the interviewed households which had at least a household member having a good self-employment or a salaried employment. It was only 17.3% of the respondents who were able to pay school fees for secondary school children belonging to the households. Due to this situation the percentage of people having formal education at least primary education was low, only 34.2% among all the interviewed households. About being able to buy new clothes, it was only 14.5% of the respondents among the interviewed households were able to buy new and not second hand cloths. However, 3.9% of the respondents were able

to sell livestock and crop products in nearby towns and also having freedom to live the way they would value so long as they do not break the laws.

Therefore, the well being situation of the households surveyed who represent the well being levels of the Maasai community of Ngorongoro District was found to be poor despite owning large numbers of cattle. This is because they fail or they have inadequate knowledge to transfer cattle into assets in terms of cash which can be used to solve daily basic needs such as food, cloths, shelter and the others. On the other hand poor well being levels was found to be attributed by the diseases affecting humans who due to the sickness, they fail to engage in other economic activities which could add to the household income thus help to improve well being situations of the households

Table 10: Households Well being Levels

Well being indicators	**Responses**	
	n	**(%)**
Being able to eat at least 3meals per day	78	13.1
Being well sheltered	68	11.4
Being able to escape avoidable morbidity and premature mortality	120	20.2
Households having at least any household members having a good self-employment or a salaried employment;	103	17.3
Being able to sell livestock and crop products whenever they like	14	2.4
Being able to pay school fees for secondary school children belonging to the households	103	17.3
Having been able to buy new (not second-hand) clothes during the previous 12 months	86	14.5
Having freedom to live the way they would value, so long as they do not break the laws	23	3.9
Total	**595**	**100.0**

4.4.2 Amount of Total Household Annual Income

Basing on poor well being levels indicated by the households surveyed, it was again found that the annual household income ranged from TZS 100000 to 5000000. The results in the Table 13 show that 24.2% of the households earned from TZS 100 000 and 500 000 while 45.8% (who are the majority) earned from TZS 500001 to 1 000000. Others were 13.3% who earned between 1000001 to 1 500 000, only few households (7.5%) and (9.2%) among the respondents earned from 1 500 001 to 2 000000 and TZS 2 000 001 above respectively. The minimum income earned was TZS 100 000 while the maximum income was 5 000 000Tsh. However, the mean income earned per year was TZS 1 090 000. The respondents mentioned livestock keeping being the main source of income on which they depended for survival. However, observation indicated that the annual incomes of the majority were smaller compared to expenses, which the earned cash was used for. The respondents reported that sometimes they failed to meet some of the basic requirements such as medical costs, clothing, school fees for their children and food because about 45% of the respondents fall below the national poverty line, which is TZS 13998 per adult equivalent for 28 days in 2007 prices.

The households incomes were seem to be affected by the diseases both human diseases as well as livestock diseases. Human diseases affected one's ability to engage in development activities which could help to add positively to the households' income and thus improve households well being. Livestock diseases affected marketability (in terms of price) of the livestock as the sick or weaker livestock were sold at the low price ranging from TZS 100000 to TZS 300000 depending on the size and sometimes they were left to die before being sold, this was compared to the price of the healthier livestock which were sold at the price ranging from TZS 600000 to TZS 1000000 depending also on the size of

the livestock to be sold. Due to these reasons, it was found that, diseases affected households' income.

Table 11: Household income

Income in TZS	Frequency	Percent
100000-500000	29	24.2
500001-1000000	55	45.8
1000001- 1500000	16	13.3
1500001-2000000	9	7.5
2000001 and above	11	9.2
Total	**120**	**100.0**

4.4.3 Value of Acquired Assets and Other Expenditure

The findings presented hereunder show the monetary values of the assets owned by the households (mainly common assets of the surveyed households). However, despite high monetary values of the owned assets possessed by the households, their well being situations were still poor because two-thirds (66.7%) failed to transfer such assets into capabilities which include issues like paying school fees, food security, good shelter, clothes, building houses, treatment, home consumptions and other socio-economic issues. For that it was only one-thirds (33%) who were able to transfer assets (livestock) to monetary values or capabilities however they still gained little as their assets which were mainly livestock had poor quality i.e. they were affected by the infectious diseases. Because of this reason, large number of livestock with high monetary value owned by the Maasai became meaningless since it could not help improve the well being situation among the households surveyed.

