

**Socio-cultural and economic risk factors for human
Brucellosis in Lolgorian Division, TransMara District**


**By
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DECLARATION

This thesis is my original work, and has not been presented for examination in any other university or institution.



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22/9/2014
Date

This thesis has been submitted for examination with my approval as the University Supervisor.



Dr. Salome Atieno Bukachi

22/09/2014
Date

DEDICATION

To my late father, Peter Alusi Muhavani, whose wise counsel has made me the
person I am.

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List of Abbreviations and Acronyms

AIDs	-	Acquired Immuno Deficiency Syndrome
FGDs	-	Focus group discussions
HIV	-	Human Immuno Deficiency Virus
KIs	-	Key Informant Interviews
MoH	-	Ministry of Health
NGO	-	Non governmental organizations
WHO	-	World Health Organization
WHO/FAO	-	World Health Organization/ Food and Agriculture Organization
MGDs	-	Millennium Development Goals
ELISA	-	Enzyme Linked Immunosorbent Assay
USA	-	United States of America
NTD	-	Neglected Tropical Diseases
NZDs	-	Neglected Zoonotic Diseases
PCR	-	Polymerase chain reaction
RBPT	-	Rose-Bengal Plate Test
CFT	-	Complement fixation test
SAT	-	Serum agglutination test
AI	-	Artificial Insemination

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Abstract

Human brucellosis is a severely debilitating disease that requires prolonged treatment resulting in considerable medical expenses and loss of income due to loss of working hours. This study was designed to investigate the socio-cultural and economic risk factors for contracting human brucellosis in Lolgorian division of TransMara district.

The overall objective of the study was to investigate the socio-cultural and economic factors that contribute to the risk of contracting human brucellosis. Emphasis was put on the traditional animal husbandry practices, the socio-cultural and dietary practices that contribute to risk of infection and gender roles and responsibilities, all of which contribute to risk of human brucellosis among residents of Lolgorian Division of Trans Mara district.

Data were collected in four locations of Lolgorian division. Tools used were structured questionnaires, key informant interviews and focus Group Discussions. The findings show that the people in this division were aware about the potential of animals transmitting diseases to humans and they knew about the existence of brucellosis and could tell the symptoms both in human and livestock. The interaction between the respondents and their animals played a role in the transmission of brucellosis. The predisposing factors to risk of brucellosis were due to the parturition of animals during abortion and handling hides and skins without protective clothing. The disease was also associated with the fact that most residents lived in close proximity with livestock especially the lambs, kids, calves and the sick animals, which predisposed them to risk of infection through the contaminated environment. Due to the cultural practices of the residents, raw milk is consumed directly from the animals. The people also eat raw meat and drink raw blood directly after a

slaughter. These practices are predisposing factors to brucellosis infections. Women and children were seen to be at risk of brucellosis due to the roles that were assigned to them, which were, milking the animals and taking care of the newly born and the sick animals.

The study concludes that animal husbandry practices such as keeping animals (especially the young and sick), inside or in close proximity of human houses, movement of animals in search of pasture, livestock breeding practices, mixing of herds, restocking as a result of purchase or acquisition through cultural events contribute to the risk of infection of human brucellosis in Lolgorian division. Slaughtering of animals, processing and trading hides/skins and consumption of raw or improperly cooked livestock products, such as milk, raw blood and meat contributed to the risk of contracting human brucellosis. Gender roles and responsibilities predispose certain genders through different activities to risk of human brucellosis among the residents of Lolgorian division.

The study recommends that socio-cultural and economic risk factors for human brucellosis, be incorporated into information, education and communication (ICT) materials. Sensitization and awareness creation campaigns, that include potential risk factors for brucellosis, be carried out among the community of Lolgorian division.

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CHAPTER ONE

Background of the study

1.1 Introduction

Brucellosis is one of the most common zoonoses worldwide and is considered a re-emerging infectious disease, according to World Health Organization (WHO), 2006. It is caused by various bacteria in the genus *brucella* which affect cattle, sheep, goats, pigs and some other animals (WHO, 2005). It may be passed to humans through direct contact with infected livestock, and drinking unpasteurized/un boiled milk from an infected animal (WHO, 2006). Common routes of infection include direct inoculation through cuts and abrasions in the skin, inoculation via the conjunctival sac of the eyes, inhalation of infectious aerosols, and ingestion of unpasteurized milk or other dairy products from infected animals. In humans, the main symptom is recurrent bouts of high temperature, hence its other name, “undulant fever” and its tendency to be mis-diagnosed as drug resistant malaria in tropical countries (WHO, 2006; WHO/FAO, 2006; Maichomo, 1997).

Diagnosis for brucellosis is carried out by laboratory tests which indicate the presence of the disease causing pathogens in collected samples (Corbel, 2006). It is acute in about half the cases, with an incubation period of two to three weeks. In the other half, the onset is insidious, with signs and symptoms developing over a period of weeks to months from the infection. The clinical manifestations are varied and nonspecific. They include fever, sweats, fatigue, malaise, anorexia, weight loss, headache, arthralgia and back pain.

Commonly, patients feel better in the morning, with symptoms worsening as the day progresses. The desire to rest can be profound, and depression is pervasive (WHO, 2006).

Brucellosis is an old disease with minimal mortality, yet it remains the commonest zoonotic disease worldwide with more than 500,000 new cases annually (Georgios, 2006). The epidemiology of human brucellosis worldwide has drastically changed over the past decade because of various sanitary, socio-economic, and political reasons. Several areas traditionally considered to be endemic for example France, Israel, and most of Latin America have achieved control of the disease. North Africa has been traditionally considered endemic for brucellosis. However, in sub-Saharan Africa, little is known about the prevalence of brucellosis. Most African countries are of poor socioeconomic status, with people living with and near their livestock, while health networks, surveillance and vaccination programmes are virtually non-existent (Georgios, 2006).

A study done in Ethiopia among the Borana and Hamar people indicates that, well known risk factors include living in close proximity of livestock, keeping and attending to livestock and the consumption of raw milk and fresh cheese. In a recent study, in southern and eastern Ethiopia, brucellosis is seen as a risk to public health in traditional livestock husbandry practices, as a consequence of raw milk consumption, close contact with animals and provision of assistance during parturition (Megersa, 2011, Regassa 2009)

Transmission of brucellosis through consumption of contaminated dairy products like unpasteurized milk and processed dairy foods from infected animals have been considered a source of infection. Infected carcasses are also a source of infection for pastoralists. The incidence of the disease in humans, and which directly relates to that in animals, is highly

dependent on animal husbandry practices, animal population density and inter-group interactions. According to Maichomo (1997), the disease in humans is related to the interaction between humans and animals, living standards, hygiene and food customs. Among the Maasai of Narok district, Kenya, brucellosis was found to be related to the fact that the Maasai keep large herds of cattle, sheep and goats which frequently mix with other herds as they roam in search of pasture and water.

1.2 Problem Statement

The constant and inevitable interaction of man and animals makes zoonotic diseases a genuine threat to health and survival for people and their livestock. Zoonotic diseases continue to burden health systems as well as undermine efforts to boost livestock production and exports. In Kenya, livestock has the potential to transform the economy in the pastoral and agro-pastoral areas where milk is the single most important diet (Kunda, 2010), yet zoonotic diseases such brucellosis are impacting negatively on this potential.

Human brucellosis is a severely debilitating disease that requires prolonged treatment with a combination of antibiotics leaving permanent and disabling sequel, and results in considerable medical expenses, in addition to loss of income due to loss of working hours. It is an important economic and medical problem for the patient because of time lost from normal activities. Prompt diagnosis and treatment with antibiotics may reduce the time a patient may be incapacitated. However, there are many regions where effective diagnosis or treatment is not available and where programmes for detection and prevention of the infection in humans and animals are not adequately carried out. In these areas, the animal

disease remains a constant threat to human welfare, particularly for those in the most vulnerable socioeconomic sections of the population (WHO, 2006).

The presence of brucellosis has often remained unrecognized through lack of awareness of the disease and misconception of the disease for malaria and typhoid. The main source of brucellosis infection among the pastoralists population is the ingestion of fresh milk. Cow, sheep, goat or camel milk contaminated with *B. melitensis* is particularly hazardous as it is drunk in fairly large volumes and may contain large numbers of organisms. Fresh blood, raw meat either alone or mixed with fresh milk, may be drunk and present an obvious potential hazard. Among the Maasai these practices are common. The strong bond the Maasai have with their cattle has necessitated them to stay in close proximities with the animals, this closeness enhances the contracting of brucellosis.

Human behavior plays a big role in disease transmission, management and control. This would mean a decreased disease burden, poverty reduction and increased food supply for large numbers of the rural poor worldwide. In the year 2000, the Millennium Declaration put health at the heart of the Millennium Development Goals, recognising that health is central to the global agenda of reducing poverty as well as an important measure of human well being, integral part of development.

Given the above, it is crucial to identify effective strategies that would help deal with zoonotic diseases, in this case brucellosis, to curb mortalities in both animals and humans, hence decreasing the disease burden and poverty related issues. Studies (Maichomo, 1997; Muriuki, 1994) carried out on brucellosis have mainly focused on the clinical and epidemiological factors yet, socio-cultural and economic factors are equally important in

the development of effective intervention strategies. An understanding of the different risk factors is important for the development of control and preventative measures (Regewwa, 2009)

This study therefore, sought to establish the socio-cultural and economic risk factors that contribute to contracting human brucellosis in Lolgorian Division, Trans Mara district. The study site was found suitable because cases of brucellosis have been reported in the neighboring Narok district (Maichomo, 1997) and the district is also a pastoralist community, therefore interaction between humans and their animals is inevitable. The study was guided by the following research questions:

1. Which traditional animal husbandry practice contribute to the risk of infection of human brucellosis in Lolgorian Division, Trans Mara District?
2. Do the socio-cultural and dietary practices contribute to risk of infection with human brucellosis in Lolgorian Division, Trans Mara District?
3. Do gender roles and responsibilities predispose certain genders to risk of contacting human brucellosis in Lolgorian Division, Trans Mara District?

1.3 Objectives

1.3.1 General Objective

The general objective of this study was to investigate the socio-cultural and economic factors that contribute to the risk of contracting human brucellosis in Lolgorian Division, Trans Mara District.

1.3.2 Specific Objectives

- Determine the traditional animal husbandry practices that contribute to the risk of infection of human brucellosis in Lolgorian Division, Trans Mara district.
- Establish the socio-cultural and dietary practices that contribute to risk of infection with human brucellosis in Lolgorian Division, Trans Mara district.
- Establish gender roles and responsibilities that contribute to risk of human brucellosis among residents of Lolgorian Division, Trans Mara district.

1.4 Justification

Emerging zoonotic diseases have assumed increasing fundamental importance in both public and animal health. They cause serious problems often leading to mortalities among animals and humans (Aluwong et al, 2010). There is now widespread recognition that a cluster of “neglected” diseases exists, which affect poor marginalized population and which neither attract the health resources nor the research needed to control them effectively. These diseases play a key role in perpetuating poverty (WHO Geneva, 2006). Zoonotic diseases are a genuine threat to health and survival of the people and their livestock. These diseases continue to burden public health systems as well as to undermine efforts to boost livestock production thus playing a key role in perpetuating poverty.

The study aimed to generate evidence on how socio-cultural and economic practices contribute towards contracting human brucellosis in Lolgorian Division of Trans Mara District. Knowledge of brucellosis occurrence in traditional livestock husbandry practice has considerable importance in reducing the economic and public health impacts of the disease (Megersa, 2011). Epidemiological and medical information has been generated in the neighbouring district (Maichomo, 1997; Muriuki, 1994), therefore there was need for anthropological information to be generated.

The objectives set were to provide information on the nature of social-cultural and economic risk factors of brucellosis in the community that would be used by policy makers during government planning exercises. This information is important for programmers who plan out activities for implementation in the district. Additional literature, in the area of socio-cultural and economic issues in human brucellosis was generated, which future scholars could build upon.

The results of this study therefore will help public health officers to improve their public health interventions by providing information that they can use to develop targeted advocacy programmes. This will have the potential of increasing people's awareness about brucellosis hence improved health. A healthy people will be able to enhance productivity in the district where the main economic activity is predominantly pastoralism. The study will also benefit the academic community by providing insight and literature into the social-cultural understanding of brucellosis in pastoralist communities

1.5 Scope and limitations of the study

This study was conducted in Lolgorian Division of Trans Mara district a pastoralist community, thus the findings cannot be generalized to the whole district. However, it provides detailed information which gives insight into socio-cultural and economic risk factors among the maasai community in Lolgorian, hence an indication of how their interaction with their livestock can present risk factors for brucellosis.

1.6 Definition of Key Terms

Brucellosis: is defined in this study as a chronic debilitating illness that is transmitted to humans by direct or indirect contact with infected domestic animals or their products.

