PUBLIC'S AWARENESS AND PRACTICE OF ONE HEALTH APPROACH IN PREVENTING ZOONOTIC DISEASES IN SIBU-SIRE DISTRICT, EAST WOLLEGA ZONE,WEST ETHIOPIA

A Thesis Submitted to the Department of Zoological science, College of Natural Science Presented in Partial Fulfillment of the Requirement For the Degree of Masters in Biology

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LIST OF ACRONYMS

CFR- Case fatality rate

EFSA -Europian Food Safety Authorities

EHEC -Enterohemorrhagic *Escherichia coli*

EIDs-Emerging Infectious Diseases
EOHZPWS - Ethiopian One Health Zoonotic Prioritization Workshop

FAO - Food and Agriculture Organization

GFN- Global Foodborn Infections Network

MRSA - Methicillin Resistant *Staphylococcus Aureus*

SARS - South Asian Respiratory Syndrome

SSAO - Sibu Sire Agricultural Office

SSDAFRD - Sibu-Sire District Animal and Fishery Resource Development

TB - Tuberculosis

UN - United Nation

WHO - World Health Organization

ABSTRACT

This study was conducted with the objective of assessing public's conception and practice of One Health Approach in preventing zoonotic diseases in Sibu- Sire district, Oromia regional state, Southwestern Ethiopia using questionnaires and face-to-face interview technique. The total number of participants consisted of 428. Males (n=316) accounted for 73.8 % and female (n=112) 26.2%. The respondents were stratified into four groups namely, teachers (n=13), students (n=79), farmers (n=299), and nurses (n=37). Among the study groups 83.4% were rural residents and the rest 16.6% urban dwellers. Around 73% of them were married. A total of 251 (58.6%) of the study subjects were illiterate, whereas 41 of them (9.6%) had basic education .The rest 32% (n=137) of the respondents attended from primary school to university education. Many of them (72.6%) of farmers and 63.3% of the students did not know about One Health Approach. Public's practice of One Health Approach to prevent zoonotic disease in the area is very low, 66.1% (n=283) of the respondents said that zoonosis prevention through One Health Approach was little. Rabies as a zoonotic disease was known to majority of the respondents (99%), With regard to rabies as a zoonotic disease, there was no significantly ($P>0.05$) different level of awareness among the different respondent groups which can imply that rabies is a well known disease in the area whereas brucellosis was known by too few respondents (0.7%). There was no statistically ($p>0.05$) significant association between knowledge about brucellosis and educational status of the participants in this study. A large number (71.1%) of the respondents consumed raw meat regardless of their knowledge about transmission of zoonotic diseases. Majority (95.7%) of farmers do not know the occurrences of zoonosis through inhalation. Over 56% of them do not know direct contact with animals could cause zoonosis. According to this study 74.2% of these farmers do not know handling animals with cut and 62.9% of them sharing the same room with animals could cause disease to human. Similarly 86.6% of the farmers do not know whether human could be infected by zoonotic diseases through vectors. In general, the present study revealed a very low level of awareness by the public about One Health Approach and major zoonotic diseases, signifying the need for public health promotion through education and inter-disciplinary One Health Approach with close collaboration among health extension workers, agricultural extension workers, wild life experts, environmentalist and kebele leaders.

Keywords- Transmission, emerging, prioritization, re-emerging

1. INTRODUCTION

1.1. Background Of The Study

One Health is an integrated strategy which involves the cumulative works on human, animal and environmental health. Even though there are challenges and limitations to come to the mind set of one health, various opportunities have emerged to promote health in the continuous changing human, animal and environmental interface (Gebreyes et al., 2014). The success that can be achieved on improving the health and wellbeing of human and animal will be based on the works accomplished in an integrated approach in all interrelated areas (Schelling et al., 2005, Graham et.,al 2008; Roch et al, 2009). This task starts with the understanding of the profound interdependence among human, animal and the larger ecological system (Gebreyes et al, 2014).

The concept of one health is mainly focuses on control of various infectious diseases that can be transmitted among and between animals, human and environment. There are different indications that show the occurrence of infectious diseases in different forms and will continue to be significant threat to global health security (Graham et al, 2008). The emergence and re-emergence of pathogens due to zoonosis will threaten the health and wellbeing of people and animals throughout the world (Taglor et al, 2001; Coker et al, 2011). A large majority of these infectious diseases are caused by microbes which have zoonotic importance (Kahn, 2006).

Zoonoses comprise of an associated group of viral, bacterial, rickettsia, fungal, parasitic and prion diseases. There are a diversity of animal reservoirs for these diseases including wildlife, livestock, pet animals and birds. The transmission may occur through direct contact with animals, through vectors such as fleas or ticks or through food or water contamination. Ethiopia has the largest livestock population on the continent and is particularly vulnerable to the effect of zoonotic diseases since its economy is largely dependent on agriculture (World Bank 2010). Roughly, 80% of households have direct contact with domestic animals, creating an opportunity for infection and spread of disease (Lindahl, 2015). Ethiopia also ranks top in the health burden of zoonotic diseases and in having a large population of poor livestock keepers (Zoonosis Hot spot, 2012). Meanwhile,

the lack of coordination among human and animal health sectors coupled to inadequate resource for public health systems have been prominent factors in contributing to weak surveillance systems and less efficient and ineffective response to public health threats in the country. Therefore, having a mutually agreed and prioritized agenda among key sectors is crucial for strengthening zoonotic disease surveillance and prevention systems in the country. Addressing the burden of zoonotic diseases is crucial because a large number of these diseases occur in Ethiopia.