Table 12: Monetary value of assets

Assets owned	Monetary values of assets owned per households		
	Mean	Minimum	Maximum
Bicycles	22500.00	0	190000
Cattle	22600000	1600000	132400000
Chicken	40895.88	0	150000
Donkey	169166.67	0	600000
Goats	1302416.67	150000	15000000
Houses	357500.00	100000	700000
Sheep	1232010.00	12000	147841200
Cellular phone	22916.67	0	160000

4.4.4 Deaths associated with infectious diseases

Death is a negative impact of diseases and it may have a trickledown effect on poverty, as any death to any livestock which is the main assets to the pastoralists may reduce amount of assets owned and since poverty was measured in terms of assets owned, the loss of asset may have impact on well being level of the household. Because of this death rates were captured during the interview so as to see whether there were deaths which were associated with the infectious diseases and whether the deaths had any impact on poverty.

4.4.4.1 Animal deaths

The study aimed at observing deaths which had occurred from July2011 to June 2012. The number of the animals that had died in total among the interviewed respondents was 595 with a minimum of 1death and maximum of 30 deaths per household. However on average the death was 4.9 animals per each household per year. The high death rate reported could be due to the prevalence of livestock diseases with absence of reliable veterinary services in the area as the majority of the people live far from the needed services and thus fail to access the service whenever they need. This is further contributed

due to small number of extension officers in the district (38 in the whole district) who fail to reach all people in the community. Moreover, inadequate information and knowledge on how to deal with the diseases attacking the livestock (especially knowledge on disease prevention) was reported to be a driver of high death rate,

However, absence of dip tanks especially at Digodigo ward was said to be a cause for the diseases prevalence and the notable death rate. High charges on treatment of the diseases were also a reason for the deaths since the majority of livestock keepers cannot afford to treat their livestock, a situation which may results into deaths of livestock. For example, costs of diagnosis, vaccination and treatment of East Cost Fever was approximated to be around TZS 50 000 to TZS 250 000 while diagnosis itself cost around 40 000 to 50 000, vaccination cost is approximated to TZS 150000 to TZS 250000 and the treatment costs were said to range between TZS 200000 and TZS 300000 an amount which the majority of the pastoralists cannot afford, given their poverty situation.

It was again found that, there is an association between livestock deaths and household income. Those households which had high death rate (21 to 30 animals) for their livestock were found to have low income (TZS 100000 to TZS 500000 per year) compared to those which had small death rate (1 to 5 animals).

For the case of humans, there were no deaths reported among the households interviewed which were linked with infectious diseases from July 2011 to June 2012. Those who were previously reported to be moderate ill and very ill were still on the treatment.

Table 13: Livestock deaths from July 2011 to June 2012

Livestock	Mean	Minimum	Maximum	(%)	Total death
Cattle	2.02	0	10	40.67227	242
Sheep	1.42	0	7	28.7395	171
Goat	1.52	0	13	30.58824	182

4.5 Costs incurred on diseases

4.5.1 Costs incurred on human diseases

It was estimated that the average costs incurred on human diseases was TZS 48330 per year whereas the minimum costs incurred were TZS 16500 and the maximum costs were TZS 216 500. The minimum medical cost seems to be low due to the fact that, the Maasai community used to take local herbs most of the time to treat themselves rather than attending formal medical /health services. Also, due to the mobility characteristics of pastoralist in search for pastures and water for their livestock, they normally find themselves very far from health centres hence unable to access modern health services.

Table 14: Costs incurred on diseases

Statistics	Total cost on all livestock diseases	Total costs incurred on human disease (in TZS)
Mean	79235.00	48330.83
Median	67250.00	41500.00
Mode	52000	32000[a]
Minimum	18500	16500
Maximum	311000	216500
Sum	**9508200**	**5799700**

4.5.2 Costs incurred on livestock diseases

It was also found that the average cost incurred on livestock diseases was TZS 79 235 with the minimum and maximum treatment cost of TZS 18 500 and TZS 311 000 per year respectively. Moreover, the treatment costs depended on the number of livestock treated, which livestock were treated as well as type of diseases treated. East Coast Fever was mentioned to have high treatment cost compared to other diseases.