Pastoralist community: is a community whose way of life is based on raising and herding of livestock

Ceremonies and rituals: these are systematic procedures of conducting certain religious or communal practices

Gender roles: Gender can be defined as being male or female. Gender refers to culturally based expectations of the roles and behaviour of women and men. It distinguishes the socially constructed from the biologically determined aspects of being male and female. Gender roles focus not only on women, but on the relationship between men and women, their roles, access to and control over resources, and division of labour and needs.

Animal husbandry practices: Is an agricultural practice of breeding, managing and raising livestock.

Socio-cultural – signifying interaction of social and cultural elements.

1.7 Study assumptions

- Traditional animal husbandry practices can contribute to the risk of infection of human brucellosis in Lolgorian Division, Trans Mara district.
- Socio-cultural and dietary practices can contribute to risk of infection with human brucellosis in Lolgorian Division, Trans Mara district.
- Gender roles and responsibilities can contribute to risk of human brucellosis among residents of Lolgorian Division ,Trans Mara district.

CHAPTER TWO

Literature Review and Theoretical Framework

2.1 Introduction

This chapter reviews literature that is relevant to this study; it covers zoonotic diseases, brucellosis, its risk factors, sources, diagnosis, treatment and prevention are reviewed in relation to the Maasai people. It also covers animal husbandry practices, socio-cultural and economic practices, gender roles and responsibilities in relation to the pastoralists. It also discusses the theoretical framework, of this study.

2.2 Zoonoses

World Health Organization (2006), defines zoonoses as diseases and infections that are naturally transmitted between vertebrate animals and humans. A zoonotic agent may be a bacterium, a virus, a fungus or other communicable disease agent (WHO, 2006). Zoonotic diseases represent one of the leading causes of illness and death from infectious disease. Worldwide, zoonotic diseases have a negative impact on commerce, travel and economics (Jaffry et al, 2009). According to the Institute of Development Studies (2013), over two thirds of all human infectious diseases have their origin in animals. The rate at which these zoonotic diseases have appeared in people has increased over the past 40 years. Zoonotic diseases have a huge impact and a disproportionate one on the poorest people in the poorest countries. In low income countries 20% of human sickness and death is due to zoonoses.

The poor in every society and particularly in developing countries bear a disproportionately high share of the burden of disease. The poor are more at risk of contracting many zoonoses

because of the strong association between poverty and living in close contact with animals, the reservoirs of disease. It is the poor who are least likely to get proper treatment once infected. 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 centres in search for treatment or diagnosis eventually becomes prohibitive. And also the impact of disease is worst in poor households where dual burden is borne since it affects both people and animals. (WHO/DFID-AHP, 2005).

2.3 Neglected zoonotic diseases (NZD)

Zoonotic diseases (zoonoses) arise from infections transmitted from vertebrate animals to people. These animals may be domesticated (livestock or companion) or wild. These diseases such as anthrax, bovine tuberculosis, brucellosis, cysticercosis, echinococcosis (hydatid disease) and rabies are called "neglected" because they are not adequately addressed nationally and internationally (WHO, 2006).

The poorest people, are defined as those who live on less than US\$ 2 per day, are often overlooked when pandemic threats emerge. They are the ones subjected to the daily burden of zoonoses, as are their animals on which they are often totally dependent for cash, animal protein and as core assets (WHO, 2011). No effective government services are available to support these people's needs, since they are generally not perceived to contribute significantly to the national and global economy. Their governments have few resources to allocate to their health as the health systems of poor countries function on only a fraction of those of developed economies. The NZDs are ancient diseases that have been known since historical times. Their transmission depends on long established relationships and

interactions between people and domestic animals or nearby wildlife reservoirs. These are serious illnesses that often cause permanent disability and, for several diseases if not dealt with early or appropriately, are inevitably fatal. These diseases tend to be overlooked by clinicians as well as policy-makers and are hence under-diagnosed and hence underreported (WHO, 2011). They often share clinical features, particularly fevers, with other more common diseases or require complex diagnostic tests to confirm their presence. One or more of these diseases is found in most poor communities where livestock are kept, affecting the health and productivity of livestock by causing infertility, death, low milk yields and rendering meat inedible. Thus they impose a dual burden on human and animal health in the very households and populations least able to cope with such problems (WHO, 2011)

2.4 Brucellosis

Brucellosis is a zoonosis disease caused by *Brucella* bacteria. In Kiswahili brucellosis is called “Ugonjwa wa maziwa” meaning a disease brought by milk. Different species of *Brucella* bacteria mostly infect domestic livestock: cattle (*B. abortus*), sheep and goats (*B. melitensis*) and pigs (*B. suis*). Dogs can also be infected with *B. canis*. While all the four species can infect humans, *B. melitensis* is thought to cause the most serious disease (Brucellosis, 1999).

2.4.1 Risk factors for brucellosis

Certain occupations are associated with a high risk of infection with brucellosis. These include people who work with farm animals, farmers, farm labourers, animal attendants, shepherds, sheep shearers, pig keepers, veterinarians and inseminators, who are at risk through direct contact with infected animals or through exposure to a heavily contaminated environment (WHO, 2006).

Brucellosis is an occupational disease of farmers, shepherds, butchers and those working in slaughter houses as well as laboratory workers (Diju, 2009). The families of farmers and animal breeders may also be at risk as domestic exposure may be inseparable from occupational exposure when animals are kept in close proximity to living accommodation. In some areas, the animals are kept in the yards of houses and may even be brought inside, especially in severe weather. In the case of recently aborted animals, this has resulted in infection of entire households. The use of dried dung as a fuel may also import infection into households. Tourists or business travelers to endemic areas may acquire brucellosis, usually by consumption of unpasteurized milk or other dairy products (WHO, 2006). Frequent traveling across the world in exchange for knowledge and expertise may predispose travelers to the risk of acquiring an alien disease endemic to a particular country (Vijay, 2009)

2.4.2 Sources of brucellosis infection

The key sources of infection are the major food-producing animals cattle, sheep, goats, pigs (WHO/FAO, 2006). Humans are infected either by direct contact with infected animals and their products or by the consumption of contaminated milk or dairy products. (Minas, 2007). The possible means of acquisition of brucellosis include: person-to-person

transmission, transmission to attendants of brucellosis patients and laboratory workers processing samples from patients. Infection from a contaminated environment; Infected animals passing through populated areas or kept in close proximity to housing may produce heavy contamination especially if abortions occur. Inhalation brucellosis may result from exposure to contaminated dust or dried dung (WHO, 2006). Contact infection may also result from contamination of skin or conjunctivae from soiled surfaces. Water sources, such as wells, may also be contaminated by recently aborted animals or by run-off of rain water from contaminated areas (WHO, 2006). Bulking of milk from many areas and production systems could pose significant health risks if the milk is not pasteurized or adequately boiled (Omore, 1999).

2.4.3 Diagnosis of brucellosis in humans

Making the diagnosis of brucellosis can sometimes be difficult because of the similar symptoms and signs shared with other febrile illnesses (Medicinenet, 2012). An accurate history obtained by the health-care provider (including travel history, occupation, animal exposure) may be very helpful in raising the suspicion of brucellosis as a possible diagnosis (Medicinenet, 2012). Diagnosis of brucellosis relies on demonstration of the agent: blood cultures in tryptose broth, bone marrow cultures. It is important to note that the culture poses a risk to laboratory personnel due to high sensitivity of brucellae. There is the demonstration of antibodies against the agent either with the classic Huddleson, Wright and/or Bengal Rose reactions, either with ELISA or the 2-mercaptoethanol assay for IgM antibodies associated with chronic disease (WHO, 2006). Diagnosis can also rely on histologic evidence of granulomatous hepatitis (hepatic biopsy). Diagnosis of brucellosis can also rely on radiologic alterations in infected vertebrae, the Pedro Pons sign and

marked osteophytosis are suspicious of brucellic spondylitis. The disease's sequelae are highly variable and may include granulomatous, hepatitis, arthritis, spondylitis, anaemia, leucopenia, thrombocytopenia, meningitis, uveitis, optic neuritis, endocarditis and various neurological orders collectively known as neurobrucellosis (Medicinenet, 2012).

2.4.4 Treatment of human brucellosis

The essential element in the treatment of all forms of human brucellosis is the administration of effective antibiotics for an adequate length of time. Patients and their families should be reassured that full clinical and bacteriological recovery is usual in human brucellosis (WHO, 2006). Antibiotics like tetracyclines, rifampicin and the aminoglycosides streptomycin and gentamicin are effective against *Brucella* bacteria. The gold standard treatment for adults is daily intramuscular injections of streptomycin 1g for 14 days and oral doxycycline 100mg twice daily for 45 days (concurrently). Gentamicin 5mg/kg by intramuscular injection once daily for 7 days is an acceptable substitute when streptomycin is not available or difficult to obtain. Another widely used regime is doxycycline plus rifampin twice daily for at least 6 weeks (Medicinenet, 2012).

2.4.5 Prevention of human brucellosis

To reduce the risk of infection, personal hygiene must be observed, adoption of safe working practices, protection of the environment and food hygiene. Farm workers, and animal attendants in particular, should wear adequate protective clothing when in contact with infected animals that are aborting or giving birth, when the shedding of *Brucella* organisms will reach maximum levels (WHO, 2006). Aborted fetuses, placenta and contaminated litter should be collected in leak-proof containers and disposed of preferably

by incineration. Children should be prevented from having contact with newborn animals or those that have recently aborted or given birth. Consumption of raw milk, blood or uncooked meat should be discouraged. For the general population which does not have direct contact with animals, the greatest potential source of brucellosis is through consumption of unpasteurized milk and dairy products. Meat may also be a significant source of infection, especially in cultures where the consumption of raw or undercooked meat products is favored. Boiling or high temperature pasteurization will kill *Brucella* in milk (WHO, 2006). Ideally all milk produced in areas in which brucellosis is present should be pasteurized. This should apply to all milk for human consumption, whether to be drunk without further processing or to be used for making other food products. However, in some cultures, raw or undercooked meat may be eaten through choice. This practice and the consumption of fresh blood, either alone or mixed with milk, should be discouraged (WHO, 2006).

2.4.6 The reality about brucellosis

The epidemiology of brucellosis in humans is much harder to trace because this disease is notoriously underreported (Foggin, 2000). According to (Madkour et al, 1989), it is estimated that the actual incidence of human brucellosis in the USA is 26 times higher than has been reported, because of the disease being either unrecognized or unreported. The hypothesis is that people simply do not recognize brucellosis symptoms in humans. The general risk factors in this, study remains the pastoralists principal occupation, that of herding and animal husbandry. The daily and seasonal requirements of the herder and his herds, puts them in very close contact with the animals, increasing the risk of contracting brucellosis.

In cattle, the disease affects productivity through reduced milk off take, abortion, neonatal deaths and increased incidences of repeat breeding (Radostits et al., 2000). Brucellosis is transmitted from infected animals to susceptible animals through ingestion of bacteria in the fields. The bacteria are shed from an infected animal at or around the time of calving or abortion. The most common clinical signs of cattle infected with *Brucella abortus* are high incidences of abortions, arthritis, swollen joints and retained after-birth (Radostits et al., 2006).

An overview on brucellosis presented at the 1st International Conference on Emerging Zoonosis held in Jerusalem, Israel in June 1997, recommended that prevention of brucellosis in humans still depends on the eradication or control of the disease in animal hosts, the exercise of hygienic precautions to limit exposure to infection through occupational activities, and the effective heating of dairy products and other potentially contaminated foods (Corbel, 1997).

A review on control and prevention of brucellosis in Africa, discusses the effective control of brucellosis through a combination of improve diagnosis, vaccination and treatment, together with measures to increase awareness, and improved farm sanitation and food hygiene. Collectively these will increase the effect of control measures and lessen the burden of the disease. Epidemiological evidence emphasizes the need for detailed knowledge about the disease and community support for its effective control. (Smits, 2004)

A study in rural Tanzania indicates that the majority of brucellosis cases presented to hospital with a long history of symptoms. Some of the cases had been to hospital several times and had received treatment for other diseases such as malaria before being diagnosed

as suffering from brucellosis. In this study, it was concluded that more efforts were to be put in place to improve accessibility to health facilities for the rural poor and health education to the public for patients to present themselves to hospital early when chronic clinical features and complications have not developed as late presentation may carry poor prognosis even after treatment (Kunda, 2007).

A recent study in rural northern Tanzania (Kunda 2010), reveals that while contact with products of conception has been shown to be a risk factor for brucellosis transmission in other places, closeness of households in livestock keeping communities and the social background have not been documented as important risk factors for brucellosis transmission. This study indicates that health education on ways to prevent brucellosis transmission through preventative measures such as protective clothing like gloves especially when assisting animal deliveries, should be given priority. Importance of increasing awareness even to those who did not keep livestock on the potential of acquiring brucellosis from their neighbours livestock through contact with infected products was emphasized.