According to the United Nations Food and Agriculture Organization (FAO), global demand for meat production will increase from 233 million metric tons in the year 2000 to 300 million in 2020 with the major need being in less developed countries (World food prospect, 1999). This trend will result in an increase in farms and the production of crops, with an expected increase in zoonotic food and vector-borne pathogens and environmental hazards. In response to the global need for prevention of diseases at the human, animal and ecosystem interface, various academic, Intergovernmental, and research centers are playing a central role. The study, detailed in the 2012 report that maps poverty and likely zoonosis hotspots, shows the vast majority of zoonotic illnesses and deaths that occur in low and middle income countries .For instance, Africa's Ethiopia, Nigeria and Tanzania had the highest rate of zoonotic illnesses and deaths (WHO, 2012).

1.2 Statement of the problem

Globally, zoonoses are said to account for 60% of all infectious diseases and 75% of all the emerging pathogens (WHO, 2004). Zoonotic diseases cause mortality and morbidity in people. Research findings have demonstrated that 13 zoonotic diseases were identified as being responsible for 2.2 million deaths every year (WHO, 2O12). About 80% of Ethiopian households have direct contact with domestic animals which increases the opportunity of contracting infection and spread of these diseases. Ethiopia is also identified as "Zoonosis Hotspots" with the highest rates of associated illnesses and deaths (WHO, 2012). The habit of consuming raw meat and milk by a significant number of the population has widened the scale of the problem. In Ethiopia, rabies, anthrax, brucellosis, leptospircosis and echinococcosis (EOHZPWS 2015) are the most common zoonotic diseases .Sibu-Sire weredaa is one of the largest districts in its livestock population in east Wollega and

presumably shares the burden of zoonotic diseases in the country. Sibu-Sire has 237,700 cattle, 54,222 goat,55,498 sheep, 20,142 donkeys, 14,700 horses, 1,794 mules and 98,528 chickens (SSDAFRD, 2018).According to the district's animal resource and fishery department; Rabies, brucellosis and bovine tuberculosis are the most widely observed zoonotic diseases in the study area. Even though there is no published information about zoonosis in the area, unhygienic handling and consumption of raw animal products is widely observed. Awareness creation on One Health Approach and zoonotic diseases can help in reducing the transmission of zoonosis to people. The present study will try to assess the conception and practices of the public about One Health Approach in preventing diseases transmission from animal to human Nevertheless, these diseases are hurting the population in the study area. Therefore, the present study was aimed at bridging the knowledge gap concerning the level of conception and practices of the community about the importance of One Health Approach in preventing zoonotic diseases in the study area. This can be an opportunity for health workers and other concerned bodies for disease prevention activity through awareness creation.

1.3. Research Questions

1) Do the public know One Health?

2) Do the different professionals mention One Health Approach to the public in the study area?

3) How far do the public know common zoonotic diseases?

4) To what extent the study subjects have awareness about the transmission route of Zoonotic diseases?

5) Do the public aware of wildlife and domestic animals could cause zoonosis?

4) Which zoonotic diseases are well known by the community and which are not?

1.4. Objectives of the Study

General objective

The general objective of this study was to assess the conception and practices of the public about One Health Approach in reducing health problems associated with zoonotic diseases in Sibu-Sire district of Eastern Wollega.

Specific objectives

The specific objectives of the current study are:

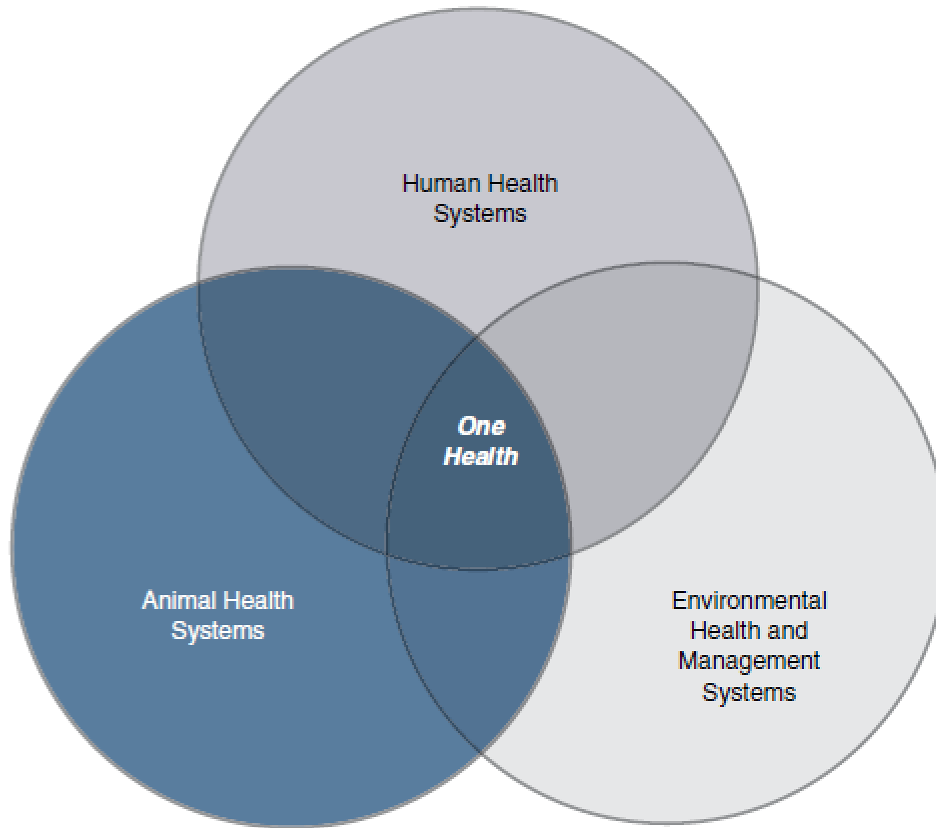
1. To assess the awareness level of the public about One Health Approach
2. To evaluate the knowledge of the public about the modes of transmission of zoonosis.
3. To compare the level of knowledge of teachers, students, farmers and nurses about One Health Approach.
4. To assess training of One Health approach by different professionals.
5. To assess which zoonotic diseases are well known by the public in the study area and which are not.
6. To assess whether the public is aware of domestic and wild animals could be a source of zoonosis.
7. To evaluate how far the residents have awareness about the importance of One Health Approach in preventing Zoonosis.
8. To assess some practices of the public that can exposes them to zoonotic diseases in the study area.

