KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS CYSTIC ECHINOCOCCOSIS IN PASTORAL COMMUNITIES IN KASESE DISTRICT UGANDA

BY

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JULY 2011
DECLARATION

I Luke Nyakarahuka declares that this study is mine, original and has not been submitted for any other degree award to any other university before.

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Date…………………………………………………..

Approval by Supervisors
This dissertation has been submitted for examination with the approval of the following supervisors

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   Date……………………………………

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   Signature………………………………

   Date……………………………………

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DEDICATION

I dedicate this work to my Mother Harriet Namara Katuleebe
ACKNOWLEDGEMENT

I would like to acknowledge the following who helped me accomplish this work.

1. The Principle Investigators of Cystic Echinococcosis Network, especially Assoc. Prof. Ejobi Francis, Assoc. Prof. M. Ocaido and Dr. Ludwig Seifert for selecting me for scholarship on CE project. This project paid my tuition and funded this research.

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### Abbreviations and Acronyms

<table>
<thead>
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<th>Description</th>
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<tbody>
<tr>
<td>CE</td>
<td>Cystic Echinococcosis</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization of the United Nations</td>
</tr>
<tr>
<td>NTD</td>
<td>Neglected Tropical Diseases</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<tr>
<td>CT</td>
<td>Computed Tomography</td>
</tr>
<tr>
<td>TB</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>DALYS</td>
<td>Disability Adjusted Life Years</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid</td>
</tr>
<tr>
<td>PCR</td>
<td>Polymerase chain reaction</td>
</tr>
<tr>
<td>RFLP</td>
<td>Restriction fragment <em>length polymorphism</em></td>
</tr>
<tr>
<td>MAAIF</td>
<td>Ministry of Agriculture Animal Industry and Fisheries</td>
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OPERATIONAL DEFINITIONS

**Cystic Echinococcosis:** Cystic echinococcosis (CE) is a disease caused by the larval cystic stage (called echinococcal cysts) of a small taeniid-type tapeworm (*Echinococcus granulosus*) that may cause illness in intermediate hosts, generally herbivorous animals and people who are infected accidentally.

**Pastoral Communities or Pastoralism** is a practice concerned with the raising of livestock. It is animal husbandry: the care, tending, and use of animals such as camels, goats, cattle, yaks, llamas, and sheep. It may have a mobile aspect, moving the herds in search of fresh pasture and water.

**Zoonosis:** Zoonosis, also called zoonotic disease refers to diseases that can be passed from animals, whether wild or domesticated to humans.
ABSTRACT

Background. Cystic Echinococcosis (CE) is a zoonotic neglected tropical disease (NTD) caused by larval stages of *Echinococcus granulosus* strains. It is a visceral disease that is difficult to diagnose and causes disability including brain damage, epilepsy, severe liver disease, and fatalities. The WHO lists Uganda as one of the countries with high endemicity of disease. An average of 20 surgical cases were reported annually in hospitals in Northeastern and Western Uganda from 1990-2003. The disease is common among pastoralists; however, neither the knowledge nor the community perceptions and practices have been studied in Uganda and the Ministry of health does not prioritize the disease in its control strategies. This study aimed to determine the knowledge, attitudes, and practices of pastoral communities in Kasese district, Western Uganda towards CE.

Materials and methods: In this cross-sectional study, a sample of 384 respondents was obtained from all nine sub-counties in Kasese district with pastoral communities. A semi-structured questionnaire, key informant interview, focused group discussion (FGD) guides and GPS were used to collect data on knowledge, attitude and practices and spatial distribution of respondents. Data was entered in Epi Info® and exported to STATA 11.2 for analysis. Logistic regression was used to calculate odds ratios and for multivariate analysis.

Results: Out of the 384 respondents, only 3.9% knew about CE, 10.7% and 6.7% had seen the disease in man and animals respectively, only 36.9% perceived themselves at risk of acquiring CE. Practices identified as potential risk factors for CE included dog ownership (64.0%), presence of stray dogs (99.2%), no de-worming of dogs (91.7%), home slaughtering (82.8%), no hand washing (89.3%), no water boiling (78.9%), and feeding uncooked infected organs to dogs (54.4%). Close association with dogs, home slaughtering of animals and education levels, were negatively associated with knowledge while religion, meat inspection water boiling and hand washing were positively associated with knowledge about CE. FGDs revealed that people think CE is caused by witchcraft.
Conclusion: The knowledge about CE is still very low and predisposing factors are many in pastoral Communities. There is need for community education for NTDs and CE targeting behavior change towards prevention of zoonotic NTDs.
CHAPTER ONE

INTRODUCTION

1.1 Background
Echinococcosis is a disease caused by larval stages of a small taeniid tapeworm in animals and human beings. It is also known as hydatid disease or hydatidosis. The intermediate hosts are mainly herbivores with man as an accidental host while the definitive hosts are mainly dogs and other canids. This makes Cystic Echinococcosis an important parasitic zoonotic Neglected Tropical Disease (NTD)

The disease has two main recognized forms; cystic echinococcosis (CE) caused by different species *Echinococcus granulosus* complex and alveolar echinococcosis caused by species *Echinococcus multilocularis*. Other species include, *E. oligarthra*, *E.vogeli*, *E. shiquicus.* Recently, a new species of Echinococcus, *E. felidis* was discovered in Kasese district (Huettner et al., 2009).

CE has worldwide distribution, but is more important in developing countries where there is poor sanitation and people live in close proximity with each other and animals (Anderson, 1997). It has been reported by Magambo et al (2006), that cystic Echinococcosis is endemic in East Africa especially in nomadic pastoral tribes. An average of 20 surgical cases per year has been seen in hospitals in Karamoja and Mbarara in Uganda in the last 10 years (Inangolet et al, 2008). The WHO lists Uganda as one of the countries with high endemicity of cystic Echinococcosis (WHO, 2010).

In Uganda especially around pastoral communities, many people own dogs in their homes for hunting, companionship, and security. A close interaction of dogs and human beings can increase the risk of transmission of cystic Echinococcosis especially where hygiene and sanitary conditions are poor (Menkir et al, 2008). Echinococcosis is one of the neglected diseases especially in the developing countries and hence given less attention. Peoples practices, attitudes, and knowledge about echinococcosis plays a significant role towards its spread, yet little is known about these in Uganda. This study therefore, was aimed at giving information on knowledge, attitude and practices which will act as a basis for further research and help in designing health education messages for behavioral change.
1.2 Problem Statement

Echinococcosis is a major parasitic zoonotic disease. It is a neglected tropical disease, which affects the poorest population living in remote, rural areas, urban slums and in conflict zones (WHO, 2009). As the case with other neglected tropical diseases, echinococcosis has a low profile and status in public health priorities. The WHO estimates that about one billion people are affected by neglected tropical disease. Echinococcosis affects the socio-economically disadvantaged of the world. It affects both humans and animals, hence zoonotic in nature.

In humans, it causes morbidity as a result of parasite larval stages in the liver, lungs and the brain. This leads to clinical signs because of mass effects, allergic reactions or through tissue necrosis/fibrosis. This impact on human health and economic costs in terms of monetary costs at diagnosis and treatment. It can also lead to permanent disability or death. However, the broad effects of the diseases on persons/patients affected by the disease are not known or have been ignored (Schantz, 2005). Globally, 3.6 million DALYs could be lost due to Echinococcosis (Craig et al., 2007). With the introduction of imaging techniques, echinococcosis has been found to be very high global public health burden.

Echinococcosis causes collateral economic damages to the poor rural farmers because it affects livestock. This occurs as result of condemnations of the affected organs such as the liver. Echinococcosis also leads to poor animal health and production which ultimately leads to economic losses to livestock owners. Infection with *E. granulosus* results into 10% reduction in the life performance of the animal in terms of meat quality, fiber production, milk production and number of surviving off springs (Heath et al., 2006).

Despite all the above effects, there is scanty information on the Echinococcus situation in Uganda. Owor and Bitakiremire (1997) reported cases of hydatidosis in Karimajong, Lango and Acholi people. There is need for more information on the prevalence, distribution and the risk factors for echinococcosis in Ugandan people and animals. The zoonotic potential needs to be assessed and the impact of echinococcosis in Uganda especially in pastoral communities that interact closely with dogs, livestock, and wild life. There was need to identify what are some of the practices that perpetuate the condition in Uganda, we do not know the knowledge levels and attitude towards CE in Uganda. There was an information gap that needed to be filled. The study establishes practices and
knowledge gaps that contribute to the spread of this disease, which could ultimately lead to instituting preventive measures.

1.3 Conceptual frame work
Figure 1 is the summarized conceptual framework in form of an epidemiological triad.

![Conceptual framework diagram]

**Figure 1:** Conceptual framework

From the conceptual framework above, it can be seen that CE is influenced by both environmental, host and agent factors as demonstrated by the epidemiologic triad above. This means that control measures need a multidisciplinary approach where both medical and veterinary sectors have key roles to play.