A study carried out in Kenya (Maichomo, 1997) in Narok district, shows that brucellosis has not been diagnosed much in humans in Kenya. However there is increasing awareness on the zoonosis situation. Brucellosis patients who are not tested are mostly treated for other diseases, mainly malaria. The study showed that accurate clinical diagnosis of flu-like diseases was difficult. However there was need for more studies to be done to identify prevalent species of *brucella* in order for effective control of brucellosis in Narok.

2.5 Animal husbandry practices among pastoralists

The Maasai are a cattle people who believe that all cattle on earth belong to them. The strong bond the Maasai have with their animals necessitates them to have a semi-nomadic way of life, as they follow the seasons in search of grass and water for their cattle. The cattle form the basis of the entire culture, being the main form of sustenance, wealth and power. The structure of the Maasai settlement is purposely designed for the protection of cattle. The families establish a settlement called *e'ngang* or *Kraal*, for themselves and their cattle. They leave a large open space in the centre of the Kraal into which the cattle are driven at night for protection against predators and cattle thieves (Tepilit, 1986). Infected animals kept in close proximity to housing may produce heavy contamination, especially if abortions occur. Inhalation brucellosis may then result from exposure to contaminated dust, dried dung etc. Contact infection may also result from contamination of skin or conjunctivae from soiled surfaces. *Brucella spp.* can survive for long periods in dust, dung, water, slurry, aborted fetuses, soil, meat and dairy products (WHO, 2006).

In a study done by Kosukeev (2003), exposure to aborted home owned animals and eating homemade milk products were independent risk factors for contracting brucellosis. Increased government efforts are necessary to improve education regarding risk factors for brucellosis transmission, especially where human contact with animals is widespread. In this study, the public health and veterinary officials in Kyrgyzstan determined the best approach to reduce the country's brucellosis burden was to focus their resources on improving health education (Kosukeev, 2003). Together with the nongovernmental Organization (NGO) rural activists for health and the Ministry of Health (MoH) staff developed a prevention campaign targeted at persons on rural privately owned farms with livestock. Prevention messages were delivered through mass media and focused on use of

protection methods (eg. Wearing protective clothes, especially when assisting in delivery; not permitting children to have contact with animals; and having sick animals checked by a veterinarian) during contact with animals and adherence to adequate sanitary standards when processing milk and milk products. Brucellosis health education brochures and flyers were distributed at infectious disease hospitals, local clinics and health outposts.

Brucellosis is widespread throughout Tanzania and causes a chronic debilitating illness to people in contact with infected animals and consuming infected dairy products (Cleaveland, 2003). Many pastoralist families are caught in a declining cycle of poverty and successful livestock reproduction is crucial to their survival. Several features of the pastoralist lifestyle such as close contact between livestock and people may predispose animals and people in these communities to a high risk of infection (Cleaveland et al, 2003).

Cleaveland et al (2003), indicates that no large-scale studies have been carried out to investigate the problem of brucellosis in humans in Tanzania and the awareness of the disease amongst people, including medical graduates was poor. This he points out is because generally there was poor agreement between results of diagnostic serological tests carried out in rural dispensaries and at veterinary research laboratories.

Brucellosis has a significant economic and zoonotic implication for the rural communities in Ethiopia in consequence of their traditional lifestyles, feeding habits and disease patterns. A study by Megersa et al, (2011) revealed that the disease was prevalent in pastoral areas, and recommended the need for implementing control measures and raising public awareness on zoonotic transmission of brucellosis.

A study in Central Mongolia on animal and human health among semi-nomadic herders concludes that prevalence of human brucellosis is related to that of brucellosis in animals. It was based on the premise that the health status of pastoral semi-nomadic communities is related to cultural factors among other factors (Foggin, 2000).

2.6 Culture and diet among the Pastoralists

The Maasai communities, who are pastoralists and practice the traditional livestock husbandry systems, have their traditional lifestyle and dietary habits pose a great risk to contracting brucellosis. The major source of livelihood for this region is livestock and livestock products. The residents sell milk and/or livestock and buy other food items (maize, beans, oil, etc.) with the sale proceeds. According to the Maasai Association, traditionally the Maasai rely on meat, milk and blood from the cattle for protein and caloric needs. People also drink animal blood on special occasions. For example it is given to a circumcised person; a woman who has given birth; and the sick. Also on a regular basis drunk elders, use the blood to alleviate intoxication and hangovers. Blood is very rich in protein and is good for the immune system (Tepilit, 1986). The women are responsible for the care of the young and sick animals and they are also involved in marketing of milk, hides and skins. All these cultural practices; the association and interaction between the people and their livestock increases the risk of contacting brucellosis. This study aims to establish the socio-cultural and economic practices that lead to risk of infection with human brucellosis.

There are many ceremonies and rituals in the Maasai society. The life of a Maasai is a well ordered progression through a series of life-stages, which are determined by age, initiated

through ceremonies and rituals and marked by specific duties and privileges. There are four major ceremonies; *Alamal lengipaata*, is the ceremony where boys undertake just before circumcision; *Emorata*, the circumcision ceremony which initiates them into warrior-hood; *Eunoto*, the graduation of warriors into elder-hood and *Olegesherr*, the confirmation to total eldership. All the ceremonies have certain features in common; ritual head shaving, continual blessings, the slaughter of an animal, ceremonial painting of the face and body, singing, dancing and feasting (Tepilit, 1986). All the activities during the ceremonies pose a high risk of contacting brucellosis.

Cattle supply milk, the staple of the Maasai diet which people consume fresh or in sour form. Babies are given ghee. However, meat and milk must never be eaten at the same time because it is believed that mixing the two will give tapeworms to people or cause their cows to be cursed with swollen udders. The Maasai drink blood during the dry season when they run short of milk. The animal is not killed in obtaining the blood but rather the tip of an arrow is used to make an incision in its jugular vein. When a woman gives birth, when a person is wounded or when a boy or girl is circumcised, he or she is given blood to replace the lost blood (Tepilit, 1986). In the event of all these activities the people are predisposed to contacting brucellosis.

A Maasai woman after delivery is served with a drink made by mixing blood drawn from a bullock or heifer with some warm milk. A ram is slaughtered and its meat is consumed solely by the women of the village. The mother breast feeds the baby for two or three months after which her milk is supplemented with cow's milk and ghee (Telipit, 2006).

2.7 Gender roles among the Maasai

Despite their considerable involvement and contribution, women's role in livestock production has often been underestimated or worse, ignored. Gender-blindness is partly the result of a paternalistic bias, but also of the attitudes of women themselves, who may have been conditioned by their culture and society to undervalue the worth of the work they do (IFAD, 2007).

The most typical pattern of division of labour is where women have complete responsibility for animals kept in the homestead. e.g. Small stock, calves, poultry or sick animals. In some ways, managing these animals is more difficult than managing camels and cattle, because they have to remain near the homestead, where good pastures are difficult to find (IFAD, 2013). Women spend considerable amounts of time in collecting and storing fodder, and in watering animals. They are also responsible for caring for and counting the grazing animals as they come home for the night, signaling any problems (sickness, birthing, poor health, missing animals etc) to the head of the household. The Maasai of Kenya are amongst examples of such systems in many parts of Africa (Homewood and Rogers, 1991)

The Maasai women retain primary responsibilities for dairy-related activities. They are responsible for milking, processing of milk and marketing of surplus milk and dairy products. In areas where they are restricted in mobility by pregnancy and raising children, religion etc., women take care of stock kept near the camp, requiring particular attention such as pregnant cows, newly born calves, injured and sick animals. Women ensure that calves have ample suckling time and supply fodder to them. They also provide sick animals with water. Maasai pastoral women also play a significant role in animal disease control. Their close contact with the cows via milking enables diseases to be spotted early. The actual treatment of the animals is done by men and herd boys; women take part only when

need arises. Women inspect animals in their subhousehold to ensure that all have returned from grazing and are healthy. Any problems are reported to the household head (ILRI, 2006)

Children in the society carry out most of the routine animal husbandry work; they do all the herding and much of the work around the homestead. Children aged 6–7 years herd small stock. This is a demanding job, as the animals move a lot and are easily lost or attacked by predators. Older children (8–9 years) herd calves which is less arduous than herding small stock. Boys (aged 11 years and older) herd cattle, which is mainly a supervisory activity as animals know their way around and set the pace. Herders merely keep the animals from straying and protect them from predators. Girls herd mostly small stock and calves. Cattle herding is seen to be too strenuous for girls, especially if they have to walk long distances. Herding small stock and calves permits girls to return to the homestead in time to help prepare food and carry out other domestic chores. The girls also assist in milking and watering of animals. It is also common in Maasai pastoral societies for girls to join boys and young men in the cattle camps for long periods (ILRI, 2006)

Molding the Maasai children's character is a communal activity while still young, children are given some minor chores like herding lambs, goat-kids and calves. The adolescent boy has been brought up to regard cattle not merely as wealth but as an extension of himself. The Maasai youth therefore spend most of their lives in close proximities with their cattle putting them at great risks of contacting brucellosis.

Women milk the cows twice a day in the morning before they leave for pastures and in the evening after they return. Children may assist in milking goats and nurse young animals

that do not get enough milk. They also take care of the young ones by making them a comfortable bedded down in the family pens (Telipit, 2006). The roles and responsibilities given to the women and children expose them to contacting brucellosis. Children can be particularly at risk as they may adopt newborn or sick animals as pets.

From the foregoing review of literature it is evident that the occurrence of brucellosis is pegged on the activities and interaction between livestock and the people. It is also clear from the above literature, that socio-economic and cultural activities play a significant role in the spread of the disease. There is need to study the traditional animal husbandry systems, the effects of socio-economic and cultural practices and how they contribute towards the transmission and spread of the disease. Most studies (Minas et al, 2007), (Muriuki et al, 1994), (Kunda et al, 2007), done have exclusively focused on epidemiological and medical aspects of brucellosis, but few studies have been done to establish how these cultural aspects contribute towards the contacting of the disease. Since there are gaps in knowledge about cultural aspects of the disease, this study will endeavour to fill some of the gaps and provide the relevant literature.

2.8 Theoretical Framework

To answer the research questions this study utilized the Ecological Systems theory under which the Social Ecological Model, examine the multiple effects and interrelatedness of social elements in an environment in the study area.

2.8.1 Ecological Systems Theory

The Ecological Systems Theory developed by Urie Bronfenbrenner (Wikipedia, 2012) holds that, we encounter different environments throughout our lifespan that influence our

behaviour in varying degrees. It also holds that development reflects the influence of several environmental systems.

Health behaviours, including physical activity participation, are thought to be improved when environments and policies support healthy choices, and individuals are motivated and educated to make those choices (World Health Organisation 1986). Educating people to make healthy choices when environments are not supportive will not be effective in making behavioural change.

The Socio-Ecological Model recognizes the interwoven relationship that exists between the individual and their environment. (Moore, 2003). The model acknowledges that it takes a combination of both individual level and environmental/policy level interventions to achieve substantial changes in health behaviours, including physical activity behaviour.

While individuals are responsible for instituting and maintaining the lifestyle changes necessary to reduce risk and improve health, individual behavior is determined to a large extent by social environment, e.g. community norms and values, regulations, and policies. Behaviour both affects and is affected by multiple levels of influence: (1) intrapersonal or individual factors; (2) interpersonal factors; (3) institutional or organizational factors; (4) community factors; and (5) public policy factors.

2.8.3. Relevance of socio-ecological model to the Study

The study was conceptualised with the basic assumption that there are risk factors for brucellosis in the community, which are determined by the interplay between the individual and the environment they live in. Human behaviour is difficult to change, especially in an environment that does not support change. In order to increase physical activity, efforts

need to focus not only on the behaviour choices of each individual but also on factors that influence those choices. The social-ecological model helps to identify opportunities to promote participation in physical activity by recognising the multiple factors that influence an individual's behaviour. Efforts to change behaviour are more likely to be successful when the multiple levels of influence are addressed at the same time.

Efforts at all multiple levels are paramount to achieve positive healthy behaviour in the community. The model focuses on the need to view people and the environment as a unitary system within the community where the person and environment have a relationship and how they continually influence each other. In the case of this study how socio-cultural and economic activities in the community are interwoven with each other and as a result risk factors for brucellosis are realized.

CHAPTER THREE

Methodology

3.1 Introduction

This section is divided into different sections covering, the research site; research design; study population; methods of data collection and analysis and ethical considerations.