4.6 Respondents' Opinions on Impact of the Diseases

During observing the extent to which the costs incurred on livestock diseases and that incurred on household members diseases affect negatively overall income of the households, the respondents were asked to give their opinions on the impacts of the infectious diseases on poverty. More than two- fifths (43.3%) of the people interviewed said that costs incurred on livestock diseases affect negatively overall income of the households, whereas 51.7% said they affect much, 5% said they had no opinion.

Table 15: Opinion on whether costs incurred on livestock diseases affects overall income

Opinion	Frequency	Percent
No opinion	6	5.0
Affects	52	43.3
Affects much	62	51.7
Total	**120**	**100.0**

About the effects of human diseases on overall income, 49.2% of the respondents said the costs incurred on the treatment of the diseases affect much the overall income and consumption expenditures of the households whereas 47.5% said it affects. The remaining

3.3% of the respondents had no opinion on whether the costs had impact on household consumption expenditure.

Table 16: Opinion on whether costs incurred on human diseases affects overall income

Opinion	Frequency	Percent
No opinion	4	3.3
Affects	57	47.5
Affects much	59	49.2
Total	**120**	**100.0**

However, the findings show that there was no significant relationship between costs incurred on diseases and household income, thus the impact of the infectious diseases on poverty is not significant. The negative relationship could be due to the fact that Maasai have a tendency of using local medicines for their treatment as well as their livestock and rarely go for scientific medical treatment. This tends to reduce the costs incurred on the treatment of infectious diseases

Table 17: Impact of infectious diseases on overall income

Independent variables*	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.209E6	213002.893		5.674	0.000
Total costs incurred on human disease	-0.432	3.039	-0.013	-0.142	0.887
Total cost on all livestock diseases	-1.294	1.618	-0.074	-0.800	0.425

***The dependent variable was poverty (household income per year 2011/2012).**

Based on multiple linear regression analysis in which the dependent variable was poverty in terms household income, assets owned and costs incurred on managing zoonotic diseases it was found that zoonotic diseases had negative impact on poverty (t= 0.074) albeit the impact was not significant (P=0.425) because of little or no costs spent by the Maasai in treating the diseases as they use traditional or local medicines.

4.7 Association between Cultural practices, Diseases and Poverty

In order to check whether there was an association between cultural practices, occurrence of diseases and poverty (in terms of overall income and assets owned); two hypotheses were tested in the study. First, there is no significant association between some cultural practices and occurrence of some infectious diseases, and second, costs incurred on infectious diseases do not have significant impact on overall income.

4.7.1 Results of the Chi-Square Model for hypothesis 1

The first hypothesis was tested using chi-square, and the results are presented below.

Table 18: Association between cultural practices and occurrence of infectious diseases

Cultural practices	Infectious diseases	Percentage of people (%)	Chi-Square	Sig
Sleeping in the same house with livestock	Anthrax	21.0	1.200	0.000
Drinking un-boiled milk	Tuberculosis	2.0	1.200	0.00
Eating raw insufficient meat	Hydatid cyst	18.0	4.246	0.039
Drinking raw animal blood	Hydatid cyst	8.0	0.167	0.683
Eating raw insufficient meat	Brucellosis	7.0	0.261	0.609

The results showed that there is significant association between some cultural practices and occurrence of some infectious diseases. For example, the findings showed that there was a strong association between sleeping in the same house with livestock and anthrax occurrence i.e. those who slept in the same house with livestock (especially calves) were susceptible to anthrax. Drinking un-boiled milk and tuberculosis occurrence had also a relationship; households which had a tendency of drinking un-boiled milk were at risk of tuberculosis infection.

Culture of eating raw/insufficient meat and hydatid cyst incidence were associated, those individuals and households who consumed raw/insufficient cooked meat seem to suffer with hydatid cyst. However, there was no significant association between drinking raw animal blood and hydatid cyst as well as eating raw insufficient meat and brucellosis occurrence

4.8.2.2 Results of the Multiple Regression Model for hypothesis 2

The second hypothesis which was about determining whether costs incurred on infectious diseases had significant impact on overall income was tested using multiple linear regression. The analysis represents a logical extension of two variables regression analysis. Instead of a single independent variable, two or more independent variables are used to estimate the values of a dependent variable (Gupta, 1990). Colinearity multicollinearity diagnostics were tested in order to detect whether there was too high correlation among the independent (X) variables. According to Lin (2007), when there is a perfect linear relationship among the predictors, the estimates for a regression model cannot be uniquely computed. The term co linearity implies that two variables are near perfect linear combinations of each other. When more than two variables are involved it is often called multicollinearity, although the two terms are often used interchangeably.