1.4 Objectives of the Study

1.4.1 General Objective
To assess the knowledge, attitudes and practices of pastoral communities in Kasese district towards Cystic Echinococcosis.
1.4.2 Specific objectives

- To establish knowledge gaps about Cystic echinococcosis among pastoral communities in Kasese district
- To determine the attitudes of pastoral communities towards Cystic echinococcosis in Kasese District
- To determine practices associated with the spread of cystic echinococcosis in Kasese district

1.5 Significance of the Study

This study is part of the CE Consortium looking at Cystic Echinococcosis in East and Central Africa with partners from Germany. In conjunction with other components of the consortium, this study was important in the following ways:

- Provided baseline information and create hypotheses that will provoke further research in Echinococcosis.
- It helped in prioritizing echinococcosis, which has been a neglected tropical disease when assessing the disease burden both nationally and internationally.
- It helped in publicizing the burden of echinococcosis to the public health sector, the government, and the policy makers so that echinococcosis can be given attention when planning.
- This study has brought together medical establishments, public health sector and Veterinary /Agricultural sector in Uganda to work together for effective control of Zoonotic diseases.
CHAPTER TWO
LITERATURE REVIEW

2.1. Species that cause Echinococcosis

Echinococcosis (hydatid disease) is the infection of humans and animals caused by the larval stages of taenid (tapeworm) cestode of the genus *Echinococcus*. Five species have been recognized, but four are of public health concern; *E. granulosus*, *E. multilocularis*, *E. vogeli*, and *E. oligarthrus*. *E. granulosus*, *E. multilocularis*, and *E. vogeli* cause cystic, alveolar, and polycystic echinococcosis respectively. *E. granulosus* is the most encountered cause of echinococcosis while *E. oligarthrus* is a rare cause of disease in humans. The most important zoonotic species are *E. granulosus* and *E. multilocularis* (Magambo et al., 2006)

The concept of strains is controversial within the species of *E. granulosus* (Maillard et al., 2006). The most common worldwide zoonotic strain is that of the domestic sheep (GI) genotype. In Africa, its mainly GI strain of *E. granulosus* that is dominant. The camel strain, G6 is only found in Africa (Jenkins et al., 2005). The camel strain, G6 Genotype has been shown to become of major public health significance in Turkana region in Kenya (Casulli et al, 2009). Other genotypes include E. ortleppi and E. canadensis. The Zoonotic potential of the horse strain (G4) *E. Equinus* and that of the wild strain, *E. shiquicus* is not yet well understood (Craig et al, 2007). Most human cases of CE in Sub-Saharan Africa are caused by the sheep strain (GI) and camel strain (G6) of *E. granulosus*. Other strains occurring in the area may include a lion strain, the horse strain (G4 or *Echinococcus equinus*) and the cattle strain (G5 or *Echinococcus ortleppi*) (Magambo et al, 2006). Heuttner et al (2009) confirmed the presence of *E. felids* in loins in Uganda of which the warthog was a possible intermediate host. This species did not occur in livestock samples from Kenya.

2.2 The life cycle of *Echinococcus granulosus*

The adult stage affects several final hosts such as domestic dogs, wild carnivores such as foxes, coyotes, wolves, and jackals. The adult worm lives in the small intestines of the definitive hosts and is about 3 to 6 mm long. Gravid proglottids release the eggs that are spread in the feces of carnivores. Intermediate hosts include sheep, cattle, swine, goats, equines, camelids and cervids. These get the infection by ingesting infective eggs during grazing or feeding. Within the intermediate hosts, the eggs hatch in the small intestines and release an oncosphere that penetrates the intestinal
wall and migrates through the circulatory system into various organs, especially the liver and lungs (WHO, 2009). In these organs, the oncosphere develops into a cyst that enlarges gradually, producing protoscolices and daughter cysts that fill the cyst interior. Carnivores get the infection by feeding on the raw materials from the intermediate hosts, mainly the visceral (Morar, 2003). After ingestion, the protoscolices evaginate and attach themselves to the mucosa and develop into adults in 30 to 80 days. Like the intermediate hosts, man acquires the infection by ingesting infective eggs (Figure 2).

**Figure 2:** The life cycle of *Echinococcus granulosus*. (Source: CDC, 2011)

### 2.3 Epidemiology of Cystic Echinococcosis

#### 2.3.1 Transmission of Echinococcosis

Various factors perpetuate the transmission and endemicity of echinococcosis. They can be biological, demographic and culture risk factors that are facilitated by husbandry systems. This is the reason why it has been associated with sheep production systems mainly in South America. Lack of
drinking water and utilities, combined with low levels of education and poor sanitary conditions increases the transmission of disease (Cairo and Pilar, 2007)

The WHO reports the disease is maintained by the dog-sheep-dog transmission cycle indicting home slaughtering as risk factor. Dogs never show any clinical signs so they are perfect carriers since they remain completely health. The eggs are mainly located on the surface of the feces and can accumulate in the perennial regions of the dog where they can be carried to any parts of the body of the dog. Hence direct contact with dog is high risk factor as well as consumption of vegetables and water contaminated with infected dog feces. People are also infected after the consumption of contaminated fruits or by hand-to-mouth transfer of tapeworm eggs from dog feces. The eggs can also be inhaled, causing primary lung disease (Morar, 2003). Sheep, goats, bovines and pigs are usually contaminated after the consumption of grass containing eggs of the parasite. The well known factor in transmission of the disease is the feeding of infected material (hydatid cysts) to dogs by pastoral communities and other rural communities where backyard slaughtering (home slaughtering) is done. In endemic areas, hunting dogs are often fed the raw viscera of backyard slaughtered animals (Cairo and Pilar, 2007; Craig et al., 2007; Jenkins et al, 2005; Bisaro, 2007). Dogs scavenging on the carcasses of intermediate hosts are also important in the transmission of the parasite (Jenkins et al, 2005). Predator-prey associations play and important role in the transmission of the disease as well as human behavior and traditional animal husbandry practices. As dogs can get infected with the wild species, they constitute a grater reservoir for echinococcosis (Craig et al., 2007). E. granulosus has got both sylvatic cycle involving domestic dogs and wild rodents as well as domestic cycle

Echinococcus eggs can be scattered in the environment by wind, water and insects where they are ingested by various hosts. The eggs survive several days outside, depending on the temperature, but numerous eggs die in nature because they cannot resist desiccation and extreme temperatures (Bisaro, 2007). Eggs passed out in the feces can stick to the animal’s fur or to grass. These eggs can survive for at least a year in the outside, during which time they are widely dispersed. Flies help to spread the eggs, as does the wind (Morar, 2003).

2.3.2 Factors associated with Echinococcosis

High endemicity of echinococcosis is found in both transhumant and nomadic pastoralists who occupy the arid and semi-arid areas of sub-Saharan Africa and keep large herds of livestock (sheep, goats, cattle, camels, and donkeys). These include the transhumant Fulani in Nigeria and the nomadic
pastoralists of Eastern African (Maasai, Turkana, Karamajong, Toposa and Nyangatom) (Magambo et al, 2006). It is high in the Turkan region because of the closes association of dogs with the population and the habit burying their dead bodies in forest (Bisaro, 2007).

Several authors have put several risk factors forward. Carol et al (2005) suggested some of the factors. These included; agricultural workers, livestock ownership, herding occupation, living in a rural area, being illiterate, having contact with dogs, nomadism, overgrazing conditions, age and gender (women).

Craig et al (2007) reported that all pastoral regions from arid to temperate and highland plateau where mainly sheep, but also bovids, camelids and other livestock support domestic cycles of the parasite with a resultant risk of exposure to humans. The risk of acquiring hydatid disease during short-term recreational travel is negligible. Most cases of hydatid disease seen in non-endemic areas occur in immigrant populations.

Yang et al (2009) reported that owning dogs was a risk factor for developing both cystic echinococcosis and alveolar echinococcosis in China. Deforestation for agricultural activities increases the risk of acquiring the wild forms of echinococcosis as it increases the number of rodents. Stray dogs not only increase the risk to E. granulosus but also to E. multilocularis when they feed on roaming rodents.

Magambo et al (2006) showed the risk factors for transmission of echinococcosis in East Africa include presence of the parasite in the dogs, behavioral interactions of humans with dogs, heterogeneity of the parasite and the susceptibility of the humans. Sheep and goats seem to be the most important intermediates in Sub-Sahara African.

The work done by Ernest et al (2008) in Tanzania showed a high percentage of fertile cysts in goats and sheep hence emphasizing their importance in the transmission of the disease. Questionnaire survey in the same area revealed that only 17.2% of the respondents were aware of hydatidosis but none of them was knowledgeable on its transmission. Up to 84.4% of the respondents had domestic ruminants and donkeys, while 89.1% had dogs. Of the households with dogs, only 19.3% had their dogs dewormed at least once in lifetime. Most of the households (87.7%) had their dogs managed.
freely and 77.2% of the respondents reported schoolchildren to be the closest friends of dogs in the family.

In a study done in Ethiopia by Nigatu et al (2008), the following factors were responsible for the perpetuation of the disease. Cultural and social taboos that favor close association dogs with human beings. Almost all cattle owners had one dog and no deworming was repotted. Backyard slaughtering of animals and slaughtering animals along the roads was common. There was a wide spread tradition of giving dogs uncooked offals, poor public awareness of the disease and improper disposal from the slaughter houses which allows easy access to carnivores. There was also a habit of disposing dead domestic or wild animals leaving them open hence allowing the maintenance cycle. Sheep, which were found to have a high infection rate, are never brought to the abattoir, they show the highest number of backyard slaughtered animals (Nigatu, 2008)

According to Ndirangu et al (1999), sheep and goats are animals most commonly slaughtered in parties and festive where meat inspection is difficult, yet these two species showed a highest viability and fertility of hydatid cysts as compared to other livestock

In Morocco, egg transmission is enhanced by many factors such as the high dog population, estimated to about 2 millions, the role of dogs in guarding livestock and farms and the close contacts with humans and livestock particularly in rural areas. In addition, 80% of dogs are free and roam during the day, during the night or all the time. The high number of stray dogs in the villages and the suburbs of cities is also a major factor in the transmission. The high percent of people without any knowledge about the disease and the route of its infection is another risk factor (Rkia and Allal, 2006)

2.3.3 Echinococcosis as zoonosis

Echinococcosis is a non-vector borne zoonosis. It is also a stage two zoonosis, which is not transmitted between humans. It has animal host reservoirs, which are dogs, domestic livestock, and wild life (Craig et al., 2007). Echinococcosis was described by Matossian (1995) and other as cyclozoonotic infection with species *E. granulosus* and *E. multilocularis* being most important. Because man can get the infection from both wild and domestic animals, and the parasite cannot be directly transmitted between humans, it is regarded as a cyclozoonosis (Craig et al, 2007).