2. LITERATURE REVIEW

2.1. One Health Approach

One Health program is the concept that the health of animal, human and the viability of ecosystems are inextricably linked. The importance of the program is increasing as the expansion of human and animal populations, ecological changes due to human impact and climate variations, and technological advancements facilitating global human, animal, and product movements have resulted in an increased risk of disease transmission between animals and people. It embraces the idea that a disease problem impacting the health of humans, animals, and the environment can only be solved through improved communication, cooperation, and collaboration across disciplines and institutions (USDA, 2015).

One Health is an integrated strategy which involves the cumulative works on human, animal and environmental health as indicated in figure 1. The success that can be achieved on improving the health and wellbeing of human and animal will be based on the works accomplished in an integrated approach in all interrelated areas (Schelling et al., 2005, Graham et.,al 2008; Roch et al, 2009). This task starts with the understanding of the profound interdependence among human, animal and the larger ecological system (Gebreyes et al, 2014).



Source: world Bank report number 122980-GLB

Fig 1. Health systems typically included with the One Health system.

The concept of one health is mainly focuses on control of various infectious diseases that can be transmitted among and between animals, human and environment.

The physiological, path-physiological, and genomic similarities among species anchor the comparative approach, and within the context of biomedical research, they support the One Medicine pathway to discovery (National Academic Research Council, 2005). The scope of One Health is impressive, broad, and growing (American Veterinary Medical Association, 2008).

Multidisciplinary groups of professionals have to cooperate to improve public health (Ayele *et, al*., 2014). A German scholar from the mid 1800's, Rudolf Virchow, who came from a farming family, was an early proponent of OH. He said, "Between animal and human

medicine there is no dividing line nor should there be. The object is different but, the experience obtained constitutes the basis of all medicine" (USDA, 2015). Aim of One Health is to improve health and well-being through the prevention of risks and the mitigation of effects of crises that originates at the interface between humans, animals and their various environments (One Health Global Network, 2015).

2.2. Origin and History of One Health Approach

Ever growing human populations, reaching 7 billion in 2011 (UNFPA, 2011), and the resulting environmental degradation from expanding land use, intensified agricultural and animal husbandry methods, and closer habitation between humans and both domesticated and wild animal species are recognized as key factors increasing shared risk across the animal-human-ecosystem interfaces (Sherman, 2010).

Generally, in the 20th century, three major movements were seen, all of which contributed largely to current thinking on one health approach. The first was the concept of 'One Medicine' which arose out of the work of Calvin Schwabe with Dinka in Sudan (Zinsstag et al., 2011). Calvin Schwabe; the 'father of veterinary epidemiology' coined and reintroduced the concept of 'One Medicine' in his book Veterinary Medicine and Human Health in 1984, which argued that 'the critical needs of man include; the combating of diseases, ensuring enough food, adequate environmental quality and a society in which human values prevail'(Schwabe, 1984). His core idea echoed the 19th century physician Rudolf Virchow who believed that, 'between animal and human medicine there are no dividing lines nor should there be' (Saunders, 2000). Schwabe renewed the basic principle that a more holistic approach to human, animal and environmental health was needed to better protect the health of all (Schwabe, 1984).

The second movement was 'Ecosystem Health' or 'Eco-Health' which was adapted from ecology and environmental management to the improvement of human health and wellbeing. The third movement, which took the title of One Health, arose because of increasing concern of disease emergence at the interface between animals, humans and ecosystems. Among a series of disease emergences of global importance in the 1990

triggering one health approach, Severe Acute Respiratory Syndrome (SARS), avian influenza and West Nile virus had strong participation from veterinary and, to a lesser extent, human public health (Nabarro, 2012).

In 1999, a series of themed conferences were organized by the Society for Tropical Veterinary

Medicine and the Wildlife Diseases Association uder the banner 'Working together to promote global health'. The second of these conferences held in 2001 in Pilanesberg, South Africa, addressed issues at the domestic animal/wildlife interface relating to disease control, conservation, sustainable food production and emerging diseases (Gibbs and Bokma, 2002). This meeting is considered as key to the early development of One Health (lee and Brumme, 2013).

In 2007, a vision supporting the concept of OH was adopted by The American Veterinary Medical Association and the American Medical Association that ended with formation of the One Health Initiative task Journal of Medicine, Physiology and Biophysics. This brought together USA human and animal health agencies, Medical doctors and Veterinarians. Within the same year, the National Strategy for Pandemic Influenza and its Implementation Plan resulted in several International Ministerial Conferences that involved the United Nations' Food and Agriculture Organization (FAO), the World Organization for Animal Health (OIE), and the WHO. It has also gained ground throughout the USA government, led by the president's new initiatives for coordination and collaboration on national security and global development policy (USDA, 2015).