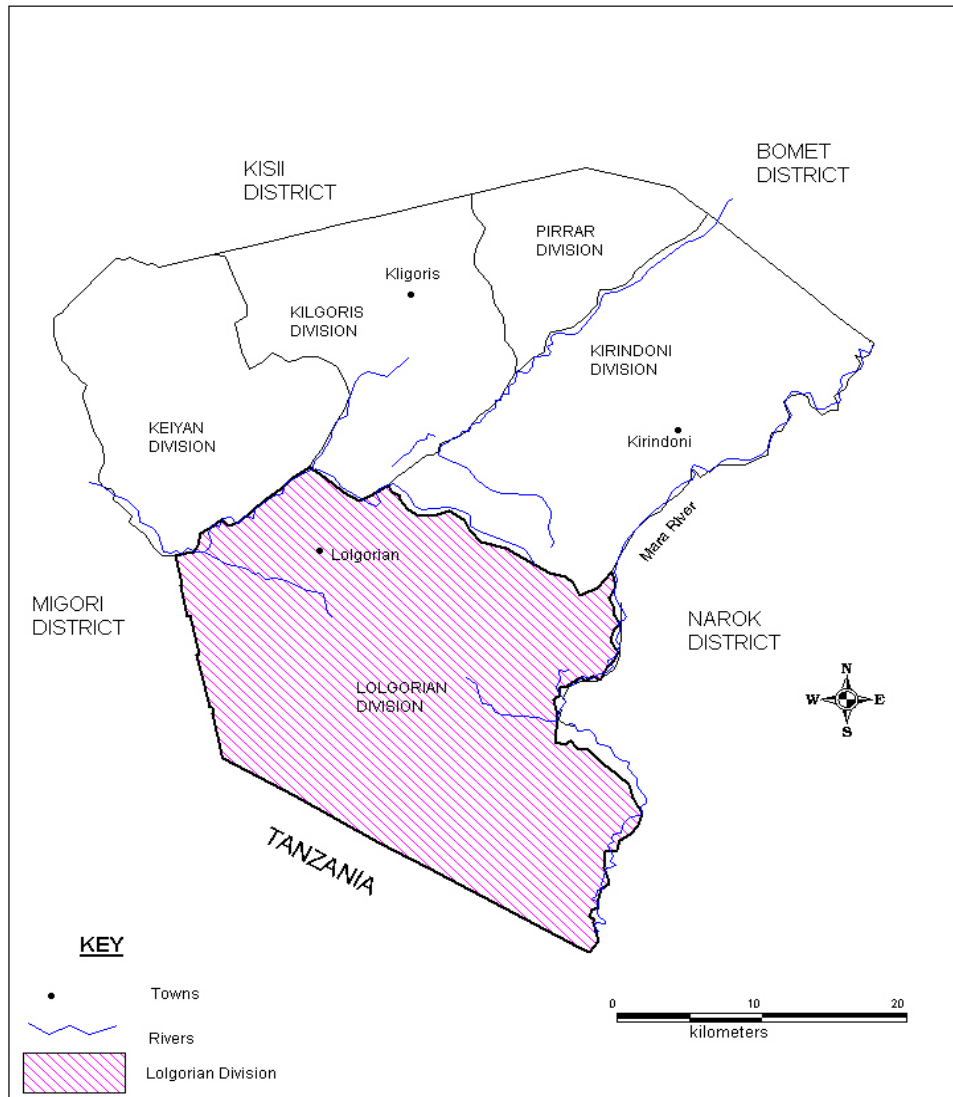
3.2 Site selection and description

3.2.1 Administrative and physical description

This study was carried out in Lolgorian division of Trans Mara district (Map 3.1). The district was carved out off Narok district in 1994 and is one of the 18 districts that make up the Rift Valley Province of Kenya. Trans Mara district is divided into five divisions namely Kilgoris, Lolgorian, Pirrar, Keiyan and Kirindon. The district is further divided into 32 locations and 58 sub-locations. Lolgorian occupies the largest area followed by Kirindon, Keiyan, Kilgoris and Pirrar respectively. The district has one constituency namely, Kilgoris and 29 wards that constitute the Trans Mara County Council.

Trans Mara district lies on the south-western part of Rift Valley Province between Latitude 0° 50' and 1°50' South and Longitude 34°35' and 35°14' East. The district borders the Republic of Tanzania to the south, Kuria and Migori districts to the west, Gucha and Bomet districts to the north and Narok district to the east. The district covers an area of about 2,932 square kilometres of which the famous Masai Mara National Reserve occupies 31 square kilometres (GOK, 2005).

Lolgorian division



Map. 3.1: Map of the study area.

3.2.2 Situation analysis

Livestock rearing remains a major production system in TransMara district upon which the predominantly pastoral Maasai depend for their livelihood. The key species are cattle, sheep, goats, donkey and poultry. The district is prone to periodic droughts particularly in the semi-arid parts and access to safe water for domestic and livestock consumption continues to be an issue. Droughts affect the livelihood sustainability of the people through deaths of animals and crops (GOK, 2005).

In Trans Mara District, 135,831 people, constituting 57.1 per cent of the district's total population were poor according to the Welfare Monitoring Survey, 1994-1997. A major effect of poverty is the high rate of school dropouts, as parents cannot meet the education costs, The poor are vulnerable to nutrition related diseases and respiratory infections due to poor shelter. Young girls were forced into early marriages and therefore denied access to education. (GOK, 2010).

In the district, the average distance to a health facility is 15 kms. The district has experienced difficulties in providing efficient health services for the fast growing population because it needs heavy investments to upgrade, modernize and construct new health facilities. Inadequate health services has resulted in high morbidity and mortality rates leading to inability to participate effectively in economically productive activities and loss of human capital (GOK, 2008).

3.3 Research Design

This study was part of a project entitled "*Improving milk safety through control of brucellosis in dairy animals*" The study was a cross-sectional survey, with both the

epidemiological and social aspects, to determine the distribution of zoonoses with emphasis on brucellosis in the pastoral areas of Trans Mara. The sampling was purposive targeting areas where brucellosis prevalence in livestock was high. This elicited 60 households from which animals were sampled. The epidemiological work involved collecting blood and serum samples, from all the animals in the 60 households. In tandem with this, the social aspect of this study, which is the focus of this thesis, administered questionnaires to the household heads in these 60 households. For purposes of this study, a cross-sectional exploratory design was adopted. Both quantitative and qualitative methods of data collection were employed.

3.4 Study population

The study population was livestock keeping households of Lolgorian Division. Within the household, household heads and if not available, any adult of 18 years and above were approached to participate in providing answers to the research instruments. The focus on adults was because of their experiences with the daily activities in the community, in relation to animal husbandry, cultural practices and gender roles would come out clearly.

3.5 Sample size and sampling procedure

A list of 126 livestock keepers was generated with the help of the area chiefs to construct a sampling frame. Participating villages and households (HHs) keeping livestock were randomly selected from the sampling frame using random computer numbers. A total of 60 respondents from the households of livestock keepers were randomly selected within the research site. To get the key informants and FGD participants, purposive sampling technique was employed.

3.6 Methods of data collection

3.6.1 Structured survey

This method involved administering a questionnaire to the sampled respondents. The questionnaire (Appendix 1) was composed of both open-ended and close-ended questions to restrict the informants to relevant issues towards the research subject and also to give them the framework to provide more information. At household level, the questions addressed: family size, herd size, abortion cases observed in the herd and clinical signs, handling of aborted material, incidences of retained placentas whenever animals aborted, recent introductions of new cattle, breeding methodology (whether Artificial Insemination (A.I) or not), instances of repeat breeding particularly those using A.I, use of communal bulls/rams/ bucks, any suspicion of infertility, among small ruminants abnormal scrotal swellings, contact with livestock from other herds, grazing and water points, use of communal pasture fields, proximity to wildlife, and confinement in house at night.

Additionally, the way in which milk, meat and blood are consumed was also assessed. Specifically, the frequency of consumption of these products, their source and mode of preparation before consumption (meat: inspected or not, consumed raw parts; milk: boiled, soured or raw) was recorded. The questionnaire was administered to household heads who are livestock keepers and whose animals were sampled and tested.

3.6.2 Key informant Interviews

Key Informant Interviews were carried out to get information about the research questions and also authenticate information obtained through the survey. The key informants were

people considered knowledgeable about the community dynamics and the situation of brucellosis. A total of 6 Key Informants were chosen and included village elders, local administrators, women representatives, veterinary and medical personnel. The major objective of this method was to complete any encountered information gaps about animal husbandry practices, cultural practices and gender roles and the perception of these activities in relation to brucellosis. An informant guide (Appendix 2) was used to conduct the interviews.

3.6.3 Focus Group Discussions

Focus group discussions were conducted with members of the community. A total of 6 FGDs constituting of two groups of men, two groups of women and two groups of youth were conducted. Two FGDs per category (men, women and youth) were held so as to confirm and clarify issues raised in each category of FGD. The discussions were conducted with the help of an FGD guide (Appendix 3) developed from findings during the survey. The FGDs were held to gain consensus on the findings gathered from other methods. Emerging issues and controversies were addressed on brucellosis as a disease, animal husbandry practices, cultural ritual and ceremonies and gender roles. The participants comprised of Village Elders, Women representatives, Teachers, Veterinary and Medical personnel, Youth leaders, Community Based Group leaders, Church Elders and the Local Administration.

3.6.4 Direct Observation

Direct observation was used to confirm the actual activities of the community that exposed them to the risk factors of brucellosis. The observations were recorded and descriptive accounts were made. A checklist (Appendix 4) was used to guide the observations.

3.7 Data Management and analysis

This study used both qualitative and quantitative methods of data collection. The quantitative data from the field was edited and screened for errors and omissions, accuracy, uniformity and completeness and then arranged to enable coding and tabulation before statistical analysis was carried out. The analysis was performed using the statistical package for social sciences (SPSS) computer software to generate frequencies and percentages and displayed using tables, charts, graphs and histograms. The qualitative data was sorted, organized, coded, and interpreted according to emerging themes relevant to the study. Key informant interviews and focus group discussions were transcribed and studied to identify the categories of themes. Direct quotations and comments by the informants and discussants were used to take their actual words into account.

3.8 Encountered problems and solutions

This study took place in Lolgorian division, Trans Mara district where the local language is Maasai. For this reason, local research assistants were used for questionnaire administration and translation during the discussions where necessary. The field work took a long period because it was part of a bigger project and therefore I was not in control of the planned activities.

3.9 Ethical considerations

Explanations were given to respondents concerning confidentiality before the interviews commenced. The information given was used for research purposes only. A brief of the study topic was given to the respondents in the form of an information sheet and they signed to show that they had given their consent to be interviewed and photographed. To ensure that the respondents gave information voluntarily, the study employed research assistants from the local communities. Ethical clearance was sought and approved from the UON/KNH Ethical review board (P8/01/2013) and a research clearance permit No. NCST/RCD/12A/012/17 to conduct research in Trans Mara district was granted by the National Council of Science and Technology (NCST).

CHAPTER FOUR

Socio-cultural and economic risk factors for human brucellosis

4.1 Introduction

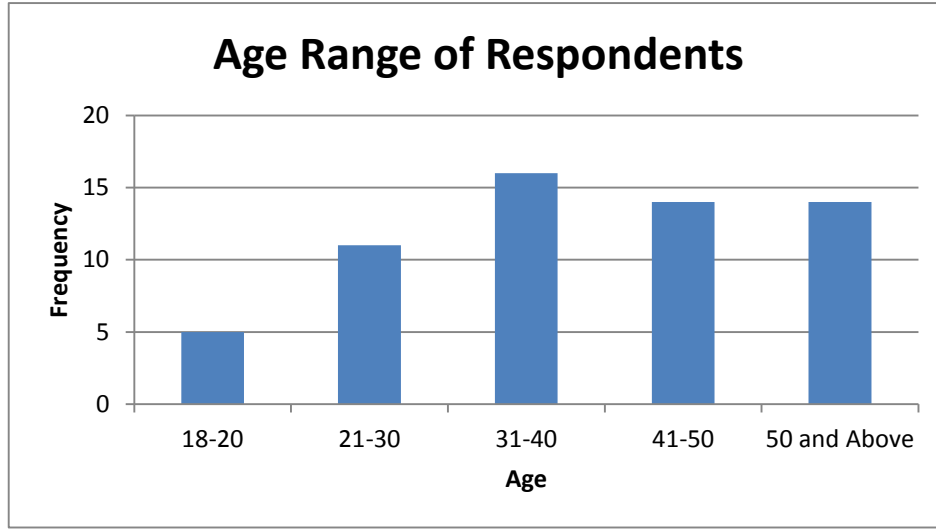
This chapter starts with presenting findings on socio-demographic characteristics of the respondents including age and the highest level of education attained, knowledge level of respondents about brucellosis and its symptoms (both in animals and humans). Knowledge of traditional animal husbandry practices that contribute to the risk of contacting brucellosis is presented. Findings on socio-cultural and dietary practices and gender roles and responsibilities that contribute to the risk of contacting brucellosis are also presented.