Basing on the results presented hereunder, it was discovered that costs incurred on infectious diseases did not have significant impact on overall income of the household. This could be due to the reason that, the Maasai community used to take local herbs most of the time to treat themselves as well as their livestock, rather than attending formal medical /health services. High costs charged on the treatment of the diseases were also a reason for not seeking scientific medical treatment since the majority cannot afford.

For example, costs of diagnosis, vaccination and treatment of East Cost Fever were approximated around TZS 50,000 to TZS 250,000 amount which majority of the pastoralists cannot afford given their poverty situation. Therefore, this reduced the amount of costs spent on infectious diseases. However, the impacts of infectious diseases may not be seen only on income rather than the impacts may be observed on other perspectives of the producer. This is related to Neselle's 2008 argument that animal diseases have multiple impacts, which are mainly felt at farm level, while broader economic impacts tend to restrict trade in livestock and livestock products. The occurrence of such diseases impacts heavily on the poor livestock producers by marginalizing them from higher-price livestock markets and restricting their capacity for value-added trade.

Table 19: Impact of infectious diseases on poverty

Independent variables*	**Un standardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	1.209E6	213002.893		5.674	0.000
Total cost on all livestock diseases	-1.294	1.618	-0.074	-0.800	0.425
Total costs incurred on human diseases	-0.432	3.039	-0.013	-0.142	0.887

***The dependent variable was household income per year 2011/2012 in TZS**

Costs incurred on livestock infectious diseases had a standardized regression coefficient of - 0.074, whereby ($p > 0.05$). The negative regression coefficient implies that costs incurred on livestock infectious diseases and household incomes are negatively related. The same applies to costs on human diseases which had a standardized regression coefficient of - 0.013, where ($p > 0.05$). Negative regression coefficient implies that costs incurred on human diseases and household incomes are negatively related.

However, effect of the infectious diseases could be seen on time spent on treating the diseases as well as time spent caring for sick people in the household whereby it reduces the time for engaging in other income generating activities which could boost the income status of the household.

The results showed that, there was significant association between time spent on treating infectious diseases and household income The more the time spent on diseases, the less the household income and vice versa is true. Those households which spent more time on treating/caring for sick people of the household seem to have less income compared to those households which spent little time in treatment and in caring for sick people of the household. For example the households which spent between 10 to 12 months on treatment/caring sick persons had income between TZS 100000 and TZS 500000Tsh per year compared to those households which spent less than 5 months which had income between TZS 1000000 and above.

Table 20: Time spent on treating diseases in households (in months)

Statistics	**Time in months**
Mean	9.38
Median	6.50
Mode	6.00
Std. Deviation	7.20
Variance	51.90
Minimum	1.00
Maximum	36.00

However, the minimum, maximum and the mean time spent by the households in treating the infectious diseases were 1, 36 and 9.38 months respectively as shown in the table 19 above. It was found that the time spent on treating the diseases and caring for sick members of the household had impact on the household income as the more time spent on treating the diseases, the little time for the family to engage in income generating activities hence reduce the income of the household.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

On the basis of the findings of the research that meet the specific objectives of the research, conclusions are given in terms of lessons learnt from the findings. Moreover, recommendations derived from the conclusions are given for improvement of cultural drivers of zoonotic diseases and their impacts on well being levels.

5.1 Conclusions

The results meeting the first objective showed that the cultural practices which are risky for transmission of zoonotic diseases that were mostly practised in the Maasai communities were the household members drinking un-boiled milk i.e. 23.1% among the interviewed households, 13.0% eating raw and insufficiently cooked meat, 26.4% drinking raw animal blood, 3.8% sleeping in the same houses with livestock especially calves, and also the Maasai were found to have a habit of not cleaning the livestock's kraals regularly by 33.7%. On the basis of these findings, it is concluded that the Maasai communities practise such risky cultures because they are uninformed or unaware of the consequences of the cultural practices

The findings showed that the persistent prevalence and the transmission rate of zoonotic diseases among the Maasai of Ngorongoro District was still high by 2%, 16%, 21%, 18%, for the tuberculosis, brucellosis, anthrax, hydatid cyst respectively. In view of this, it is concluded that zoonotic diseases are persistent in the research area. If they are not controlled sufficiently, the diseases are likely to contribute to perpetuation of poverty among the Maasai due to the losses they cause as livestock production is the main economic activity in the study area.