2.3. Principles of One Health Approach

One Health recognizes the inextricable linkage of human, livestock, companion animal, wildlife and environmental health implying an added value to the health and wellbeing of humans, animals and environment (Zinsstag et al., 2011). This concept is more expanded compared to One Medicine that stated 'human and veterinary medicine share a common body of knowledge in anatomy, physiology, pathology and the origins of diseases in all species' (Schwabe, 1984) and thereby recognizing the mutual benefits available through the connection of veterinary medicine and human health. So, One Health is different from One

Medicine in that ecosystem health is added into the animal-human interface to incorporate the environment, as well as wildlife populations, and recognize that sustainable development and continued human and animal health are dependent on healthy surrounding ecosystems (Zinsstag, 2011).

This new concept is the function of the collaborative efforts and communication of multiple disciplines working to attain optimal health of people, animals and the environment. One Health is an integrated strategy which involves the cumulative works of veterinary medicine, human medicine, environmental science and public health (Samuel et al., 2013). More recently, it is defined as the collaborative effort of multiple health science professions together with their related disciplines and institutions working locally, nationally, and globally to attain optimal health for people, domestic animals, wild life, plants and our environments (One Health Commission, 2015).

Improving the health and well-being through the prevention of risks and the mitigation of effects of crises that originate at the interface of humans, animals and their various environments is the aim of One Health Approach. To promote this multi-sectoral and collaborative approach and a whole society approach to health hazards, a systemic change of perspective in the management of risks is crucial (One Health Global Network, 2015). Meeting new global challenges head-on through collaboration among multiple professions: Veterinary Medicine, human medicine, environmental health, wildlife and public health (AVMA, 2008).

2.4. Zoonosis

Zoonoses are defined as those diseases and infections naturally transmitted between people and vertebrate animals (WHO, 2005). Zoonoses constitute a diverse group of viral, bacterial, rickettsial, fungal, parasitic, and prion disease with a variety of animal reservoirs, including wildlife, livestock, pet animals, and birds (Nkuchia et al., 2007). The transmission may occur through direct contact with the animal, through vectors (such as fleas or ticks), or through food or water contamination (James, 2005).Globally, zoonoses are said to

account for 60% of all infectious disease pathogens and 75% of all emerging pathogens (WHO, 2004).

In both developing and developed countries, a number of new zoonoses have emerged. This might be the result of either newly discovered pathogens or agents that are already known, usually appearing in animal species in which the disease had not previously been detected (Jonathan and Joshua, 2006).Many diseases that affect humans which are new, emerging and re-*emerging*, were caused by pathogens that originated from animals. Moreover, a number of zoonotic diseases, including rabies, brucellosis, bovine tuberculosis and echinococcosis continue to affect humans and animals in many countries, particularly developing nations (Meslin et al., 2000).

It has been observe that 75% of emerging pathogens all within the category of zoonotic diseases (WHO, 2005). Zoonotic diseases cause mortality and morbidity in people, while also imposing significant economic losses in the livestock sector. Their burden tends to fall most heavily on poor societies (WHO, 2005). They have both direct and indirect effects on livestock health and production (Smits and Cutler, 2004). Indirect effects occur as a result of the risk of human disease, the economic impact on livestock producers through barriers to trade, the costs associated with control programmes, the increased cost of marketing produce to ensure it is safe for human consumption, and the loss of markets because of decreased consumer confidence (Mc Dermott and Arimi, 2002).

Different studies conducted so far on animals from different districts of Jimma zone indicated the occurrence of zoonotic diseases. For example, Tolosa et al., (2009) reported the prevalence of 2.93 and 31.44% in Jimma area for *Taenia saginata metacestodes* and hydatidcysts, respectively. Prevalence values ranging from 2.93 to 4.4%was reported for bovine cysticercosis in cattle slaughtered at Jimma abattoir (Megersa et al., 2010; Tolosa, 2010).Whereas, herd level and individual animal level prevalence of bovine tuberculosis was found to be 48.6and 21.4%, respectively in and around Jimma (Tigre et al., 2012). Moreover, information from Jimma town health center and Jimma zone health bureau showed that rabies was one of the ten listed health problems in the area (personal communication). According to WHO (2011), rabies is a wide spread zoonotic disease that is found on all the continents, but more than 95% of human deaths occur in Asia and Africa.

2.5. Zoonosis and One Health

One health is a concept that aims to bring together human, animal and environmental health. The one health approach plays a significant role in the prevention and control of zoonoses. It has been noted by the World Health Organization (WHO) and Graham, et al. that approximately 75% of new emerging human infectious diseases are defined as zoonotic, meaning that they may be naturally transmitted from vertebrate animals to humans.

New and reemerging zoonoses have evolved throughout the last three decades partly as a consequence of the increasing interdependence of humans on animals and their products and our close association with companion animals. Zoonoses should therefore be considered the single most critical risk factor to human health and well-being, with regard to infectious diseases. Of the 1461 infectious diseases recognized to occur in humans by the National Academy of Sciences, Institute of Medicine, approximately 60% are caused by multi host pathogens, characterized by their movement across various species. This gives significant credence to the importance of examining health effects across species, in order to fully understand the public health and economic impact of such diseases and to help implement treatment and preventive programs. The preventive programs can be better addressed through collaborative effort of multiple health science professions together with their related disciplines and institutions working locally, nationally, and globally to attain optimal health for people, domestic animals, wild life, plants and our environments (One Health Commission, 2015). The One Health movement is intended to improve the health of multiple species and the environment, and it has great potential and promise in this regard. One Health messages must resonate with wildlife, human, and domestic animal health professions. This is perhaps best achieved by collaboration of these allied fields in message development and communication design efforts. Communication and coordination is needed in One Health Approach to ensure consistency and effectiveness. Transforming One Health Approach into action is helpful to reduce the threat caused by zoonosis because this approach plays a significant role in the prevention and control of zoonoses.