4.2 Lay knowledge about brucellosis and traditional animal husbandry practices

4.2.1 Socio-demographic Characteristics of the Respondents

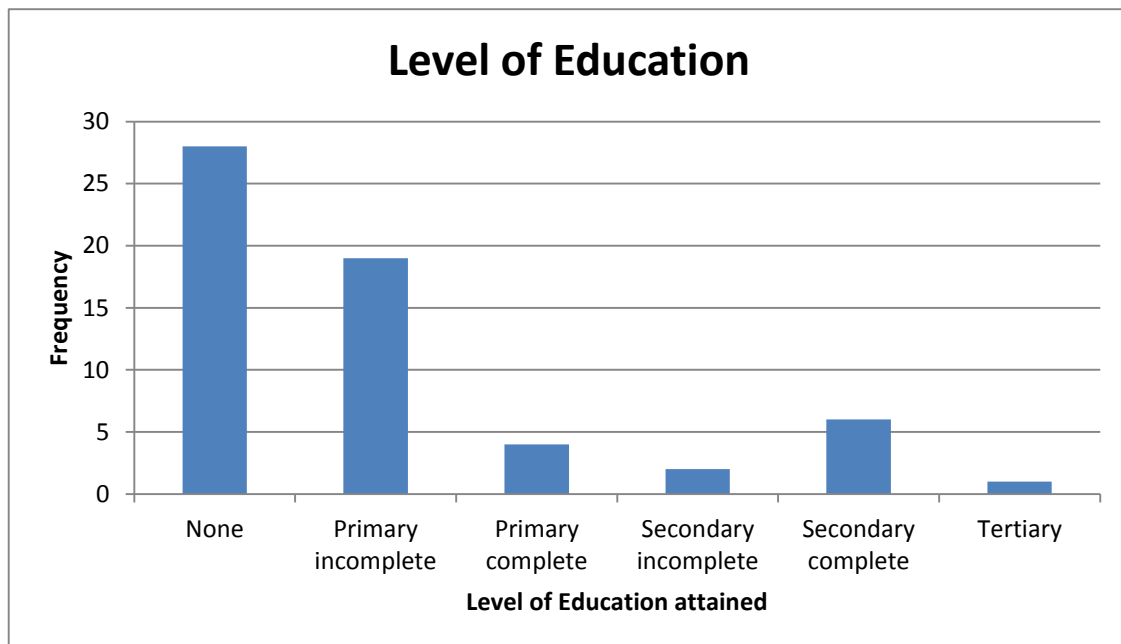
This study was carried out in four locations of Lolgorian division, Trans Mara District. The locations included Oloirien, Moyoi, Olomotonyi and Lolgorian. The respondents that took part in this study were predominantly 88.3% male with their ages ranging between 18 - 74 years. There were 11.7% females who participated in the study. The modal range of respondents' age was in the 31- 40 age bracket. However, the respondents who were above 51 years of age constituted 23.3% of the respondents (Figure 4.1).

Figure 4.1: Age Range of Respondents



As far as the highest educational level of respondents is concerned, the data indicated that a majority of respondents, 46.7% had no formal education while only 10% had completed their secondary education (Figure 4.2).

Figure 4.2: Level of Education



Lolgorian division is a livestock production area, and an overwhelming 96.7% of the respondents confirmed that they practiced livestock keeping as their main occupation.

4.2.2 Knowledge about Brucellosis

Lack of knowledge on the causative agent, mode of transmission and preventative measures against brucellosis can be detrimental. In Lolgorian division, a majority (91.7%) of respondents were knowledgeable about the existence of zoonoses within the community. Almost all (93.3%) of the respondents had heard about brucellosis before and associated it with cattle milk.

“...I have been running my clinic for the last 10 years and I can rank brucellosis 3rd in the location preceded by Malaria and typhoid. I have treated many patients with brucellosis and try to educate them on how to avoid re-infection. Many patients are aware of the disease and its symptoms but still do not understand how they contacted the disease and therefore are still careless with the risk factors involved” (55 years old male, private Clinician)

They were aware about the potential of animals transmitting diseases to humans. The magnitude of the problem in the community was established by 91.7% of the respondents indicating that the disease is a problem within the community. When asked about the animal species affected, a majority, (90%) of the respondents reported that cattle are mainly affected by the disease.

Knowledge on the symptoms of brucellosis in Humans: Symptoms associated with brucellosis are usually mistaken for those of Malaria and Typhoid. Respondents associated brucellosis infection in humans with an experience of joint pains (80%) and fatigue

(48.3%). Apart from the above symptoms, others included back pains (30%), sweats (5%), headache (35%) and lack of sleep at night (3.3%) (Table 4.1).

Table 4.1: Distribution of respondents by knowledge on symptoms associated with brucellosis

Symptom	% of respondents
Joint pains	80
Fatigue	48.3
Headache	35
Back pains	30
Fever	15
Sweating	5
Lack of sleep at night	3.3
Don't know	10

This information about symptoms was also confirmed by a key informant from Lolgorian sub-district hospital who indicated that approximately 10% of adults who sought services at the facility suffered from brucellosis, and mainly complained of joint pains and headaches. This is how the key informant put it:

“...Brucellosis is a problem in this area, out of 20 adults who come to this hospital for services at least two are diagnosed with brucellosis. The symptoms that patients report when they come to hospital are usually joint pains and headaches. It is important to note that brucellosis is usually mistaken for Malaria and Typhoid. However, to confirm brucellosis infection, laboratory tests are done.” (A 45 years old Male Officer In charge, Lolgorian Sub-district hospital)

Knowledge on the symptoms of brucellosis in Animals: Knowledge about symptoms of brucellosis in animals is extremely important because it could be a pointer to the disease in humans. A majority, (76.7%), of respondents were of the view that an observation of abortions in animals would point to brucellosis infection in the affected animals. However,

18.3% of the respondents indicated that a drop in milk production is a symptom of the disease in animals. Apart from the drop in milk production and abortion, 16.7% of the respondents mentioned other symptoms of the disease in animals. These other symptoms included coughing, swelling of joints, raised hair coat, fever, swelling of teats and loss of appetite.

The respondent's attribution of abortion in animals to brucellosis infection is illustrated by the following excerpt from a key informant interview;

“...abortion cases are common in cattle as well as sheep and goats and this we attribute to “nangida”(meaning brucellosis in the local dialect-maasai). Swelling of the testicles in sheep and goats is also indicative that the animals are suffering from brucellosis. (39 year old Male Key Informant, Oloiren)

4.3.3 Pointers to the Existence of Brucellosis

Transmission of brucellosis between animals according to a livestock personnel, occurs mainly by environmental contamination after abortions or by direct contact, but sexual transmission is also an important route of infection. On abortion in animals, 56.7% of respondents indicated having observed abortions in their animals in the past one year with 35% indicating that they had observed retained placenta in their animals. Cases of failed breeding, infertility in livestock, abnormal scrotal swellings in either cattle, sheep or goats were also observed (Table 4.2).

Table 4.2: Possible Pointers to Brucellosis Infection in Animals

Observed Attribute (Period: 2012-2013)	% of respondents with observation
Cases of abortion	
Cattle	43.3
Sheep	8.3
Goats	6.7
Cases of abnormal scrotal swellings	
Cattle	21.7
Sheep	5
Goats	5
Cases of retained placenta	35
Cases of repeated/failed breeding	48.3
Cases of infertility	41.7

4.2.3 Traditional Animal Husbandry Practices

The traditional lifestyle and beliefs of pastoralists creates favourable conditions for the spread and transmission of brucellosis. Brucellosis affects the health and productivity of livestock as well as that of their owners and can have a deep economic impact. This study established existence of traditional animal husbandry practices of relevance to the transmission and spread of brucellosis within the animal population and humans as presented in the following sub-sections.

Livestock varieties kept: Pastoral communities, who practice traditional animal husbandry, depend on livestock for their livelihood. The study results indicate that the people of Trans Mara district engaged in livestock production as their main economic activity. The population proportions indicate that, a majority (96.7%) of the respondents were engaged in livestock production with 35% owning between 31-60 heads of cattle. As far as sheep and goats were concerned, 31.7% of respondents owned between 0-30 shoats with 20% owning above 120 sheep and goats per individual (Table 4.3).

Table 4.3: Number (Ranges) of Animal Species Owned

Animal species	Number owned (Range)	% of Respondents
Cattle	0-30	23.3
	31-60	35.0
	61-90	8.3
	91-120	16.7
	>120	16.7
	Total	100
Sheep and goats		
	0-30	31.7
	31-60	18.3
	61-90	11.7
	91-120	18.3
	>120	20.0
	Total	100

Livestock housing: In most pastoral homes, livestock are kept in close proximity to human shelters. Physical contact between humans and potentially infected animals poses a great risk to brucellosis infection. According to direct observation, the *enkaji* (a maasai traditional house) is small, measuring about three by five metres and standing only 1.5 m high. It is loaf-shaped and made of mud, sticks, grass, cow dung and cow's urine. *Brucella* spp can survive for long periods in dung and therefore as the women construct the houses using cow dung they are at risk of contacting brucellosis. Within this space, the family cooks, eats, sleeps, socializes, and stores food, fuel, and other household possessions. Small livestock are also often accommodated within the *enkaji*. Results indicate that a majority (76.7%) of respondents, confined animals in the houses where they also lived particularly at night. According to a key informant the animals that mostly spent their nights in close proximity to humans included calves, lambs and kids. Those animals perceived to be sick by their handlers were made to also spend their nights in houses where humans also lived. Some (18.3%) sick animals were made to share houses with humans at night. For the

residents of Lolgorian, sharing houses with animals was nothing out of the ordinary as is emphasized by the following information from a key informant interview;

“...sick animals are kept in the house at night for close observation They are nursed until they regain their strength before being mixed with the rest again. Calves, lambs and kids are also kept in the house, because they are usually young and weak and can be crushed by the larger animals. They all need special attention, especially when it comes to feeding. During the rainy season we keep the animals in the houses especially the newly born, because they cannot manage the mud in the bomas” (48 years old, female key informant from Olomotonyi village)

Movement of Animals: In terms of movement of animals, pastoralists raise their livestock on marginal land and are constantly or seasonally migrating in search of fodder and water, as shown in the following sub-sections:.

Movement of Livestock: A key informant reported that, traditionally, the pastoralists move seasonally from their home bases and drive their herds to places with pasture and water and come back to their homesteads in other seasons when pasture improves. Migration and contact with other animals on common grazing grounds or at water sources form a major risk for transmission of brucellosis in pastoral livestock. The risk of brucellosis transmission from infected animals to healthy ones was exhibited through communal grazing and watering of livestock in common places. The residents of Trans Mara graze their livestock through communal grazing as they do not have restricted areas for grazing. A large percentage (86.7%) of respondents did not have restricted areas for grazing or watering points for their animals.

Livestock was also grazed in close proximity with wildlife, which moves freely to the grazing areas from the Maasai Mara Game reserve (Plate 4.1). The location of human settlement close to the Maasai Mara Game reserve increased contact between domestic and wild animals. Eighty five percent of the respondents grazed their animals in close proximity to wild animals enhancing the close interaction between livestock and wildlife. This was confirmed by the following information from an FGD discussion:

“... during the dry season, we drive our cattle towards the Mara Park, there is plenty of grass there. Our animals graze very closely with the wildlife, they even drink water in common drinking water points” (65 years old male, Olomotonyi village).



Plate 4.1: Wild animals from the Park graze freely with livestock

Restocking of Livestock: There was a high mobility of livestock within Trans Mara district. Results indicate that 81.7% of the respondents had acquired livestock from different areas

within the region into their herds. There was consensus in the FGDs that acquisition of livestock was mainly through purchases, to replace lost ones through mortality from drought or diseases.

“...we the maasai love cattle and we are proud to own the best cattle. I have a Sahiwal bull, the best in my village, it cost me a lot of money and I purchased it all the way from Meru. It serves most of the cows in my village, (56 years old male, FGD, Moyoi village)

New introductions were also made through cultural events such as payment of bride wealth and gifts based on reciprocity. It was evident that the residents looked out for one another especially in times of disasters, as is expressed by one key informant who said the following:

“...when a farmer loses his animals from disasters like diseases, drought or theft, friends and relatives assist the affected members of the community. The farmer is given cows to milk especially if he has small children. The animals are given as gifts or on loan until he recovers from the tragedy, and is able to build up his stock again.” (52 years old male, Oloirein village)

Assisting animals during parturition: Brucellosis is usually spread by animals through infected birthing tissues and fluids. In pastoral areas, majority of livestock keepers treat their animals when need arises. Almost all (96.7%) respondents indicated that they assisted their animals during parturition. This assistance was mainly carried out without use of protective clothing to guard against zoonotic diseases including brucellosis. A majority (96.7%) of the respondents indicated that the assistance of animals during parturition was not a gender-specific function as any available person (either man or woman) would assist

the pregnant animals. The risk for exposure to zoonotic pathogens was not limited to physical assistance of in-calf animals during birth. The calves were also handled without use of protective clothing. The high contact between animals and their handlers and the animal birthing fluids is illuminated through the following statement;

“...the Maasai people have great love for their animals particularly cattle. Whenever a cow calves and we observe that the calf has difficulty with breathing due to birthing fluids covering the nostrils, we pull it out to clear the breathing channel using our mouths. That makes the calf to start breathing normally” (65 years old male key informant from Oloopi kidong’oe village).