Budke et al lists echinococcosis as one of the most important parasitic zoonoses. Parasitic zoonoses have been documented as one of causes of human suffering and are of veterinary public health
importance (Carlos et al., 2005). Craig et al (2007) documented echinococcosis as a major zoonotic larval cestode mainly caused by *E. granulosus* and *E. multilocularis*. They reported that the disease is maintained by reservoirs, which are domestic livestock, dogs, or wildlife. Echinococcosis is one of non-prioritized neglected non-vector borne zoonotic infections. Others in this category include rabies, brucellosis, anthrax, and leptospirosis. The zoonotic risk is exacerbated by adaptation of the parasite to the synanthropic life cycles involving dogs and livestock hence creating host parasite relationships.

2.4. Echinococcosis as public health burden

Only recently, the World Health Organization included echinococcosis as part of Neglected Zoonoses subgroups for 2008-2015 strategic plans for the control of Neglected Tropical diseases (NTDS). The disease is also being included in the review of the Global Burden of Disease. Unlike other NTDS whose clinical signs can easily be appreciated or diagnosed, echinococcosis requires a high index suspicion and confirmatory imaging techniques. Where these techniques have been used, the burden of diseases is high.

Despite its worldwide distribution, the highest public health burden is in the tropics. The species of public health importance are *E. granulosus*, which causes Cystic Echinococcosis (CE), and *E. multilocularis* that causes Alveolar Echinococcosis (AE) (Budke et al., 2009).

Many authors have reported echinococcosis as public health problem. The research done in Latin America showed that echinococcosis is an important public health problem. Because of its chronic course of progression, it causes various degrees of handicap, and even death. The people usually affected are rural workers and their family, people that live in small towns or impoverished town belts, migrants from rural towns that often settle in extremely poor neighborhoods. These groups of people have high level of unfilled needs with severe social fragility (Ciro and Pilar, 2007).

The disease causes long-term ill health of persons who are either on long-term treatment that is expensive or affected by the untreated disease. Even after treatment, individuals’ long-term quality of life affected by echinococcosis remains permanently affected. In a study done by Budke et al (2009) showed that individuals who were previously unaware that they have echinococcosis, and later diagnosed, showed a reduction in the quality of life. It affects the socio-economically poor of the world
It is not easy calculating the burden of zoonotic disease like echinococcosis because of the animals’ health losses and human health impacts. This is further complicated by the interaction of the domestic dogs, livestock, and wildlife in the life cycle of the parasite. There is also gross under-reporting on the levels of morbidity mortalities associated with echinococcosis in endemic regions (Craig et al, 2007).

The WHO has suggested the DALYs (Disability Adjusted Life Years) which is health years (whole years or fraction) of life lost due to a particular pathogen or disease. However establishing the indices for echinococcosis is not easy because records are not always kept and accurate, and there is gross under reporting of the diseases. The burden of the disease is best determined using surgical incidence rates or ultrasound-based prevalence rates (Craig et al, 2007).

Work done by Budke et al (2009) in China found that the DALYs lost in terms of medical treatment cost, lost income, physical and social suffering were significant. This decrease in the quality of life impacts on the economy in many ways. These include impairment in the workplace leading to low high paying work, absence from duty or requiring long nursing care (Schantz, 2005). CE cause as much as DALYs lost as other well-known NTDs such as Chagas disease, dengue, onchocerciasis, and trypanosomiasis. Echinococcosis cause serious morbidity as reported by Budke et al (2009).

Crude estimates in 1990s showed that 2-3million cases of echinococcosis occurred at one time in the world. Allowing 10% under-reporting, the total global burden was estimated to be 1,009,662 DALYS lost due to human CE. This was similar to the total DALYs lost due to Ochocerciasssis and American trypanasomiasis and slightly lower than the total number lost due to African Trypanasomiasis (Budke et al 2009). Craig et al (2009) estimates the number of cases presently to be 1.2 million cases equivalent to 3,600,000 lost DALYs. Multiple echinococcosis is becoming a challenging problem in children in Tunisia (Brahim et al, 2008). Several suggestions have been put forward to suggest why Echinococcosis has remained unrecognized despite this public health burden.

One is such reason is difficulty in diagnosis. Whereas new diagnostic techniques have come up, the population at risk does not have financial and physical access to these diagnostic technologies. For example, the information known in nomadic pastoralists in Turkan region in Kenya is because of
dedicated researchers. Another reason is the chronic nature of the disease where clinical signs can develop after five to ten years. This long incubation period makes echinococcosis look less dire than then infections with short incubation period especially in governments dealing with a myriad of public health crisis. In addition, unlike other diseases with acute outbreaks that result in national and international media coverage, echinococcosis is never publicized, hence no outcry from the affected populations to put the sitting governments on pressure to effectively control the infection. Since it also affects livestock, there is a possible tendency for the public health sector to think that disease is a mandate of the Veterinary/Agricultural sector.

As with humans, the disease is insidious in animals without showing recognizable clinical and as a result many farmers do not recognize that they have the problem. A third reason for the neglected status of echinococcosis could be the difficult in treatment which is long term and often only partially effective. This require long term treatment which is lacking in the developing countries (Budke et al, 2009)

Craig et al (2007) suggested several reasons as to why echinococcosis is still not in the spotlight of governments or regional authorities. These include it being non-vector born and chronic, difficulty in diagnosis and treatment, its occurrence in resource poor who usually interact with domestic dogs and lack of cooperation between medical and veterinary sectors.

2.5 Challenges in control and prevention in East Africa

A study done by Kang in Kenya showed the postmortem meat inspection has a positive effect on the control of echinococcosis (Kang, 2000). He further suggests provision of inspection services especially to the pastoral communities and training of individuals involved in home slaughtering to identify the cysts and disposal them properly. This person would be required to move with the manyata as is goes to another place. This should be harnessed with elders’ knowledge on what they consider as safe meat for effective control of the disease i.e. involving and training the community in identification and disposal of cysts is important in the control of the diseases. Reducing the biomass of the parasites without adequate community education and involvement will not help in the pastoral communities (Kang, 2000).

Nigatu et al (2009) recommends enforcement of legislation that will put an end to backyard and roadside slaughtering practices, establishment of policy on dog keeping and handling including registration, treatment and elimination of stray dogs, promoting construction of abattoirs with their
appropriate disposal pits particularly in rural areas and conduct an obligatory meat inspection services (Nigatu et al, 2009).

Prevention of cystic echinococcosis in East Africa can also be achieved by avoiding close contact with dogs. Careful washing of fresh produce can also reduce infection. Prohibition of home slaughter of sheep and proper offal disposal prevents dogs from consuming infected viscera, thus disrupting the life cycle of the parasite. Elimination of stray dogs and surveillance techniques, involving either diagnostic purging of dogs or coproantigen tests, has helped to reduce infections in some endemic areas. Vaccination is also a prospect for prevention of echinococcosis, since protective immunity develops in intermediate hosts (Morar, 2008). Goats and sheep should be part of control strategy East Africa since their cyst show a high viability and fertility (Ndirangu, 1999).

Control of hydatidosis is less effective without the support of dog-owners, and this support can only be obtained if the people have a clear understanding of the life cycle of the hydatid parasite(s) and what risk factors contribute to human infections. Dissemination of this information is the biggest challenge for hydatid control. Participatory planning between dog-owners and community leaders should evaluate the possible control technologies, and should enable a choice of those aspects that suit the sociology and economic status of the particular community. Collection of baseline data is essential, as is on-going surveillance.

According to Magambo et al (2006), the main constraints for cystic echinococcosis control in Turkana include the nomadic nature of the Turkana community and their neighbors, lack of long term funding and government support, failure of the community to adopt control measures due to presence of other myriads problems related to poverty. Other suggested measures include establishment of well-equipped standardized abattoirs, creation of public awareness in terms of knowledge of zoonotic importance of echinococcosis/hydatidosis and control of stray dogs in order to minimize the risk of acquiring the two most important zoonotic diseases (hydatidosis and rabies) are paramount importance(Kebede et al., 2008).
3.1 Study Area

The study was conducted in Kasese District. This district is located in western Uganda. It lies between latitudes 0° 12’S and 0° 26N; longitudes 29° 42’E and 30° 18’E. Kasese district is bordered by Bundibugyo in the North, the North East by Kabarole, to the South East by Kamwenge, to the South by Bushenyi and to the West by the Democratic Republic of Congo. Kasese District has a total surface area of 3,389.8 square kilometers, of which 2911.3 square kilometres (86 per cent) is dry land, 409.7 square kilometers (12 %) is open water, and 68.8 square kilometers (2 per cent) is permanent swamp/wetland. About 63 per cent of the land area (1834.6 square kilometres) is occupied by nature and wildlife conservation schemes; and other government projects such as prison farms, mining institutions and irrigation farming. The population density in Kasese is 183 persons per square kilometre (450 persons per square kilometre in the area actually occupied by people) (Figure 3).