2.6.One Health And Food Safety

Zoonoses and communicable diseases common to man and animals continue to have high incidence rates and to cause significant morbidity and mortality worldwide (Acha and Szyfres, 2003; Kahn, 2006). Zoonotic infections, transmissible between humans and animals, are closely associated with pastorals (Schelling *et al*., 2007). Zoonoses have important impacts on public health and livestock economies representing 61% of all infectious organisms known to be pathogenic to humans (Taylor *et al*., 2001). Rabies is one of the zoonotic diseases which have been recognized since early history and others such as BSE (Bovine Spongiform Encephalopathy) are recognized as emerging ones (Hugh-Jones *et al*., 2008).

Vertebrate animals (including humans) are the reservoirs of zoonotic infections, and the disease agents are transmitted directly or indirectly between them. Infection as are result of contact with an infected animal host represents a direct mode of transmission, whereas infection as a result of contact with a vector or vehicle is an indirect mode. Transmission of pathogens from livestock to pastoralists may occur through consumption of raw milk and meat or through obstetric work (Kahn, 2006).

Food borne diseases are caused by a wide range of agents; and can result in mild disease or life threatening illnesses. There are more than 250 known food borne diseases. Biological contaminants are the main causes of food borne diseases and are responsible for a wide range of illnesses (Newell *et al*., 2010).Diseases such as salmonellosis, shigellosis, brucellosis, amoebiasis, campylobacteriosis staphylococci and *Clostridium botulinum* are considered as food borne zoonotic diseases.

Parasitic diseases such as toxoplasmosis and trichinosis are a problem throughout the world, while in developing countries taeniasis and cysticercosis are also have importance. Some plants such as mushrooms and fish carry harmful toxins.

Chemical Hazards includes intoxication due to chemical contamination of food, residues on food or food contact surfaces, pesticides and metal residues, cleaning compounds and metal residues. Besides to this physical hazard such as metal shavings packing staples, pins, glass,

hair, fingernails, wood, stones and tooth picks involve in injuries caused by chewing or ingesting foreign objects in food (Acha and Szyfres, 2003).

Food poisoning can occur within the home, at work or in public eating places (restaurants). Within the home there are numerous interconnections and interactions among water, sanitation, flies, animals, personal hygiene and food that are responsible for diarrhea transmission. The temperature and time of cooking and the storage of food are important factors (Acha and Szyfres, 2003; Newell *et al*., 2010).

In sub Saharan Africa, millions of small-scale farmers efficiently supply the great majority of the meat, milk and fish market. Animal products have a high nutritional value which enhances public health, while the production, transportation, processing and retailing of these products provide income and employment to millions. On the other hand, animal source foods are single most important source of food borne disease (Newell *et al*., 2010).

Majority of the animal source foods are distributed through informal markets without adequate safety inspection, and as a result, most of the people living in the region are exposed to a variety of food-borne agents which can cause diarrhea, fever, chronic wasting, abortions, or even epilepsy and cancer. These infections can have severely negative impacts on the population, including a higher infant mortality, and may contribute significantly to area poverty (Kahn, 2006; Patel and Burke, 2009; Newell *et al*., 2010). These conditions show that current food safety management seems to be neither effective nor efficient. Moreover, there is a tendency to adopt international food quality standards without considering local contexts with the result conventional food safety policies often try and ban any product with hazards in it. Small-scale farmers have difficulties to comply with these standards and could therefore be prevented from marketing their products (Graham, *et al.*, 2008).

2.7. Zoonosis and Poverty

Zoonotic diseases with pandemic potential, such as avian or ’swine’ influenza and SARS, have received committed attention from world leaders, and while zoonotic diseases related to industrialized food production systems have received some recognition leading to at least in some countries efficient risk mitigation action, a number of very important zoonotic

diseases, disproportionately affecting poor and marginalized populations, are largely ignored. These types of zoonoses are many, and the prevalence in animal populations varies according to local agricultural, demographic, and geographic conditions. For many such diseases solutions to dramatically decrease the disease burden are well known, but action is lagging (for example, for many of the parasitic zoonoses). WHO refers to such diseases as 'Neglected Diseases' (Molyneux et al., 2011).

The group of Neglected Zoonoses include bacterial diseases, such as brucellosis (with significant sequelae), leptospirosis, Q-fever (with high mortality), and bovine TB. Bovine TB appears to be increasing in many poor settings with HIV infections as an important factor for progression of TB infection to active TB disease. For both, brucellosis and bovine TB the disease in cattle causes lowered productivity, but seldom have death, and both infections been largely eradicated from the bovine population in the developed world, by a test-and-slaughter program, thereby in effect eliminating this human health problem (Godfroid and Käsbohrer 2002).

Important zoonotic parasitic diseases include schistosomiasis, cysticercosis, trematodiasis, and echinococcosis, several of which with significant mortality rates or long-term sequelae including cancer and neurological disorders. Cysticercosis is emerging as a serious public health and agricultural problem in poor (García et al., 2003).