As the results in section 4.6 show, it was found that zoonotic diseases had negative impact on poverty ($\beta = 0.074$), albeit the impact was not significant ($p = 0.425$) because of little or no costs spent by the Maasai in treating the diseases. In view of this, it is concluded that costs spent by the Maasai in managing livestock diseases were low as they use traditional or local medicines for the treatment

In section 4.8.2.2 the results show that time spent on managing livestock and human diseases had impact on household income. On the basis of this, it is concluded that household incomes in the study area are low because they spend more time on treating the diseases and taking care of sick livestock and persons, hence they do not have enough time to engage in development activities as diseases affect one's ability to produce or engage in other income generating activities, which could make better household income.

5.2 Recommendations

The following recommendations which have been derived from the conclusions are important for avoiding cultural practises that are risky for transmissions of zoonotic diseases, reducing diseases burden in order to improve socioeconomic well being in Ngorongoro District and among pastoralists in Tanzania at large. In order to increase chances of the recommendations being taken up they are addressed to various stakeholders.

5.2.1 Policy level recommendations

There is need for policy makers to consider the following recommendations:

- On the basis of the conclusion that the Maasai drink un-boiled milk because they do not know the consequences of it as they have inadequate information on the side

effects, it is recommended that health campaigns should be effectively done to the Maasai communities so as to raise their awareness which will help them change.

- Regarding the conclusion that some pastoralists water and graze livestock in the same areas with wild animals thus increase the diseases transmission rate, it is recommended that the policy should be set, and clear boundaries established on places for wild animals and places for livestock especially on the areas which are close to the national parks or game reserves.

- Incomes of the Maasai should be improved by persuading them to engage in other income generating activities rather than relying only on livestock which may result into impoverishment in case of massive death of livestock.

- At every health centre there should be enough number of zoonotic experts to provide health counselling to the Maasai. This will improve the situation of diseases prevalence.

5.2.2 Recommendations to local government authorities

- Local government leaders in Ngorongoro District should ensure that planning of land use is kept on practice as to separate areas for wild animals and that of livestock grazing so as to reduce the extent to which livestock meet wild animals as this will reduce the transmission of the diseases from wild animals to livestock and humans as the whole.

- Dip tanks should be constructed at ward level or village level whenever possible so as to give opportunity for the livestock to be dipped because by doing this tick-borne diseases will be controlled.

- Regarding the conclusion that some Maasai slept in the same houses with livestock, especially calves, because they had no alternative and wanted to protect them from being harmed by wild animal and other giant livestock, it is recommended that District council, through livestock department, should provide training to the pastoralists on how they can construct kraals for the calves.

5.3.3 Recommendations to development partners

- Non-Governmental Organizations (NGOs) and other development partners and stakeholders should provide education to the Maasai on how to stop practising cultures which are risky for the transmission of livestock infectious diseases among the Maasai communities so as to increase curiosity among the pastoralists societies.

5.3.4 Recommendations to pastoralists

- Since cultural elements practised by the pastoralists have shown to have multiple impacts as they have been acting as drivers for the said infectious diseases, the pastoralists should stop practising such cultures willingly and instead they should go for good practices which would bring prestige to their ethnic group.

- The pastoralists should use their livestock as assets and as a source of income which is to be used to get other basic needs like food, shelter and cloths together with other necessities of life, the aim being to improve their standards of living.

5.3.5 Recommendation for further research

There is a need to undertake further studies to determine cultural drivers of zoonotic diseases and the impacts of the zoonotic disease on poverty particularly managing costs of the diseases to assess further their implication to the household income. This will help in knowing where the gaps are and formulate strategies to counteract the situation. Generally, more research in this area is required to generate empirical information that can be applicable to large part of the country.