Kasese district has 24 lower Local Governments; of which 20 are rural sub counties and 4 are town councils. The district has two counties (Bukonzo and Busongora), 4 Parliamentary constituencies namely Bukonzo West, Bukonzo East, Busongora North, Busongora South. The population of Kasese is estimated to be 646,677. Of this, 51% (329,805) are females and 49% (316,872) are males. This population is projected from the population census of 2002 with a growth rate of 3.6%, where Kasese had 523,033 people, which was 2.1% of the Ugandan total population. With this population, there is an estimated 133,992 households with an average of 4.9 people per household. The disease burden of Kasese district shows intestinal worm ranking number three in the disease burden with malaria and Acute Respiratory Infections ranking number one and number two respectively.
Figure 3: Location of Kasese district and the two counties of Busongora and Bukonzo. Source: Kasese district website (www.kasese.go.ug/)

Coordinates were collected using a GPS. A map of studied sites was drawn as shown in figure 4.

Figure 4: A map showing studied sites mapped using the ArcGIS technology
3.2 Study population

The study population was household heads within pastoral communities in Busongora and Bukonjo Counties. Kasese is a multi-ethnic district with many people of different ethnic backgrounds. The main languages and ethnic groups that dominate the area are the Lukonja and Lutooro of the Bakonjo and Batooro people respectively. Nevertheless, there are also other groups in the district who include the Banyankole, Basongora and Bakiga. There is also common usage of English, Swahili, and Luganda.

3.3 Research Design

The study design was a cross-sectional survey, which was descriptive in nature. Both qualitative and quantitative data were collected.

3.4 Sample size Determination

A formula adapted from Thrusfield (2001) was used which states that;

\[ n = \frac{1.96^2 \cdot P_{\text{exp}}(1-P_{\text{exp}})}{d^2} \]

Where:

- \( n \) = require sample size
- \( P_{\text{exp}} \) = percentage of picking a choice, expressed as decimal
- \( d \) = desired absolute precision

Assumptions:

- 95% confidence interval
- Allowable error \( d \) is 5%

Assuming a 50% proportion of knowledge about CE(http://www.surveysystem.com/sample-size-formula.htm)

Where \( p=0.5 \)

Substituting in the formula

Therefore:

\[ n = \frac{1.96^2 \cdot 0.5(1-0.5)}{0.05^2} = 384.16 \]
3.5 Sampling procedures

For the study of factors, a purposive sampling procedure was used to administer a questionnaire. This was because the study was mainly interested in people who practice pastoralism. Data were collected from areas where we expected exposure factors such as people with animals or households near conservation areas or those who take animals to graze in the parks. These were mainly the Basongora pastoral communities.

3.5.1 Inclusion and Exclusion Criteria

All adults that were 18 years of age and above were included in this study. These had to be household heads in pastoral communities of the study sites. Children and the very elderly were excluded from this study.

3.6 Study Variables

3.6.1 Dependent variables

- Practices/factors associated with spread of CE
- Knowledge about CE
- Attitude towards infection with CE

3.6.2 Independent variables

- Sex of study participants
- Age
- Occupation
- Level of education
- Animal keeping
- Animal management system
- Dog ownership
- Using dogs to guard livestock
- Dog confinement
- Interaction of human with dogs
- Deworming of dogs
- Home slaughtering
- Meat inspection
- Feeding of dogs with cysts
- Handling of dog fecal matter
- Vegetable (raw) consumption
- Hand washing
- Water treatment
- Source of water

### 3.7 Data collection methods

#### 3.7.1 Quantitative Data

Trained research assistants collected quantitative data from household respondents using structured questionnaires. The structured questionnaire collected data on socio-demographic characteristics as well as attitude, practice, and knowledge gaps. The questionnaire was pre-tested first Kiruhura district pastoral communities near Lake Mburo National Park. Since the disease does not have a specific local name, pictures of infected human beings and cysts in animal organs were used to explain to participants. The implication of this was that there could have been a misclassification of the responses.

#### 4.7.2 Qualitative data

Qualitative data was collected using focus group discussions (FGDS), key informant interview guides, and observation checklists. This was used to supplement the data (triangulation) that was collected quantitatively. A total of 4 key informant interviews and 3 FGDs were done for this research. Data were collected by note taker and by voice recording in order to capture all the discussions. Since the disease does not have a specific local name, pictures of infected human beings and cysts in animal organs were used to explain to participants.

### 3.8 Data Management and Analysis

#### 3.8.1 Quantitative Data management

The collected data were coded, entered using Epi Info statistical analysis computer package Version 3.2.2. Data cleaning was done using Excel spread sheet and later exported to STATA 11.2 program for analysis.
Knowledge and attitude were measured as binary outcomes. Individuals were asked whether they know the disease or not, hence this was a Yes or No question which is binary. Attitude was measured as being poor or good. This was assessed by asking if an individual thinks is at risk of acquiring the disease or not. Those who responded that they are not at risk of acquiring the disease were categorized as having poor attitude and vice versa.

Univariate analysis was done to generate frequencies, proportions for categorical variables. Bivariable analysis was done to test association between two variables; one dependent variable and one independent variable. This was done using logistic regression since most of dependent variables were binary.

The logistic regression technique was also preferred to other techniques because it generates Odds Ratios (ORs) that are easy to interpret with their corresponding p-values and 95% confidence intervals, which are used to assess for statistical significance. A multivariate logistical analysis was also done to determine the factors associated with knowledge and attitude towards the disease. ORs were computed for the three outcomes with the various socio demographic characteristics. At multivariate level, independent variables that were significantly associated were run simultaneously with the specific outcome. The main unit of analysis was and individual at household level. The data were presented in narrative texts, tables, and figures.

3.8.2 Qualitative Data management

All qualitative data was translated into English. It was analyzed manually using the latent content analysis where notes from the field and transcriptions were read through, themes, and categories generated. These were always compared with the original transcripts to avoid data loss and for consistency. A report was generated according to thematic areas and incorporated with quantitative results.

3.8.3 Quality control

The tools were pretested and refined for actual data collection. The research assistants were trained on how to use the tools. The tools were not self-administered, and both the principle investigator and research assistants new the the local language, so there was no need to translated the tools into local language. During data collection, the principle investigator held meetings every day to discuss the completed questionnaire and other issues that were coming up during fieldwork.
3.9 Ethical Consideration

Approval was obtained from Makerere University School of Public Health higher degree Committee and its Institutional Review Board (IRB). Permission was got from Kasese District Authorities and information about benefits and risks of participating into the study were communicated to each participant. Consent was obtained from the participants verbally and confidentiality was ensured as the information collected was used for research purposes only.
CHAPTER FOUR

RESULTS

4.1 Socio-demographic Background

Table 1 presents percentages of socio-demographic factors. All participants were adults with the age group of 39-48 having the highest percentage of 49.7% (191/384). Most of the participants were male with 77% (296/384) while Anglican were 58.9% (226/384) and catholic with 21.6% (83/384) were the most predominant religions. Most of the study participants were from Busongora County with 88.3% (338/384), although not all the participants were Basongora by tribe. The major occupation was pastoralism with 54.6% (238/384) followed by peasant with 22.8% (28/384). On education, 47.5% (113/384) of the participants had never attended any formal education, 29.5% had stopped in primary while 17.5% and 5.5% had attended secondary and tertiary respectively.

Table 1: Socio-demographic Background

<table>
<thead>
<tr>
<th>Variable</th>
<th>Characteristic</th>
<th>Frequency (n=384)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in full years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18-38</td>
<td>124</td>
<td>32.3</td>
</tr>
<tr>
<td></td>
<td>39-59</td>
<td>191</td>
<td>49.7</td>
</tr>
<tr>
<td></td>
<td>60-80</td>
<td>69</td>
<td>17.9</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>296</td>
<td>77.1</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>88</td>
<td>22.9</td>
</tr>
<tr>
<td>Religion</td>
<td>Protestant</td>
<td>226</td>
<td>58.8</td>
</tr>
<tr>
<td></td>
<td>Catholic</td>
<td>83</td>
<td>21.6</td>
</tr>
<tr>
<td></td>
<td>Moslem</td>
<td>33</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>Other religions</td>
<td>42</td>
<td>10.9</td>
</tr>
<tr>
<td>County</td>
<td>Busongora</td>
<td>338</td>
<td>88.3</td>
</tr>
<tr>
<td></td>
<td>Bukonzo</td>
<td>45</td>
<td>11.8</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Musongora</td>
<td>185</td>
<td>48.4</td>
</tr>
<tr>
<td></td>
<td>Mukonzo</td>
<td>68</td>
<td>17.8</td>
</tr>
<tr>
<td></td>
<td>Other tribes</td>
<td>129</td>
<td>33.8</td>
</tr>
<tr>
<td>Occupation</td>
<td>Peasant</td>
<td>87</td>
<td>22.8</td>
</tr>
<tr>
<td></td>
<td>Pastoralist</td>
<td>238</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td>Other Occupations</td>
<td>58</td>
<td>15.1</td>
</tr>
<tr>
<td>Education Level</td>
<td>No formal Education</td>
<td>182</td>
<td>47.5</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>113</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>67</td>
<td>17.5</td>
</tr>
<tr>
<td></td>
<td>Post-secondary</td>
<td>21</td>
<td>5.5</td>
</tr>
</tbody>
</table>
4.2 Knowledge towards Cystic Echinococcosis (CE) in Kasese district

Table 2 represents knowledge levels towards cystic echinococcosis. It can be seen that the knowledge about CE is still very low. Out of 384 respondents, only 3.9 % (15/384) had ever heard or seen hydatid disease (CE), only 6.7% have seen CE animals and 10.7% had seen the CE in animals. CE being a zoonotic disease, people had little knowledge on zoonotic infections with only 11.2 % (n=384) having heard about or know what zoonoses are. Participants were aware of the dangers eating food contaminated by dog feces with 89.4 % (337/384), but none mentioned hydatidosis as one of the dangers.