The Maasai and the livestock are one, they value the animals greatly. These sentiments were echoed and confirmed through consensus during focus group discussions held in Moyoi. One discussant was passionate about his livestock and this is what he had to say

“...livestock for us the Maasai is very important, we believe that God entrusted us to take care of livestock. Our lives are tied around our livestock and there is absolutely nothing we cannot do for our livestock. Livestock is our pride, even if it means sleeping with them in our houses to shield them from any danger. We are ever ready to protect our animals. We normally help our animals when birthing, especially when they encounter difficulty, we sometimes have to literally pull out the calves with our bare hands.” (72 years old male, Moyoi village)

Livestock breeding: A key informant in the Ministry of Livestock and Fisheries indicated that, in livestock, there is a greater susceptibility to brucellosis in sexually mature animals, although it is possible for young animals to be latently infected and these animals may

eventually become a source of infection when mature. As far as animal breeding practices are concerned, whereas a majority of respondents used bulls, rams or bucks from their own herds, 43.3%, 41.7% and 43.3% used communal bulls, rams and bucks respectively, for breeding purposes. All respondents (100%) interviewed confirmed that they did not use Artificial Insemination (AI). This method was not popular because of instances of repeated breeding, as reported by a key informant.

4.3 Socio-cultural and dietary practices contributing to risk factors of human brucellosis

4.3.1 Introduction

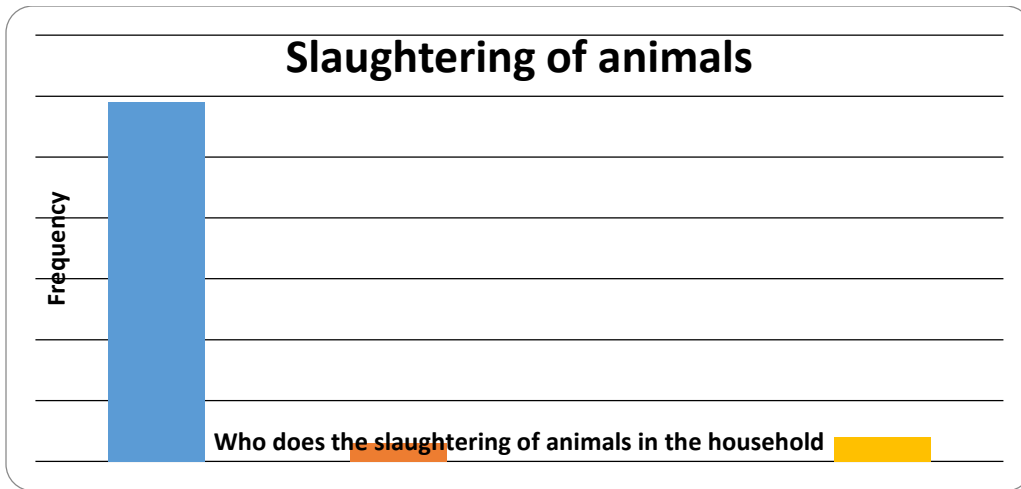
Socio-cultural and dietary practices are relevant to the contracting of brucellosis. Livestock are the primary source of income for the pastoralists. Livestock serves as a social utility and plays an important role in the pastoralists economy. Livestock are traded for other livestock, cash or livestock products such as milk and hides/skins. Traditional beliefs and practices may contribute to the spread of brucellosis. Food habits and lifestyle of pastoralists enhance transmission of brucellosis to the human population. Various activities related to livestock are usually undertaken in this community. These activities include ceremonies and rituals and other economic activities that generate income.

4.3.2 Slaughtering of animals

A common component of meals of people involved in pastoral production besides milk is meat. The slaughtering process, often done without protective wear, enhances contact between the people involved in the process with fluids from the slaughtered animals. This may put the people at a risk of zoonoses infection including brucellosis. Results indicate that 98.3% of respondents were of the view that the people involved in slaughtering of

animals are mostly men. The implication is that men in this community are more likely to be infected with zoonoses through contact with body fluids of slaughtered animals (Figure 4.3).

Figure 4.3: Slaughtering of animals



In one of the focus group discussions held in Oloirien, the men concurred that they did most of the slaughtering, but women were also given a chance to slaughter small ruminants because it was customary especially after child birth. During the discussions it came out clearly that wearing of protective gear when slaughtering was never done.

“...Slaughtering animals is mainly done by us men and we do not use protective gear. I think it would be uncomfortable for me to wear something on my hands when slaughtering. It is a natural skill we learn over the years and has been done by our forefathers.” (Discussant Male FGD, Oloirien Village)

4.3.3 Processing and handling of Hides/Skins

Hides/skins are processed to produce beddings, belts or decorations for milk containers. Thirty percent of the respondents reported that they sold hides and skin to leather product

dealers while 70% indicated that they used the hides and skin in the homes. During discussions from an FGD in Oloirien village, women were in charge of processing and sale of the hides and skins.

“...it is our duty to process the hides and skins. Rarely do we sell hides; they make very comfortable beds for the family. We sell the skins and use the money to purchase other household items that we need” (27 years old female, Oloirien village)

After slaughtering of animals, the animal skins/hides are processed to produce beddings, belts or decorations for milk containers. Some are also prepared for sale to leather product dealers (Plate 4.2). According to 91.7% of the respondents, the handling of the skins/hides after slaughtering is not done with precaution to avoid chances of zoonoses infection. The handlers do not carry out their activities with protective wear (Plate 4.3).



Plate 4.2: Sheep skin that has been put out to dry in the sun.



Plate 4.3: Hide being put out to dry in the sun

4.3.4 Consumption of livestock products

Traditionally, the Maasai diet consisted of meat, milk, and blood from livestock for protein and caloric needs.

Taking raw blood: One Key informant reported that, cattle blood is very rich in protein and is good for the immune system and is obtained by nicking the jugular vein. Raw blood is also taken particularly by herdsman in the grazing fields away from their manyattas and those people involved in the slaughtering of animals. Women who have given birth take blood to restore what was lost during child birth. The Maasai morans also take raw blood after undergoing circumcision to restore lost blood during the process. In the event of perceived anemia an individual was given raw blood to restore the blood level within the body. Also, on a regular basis drunk elders, use the blood to alleviate intoxication and

hangovers. According to 76.7% of the respondents, raw blood was taken during various occasions. This exposes the raw blood consumers to the risk of zoonotic infections. A Key informant from Lolgorian indicated that when a person was recovering from sickness and was said to be anemic, they were given blood from a goat:

“...If a member of the family was said to be ill and the doctor said they didn’t have enough blood, we simply get blood from a healthy goat and the patient is given blood for 2-5 days. And within no time, they are up and about. The blood is said to be rich in iron. Fresh warm blood direct from an animal, particularly goats, is given to morans after circumcision and women after delivery. This replenishes the blood that is lost during either the process of giving birth or circumcision” (55 years old female, Lolgorian county)

To support the notion of perceived anemia and use of raw blood to restore the blood level within the body, a respondent from an FGD in Lolgorian had shared the following information;

“I underwent an operation in Nairobi and was hospitalized for three weeks. When I was discharged, I was very weak and dizzy all the time. This was attributed to the fact that I lost a lot of blood during the operation. I was given fresh blood from a goat for 4 days and I recovered completely from the dizziness and I feel much stronger” (53 years old female, Lolgorian village)

Eating uncooked or semi-cooked meat: To mark the various ceremonies by the maasai, animals are slaughtered for the ceremony. According to the Lolgorian residents organs were eaten raw. Eighty one point seven percent of respondents indicated that there were occasions when people ate uncooked meat and raw organs of slaughtered animals (Figure 4.4). More specifically kidney (81.7%), liver (80%) and other body parts (21.7%).

Figure 4.4: Consumption of un-cooked/raw organs



A 45 year old key informant from Olomotonyi location indicated that:

...the local community, the Maasai, eat raw body parts like the kidney and liver. They are eaten straight from the slaughtered animal while the organs are still warm. The meat is usually half roasted and certain parts of the intestine are also eaten raw.

Following an FGD in Lolgorian village a discussant emphasized the fact that raw organs were eaten immediately after a slaughter, and this is how she explained it:

“...the kidneys are exceptionally sweet when eaten straight from the slaughtered animal. They are best eaten when still warm. When our women deliver traditionally we slaughter an animal for them and these are some of the parts that are given to them.” (33 yrs old female, Lolgorian village)

Drinking unboiled milk: Milk or *kule*, as it is referred to in the maasai community, is consumed in various forms, fresh or curdled, pure or mixed with other elements such as blood, as well as in porridges or teas. Its principal purpose is to provide sustenance, being the basis for herd production and family nutrition. The main use of milk in Maasai culture is as the basic diet item, consumed up to three times a day.

Eighty percent of the respondents were of the view that milk is not always boiled before consumption. During milking, mothers gave their hungry children milk straight from the cow (Plate 4.4 (a,b)). This information was also confirmed through consensus during focus group discussions.

...when the children are hungry, I don't have time to light a fire to boil the milk. The milk direct from the cow is still warm anyway. Us Maasai women have many chores waiting to be done here at home before sun set. For the children to get out of the way we quickly milk, get their stomachs full and send them out to play (32 years old female Olomotonyi village)

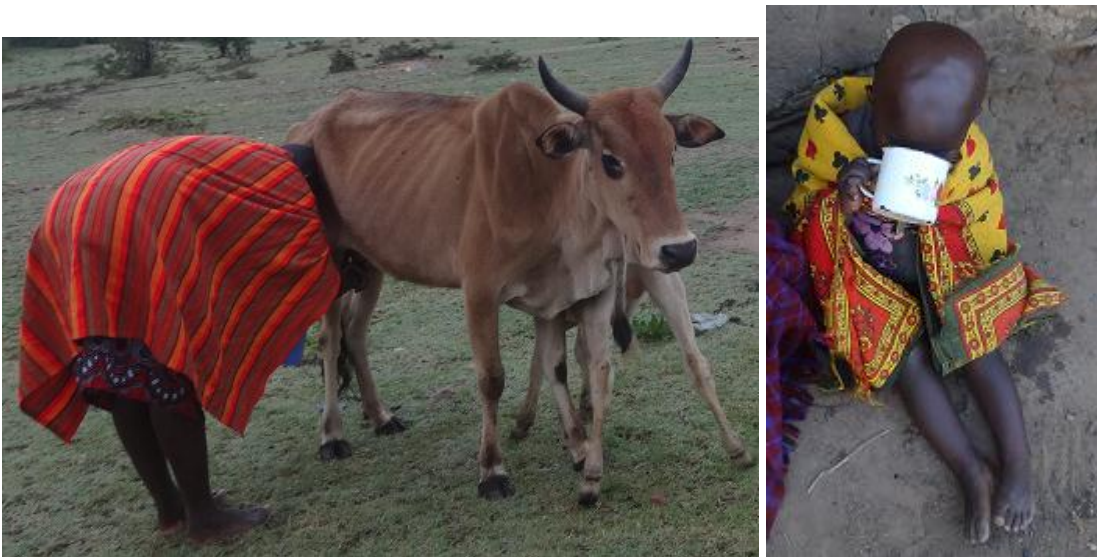


Plate 4.4 (a and b): A maasai woman milking a cow (a) and a child drinking milk straight from the cow (b)

4.4 Gender roles and responsibilities in Animal husbandry

4.4.1 Introduction

In traditional animal husbandry practices, there are different gender roles and responsibilities assigned to members in the community. Livestock is generally considered a key asset for pastoralists; all household members have access to livestock and are involved in production and well being of the livestock. Animal husbandry activities are a daily occupation with women responsible for the bulk of the work. They include herding, taking care of and treatment of sick animals and also taking care of the newly borne.

4.4.2 Gender roles in herding

Livestock herding: Herding of cattle, goats and sheep is the primary source of income for the pastoralists. Livestock serves as a social utility and plays an important role in the Maasai economy. The task of herding is undertaken mostly by boys and young men, with the older men playing a more supervisory role, providing direction on animal husbandry, range management and making decisions about the overall use of communal resources.

From FGD discussions in Olomotonyi village, the task of herding livestock was performed by boys and girls for the small ruminants and the larger animals by the older boys:

“... we engage our young children at an early age how to be responsible by taking care of the animals. The boys and girls take care of the sheep and goats, while the older boys take care of the cattle. The older people are left to other matters of the

clan, giving advice where necessary.” (72 years old male discussant, FGD, Olomotonyi village)

A young key informant from Oloopi kidong’oe explained the responsibilities that had been enthroned on them:

“...the young men were entrusted with large numbers of livestock, usually belonging to several pastoralists. We were expected to drive them out to pasture especially during the dry season and make sure also that they drink water from the water points. We are expected to protect our animals from predators especially when we graze them along the Mara Park. Young girls are also involved in the grazing of goats and sheep” (20 years old male Oloopi kidong’oe village)

Children in Lolgorian division took care of sheep and goats and calves at a very young age. (Plate 4.5, 4.6). This is a demanding job, as the animals move a lot and are easily lost or attacked by predators. The children therefore spend most of their lives in close proximities with their cattle putting them at great risks of contacting brucellosis.