Humans acquire Taeniasolium tapeworms when eating raw or undercooked pork meat contaminated with cysticerci. The route of transmission is, pigs are infected through Taenia eggs shed in human feces, and the disease is thus strongly associated with pigs raised under poor hygienic conditions. This again means that the cycle of infection can be relatively easily broken when introducing efficient management, as has been the case in most developed countries. Given that 70 % of the rural population in poor countries is dependent on live stock and working animals to survive (FAO 2002), the effect of these animals carrying a zoonotic disease can be dramatic, both relative to human health directly, but also as it affects the potential to earn an income. This also affects the potential mitigation action; for instance the large-scale culling of animals, which can be a viable solution in rich countries, might be problematic in the poorest countries. Such solutions would mean not

only loss of food, but also a serious socio-economical disruption, in some cases leading to national instability.

2.8. Zoonotic Diseases Status In Ethiopia

According to the studies conducted in Ethiopia, many food borne zoonotic diseases are reported from different areas of the country. Among this, sporadic occurrence of anthrax in cattle and other domestic animals including man has been reported in different parts of the country. Campylobacter has been isolated from cattle, sheep, goats, swine and chicken .The frequency of isolation from live chicken and swine was higher than the other food animals (Tesfaye et. al., 2005). Survey conducted on food animals, before their slaughter at Addis Abattoir has shown that cattle, sheep and goats harbor Listeria in their gastro intestinal tract with the potential to contaminate carcasses during dressing operation (Molla et al., 2004; Belay, 2006).

Bovine tuberculosis is widely spread all over the country in cattle managed under extensive and intensive management system with higher prevalence in extensive system. Abattoir survey showed that the prevalence ranges between 0.02 % in Gondar to7.96% in Woliata Sodo. M. bovis causes extra pulmonary tuberculosis in humans and most of the infection is due to ingestion of unpasteurized or not properly boiled milk and milk products (Teshome, 1986; Kiros, 1998; Kinfe and Eshetu, 2005). The sero prevalence of brucellosis in food animals lies between 0.49% in bovine in Bahir Dar Ethiopia (Tadesse and Girma, 2008) and 9 % in camels in Fentalie district (Mekonen et al., 2010). Bovine cysticercosis is highly prevalent in Ethiopia in which human acquire the infection through consumption of raw meat of animal origin. Study carried out in different parts of Ethiopia showed that the prevalence of the disease in bovines ranges from 4.4% in Jimma (Megersa et al., 2010) to 26.5% in Awassa (Abuna et al., 2008). Infection of food animals and humans with *Toxoplasma gondii* has been confirmed through serological studies.

2.9. CRITERIA FOR ZOONOTIC DISEASE PRIORITIZATION IN ETHIOPIA

A- Severity of human disease in Ethiopia

Diseases having the highest death rate (i.e., number of deaths per population) in humans were deemed to have priority and the criterion was given the highest weight. However, death rate data for each of the 43 zoonotic diseases of concern are not available. A proxy was established in which the diseases are ranked based on their known presence in Ethiopia and the global case-fatality rate (CFR). A disease is given full weight for this criterion if there was any data indicating its presence in Ethiopia and the disease had a high CFR (≥5%). The next highest credit (two-thirds) was given for diseases which were known to be present in Ethiopia, but had a low CFR (5%). The lowest credit (one third) was given to diseases not present, or not known to be present, in Ethiopia, but with a high CFR (≥5%). No credit is given to diseases not present or not known to be present in Ethiopia and with a low CFR (5%)(Emily et al.,2016).

B- Proportion of human disease attributed to animal exposure

Diseases that are not known to spread from person to person (and thus all cases result from animal exposure) were assigned the full weight of the criterion (e.g. rabies). Diseases which can spread from animal to person and then are maintained from person to person received half credit (e.g. ebola). And finally, diseases known to spread mainly between people (cases rarely originating from animal exposure) received no credit (Emily et al.,2016).

C- Burden of animal disease

Priority is given to diseases that have negative impacts at the household level in Ethiopia by causing disease or production losses in livestock. Assessing the burden of disease in animals is challenging because data were available for very few of the 43 diseases. For those diseases with data available, they differed across regions and species. Diseases were ranked and assigned weights based on whether the disease was present or not present (or not known to be present) in Ethiopia, and whether the disease causes production losses. If the effect on livestock production was unknown, the final weight was assigned based on whether or not the disease was an OIE reportable disease. If the disease is present in Ethiopia and 1) causes production losses or 2) is an OIE reportable disease it received the

full weight of the criterion.Diseases present in Ethiopia that 1) do not cause production losses or 2) are not OIE reportable received the next highest credit (two-thirds).Diseases not known to be present in Ethiopia and 1) known to cause production losses or 2) are OIE reportable received the lowest credit (one-third). Diseases not known to be present in Ethiopia and 1) not known to cause production losses or 2) not OIE reportable did not receive credit (Emily et al.,2016).

D- Availability of interventions

A full weight was assigned to diseases for which vaccines targeting animals existed. Half credit was given to diseases that had vaccines or medical intervention available for people, but not an animal vaccine. No credit was assigned when interventions for animals or people was not available (Emily et.,al2016).

E-Existing inter-sectoral collaboration

Finally, the group prioritized diseases in which inter-sectoral collaboration is already present within Ethiopia and these diseases received full credit for this criterion. Half credit was given to diseases with prior or weak collaborations. Based on the decision tree analysis using these five criteria, the final normalized scores for the 43 diseases under consideration were tabulated.