FGDs further revealed a knowledge gap where by participants reported that the disease is caused by witchcraft and that it can only be treated by traditional healers; “this disease can only be treated by a traditional healer who lives near the lake” reported a 54 year old lady in one of the FGDs. Another male-aged 29 years said, “My friend betrayed his friend by not paying back the money he owed him, then after one month, his stomach became large”. Participants reported to have seen the disease both in slaughtered animals and in human. In man, the disease was mainly associated with pregnancy. “You can think some is pregnant,” said one of the women in the FGD. The disease is given a local Ekibaale or Enzimba meaning a big stone in the stomach or swollen stomach.

Key informant interviews with health workers especially surgeons that work in the hospital Kagando and Kilembe hospital revealed that people do not usually take such cases to the hospitals, as they tend to seek traditional medicine. They also reported challenges in the diagnosis of the disease, as they do not have well trained radiologists to diagnose the disease using an ultrasound; hence, they end up missing some of the cases. However, the veterinary officers who do meat inspection in animals reported seeing one case of hydatid disease every two months or more.
Table 2: Knowledge toward Cystic Echinococcosis (CE) in Kasese district

<table>
<thead>
<tr>
<th>Variable for Knowledge</th>
<th>Frequency (n=384)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever heard about Zoonoses</td>
<td>43</td>
<td>11.2</td>
</tr>
<tr>
<td>Ever heard about CE</td>
<td>15</td>
<td>3.9</td>
</tr>
<tr>
<td>Ever been infected by CE</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Ever seen hydatid disease in animal organs</td>
<td>25</td>
<td>6.7</td>
</tr>
<tr>
<td>Has ever seen hydatid disease in man</td>
<td>41</td>
<td>10.7</td>
</tr>
<tr>
<td>Aware of the dangers of eating food contaminated with dogs feces</td>
<td>337</td>
<td>89.4</td>
</tr>
</tbody>
</table>

4.3 Attitudes towards Cystic Echinococcosis

Table 3 shows the assessment of people’s attitude towards CE. Attitude was assessed by asking relevant questions on how participants perceived the disease. Sixty three percent (243/384) of the participants did not perceive themselves at risk of being infected by CE whereas only 10 % (38/384) think that they can get hydatidosis from close association with dogs. There was a lot of stigma on people who would develop this condition with 80.7 % (310/384) of the participants reporting not to associate with CE patients. This was assessed by showing participants pictures of people infected by CE.

Focused group discussions reveled that people think CE is caused by witchcraft and that the disease can only be treated using traditional means, how they could not reveal whether the people that were infected recovered after being treated by traditional healers. No one believed that they could get the disease from close association with dogs. “How can human beings become infected with a disease of dogs” wondered a middle aged lady.
Table 3: Attitudes towards Cystic Echinococcosis

<table>
<thead>
<tr>
<th>Attitude variable</th>
<th>Frequency (n=384)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Think that they are at risk of acquiring CE</td>
<td>142</td>
<td>36.9</td>
</tr>
<tr>
<td>Think that can get infected with CE from close association with Dogs</td>
<td>38</td>
<td>9.9</td>
</tr>
<tr>
<td>Do not associate with People infected with CE</td>
<td>310</td>
<td>80.7</td>
</tr>
</tbody>
</table>

4.4. Practices of pastoral communities in Kasese district
Table 4 shows the practices that are risk factors for CE from 384 respondents. These included pastoralism (46%), dog ownership (64.0%), and presence of stray dogs (99.2%), grazing of livestock with dogs (71.6%). Others include lack of deworming of dogs (91.7%), close association with dogs (91.2%), home slaughtering of animals without meant inspection (82.3%), feeding dogs with uncooked infected organs (54.4%), no water boiling (78.9%), no hand washing when handling food or when eating light foods (89.3%) and lack of meat inspection at the source of meat (38.6%).

FGDs re-affirmed these factors as reports were not contrary to what was reported using questionnaire. Majority of participants revealed that they do not see inspectors when they are buying meat, they admitted to eating uninspected meat. “Even when the inspectors come, they just stamp and ask for their money and run away,” said one of the butcher men in Mubuku village.

On hand washing, the participants reported that one in ten (1/10) people wash their hands especially when they are going to eat light foods, but most of the people reported to wash their hands without soap especially men. “What’s the use of washing hands with dirty water?” wondered a community leader. Another one noted, “Some people especially men just pass hands in water as a way of washing hands”

On water boiling, the participants gave several reasons why they do not boil water; one elderly woman said, “If you boil water, it loses its sweetness”.

24
Table 4: Practices of pastoral communities in Kasese district

<table>
<thead>
<tr>
<th>Practices</th>
<th>Frequency(n=384)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog Ownership</td>
<td>244</td>
<td>64.0</td>
</tr>
<tr>
<td>Presence of stray dogs</td>
<td>381</td>
<td>99.2</td>
</tr>
<tr>
<td>Grazing dogs with Livestock</td>
<td>275</td>
<td>71.6</td>
</tr>
<tr>
<td>Deworming of Dogs</td>
<td>32</td>
<td>8.3</td>
</tr>
<tr>
<td>Closely associated with dogs</td>
<td>350</td>
<td>91.2</td>
</tr>
<tr>
<td>Home slaughtering of animals</td>
<td>318</td>
<td>82.8</td>
</tr>
<tr>
<td>Meat inspection done at home</td>
<td>10</td>
<td>2.7</td>
</tr>
<tr>
<td>Feeding of dogs uncooked organs from animals</td>
<td>209</td>
<td>54.4</td>
</tr>
<tr>
<td>Dogs feces not disposed-off</td>
<td>367</td>
<td>97.6</td>
</tr>
<tr>
<td>No water boiling</td>
<td>303</td>
<td>78.9</td>
</tr>
<tr>
<td>No hand washing</td>
<td>332</td>
<td>89.3</td>
</tr>
<tr>
<td>No meat inspection at source meat</td>
<td>147</td>
<td>38.6</td>
</tr>
</tbody>
</table>

Appendix 6 shows meat sold under unhygienic conditions. This is an indicator that they are no meat inspectors, otherwise such premises would have been banned from selling meat for human consumption. This is used as an indirect measure of lack of meat inspection services, a factor that is very important in epidemiology of cystic Echinococcosis.

Appendix 7 show cysts caused by *Echinococcus granulosus* in cattle and small ruminants respectively as was found in one of the study sites. Such cyst can occur in man causing disease, the situation is worse if such cysts occur in the brain of human beings. People are infected with such cysts when they ingest food or water contaminated with dog’s feces.

Appendix 8 show close association of dogs with people. A dog sleeping near where children and their mothers were sleeping whereas on the right is a stray dog that contaminates the environment with fecal matter which may contain eggs of echinococcus.
Pastoral communities as shown appendix 9 have been documented to be the most at risk for Cystic echinococcosis. As can be seen from appendix 10, un-protected water sources were found in the study sites. Dogs’ feces, which contain eggs, can be ingested if such water is taken without boiling

**4.5 Statistical modeling for Knowledge, attitudes and practices towards Cystic Echinococcosis**

Using stepwise procedure in model building where by you add and remove variable using predictive models. Models were developed to show the determinants of knowledge and attitude towards CE and find out the most important factors associated with CE. Using the test for goodness of fit (LL test) which can be easily be got using the `lfit` command in STATA software, the goodness of fit was tested iteratively and until a model that best fits the data was got. Once a P-value greater than 0.05 was got, the null hypothesis could not be rejected; and hence the model would be regarded to fit the data. Other tests such as sensitivity tests and log likelihood were used. Although some of the factors included in the model does not make any biological or logical sense and may not be statically significant, they played critical role in the model. The following paragraphs explain some of the models that were conducted.