Plate 4.5: Children looking after sheep and goats



Plate 4.6: Children looking after calves

4.4.3 Gender roles in care and treatment of animals

Care and treatment of sick animals and newly borne: The pastoralists value the good health of their livestock. Besides performing domestic roles, women and young girls were responsible for home-based herds; these are the sick animals, newborn calves, their mothers and the small stock. They feed and treated sick animals and made sure they had water. In an FGD the women were in agreement when one of them made the following statement:

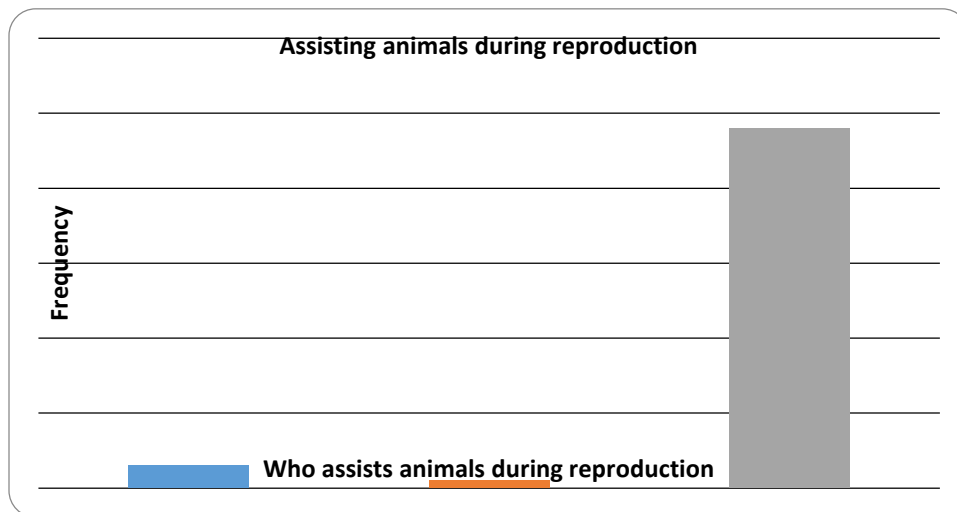
“...we monitor animals closely, we take care of sick animals and prepare medicine for their treatment and treat less serious diseases. We can single out animals that are sick, those that are weak, about milk yield, animal temperament, and can even tell when an animal is missing. We milk the animals every morning and evening, we know all our animals. (29 years old female, Moyoi village)

Similar sentiments were expressed by a Key informant from Oloirien village :

“...Women have complete responsibility for animals kept at the homestead. Women spend considerable amounts of time in collecting and storing fodder, especially during the dry season when good pastures are difficult to find and we also have to walk for long distances to fetch water for these animals.” (42 years old female, Oloirien village).

Assisting in reproduction: The residents of Lolgorian assisted their animals during reproduction. This was particularly when the process was seen to take long or the animal(s) appeared to be struggling. According to 96.7% of the respondents, any available person whether men or women, in the household or grazing fields where reproduction took place assisted the animals during calving. (Fig. 4.6)

Figure 4.6: Assisting animals during reproduction



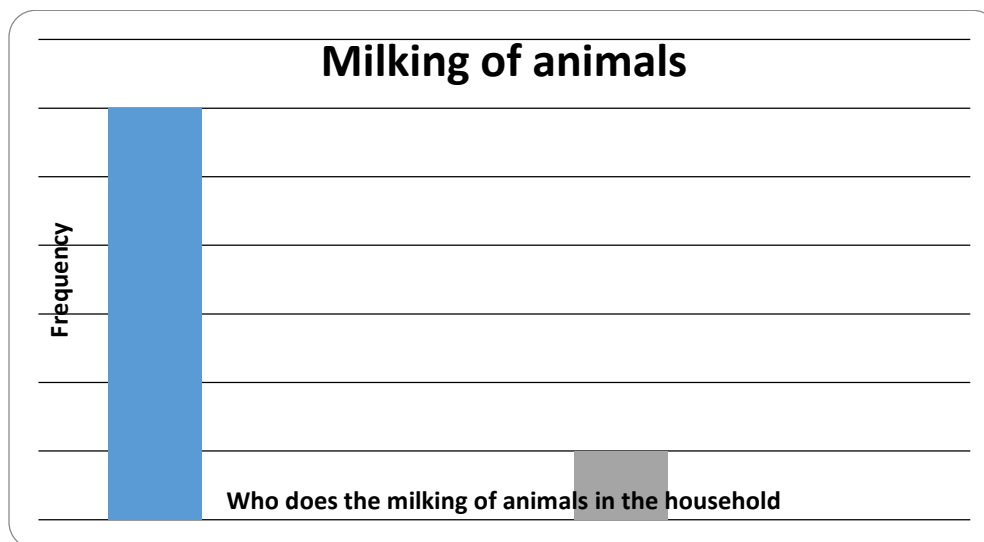
All respondents who answered to the question as to whether protective clothing (gloves) was put on during the assistance of reproducing animals gave negative responses. This was further illustrated by one of the key informants in the following quote:

...an animal is assisted when the offspring is thought to be too big and the animal is seen to be weak. When an offspring is not born naturally with the head first, then definitely it needs assistance. We then clean up the after births of the animals and we do it with our bare hands (41 years old male, Oloirien village)

4.4.4 Gender roles in milking

Milking of animals: Women are typically responsible for milking, processing and selling milk products (Figure 4.5). Girls are responsible for chores such as cooking and milking, skills which they learn from their mothers at an early age. Milking is done before cattle leave their night enclosures and on their return in the evening. The close constant closeness of women with livestock, put them at great risk of brucellosis. The residents of Lolgorian division were socially stratified in terms of the roles performed by men, women, boys and girls.

Figure 4.5: Milking of animals



According to 100% of them, milking of cattle was mainly done by women. Girls sometimes assisted their mothers to milk (16.7%), (Plate 4.7). It was clear from the Focus group

discussions held at Moyoi indicating that it was the role of women to milk the cows and were assisted by the young girls. This is further emphasized in the following statement by one woman at the FGD discussions;

“...since I was born and now I am a grandmother, it has been, and still is the role of women to milk the cows. The young girls are also taught how to milk at a young age and soon take over from their mothers.” (67 years old female, Moyoi village)



Plate 4.7: A maasai girl milking a cow

From the discussions held in the FGDs, the women were asked whether they continued to milk the cows even when they had wounds. This is what the women at the FGD had to say;

“...It depends on the size of the wound, if it is a tiny one, then that is no big deal, but if it is a big one then we stop milking and ask for assistance from our fellow women.” (33 years old female, Moyoi village)

CHAPTER FIVE

Discussion, Conclusions and Recommendations

5.1 Introduction

This chapter presents the discussion of the findings on the socio-cultural and economic risk factors for human brucellosis in Lolgorian division of Trans Mara district. Conclusions and recommendations are also included.

5.2 Discussion

The main themes of the discussion in this sub-section are community knowledge on brucellosis, traditional animal husbandry practices, socio-cultural and dietary practices and gender roles and responsibilities.

5.2.1 Community knowledge on brucellosis

Brucellosis is one of the most common zoonotic diseases in the world. It has emerged as a major public health concern worldwide with implications for the economic prosperity of many nations (Pappas et al, 2006). It was evident from this study that the occurrence of brucellosis is pegged on the activities and interaction between livestock and the people. It is also clear from the results, that socio-economic and cultural activities play a significant role in the spread of the disease.

Knowledge and symptoms of brucellosis in humans: In this study the respondents were knowledgeable of the existence of brucellosis in their community. They were able to list the symptoms of brucellosis, i.e joint pains, fatigue, back pains, sweats, headache and lack of sleep at night. However, their knowledge was low in relation to mode of transmission. In a similar study by Grahn, (2013), many participants held that fever was something

normal one had every now and then, and that it does not have an infectious origin. This has negative health implications, since fever is often the first sign of human brucellosis. This means that in order to receive quick adequate health care, hence avoiding a chronic incapacitating state of disease, they ought to seek help earlier before they begin to suffer from chronic joint aches. At this point, the disease is much more difficult to treat (WHO, 2006). Regessa et al (2009) also reported that, as much as brucellosis was common among patients with recurrent, unresolved febrile illnesses, the disease was not always diagnosed and treated due to lack of awareness.

The results from this study show that brucellosis was the third most important disease preceded by malaria and typhoid. Symptoms associated with brucellosis are usually mistaken for those of malaria and typhoid and therefore members of the community only agreed to a brucellosis laboratory test after they had been treated for malaria and typhoid without improvement. The clinical picture is not specific and diagnosis needs support from laboratory tests. Human brucellosis manifests itself as an acute or sub-acute illness, its first stage characterized by intermittent or remittent fever accompanied by ague, malaise, anorexia, sweating, muscle pain and prostration (Corbel et al, 2006). Without proper and prompt treatment, the acute phase might develop into a chronic incapacitating one marked by persistent localized infection, such as osteoarticular complications, or the more non-specific “chronic fatigue syndrome” (Corbel et al, 2006).

In tropical countries human brucellosis may be misdiagnosed as drug-resistant malaria (WHO, 2006) and it is under-detected, hence under-reported in most parts of the world (Corbel et al, 2006).

Knowledge and symptoms of brucellosis in animals: Brucellosis in animals causes significant economic losses due to abortions, reduced fertility and lowered milk production in livestock (WHO, 2006). The abortions often occur during late pregnancy, frequently followed by retained placentas. The infection also can cause testicular infections in males leading to orchitis and epididymitis. Notably, fever is not a clinical sign in animals (Epiwebb, 2012). A majority of respondents in Lolgorian division were knowledgeable about the brucellosis symptoms in livestock. They were able to relate cases of abortion, retained placentas, infertility, abnormal scrotal swellings and a drop in milk production to brucellosis. However, the respondents were not able to pin point the actual agents of transmission.

A study done in Nigeria (Adesiji et al, 2005) confirmed lack of knowledge on the causative agent, mode of transmission and preventative measures against brucellosis in the location.

5.2.2 Animal husbandry practices

Since brucellosis has a multiple route of transmission (Quinn et al, 2002), there are many risk factors for spreading the disease within the animal population, as well as from animals to humans.

Proximity of livestock to humans: In Lolgorian division, the respondents confined animals in their houses at night especially the calves, lambs and kids. Animals perceived to be sick and weak were made to also spend their nights in houses where humans also lived, until they recovered and gained their strength. Similar findings were noted by Regessa et al (2009) in Ethiopia. Considering the fact that the animals may litter the house with their dung, and given the fact that the houses of the respondents were made of dung, and the fact

that the bacteria can survive in dung for a long time, (WHO 2006), presents a potential risk factor for brucellosis transmission.

In a study done in Tajikistan, it was observed that the practice of living close to one's animals is a common feature, especially during winter, an aspect worth noticing since there are multiple routes of infection to humans (FAO, 2010). It was also noticed that it is a widespread practice in Tajikistan to collect dung for fuel during winter, important to bear in mind in view of the fact that the bacteria can survive in dung for a long time; hence dried dung can import infection to households (Corbel et al, 2006).

Acquisition and movement of livestock: In Lolgorian division, respondents acquired livestock from different parts of the region into their herds, in search of better improved breeds. Other new introductions were also made through bride wealth and in form of gifts based on reciprocity, natural calamities such as drought or diseases. This activity posed a great risk of introducing brucellosis to both humans and livestock.

Similarly, according to a study in Egypt (Holt, 2011), it was reported that farmers would sell animals which abort to the butcher. If ruminants infected with *Brucella spp.* are often sent for slaughter this may mean abattoir workers may be at a high risk of occupational infection with *Brucella spp.* Holt (2011) also indicated that some farmers would sell animals in markets if they believed they were infected with *Brucella spp.* This may increase the transmission of brucellosis, not only between households in the same village, but also between villages and even larger geographical areas as animals purchased at a market can be moved without restriction to anywhere. This study also found out that exchange of animals for breeding purposes was a common practice among this community, in Lolgorian

division. This practice has been noted (Regessa et al, 2006), to increase the risk for brucellosis.

Migration and contact with other animals on common grazing grounds or at water sources form a major risk for transmission of brucellosis in pastoral communities. The respondents of Lolgorian do not have restricted areas for grazing or watering points for their animals, they graze their livestock through communal grazing.

Livestock was also grazed in close proximity with wildlife, which move freely to the grazing areas by the Park. The location of human settlement close to the Park increased contact between domestic and wild animals, thus enhancing transmission of diseases from wildlife to domestic animals and then to humans.