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APPENDICES

Appendix 1: A Copy of the Household Questionnaire that was Used

A. HOUSEHOLD SOCIO-DEMOGRAPHIC ATTRIBUTES

1. Division of residence ……..
2. Ward of residence…….
3. Village of residence ……
4. Household members

HH members' serial numbers	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Name (Only one)												
Sex (1 = M; 2 = F2)												
Date of birth												
Yrs of schooling												
Marital status												
Relationship with HH head												
Main occupation												
Health status*												

*1. Very healthy; 2.Moderately healthy; 3.Moderately ill; 4.Very ill

Key to Question Number 6

Marital status	**Relationship with the household head**	**Main occupation**
1. Married	1. Household head	1. Crop production
2. Never married	2. Household head's spouse	2. Livestock keeping
3. Widower	3. Household head's child	3. Government employment
4. Widow	4. Household's grand child	4. Non-government employment
5. Divorced	5. Household heads nephew/niece	5. Technical employment
6. Separated	6. Household head's brother/sister	6. Service provision
7. Too young to be married	7. Household head's son/daughter-in law	7. Licensed trade
	8. Household head's father/mother	8. Non-licensed trade
	9. Other type of relationship	9. Student/Pupil

5. Would you kindly tell me what you think those who are moderately ill and very ill are suffering from?

   ……
   ……

B. GENERAL QUESTIONS ON CULTURAL FACTORS AND RISKS OF ZOONOSES TRANSMISSION

6. Attributes of the house in which the household members live

House	Attributes of the house
1. Whether the household owns the house	1 = Yes; 2 = No
2. Type of house	1 = Traditional Maasai house (*Engaji*), 2. Modern house with iron sheets roofs
2. Floor of the house	1= Soil, 2= Timber, 3= Floor tiles, 4= Cement, 5=Others
3. Walls of the house	1 = Block or baked bricks, 2 = Mud bricks, 3 = Iron sheets/Soil + timber, 4 = Thatch/Boxes, 5 = Wood and soil, 6 = Others
4. Windows of the house	1=Having windows which can be opened, 2=Having windows which cannot be opened, 3=Having no windows
5. Roof of the house	1 = Roofing tiles/Cement, 2 = Iron sheets/Asbestos, 3 = Timber/ Soil/Thatch, 4 = Others
6. Main source of light used in the light	1 = Electricity/Gas/Solar power, 2. Lantern lamp, 3 = Small oil lamp (*Kibatari*), 4. Fire wood, 5 = Wood charcoal, 6 = Others
7. Main source of power for cooking	1 = Electricity/Gas/Solar power, 2 = Fire wood, 3 = Wood charcoal, 4 = Others

7. (a) From July 2011 to June 2012, did any livestock stay in the same house with household members?

Questions about livestock having stayed in the same house with household members	Response
Whether any livestock stayed in the same house with any household members (1 = Yes, 2 = No)	
Whether calves stayed in the same house with household members (1 = Yes, 2 = No)	
Whether sheep stayed in the same house with household members (1 = Yes, 2 = No)	
Whether goats stayed in the same house with household members ((1 = Yes, 2 = No)	
Duration for which calves stayed in the same house with household members (days/months)	
Duration for which sheep stayed in the same house with household members (days/months)	
Duration for which goats stayed in the same house with household members (days/months)	
Reasons for calves staying in the same house with household members	
Reasons for sheep staying in the same house with household members	
Reasons for goats staying in the same house with household members	

8. From July 2011 to June 2012, did any member of your household consume raw blood of animals? 1. Yes 2. No

9. (a) Do you keep cattle, sheep, and goats in the same kraal? 1. Yes 2. No.
   (b) If No, please explain how you keep the livestock belonging to the three species of livestock.
   ……...

10. (a) How frequently do you clean the kraal for cattle? …….....
    (b) How frequently do you clean the kraal for sheep and goats? ……

11. (a) In your opinion, is there any significant association between some cultural practices and occurrence of some infectious diseases in your household? 1. Yes 2. No.
    (b) If yes please explain a bit ……..

12. What were the commonest diseases that affected your livestock from July 2011 to June 2012?

Commonest diseases that affected the household's cattle	**Commonest diseases that affected the household's sheep**	**Commonest diseases that affected the household's goats**
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.

13. What were the commonest human diseases with respect to your household members from July 2011 to June 2012?
    1. …….....
    2. …….....
    3. …….....
    4. …….....
    5. …….....
    6. …….....
    7. …….....
    8. …….....
    9. …….....
    10. …….....