**4.5.1 Practices associated with knowledge towards CE**

The table 5 below shows the model that was built for knowledge about CE using several independent variables

<table>
<thead>
<tr>
<th>Knowledge about CE</th>
<th>Adjusted OR</th>
<th>Std. Err.</th>
<th>Z</th>
<th>P-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educated</td>
<td>4.32</td>
<td>2.61</td>
<td>2.42</td>
<td>0.016</td>
<td>1.32, 14.13</td>
</tr>
<tr>
<td>Grazing with dogs</td>
<td>0.60</td>
<td>1.01</td>
<td>-0.30</td>
<td>0.763</td>
<td>0.022, 16.43</td>
</tr>
<tr>
<td>Seen CE in man</td>
<td>7.23</td>
<td>11.42</td>
<td>1.25</td>
<td>0.211</td>
<td>0.32,160.12</td>
</tr>
<tr>
<td>Good perception</td>
<td>23.70</td>
<td>35.37</td>
<td>2.12</td>
<td>0.034</td>
<td>1.27, 441.60</td>
</tr>
<tr>
<td>Playing with dogs</td>
<td>0.01</td>
<td>0.037</td>
<td>-1.41</td>
<td>0.159</td>
<td>0.000, 5.62</td>
</tr>
<tr>
<td>Ability to be infected</td>
<td>3.93</td>
<td>7.059</td>
<td>0.76</td>
<td>0.446</td>
<td>0.12, 133.011</td>
</tr>
<tr>
<td>Seen hydatid in animals</td>
<td>88.28</td>
<td>141.20</td>
<td>2.80</td>
<td>0.005</td>
<td>3.84 , 2029.44</td>
</tr>
<tr>
<td>Pastoralism</td>
<td>0.33</td>
<td>0.163</td>
<td>-2.27</td>
<td>0.023</td>
<td>0.13, 0.86</td>
</tr>
<tr>
<td>Own dogs</td>
<td>18.01</td>
<td>34.58</td>
<td>1.51</td>
<td>0.132</td>
<td>0.43, 776.6</td>
</tr>
<tr>
<td>Home slaughtering</td>
<td>0.09</td>
<td>0.155</td>
<td>-1.43</td>
<td>0.151</td>
<td>0.02, 2.37</td>
</tr>
</tbody>
</table>

Logistic model for knowledge of CE, goodness-of-fit test
The probability value above shows that the model best fits the data since its above 0.05. Hence the factors that determine knowledge about CE show from the above model include age, presence of inspectors at source of meat, slaughtering animals at home, dog ownership, animal management system, education level, religion and perception about the disease. Although some variables do not make logical sense (biological plausibility), they make an overall important contribution to the model.

**The final model is:**

\[
\text{Logit } p(\text{knowledge about CE}) = \alpha + \beta_1 \text{age} + \beta_2 \text{Educ} + \beta_3 \text{religion} + \beta_4 \text{pastoralism} + \beta_5 \text{home slaughtering of animals} + \beta_6 \text{dog ownership} + \beta_7 \text{perception about the disease.}
\]

Substituting in the \( \beta \)s, we get:

\[
\text{Logit } p(\text{knowledge about CE}) = -7.932 - 0.011 \text{age} + 0.962 \text{Education level} + 2.172 \text{religion} - 0.65 \text{pastoralism} - 1.597 \text{home slaughtering of animals} + 0.745 \text{dog ownership} + 2.80 \text{perception about the disease.}
\]

### 4.5.2 Practices associated with attitude towards CE

The same procedures (stepwise model building) were used. The results were as follows:

<table>
<thead>
<tr>
<th>Attitude towards CE</th>
<th>Adjusted OR</th>
<th>Std. Err.</th>
<th>z</th>
<th>P-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pastoralism</td>
<td>1.177</td>
<td>0.119</td>
<td>1.61</td>
<td>0.106</td>
<td>0.97, 1.43</td>
</tr>
<tr>
<td>Sex</td>
<td>0.863</td>
<td>0.242</td>
<td>-0.52</td>
<td>0.601</td>
<td>0.49, 1.49</td>
</tr>
<tr>
<td>Seen CE disease</td>
<td>2.640</td>
<td>1.366</td>
<td>1.88</td>
<td>0.061</td>
<td>0.96, 7.27</td>
</tr>
<tr>
<td>Playing with Dogs</td>
<td>3.526</td>
<td>1.982</td>
<td>2.24</td>
<td>0.025</td>
<td>1.17, 10.61</td>
</tr>
<tr>
<td>Deworming Dogs</td>
<td>2.087</td>
<td>0.953</td>
<td>1.61</td>
<td>0.107</td>
<td>0.85, 5.11</td>
</tr>
<tr>
<td>Home slaughtering</td>
<td>0.376</td>
<td>0.125</td>
<td>-2.94</td>
<td>0.003</td>
<td>0.19, 0.72</td>
</tr>
<tr>
<td>Feeding dogs cysts</td>
<td>0.962</td>
<td>0.244</td>
<td>-0.15</td>
<td>0.882</td>
<td>0.58, 1.58</td>
</tr>
<tr>
<td>Knowledge about CE</td>
<td>6.192</td>
<td>5.399</td>
<td>2.09</td>
<td>0.037</td>
<td>1.12, 34.20</td>
</tr>
<tr>
<td>Seen disease in animals</td>
<td>1.288</td>
<td>0.689</td>
<td>0.47</td>
<td>0.636</td>
<td>0.45, 3.68</td>
</tr>
<tr>
<td>Associate with infected people</td>
<td>1.331</td>
<td>0.1546</td>
<td>2.46</td>
<td>0.014</td>
<td>1.06, 1.67</td>
</tr>
</tbody>
</table>

Testing the goodness-of-fit of a model to the data, the following output was got:

**Logistic Model for attitude towards CE, goodness of fit test**

27
Number of observations = 371
Number of Covariate Patterns = 355
Pearson Chi-square = 347.98
Prob>chi2 = 0.3710

The results of the model above show a probability of the Pearson chi-square value above 0.05, hence the model fits the data. From model two above attitude is determined several factors which include age, occupation, tribe, religion tribe, sex, close association with dogs, having knowledge about CE, and others as shown above. Some of these factors contribute positively while others

Attitude towards CE is determined several factors which include age, occupation, tribe, religion tribe, sex, close association with dogs, having knowledge about CE, having seen the animals and man infected with with CE and home slaughtering

Modeling to determine factors influence deworming of dogs, it was found out that educational level, tribe, religion, age, animal management, being aware of dangers of eating contaminated food and association with dogs play a critical role in influencing this behavior.

The factors that determine home slaughtering behaviour include tribe, religion, sex, occupation, animals kept, having dogs in a household, and attitude towards CE as was developed from the model.

From the model the factors that determine the behavior of feeding dogs with uncooked infected organs or cysts include; tribe, religion, sex, age, occupation, education level and animal managements system.

Tribe, religion, sex, age, education level, animals kept animal management system, knowledge of CE and knowledge about zoonoses influenced hand washing

Determinants of water boiling behavior include tribe religion, age, education level, individuals who have seen the disease in man and animals and knowledge about CE and zoonoses.
CHAPTER FIVE
DISCUSSION

5.1 Socio-demographic factors
The socio-demographic factors indicate that all interviewed people are adults of age 18 and above. This was because it was the intention of this study to interview only adult individuals as the inclusion criteria. Adults are more likely to be knowledgeable about CE since it is a chronic disease, however this relationship was not significant with a p-value <0.63 and the fact that the disease is most prevalent in adults 20 years and above (Craig et al, 2007). Age contributed to the overall models that determined knowledge and perception towards CE and to the risk factors for CE.

Out of 384 study participants, 44.4% were the Basongora tribe, but this number was much less than the expected since our target group was pastoral communities that are mainly Basongora. Presence of other tribes shows multicultural interactions that may contribute to complexity of CE. There was no significant association between tribe and knowledge and attitude with a P>0.73. This was contrary to what other authors have found such as Schantz (1976), who reported CE to be more popular in American Indian, Zuni and Santo tribes in New Mexico. However, tribe was significantly associated with deworming of dogs. Bankonzo tribe were 4.8 times more likely to deworm dogs (OR=4.8; 95%CI 1.51, 15.23) and other tribes were 6.3 times more likely to deworm dogs than the Basongora tribe was. This means that the Basongora tribe not sensitized about the importance of deworming or they do not access the deworming services. Tribe was also significantly associated with other factors. For example, Basongora tribe is more likely to feed uncooked meat to dogs, they are less likely to wash their hand and boil water for domestic use. The variable of tribe also played a significant role in models that determine knowledge, attitude, and practices towards cystic echinococcosis. The reason we see tribe playing critical role in determining these factors is that different tribes have different cultural practices that act as social determinants of disease. CE is one of the diseases that are socially constructed due to different cultural practices in different tribes like keeping many dogs, keeping a lot of livestock and a culture of preserving stray dogs s reported by Yang et al(2009) in China.

Another socio-demographic factor that was measured was religion, most of the study participants were Christians (90%, n=384) and the rest were non-Christians mostly Muslims. This was significant because we know that religious virtues can determine some practices like most Islam communities do not keep dogs unlike the Christian values. In addition, different religions have different slaughter
habits that can influence the behavior of feeding dogs cysts. For example, strong Tibetan tribes such as Sichuan keep many guard dogs where as strong Buddhists beliefs do not support the elimination of stray dogs (Yang, 2009), such factors have been shown to contribute to prevalence of cystic echinococcosis. Religion was statistically significantly with many variables in this study such as knowledge about CE and perception about CE. Moslems were more knowledgeable about CE (OR=5.6) than other religions. This was consistent with what Youngster (2002) reported in Muslim communities in Southern Israel where the prevalence of CE was found to be very high.

Occupation of an individual has been found to be one of the most important factors in the epidemiology of the CE disease. From this study, out of the 384 participants, 54.6% were pastoralists, 22.5% were peasants, there was only one hunter, and other occupations accounted for only 15%. Pastoralists were the majority because this study specifically targeted pastoral communities where the incidence of CE has been documented by many authors to be high (Macpherson, 1989), (Wang, 2001), (Wachira, 1991), (Craig, 2006), etc. Although pastoralism was predominant activity, it was much lower than the expected level, with most of the people turning into subsistence farmers. Pastoralists were 87% less likely to be knowledgeable about CE compared to other tribes. This is because they are few outreach programs targeting pastoralists to educate them about neglected diseases such as CE. Occupational activity also contributed significantly to determining other behaviors’ such as attitude and perception, hand washing, water boiling and in the models that determine these practices. Peasants for example have been found to be at high risk of developing the disease as shown by Wang (1991) in the Xiji County in China. Whereas Rausch (2003) reported CE in hunters, there was no significant numbers of hunters surveyed in this study.