Parturition: The people of Lolgorian division assisted their animals during parturition. They exposed themselves to the risk of brucellosis more so because they did not wear any protective clothing. They went out of their way to even clear the breathing channels of newly borne animals that had blocked due to birthing fluids. On the same note, studies (Holt, 2011, Megessa, 2011) done in Egypt and Ethiopia, indicate that most people in the village assist with calving, usually by pulling the calf out or removing foetal membranes. Holt (2011) further, reiterates that most farmers dispose of placentas and aborted fetuses in the water canals, and the dump of animal carcasses in water canals. In addition, no protective gloves or masks were used when assisting with the parturition or abortion of animals or whilst handling placentas and aborted fetuses.

A study done in Tanzania (Kunda et al, 2010) examined risk factors for human brucellosis and showed that out of the livestock-associated risk factors, brucellosis was strongly

associated with assisting aborting livestock. An abortion storm in a herd of livestock is among the common features of brucellosis in livestock (Kunda, 2010).

5.2.3 Socio-cultural and dietary practices

The traditional lifestyle and beliefs of pastoralists (Smits, 2013), and small-scale farmers with confined livestock, together with certain farming environments, create favourable conditions for the spread and transmission of brucellosis.

Raw milk: The respondents in Lolgorian division reported that milk formed an important component of their diet and is sometimes consumed before boiling. Results show that milk (*kule*) consumed up to three times a day in various forms, fresh or curdled, pure or mixed with other elements. Its principal purpose is to provide sustenance, it being the basis for herd production and family nutrition. This is a serious matter, since consumption of infected milk products is the greatest hazard of contracting brucellosis (Corbel et al, 2006).

The milker's and herders of Nigeria (Asesiji, 2005), have a similar habit of drinking raw milk, they believe that it is nutritious and even apply it on wounds as they are convinced that it hastens healing of wounds. In another study (Grahn, 2013) in Tajikistan the residents consumed fresh unboiled milk. Brucellosis has been associated with consumption of unboiled/not well boiled milk (Megerssa et al, 2011, Regassa, 2009, WHO, 2006). This habit of consuming raw milk and its products is thus a possible risk factor for brucellosis infection among the massai community of Lolgorian division.

Raw meat and fresh blood: To mark the various ceremonies by the residents of Lolgorian division, animals were slaughtered and various organs were eaten raw. On such occasions people ate uncooked meat and raw organs of slaughtered animals, especially the raw kidney

and liver which were said to be a delicacy. These cultural practices can contribute towards the spread of the disease from animals to humans. In Southern Sudan, a similar practice of eating raw liver or other offal with spices, was observed and found to be an important factor in contracting brucellosis, after patients were found to have a combination of two species variations of *Brucella* bacteria (Mfinanga et al, 2013). In consumption of raw animal products being a risk factor Regassa et al (2009), also observed similar findings in Ethiopia.

5.2.4 Gender roles and responsibilities

The term gender refers to culturally based expectations of the roles and behaviour of women and men. It distinguishes the socially constructed from the biologically determined aspects of being male and female. Gender issues focus not only on women, but on the relationship between men and women, their roles, access to and control over resources, and division of labour and needs. Gender relations determine household security, well-being of the family, planning, production and many other aspects of life (IFAD, 2003)

Findings from Lolgorian division show that the task of herding was undertaken mostly by boys and young men, with the older men playing a more supervisory role, providing direction on animal husbandry, range management and making decisions about the overall use of communal resources. Women play an important role in livestock management, processing and marketing, acting as care providers, feed gatherers, and birth attendants. Women and young girls were responsible for home-based herds; these are the sick animals, newborn calves, their mothers and the small stock. They feed and treated sick animals. Women are typically responsible for milking, processing and selling milk products. Girls

are responsible for chores such as cooking and milking, skills. The close constant closeness of women with livestock put them at great risk of brucellosis.

The residents of Lolgorian assisted their animals during reproduction. Any available person whether men or women, in the household or grazing fields where reproduction took place assisted the needy animals. However all did not use protective clothing (gloves) and therefore were at risk of contacting brucellosis

Molding the Maasai children's character is a communal activity while still young; children are given some minor chores like herding lambs, goat-kids and calves. An informant, who spent years among the Masaai in Kenya, noted that herding teaches children responsibility for the family possessions, and to break this down, would in effect mean breaking down pastoral culture (FAO, 2013).

5.3 Conclusion

The study has revealed that animal husbandry practices such as keeping animals (especially the young and sick), inside or in close proximity of human houses, movement of animals in search of pasture, breeding, to mixing herds, restocking as a result of purchase of acquisition through cultural events such as marriages, assisting animals during parturition and especially without using any protective clothing and livestock breeding practices using communal bulls, rums and bucks, contribute to the risk of infection of human brucellosis in Lolgorian division.

In terms of socio-cultural and dietary practices that contribute to the risk of human brucellosis, the study concludes that slaughtering of animals, processing and trading

hides/skins and consumption of raw or improperly cooked livestock products, such as milk, raw blood and meat.

Gender roles and responsibilities predispose certain genders through different activities to risk of human brucellosis among the residents of Lolgorian division.

5.4 Recommendations

The study recommends the following:

- Socio-cultural and economic risk factors for human brucellosis, should be incorporated into information, education and communication (ICT) materials.
- That sensitization and awareness creation campaigns, that include potential risk factors for brucellosis, be carried out among the community of Lolgorian division.
- A study on the community's knowledge on brucellosis, and the linkage between their practices and brucellosis need to be carried out.

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Appendices

Appendix 1: Brucellosis Questionnaire

Consent

My name is Phyllis M. Alusi, a student at the Institute of Anthropology, Gender and African Studies (IAGAS). I am doing research on cultural practices and brucellosis which is a common disease in this area. This questionnaire seeks to get information from you about your knowledge on this disease. The purpose of this activity is to establish how you practice your animal husbandry; how you handle your animal products and how you conduct your ceremonies. The information obtained will be used to understand how best to handle the animals and products to avoid contacting of the disease in future. This information you provide and photographs taken will be treated with confidentiality, and is purposely for this study. If you accept to participate in this study, please sign here..... Date.....

A. Background Information

Name of Respondent (Optional).....

1. SexDivision.....LocationVillageAge.....

2. What is the highest level of education attained by the head of the respondent?

0. None 1 Primary Incomplete 2. Primary complete

3. Secondary incomplete 4. Secondary complete 5. Tertiary

3. What is your occupation?.....

B. Knowledge about Brucellosis

4. How many animals do you keep?

Livestock kept	Number
Cattle	
Shoats	

5. Do you know about any diseases that are transmitted from animals to humans?

1. Yes 2. No

6. If YES in Q 5 (above) please name the disease(s) that are transmitted from animals to humans

.....
.....

7. Have you ever heard of brucellosis (Ugonjwa wa maziwa)?

1. Yes 2. No

8. (If YES above ask) Is brucellosis a problem in this community?

1. Yes 2. No

9. What do you think causes brucellosis?

.....
.....

10. What are the symptoms of brucellosis in humans?

1. Fever 2.Sweating 3.Fatigue 4. Lack of sleep at night.

5. Headache. 6. Back Pains. 9. Other (specify).....

7. Don't know

C. Animal husbandry practices

11. Which animal species are affected by brucellosis (*Indicate all that applies*)

1. Cattle 2. Sheep. 3. Goats. 4. Others (specify).....

12. How does someone contract brucellosis? (*Indicate all that applies*)

1. Eating of raw meat 2. Staying in close proximity with animals.

3. Consuming raw milk 4 Others (Specify).....

13. What are the symptoms of brucellosis in animals? (*Indicate all that applies*)

1. Abortions 2. Drop in milk production 9. Other (specify)

14. Have you had cases of abortions in your herd in the last 1 year?

1. Yes 2. No

15. How do you handle aborted material?

1. Buried 2. Burnt 9. Other (Specify).....

16. In the last 1 year, have you had any cases of retained placenta after abortions?

1. Yes 2. No

17. In the last 1 year, have you had any cases of repeat or failed breeding in your livestock?

1. Yes 2. No

18. In the last 1 year, have you had any cases of infertility in your livestock?

1. Yes 2. No

19. Do you use communal bulls for breeding?

1. Yes 2. No

20. Do you use communal rams for breeding?

1. Yes 2. No

21. Do you use communal bucks for breeding?

1. Yes 2. No

22. Have you had cases of abnormal scrotal swelling in the following livestock in the last 1 year?

Livestock species	Response	
Cattle	1. Yes	2. No
Sheep	1. Yes	2. No
Goats	1. Yes	2. No

23. Do your livestock have contact with other peoples' livestock during grazing and/or watering?

1. Yes 2. No

24. Do you graze your animals near wild animals?

1. Yes 2. No

C. Management of Brucellosis

25. Can brucellosis be treated?

1. Yes 2. No

26. How do you treat brucellosis in humans

.....

27. How do you control brucellosis in humans

.....

28. How do you treat brucellosis in animals

.....

29. What do you observe in animals to conclude that it has brucellosis?.....

30. Have you experienced any abortions in your livestock in the past 1 year?

Livestock species	Response		
Cattle	1. Yes	2. No	3. N/A
Goats	1. Yes	2. No	3. N/A
Sheep	1. Yes	2. No	3. N/A

Risk Factors for Brucellosis

31. Who mainly does the milking of animals in your household?

1. Men. 2. Women. 3. Girls. 4. Boys

32. Who does the slaughtering of animals in your household

1. Men. 2. Women. 3. Girls. 4. Boys

33. Do we have occasions when people eat uncooked meat or some raw organs of slaughtered animals

1. Yes 2. No

34. If Yes in Q 22. (above), what are these occasions

.....

.....

.....

35. If YES which body parts are eaten raw and why?

1. Kidneys 2. Liver. 3. Other (Specify).....

(Why).....

36. Do we have occasions when raw (un boiled) milk is taken)

- 1. Yes 2. No

37. If YES in Q 25 above, during what occasions is raw milk taken?

.....
.....

38. Why is raw milk taken during the above occasions?

.....
.....

39. Do we have occasions when raw animal blood is eaten?

- 1. Yes 2. No

40. If YES in Q 28 (above), under what circumstances is raw animal blood eaten?

.....
.....

41. Do you keep your animals close to your sleeping area overnight?

- 1. Yes 2. No

(Observation results.....).

42. Do you graze your animals (sheep, goats and cattle) separately?

- 1. Yes 2. No

(Observation results.....).

43. Do you assist your animals during reproduction

- 1. Yes 2. No

44. If Yes for Q 32 (above), who does the assistance of animals during reproduction?

- 1. Men 2. Women. 3. Any available person.

4. Other (Specify).....

45. During assistance of reproduction in your animals do you put on protective gloves?

1. Yes 2. No 3. N/A

46. Do you sell livestock skins and hides

1. Yes 2. No

47. If Yes for Q 35 (above), do you handle the livestock skins and hides with protective gloves?

1. Yes 2. No 3. N/A

THE END

Appendix 2: Checklist for conducting key informant interviews

1. Knowledge on brucellosis

- Any local name for brucellosis
- What do you think causes brucellosis
- How do you tell it apart from the other diseases
- Current status, do you think you have a brucellosis problem in the community

2. Animal husbandry

- When do you consider to have routine checks for brucellosis
- If you suspect an animal has brucellosis what action do you take
- How close is the proximity of animals to the people when they come in for the night?
- If an animals aborts, how is the aborted material handled
- If an animal is sick who takes care of it?
- When an animal is slaughtered, is the meat inspected before consumption?
- Who milks the animals?
- How is the milk consumed?

C. Cultural ceremonies

- What is the importance of slaughtering animals during the cultural ceremonies?
- Is the meat purely for sacrifice or is consumed by the people?

- What does the meat symbolize?
- How is the meat prepared for consumption?
- Is the blood for ceremonial purposes or also for consumption?

D. Gender roles and responsibilities

- Who milks the cows?
- Who takes care of the sick animals?

Appendix 3: Focus Group Discussion guide

1. Knowledge on brucellosis

- How can you define brucellosis
- How would you identify a case of brucellosis
- How would you be able to identify that there is a brucellosis problem in the community
- What are the effects of brucellosis on the individual/community?

2. Animal husbandry

- Do you have adequate facilities for diagnosis for brucellosis
- When an animal is sick, how do you take care of it
- In case an animal aborts, what happens
- Who handles the hides and skins from the animals

3. Cultural Ceremonies

- Significance of the cultural ceremonies in relation to slaughtering of animals
- Significance of the cultural ceremonies in relation to drinking blood, milk and eating meat

4. Gender roles and responsibilities

- Whose responsibility is it to milk the animals
- Whose responsibility is it to care for the sick animals

Appendix 4: Checklist for conducting the observation

- The proximity between the houses and where the animals are kept
- The process of milking the cows
- Milk consumption
- How the meat is prepared
- Housing for the small ruminants and calves