After further discussion and voting by the selection committee, five zoonotic diseases were selected and ranked from among the top ten diseases for initial inter-sectoral engagement by human and animal health agencies. The five prioritized diseases were rabies, anthrax, brucellosis, Leptospirosis, and echinococcosis (Emily et al.,2016)

2.10. ETIOLOGY OF ZOONOTIC DISEASES

Etiology of rabies

Rabies is an acute viral encephalomyelitis caused by members of the lyssavirus genus. The disease may be caused by rabies virus genotype 1 (classical rabies) or less commonly by rabies-related lyssaviruses. The presentations are clinically indistinguishable. Rabies-related lyssaviruses implicated in human disease include European bat lyssaviruses (EBLVs) and Australian bat lyssavirus (ABLV).

Etiology of anthrax

Anthrax results from infection by Bacillus anthracis, a spore forming, Gram positive aerobic rod in the family Bacillaceae. Fully virulent B. anthracis isolates have two plasmids: pX01, which codes for a tripartite protein exotoxin complex, and pX02, which encodes the capsule genes. B. anthracis is a member of the Bacillus cereus sensu lato group, which also contains the closely related organism's B. cereus and Bacillus thuringiensis, as well as a few other species. A few B. cereus isolates that contain plasmids closely related to pX01 have caused anthrax-like diseases. Isolates that carry both pX01 and pX02-like plasmids have been termed Bacillus cereus biovar anthracis. Studies suggest that this organism may be as virulent as B. anthracis. B. cereus that have only a pX01-like plasmid, but can produce a capsule with other genes, can also cause similar illnesses.

Etiology of brucellosis

Brucellosis results from infection by members of the genus Brucella, a Gram negative coccobacillus in the family Brucellaceae (class Alphaproteobacteria) . The currently recognized species include B**.** abortus, B. melitensis, B. suis, B. ovis, B. canis, B. ceti, B. pinnipedialis, B. neotomae, B. microti and B. inopinata. Some of these organisms contain multiple biovars. B. vulpis and B. papionis have been proposed as new species, and several isolates from wild rodents in Australia, some of which were originally identified as B. suis biovar 3, might also be a novel species of Brucella. Additional unnamed brucellae have been isolated from frogs and other hosts.

Etiology of bovine TB

Bovine tuberculosis results from infection by Mycobacterium bovis, a Gram positive, acid-fast bacterium in the Mycobacterium tuberculosis complex of the family Mycobacteriaceae. Cattle are the primary hosts for M. bovis, but other domesticated and wild animals can also be infected Species reported to be spillover hosts include sheep, goats, horses, pigs, dogs, cats, ferrets, camels, llamas, many species of wild ruminants including deer and elk; elephants, rhinoceroses, foxes, coyotes, mink, primates, opossums, otters, seals, sea lions, hares, raccoons, bears, warthogs, large cats (including lions, tiger s, leopards, cheetahs and lynx) and several species of rodents. Most mammals may be susceptible. Little is known about the susceptibility of birds to M. bovis, although they are generally thought to be resistant. Experimental infections have recently been reported in pigeons after oral or intra-tracheal inoculation, and in crows after intraperitoneal inoculation. Some avian species, including mallard ducks, appear to be resistant to experimental infection.

2.11. TRANSMISSION OF ZOONOTIC DISEASES

Transmission of rabies

Rabies is a zoonotic viral disease which infects domestic and wild animals. It is transmitted to other animals and humans through close contact with saliva from infected animals. The exposure is always nearly through a bite, but rabies can also be transmitted if a rabid animal scratches a person or if its saliva comes into contact with broken skin. The time between exposure and the onset of symptoms is variable but averages two to twelve weeks in humans. Incubation periods of over one year have been reported. Person to person transmission is extremely rare; however, precautions should be taken to prevent exposure to the saliva of the diseased person. Tissues from individuals with rabies must not be used in transplant procedures.

Transmission of anthrax

Anthrax is usually transmitted by bacterial endospores, although vegetative cells might establish infections in some forms of anthrax (e.g., the oropharyngeal form acquired by eating contaminated meat). Animals are mainly thought to become infected when they

ingest spores; however, inhalation could also play a role, and entry through skin lesions may be possible. While the vegetative cells of *B. anthracis* are destroyed in the acid environment of the stomach, spores are resistant to digestion and can germinate when they reach the intestines. Animals, including herbivores, must eat fairly large doses of *B. anthracis* to become infected by the oral route. Herbivores usually acquire spores from soil or plants in pastures; however, contaminated feed (e.g., forage, bone meal) has been responsible for some outbreaks outside endemic areas. Other routes of transmission may also be possibleoal-like lesions on the skin at the site of inoculation (Inglesby et al., 1999).

Transmission of brucellosis

Common routes of transmission of brucellosis 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 infectious unpasteurized milk or other dairy products. Blood transfusion, tissue transplantation and sexual transmission are possible but rare routes of infection.

Transmission of bovine TB

M. bovis can be transmitted by the inhalation of aerosols, by ingestion, or through breaks in the skin. The importance of these routes varies between species. Bovine tuberculosis is usually maintained in cattle populations, but a few other species can become reservoir hosts. Most species are considered to be spillover hosts. Populations of spillover hosts do not maintain M. bovis indefinitely in the absence of maintenance hosts, but may transmit the infection between their members (or to other species) for a time. Some spillover hosts can become maintenance hosts if their population density is high. Cattle shed M. bovis in respiratory secretions, feces and milk, and sometimes in the urine, vaginal secretions or semen. Large numbers of organisms may be shed in the late stages of infection. Asymptomatic and anergic carriers occur. In most cases, M. bovis is transmitted between cattle in aerosols during close contact. Some animals become infected when they ingest the organism; this route may be particularly important in calves that nurse from infected cows. Cutaneous, genital, and congenital infections have been seen but are rare. All infected cattle may not transmit the disease.