C. ABOUT ANTHRAX IN HUMANS

14. (a) From 1/7/2011 to 30/6/2012, did any member of your household get cuts or abrasions on his/her skin when processing meat or hides/skins? 1 = Yes, 2 = No
    (b) If yes, what did he/she do to continue processing the meat and or hides/skins?
    ……
    Is what he/she did to continue processing the meat and or hides/skins the way it is done by the majority of people in your area? (1.Yes, 2. No)

(c) If yes to (c), about how much proportion of the people do you think do so? … % or how many in 10 …..

15. (a) In your household, how is meat cooked to ensure it is not undercooked?
……..…….
(b) In your household, how is meat roasted to ensure it is not insufficiently roasted?
……
(a) What are the health risks/diseases that can be due to eating undercooked meat?
……

(b) What are the health risks/diseases that can be due to eating insufficiently roasted meat?

16. From 1/7/2011 to 30/6/2012, did any member of your household display symptoms of anthrax, particularly the following ones?

Signs of anthrax in humans	**Whether the household members with the following serial numbers had the symptoms (1=Yes, 2= No)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
An ulcer with a depressed black centre (skin lesions for people who had skin contact with anthrax meat)												
Vomiting of blood and blood diarrhoea (GIT lesions for people who ate meat from anthrax-suspected cases												
Difficult breathing (people who accidentally inhaled anthrax spores)												

17. (a) If any member of the household had the above signs of anthrax, what medicines was he/she given for treatment? ……
(b) For how long was the treatment? ……..……

D. ABOUT ANTHRAX IN LIVESTOCK

18. From 1/7/2011 to 30/6/2012, did any of your cattle, sheep, and goats display any of the following clinical signs of anthrax?

Signs of anthrax in livestock	**Whether any of the livestock had the symptoms (1=Yes, 2= No)**		
	Cattle	**Sheep**	**Goats**
Sudden death not associated with a known disease			
If there was sudden death of animals, were the following signs observed?			
Blood coming out of natural openings (e.g. nostril, mouth, anus, vulva)			
Blood not clotting			
Absence of stiffening (*rigor mortis*) after death			
If no livestock died, was there any of them which had swelling (oedema) around the throat, tongue, flanks, etc?			

19. If the livestock had the above signs of anthrax, what did you do to solve the problem?
.....

.....

E. ABOUT HUMAN TB

20. Did any member of your household display symptoms of pulmonary M. tuberculosis, particularly the following ones from 1/7/2011 to 30/6/2012?

Symptoms of pulmonary *M. tuberculosis* in humans	**Whether the household members with the following serial numbers had the symptoms (1=Yes, 2= No)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Chronic coughing (≥ 2 weeks)												
Progressive emaciation and weight loss												
Fluctuating temperature (fever)												
Difficult breathing												
Swollen lymph glands in neck region (especially in children)												

21. (a) If any member of the household had the above symptoms, what medicines was he/she given for treatment?
(b) For how long was the treatment? ……

ABOUT BOVINE TB IN LIVESTOCK AND IN HUMANS

22. (a) From 1/7/2011 to 30/6/2012, did any member of your household drink milk which had not been boiled to the boiling point? 1=Yes, 2=No
(b) In about how many households …… out of 100 or ……out of 10 do you think un-boiled milk is drunk?
(c) Why do you think people drink un-boiled milk (any advantages of that)? …….
(d) What do you think are the health risks of drinking un-boiled milk? ……
23. In herding cattle, from 1/7/2011 to 30/6/2012:
(a) About how many days ……. per month and for how many months ……. did they come in contact with wild animals?
(b) About how many days ……. per month and for how many months ……were they herded in areas where also wild animals graze?
(c) About how many days ……. per month and for how many months ……..were they watered on natural water sources where also wild animals drink water?

24. In herding sheep and goats, from 1/7/2011 to 30/6/2012:
(a) About how many days ……. per month and for how many months ……. did they come in contact with wild animals?
(b) About how many days ……. per month and for how many months ……were they herded in areas where also wild animals graze?
(c) About how many days ……. per month and for how many months ……..were they watered on natural water sources where also wild animals drink water?

25. On average, how many cattle did you normally graze together from 1/7/2011 to 30/6/2012? ……

26. On average, how many sheep and goats did you normally graze together from 1/7/2011 to 30/6/2012? …

27. From 1/7/2011 to 30/6/2012, did any of your cattle, sheep, and goats display symptoms of bovine TB, particularly the following ones?