Among 384 surveyed individuals, 47.5% had no formal education, 29.5 had stopped at primary level, 17% in secondary level and only 5.5 % had reached in tertiary levels. This was an indicator of low literacy levels, which is a risk factor for CE. Although education is important in knowledge acquisition, it was not significantly associated with knowledge about CE. There was no significant difference between different education levels as far as knowledgeable about CE is concerned. This is more likely scenario with neglected tropical disease like cystic echinococcosis, even the educated communities do not usually know about it. However, education played a critical role determining other factors associated with CE such as perceptions about the disease, deworming of dogs, hand washing, water boiling, feeding dog infected cysts, etc. This shows a critical role of education in
controlling the transmission of CE. If education levels are high, they are chances that the transmission level of the disease will be low. The role of education in reducing or controlling cystic echinococcosis has been dully emphasized by Ozcelik, (2007) who designed health education messages to control the disease in Turkey and also Attanasio(1984) in Sardinia

5.2 Knowledge about Cystic Echinococcosis
The reasons for low levels of knowledge about this disease are attributed to poor diagnosis as reported by medical and veterinary personnel. The disease is expensive to diagnose and treat and most of the time, individuals seek out for alternative medicine by going to traditional healers. Knowledge about the disease is very important if its prevention and control strategies are to be effective. With these low levels of knowledge of the disease, it means the population in Kasese district is at risk of developing the disease.

Many Authors such as Moro (2008), Masala (2004), and Neghina (2011) have emphasized the importance of knowledge and education about the CE in instituting control and prevention strategies. It was found out that knowledge about CE is determined by many factors, which include age, presence of inspectors at source of meat, slaughtering animals at home, dog ownership, animal management system, education level, religion, and perception about the disease. This was consistent with findings of Nasrieh (2003) in Jordan. Therefore, to improve on knowledge about the disease, the above factors need to be modified

5.3 Attitude towards Cystic Echinococcosis
Perception about a disease can influence its epidemiology. If people perceive themselves at risk of acquiring the disease, they are more likely to guard against getting the disease and vice versa. Among 384 participants, 63% did not perceive themselves at risk of being infected by CE whereas only 10 % think that they can get hydatidosis from close association with dogs. There was a lot of stigma on people who would develop this condition with 80.7 %( n=384) of the participants reporting not to associate with CE patients. This one still show lack of sensitization on the dangers of CE in pastoral communities of Kasese district. People beliefs about acquiring CE was significant in a study done by Moro et al (2008) in Peru. Therefore, peoples’ attitudes should be changed to influence disease dynamics. According to this study, education was key determinant of perception about the disease (P<0.0000), however other factors that influenced attitude towards CE include people who have seen
the disease (OR=3.82), those who have knowledge about zoonoses (OR=4.7) and home slaughtering (OR=0.3). The rest of the factors were not significant where tested with perception about the disease. This was also documented by Hemachander (2008) who found out that people knew only rabies as a disease they can acquire from dogs. In this study as well, people had no idea of other zoonoses from dogs such as CE.

5.4 Practices associated with Cystic Echinococcosis
Several practices are associated with Cystic Echinococcosis. In studies done by Yang et al (2006), Rafiei (2007), Wang (2005), they all showed that dog ownership was a risk factor for Cystic Echinococcosis, meaning that these pastoral groups in Kasese are at risk of acquiring CE. As was found out in this study, a high population of stray dogs (99.2%) is a significant risk factor of CE. Many areas where CE has been diagnosed also have high levels of stray dogs (Dakkak, 2010). Molan (1993) found 50% prevalence in stray dogs in Iraq. This put communities in Kasese and parts of Uganda where stray dogs exist at risk of developing Cystic echinococcosis. This is coupled by a poor deworming culture of dogs where only 8.3% of 384 participants dewormed their dogs. This means that dogs remain as carriers of the adult worm, hence leading contamination of the environment with fecal matter. Deworming has been shown to significantly reduce the spread of the disease both in dogs and man (Larrieu, 1993). The close association of people with dogs especially children who can acquire this disease when they are still young and signs come later in life further exacerbates this factor.

Among 384, 82.3% were practicing home slaughtering. With this practice, there is no meat inspection and the probability of feeding dogs with cyst is very high. Home slaughtering has been documented as one of the risk factors for cystic echinococcosis (Buishi, 2005). Chu (2010), found the home slaughtering was highly associated with prevalence of cystic echinococcosis (OR=3.2, 95% CI:1.297-7.809. A model was built to find out which factors when combined together determine this behavior of home slaughtering and this included tribe, religion, sex, occupation, animals kept, dog ownership and attitude towards CE.

Hygiene and sanitation status can influence the epidemiology of a disease. Poor hygiene practices such as poor hand washing habits, drinking un-boiled water and eating contaminated food can lead to risk of developing CE (Moro et al, 2008). In this study the hygiene levels were low where by only 4.3 %( n=384) washed their hand when going to eat. On investigating the factors associated with hand
washing, hand washing was positively associated with several factors. All these ORs were statistically significant meaning that to improve on this behavior, we need to modify these factors, and in the process, we are able to reduce the risk of transmission of the disease between different animals and man. A model for factors that determine hand washing include tribe, religion, sex, age, education level, animals kept animal management system, knowledge of CE and knowledge about zoonoses. Almost the same factors play a critical role in determining the practice of water boiling. These findings were consistent with those found out by Yang et al (2006)
CHAPTER SIX
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions
The following are my conclusions from the findings of this study:

- The knowledge about Cystic Echinococcosis is generally very low. Just like many other neglected zoonoses, the residents in Kasese district do not know the dangers associated with the disease, its life cycle and control and preventive measures.
- The attitude about the disease is poor. Many people think that they cannot get infected by the disease and associate it with witchcraft.
- They are many practices or factors that can predispose the pastoral communities of Kasese to infection by Cystic Echinococcosis or people could actually be infected by the disease since some lesions/cysts were found in animals.

6.2 Recommendations
The following are my recommendations:

- Cystic Echinococcosis prevalence survey should be done by Ministries of Health and Agriculture, animal Industry and fisheries of Uganda and other stakeholders to determine the burden of Cystic echinococcosis both human and animal populations in Kasese district and Uganda at large.
- Analytic studies such as case-control studies should be done by research Institutions such as School of Public Health to determine risk factors in Ugandan situation in order to give a direction on the control and preventive measures.
- Sensitization of people, especially pastoral communities on mode of transmission of Cystic Echinococcosis, and how it can be controlled and prevented using Education, Information and Communication (EIC) materials. This should be done by Health Promotion Department of Ministry of Health Uganda.

6.3 Limitations

- The study did not measure the prevalence of Cystic Echinocosis because it needed ultrasound, which was not available at the time, and therefore it could not link the factors to the disease.
- It was also very hard to describe the disease to the participants, unless using pictures which could have compromised the response concerning the disease.
REFERENCES


http://en.wikipedia.org/wiki/Echinococcosis. This page was last modified on 11 July 2011 at 19:41.


APPENDIX

Appendix 1: Consent form for Participants of this study

Name of principle Investigator…………………………………………………………………….
Name of Organization………………………………………………………………………………
Name of sponsor……………………………………………………………………………………

Knowledge, Attitude and Practices towards Cystic Echinococcosis in Pastoral Communities in Kasese District

Introduction and what we are doing
I am………………………… from Makerere University School of Public Health. I am conducting a research on a neglected tropical zoonotic disease called Cystic Echinococcosis(show pictures and explain the disease further). It is aimed at establishing the knowledge, attitudes and practices towards cystic Echinococcus.

Purpose of the Research
This study will be important in designing control measures of diseases caused by parasites and found in dogs and later transmitted to man.

Procedures:
You have been randomly chosen to participate in this research. In order to understand this condition better, you will be asked questions to assess your knowledge and practices. You will not be blamed for anything you say. You choose to accept to participate or not to participate in this interview, but I would be happy if you agree. This interview will take a maximum of 20 minutes.

Risks
The study has no harm but only takes respondents’ time to participate in answering the questions.

Benefits
Taking part in this study may not provide you with benefits, however you and your community members may benefit in future from the information that will be learned from this study.

Incentives
You will not be provide with any incentives to take part in this study

Confidentiality
The information obtained here will be confidential and will only be used for research purpose. Information collected about you will be stored in a file that does not bear your name but only a code...
and kept under lock and key and will not be divulged to anyone except the research team and sponsors

**Right to refuse or to withdraw:**

You do not have to take part in this study if you do not wish, and refusing to participate will not affect you or your family. You may stop participating in this study at any time that you wish without losing any of your rights

**Who to contact**

If you have any questions regarding this study, you may ask now or later. If you wish to later, you may contact me on the following number

Dr. Luke Nyakarahuka, Makerere University School of Public Health

0776970840, 0700592850

**Certificate of consent to the study**

I confirm that I have read the information sheet above concerning the study and have had the opportunity to ask questions and have had these answered satisfactorily. I understand that my participation is voluntary and I am free to withdraw consent at any time, without giving a reason, without my legal rights being affected. I understand that data collected may be looked at by responsible representatives from the MUSPH for the purposes of monitoring and auditing to ensure that the study is being conducted properly. I give permission for these individuals to have access to relevant information and I allow participate in the study

Name…………………………………… Signature…………………………………..
Appendix 2: Questionnaire for Quantitative Data

GPS Coordinates......................................................