Clinical signs of bovine TB in livestock	**Whether the livestock had the symptoms (1=Yes, 2= No)**		
	Cattle	**Sheep**	**Goats**
Progressive loss of body condition (emaciation)			
Weakness			
Fluctuating fever			
Chronic cough			
Swollen superficial lymph glands			
Difficult breathing			

28. If the livestock had the above signs of *M. bovis*, what did you do to solve the problem?

F. POVERTY IN NGORONGORO DISTRICT

29. Types and numbers of livestock species kept by all the household members

Places where the animals are kept	**Number of animals kept (If not kept, write 0)**						
	Beef cattle	**Dairy cattle**	**Goats**	**Sheep**	**Pigs**	**Chickens**	**Ducks**
1.							
2.							
3.							
4.							

30. Number of livestock which died from the diseases and other causes from July 2011 to June 2012?

Animal	**Number of animals which died**	**Cause(s) of death**	**Monetary value of the animals**	**Value of the animal salvaged**
1. Cattle				
2. Sheep				
3. Goat				
4. Pigs				

31. To what extent does the costs incurred on livestock diseases affect negatively overall income and consumption expenditures in your household (1 = Does never affect; 2 = Hardly affects; 3. No opinion; 4 = Affects; 5 =Affects much)

32. To what extent does the costs incurred on your family members' diseases affect negatively overall income and consumption expenditures in your household (1 = Does never affect; 2 = Hardly affects; 3. No opinion; 4 = Affects; 5 =Affects much)

33. How much direct cost did your household incur on livestock and on household members' diseases from July 2011 to June 2012?

Commonest diseases of the household's cattle	**Costs incurred on the following items**				
	Consulting vets and MDs	**Diagnosis**	**Vaccination**	**Treatment**	**Travelling seeking health services**
Livestock TB cases					
Livestock Anthrax cases					
Other livestock diseases					
Human TB cases					
Human anthrax cases					
Other human diseases					

34. How much indirect cost did your household incur on livestock diseases from July 2011 to June 2012?

Non-monetary value	**TSh**
Income lost when seeking treatment and correct diagnosis for anthrax and/or TB	
Income lost when convalescing from anthrax and/or TB	
Income lost by other household members accompanying/caring for the patients having anthrax and TB problems	
Income lost by other household members accompanying/caring for the patients having problems with other illnesses	
Total	

35. Types of assets you and your household members own

Asset owned	**Amount**	**Monetary value**	**Source of cash used to obtain the asset**
Automobile			
Bicycle			
Cattle			
Cellular phone			
Chickens			
Cupboard			
Donkeys			
Ducks			
Goats			
Hand hoe			
House			
Machete			
Mattress			
Mosquito net			
Motor cycle			
Pigs			
Press iron			
Refrigerator			

Satellite dish			
Sewing machine			
Sheep			
Sofa set			
TV set			
Watch			
Wooden bed			

36. To what extents do the following items apply as indicators of well being in your household?

Item	**Applicability as an indicator of well being in the household (1=Applicable, 2=Not applicable)**	**The situation in your household**
Being able to eat at least 3 meals per day		Number of meals
Being well sheltered		1=Yes, 2=No
Being able to escape avoidable morbidity and premature mortality		1=Yes, 2=No
Households having at least any household members having a good self-employment or a salaried employment;		1=Yes, 2=No
Being able to sell livestock and crop products whenever they like		1=Yes, 2=No
Being able to pay school fees for secondary school children belonging to the households		1=Yes, 2=No, 3=Not Applicable
Having been able to buy new (not second-hand) clothes during the previous 12 months		1=Yes, 2=No
Having freedom to live the way they would value, so long as they do not break the laws		1=Yes, 2=No

THANK YOU FOR YOUR COOPERATION

Appendix 2: A Checklist of Items for Discussion with Livestock Officers

1. Commonest livestock diseases in the district
2. Extent to which human environment explain occurrence of zoonoses
3. Extent to which livestock cause human diseases occurrence in the district.
4. Traditional, social cultural factors which cause livestock infectious diseases.
5. How human diseases contribute to impoverishing people.
7. Cultural drivers of zoonotic diseases and their impact on poverty.

“THANK YOU FOR YOUR COOPERATION”

Appendix 3: A checklist of items for discussion with Clinical Officers

1. Deaths related to zoonotic diseases for the past one year
2. Commonest human diseases in the district

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