A. Identifiers
A1 District.......................................................... A2 Subcounty......................................................
A3 Village/LCI........................................ A4 Name of Respondent (optional)........................................
A5 Date............................................................. A6 Tribe.............................................................
A7 Religion
1. Catholic......................................................
2. Protestant............................................... 
3. Moslem....................................................
4. Others (specify)...........................................
A8 Sex
1. Male
2. Female
A9 Age

B. Assessing Practices

B1 What’s your occupation?
1. Peasant
2. Herdsmen
3. Pastoralist
4. Hunter
5. Other occupations (specify)..............................

B2 What’s your level of education?
1. No
2. Primary
3. Secondary
4. Post secondary
5. Others (specify).............................................

B3 What animals do you keep?
1. Cattle
2. Sheep
3. Goats  
4. Swine  
5. dogs  
6. Others specify………………..  

B4 Which management system do you use to keep your animals?  
1. Pastorism  
2. Nomadism  
3. Transhumance  
4. Zerograzing  
5. Tethering  
6. Agro-pastoral systems(Crops and Animals)  
7. Others (specify)………………..  

B5 Do you own dog(s)?  
1. Yes  
2. No  

If No, skip to B 14  

B5.1 If yes, How many dogs do you have  

B6 Do you graze livestock with dogs?  
1. Yes  
2. No  

B7 Do you use dogs to guard livestock?  
1. Yes  
2. No  

B8 Are dogs restricted?  
1. Yes  
2. No  

B9 How are they confined?  
1. Free only at night  
2. Free only day Time  
3. Free through out  

B10 Do have stray dogs in this Village  
1. Yes
2. No

**B11** Do you or your children sometimes play with dogs?
   1. Yes
   2. No

**B12** Do you deworm dogs?
   a) Yes
   b) No

**B13.1** If yes, How often
   1. Every three months
   2. Once a year
   3. Others (Specify)

**B14** Do you slaughter animals at home?
   1. Yes
   2. No

If No, skip to **B17**

**B15** Which animals do you normally slaughter at home?
   1. Sheep
   2. Goats
   3. Cattle
   4. Swine
   5. Others (specify)---------------

**B16** Is there any meat inspection done at your homes?
   1. Yes
   2. No

**B17** Do meat inspectors inspect meat at Parties and Festives
   1. Yes
   2. No

**B18** Are dogs usually seen in parties?
   1. Yes
   2. No

**B19** Do you sometimes give dog’s uncooked organs/Meat to eat?
   1. Yes
2. No

If No, skip to 21

B20 Which Organs do you give to dogs?
   1. Liver
   2. Lungs
   3. Other (specify)---------

B21 Are dogs’ faeces disposed off.
   1. Yes
   2. No

B22 Do you use dogs foe nursing/cleaning children feces
   1. No
   2. Yes

B23 If yes how?
   1. In pit latrine
   2. In backyard
   3. In banana plantation
   4. We dig a hole
   5. Other specify

B24 Do you eat vegetables?
   1. Yes
   2. No

B25 What about raw Vegetables/Fruits
   1. Yes
   2. No

B26 Where do you get your water for drinking and domestic use?
   1. Well
   2. Open steam
   3. Spring
   4. Tap water
   5. Dam
   6. Others (specify)……………

B27 Do you boil water for drinking?
1. Yes
2. No

B28. If yes how often do you take boiled water

B29. Do you wash hands before eating light foods eg pancake, sugarcane, mango, pawpaw, roasted cassava, etc?
   1. Yes
   2. No
   3. Sometimes

B30. If yes how often

B31. Do you wash hands after handling or touching dogs?
   1. Yes
   2. No
   3. Sometimes

B32. If Yes how often

B33. Where do you buy meat for home consumption?
   1. Market
   2. Abattoir
   3. Home slaughtered
   4. Road slaughtering
   5. Others (specify)

B34. Are there meat inspectors at source of your meat
   1. Yes
   2. No

C. Knowledge and Attitude Cystic Echinococcosis

C1. Do you know a disease called Echinococcosis or Hydatid disease (describe disease)
   1. Yes
   2. NO

C2. Do you know what zoonotic diseases are?
   1. Yes
   2. No
C3 If yes, can you briefly explain what they are…………………
C4 Have you ever been infected or treated with hydatid disease
   1. Yes
   2. No

C5 Do you think you can acquire Hydatid Disease from dogs’ feces?
   1. Yes
   2. No

C6 Have you ever seen hydatid disease in Slaughtered animals (Show the picture in animals )
   1. Yes
   2. No

C7 If yes which organ was affected……………

C8 Which place (village) did you see hydatid disease.

……………………………

C9 Have you ever seen hydatid disease in man (Show the picture in man)
   1. Yes
   2. No

C10 If yes, where………………………

C11 Are you aware of dangers in eating raw/contaminated vegetables?
   1. Yes
   2. No

C12 If yes, what are the dangers?
   1. Diseases
   2. Worms
   3. Diarrhoea
   4. Fevers
   5. Others (specify)

C13. Do you think you can acquire echinococcosis/ or be infected by echinococcus spp
   1. Yes
   2. No

C14 If yes why?…………………

C15 If no why?………………………. 
C16 Do you associate with people infected with hydatid disease?

End!

Thank you for participating in this study.

Appendix 3: Qualitative data collection tools

Focused Group Discussion Guide

Consent for FGDs

Group of……………………………Name of Village……………………………

Introductions………………………………………………………………………

We are from the district health office and Makerere University School of Public health. We have gathered here to collectively discuss the issues related to Disease caused by a dog tape worm called cystic echinococcosis. The discussion is aimed at generating the information on our knowledge, attitude and practices regarding this disease. Findings of this study will be used by DHT and other stakeholders in designing control and preventive measures against this disease. This study has no risks apart from the time you will be spending here in discussions. The Discussion will take not more than an hour and information gathered here will be confidential through the use of generalized statements and not names and will only be used for the purpose of this study only

We are kindly requesting that we openly discuss the issues intensively in order to generate relevant information and participation in this discussion is voluntary. You are free to discuss among your selves and ask questions if need be. Your decision to stay will be an indicator of your consent. We will be taking notes and we request that you allow us to record the proceedings of this discussion.

Now that you have accepted to stay we request that you put a signature/Thumbprint

1. ………………………………………2………………………………………………
2…………………………………………3………………………………………
5…………………………………………6………………………………………
7………………………………8……………………………………
11…………………………12……………………………………
FGD guide

1. Explain the a disease called Echinococcosis( show pictures both in man and animals)

2. Which animals does it affect?

3. How does the disease present in animals and man?

4. How is it transmitted?

5. How can it be prevented/treated?

Tool 3: Key informant interview Guide
Consent for KI

I am …………………………… from the School of public health Makerere University. Am here to collect data on knowledge, practices and attitude on Cystic Echinococcosis (CE). The findings of this study will help in designing control measures for parasitic Zoonoses. You have been selected to do this study because of your position in this sub county. Your input will be very important for this study as it will provide insight to the problem. The study has less no risks and the discussion will take less than an hour of your time. The data will only be used for the purposes of study and no title names will be used in the report. You are free to refuse or with draw from the study. You are free to contact me on issues related to the study

Are you willing to take part in the study  yes/No?

If yes, please sign
Title of the KI……………………….Signature……………
Interviewer………………………….Signature……………..
Kl guide

1. Have you ever encountered Hydatid Disease (Cystic Echinococcosis) in Your Practice?
2. If so, which species /Animal were affected?
3. Which organs were affected?
4. What are species of echinococcus we have here in Uganda
5. Which the strains of echinococcus we have here in Uganda
6. Where are the animals slaughtered in your area of operation/District?
7. Are there meat inspectors in the above places of slaughter?
8. How is home slaughtering/Backyard slaughtering in your area of operation?
9. Explain how meat inspection done when Animals are slaughtered at home?
10. Which animals are mainly slaughtered at home?
11. How many people keep dogs in your area of operation?
12. How are dogs confined?
13. How many keep livestock (Cattle, sheep, goat) in your area of operation
14. Are there stray dogs in your area/District?
15. What do people use to guard livestock in your area?
16. Have you encountered a situation where people feed raw meat/organs/Cysts to dogs?
17. How do you dispose off the hydatid cysts once encountered?
18. How do you rate the level of sanitation in your area of operation?
19. How often is meat inspection done in your area/District?
20. Name the management systems in your district/Subcounty of operation (You can tick more than one)
21. What’s is the relationship between people in your area of operation with dogs
22. Please explain deworming in your area/District
23. Have you had any human being affected by echinococcosis?
Appendix 4: Research administering a questionnaire

The researcher administering a questionnaire to a household head in Karungi baati pastoral community in Kasese district.

Appendix 5: Researcher conducting a Focused Group Discussion

One of focused group discussion (FGD) in Busongora county Kasese district.
Appendix 6: Showing unhygienic uninspected meat in Mubuku trading Centre in Kasese District

Appendix 7. Cysts of Echinococcus granulosa

Showing some of the cysts of hydatid disease
Appendix 8. Showing close association of people with dogs

Close association of dogs with people.

Appendix 9: Showing pastoral communities in Study areas

Appendix 10: Showing unprotected water sources

Showing unprotected water sources are some of the risk factors for Cystic Echinococcosis.

END