2.12. CLINICAL SIGNS OF ZOONOTIC DISEASES

Clinical signs rabies

Early symptoms of rabies are non-specific, but often include pain or paresthesia at the inoculation site. The diseases progresses to an acute neurologic phase characterized by delirium, convulsion, muscle weakness, paralysis. Spasms of the swallowing muscles can lead to a fear of water(hydrophobia),and may be precipitated by blowing on the patient's face (aerophobia).Not all persons exposed to rabies virus develop disease, but if symptoms do occur, rabies is almost invariably fatal.

Clinical Signs of Anthrax

Anthrax can be a peracute, acute, subacute or chronic disease. More susceptible In species tend to develop peracute and acute illnesses, while subacute and chronic cases are more likely to be reported in resistant hosts.In ruminants, peracute systemic disease is common, and sudden death is often the only sign. Staggering, trembling and dyspnea is sometimes noted shortly before death, followed by rapid collapse and, in some cases, terminal convulsions. Ruminants with the acute form of anthrax are ill for a short period (typically up to 2 days) before they die. Fever and excitement may be noted initially, but this is often followed by depression, stupor and anorexia.

Other clinical signs may include disorientation, muscle tremors, dyspnea, hematuria, diarrhea, congested mucous membranes, and small scattered hemorrhages on the skin and mucous membranes. Pregnant cows may abort, and milk production can drop severely. The milk may also appear bloody or discolored with a yellow tinge. Bloody discharges from orifices such as the nose, mouth and anus are sometimes seen terminally. Some ruminants develop subcutaneous edematous swellings, often in the ventral neck, thorax and shoulders, but sometimes at other sites including the genitalia. Pulmonary anthrax, with a productive cough and an acute course, has been reported rarely. What appeared to be a cutaneous form of anthrax was seen in some previously vaccinated cattle during an outbreak in Canada. These animals did not seem to have any systemic signs, but they developed variable numbers of expanding areas of dark, necrotic skin, on one or both sides of the body. The affected skin eventually sloughed, leaving bloody, crusted areas that healed spontaneously

in a few weeks. Anthrax mastitis, with clinical signs mainly limited to the udder, was also reported in a cow during this outbreak. The appearance of anthrax in wild herbivores varies with the species, but tends to resemble the disease in domesticated ruminants. An acute course is common in horses. Frequently reported clinical signs in this species include fever, anorexia, depression, other signs of sepsis, severe colic and, in some cases, bloody diarrhea. Some horses have swellings on the neck, sternum, lower abdomen and genitalia. Swelling of the neck can cause dyspnea. Affected horses usually die within 3 days, but some can survive longer.

Clinical Signs of brucellosis

Brucellae can infect people asymptomatically or cause diverse syndromes that may appear insidiously or abruptly. Acute brucellosis is usually a febrile illness with nonspecific flu-like signs such as fever, chills, headache, malaise, back pain, myalgia and lymphadenopathy, which may be accompanied by splenomegaly and/or hepatomegaly. Patients may experience drenching sweats, particularly at night. Nonspecific gastrointestinal signs including anorexia, vomiting, diarrhea and constipation may also be seen.Some people recover spontaneously, while others develop persistent nonspecific symptoms (e.g., fever, weakness) that typically wax and wane. Localized infections in various organs and tissues can result in a wide range of syndromes. Fever may be absent or mild in these cases.

Infections in bones and joints, the most common sites of localization, can appear as arthritis, spondylitis, sacroiliitis, osteomyelitis, bursitis and tenosynovitis. Brucellosis can also be characterized by neurological involvement (e.g., meningitis, meningoencephalitis, brain abscesses), ocular signs (uveitis, optic neuritis, endophthalmitis and other signs), anemia, thrombocytopenia, nephritis, cardiovascular complications (e.g., vasculitis, aneurisms, endocarditis), respiratory involvement (e.g., bronchopneumonia or pulmonary abscesses), peritonitis, pancreatitis, myelitis, and cutaneous rashes, ulcers or abscesses. Elevations in the liver enzyme alanine aminotransferase (ALT), with only mild increases in aspartate aminotransferase and no unusual liver pathology, were reported to be common in people infected with B. suis on 2 islands in Polynesia. Epididymo-orchitis, prostatitis and

seminal vesiculitis can be seen in males, and pregnant women may abort or give birth prematurely.

Sepsis, pneumonia and other syndromes have been reported in congenitally infected infants, but some infected newborns are asymptomatic. Deaths are uncommon except in infants, and are usually caused by endocarditis or infections affecting the brain. After treatment, recovery may take a few weeks to months. Descriptions of brucellosis are mostly derived from cases caused by B. melitensis, B. abortus and B. suis. However, B. canis infections have been consistent with these descriptions, as were the four cases caused by brucellae from marine mammals. Two of these patients had neurological signs, one had spinal osteomyelitis, and the fourth had nonspecific signs of illness and severe sinusitis. Two people infected with B. neotomae developed neurological signs (e.g., recurrent headache, disorientation, hemiparesis), with additional symptoms that included intermittent fever, malaise, lethargy, myalgia, joint pain, weight loss, cough and anorexia. B. inopinata was isolated from an infected breast implant, possibly following a systemic infection. An organism that might also be B. inopinata was found in the lungs of a person with chronic destructive pneumonia.

Clinical signs Bovine TB

Tuberculosis can be difficult to diagnose based only on the clinical signs. In developed countries, few infections become symptomatic; most are diagnosed by routine testing or found at the slaughterhouse. In cervids, tuberculosis should be considered in the differential diagnosis when abscesses of unknown etiology are found.

2.13. DIAGNOSTIC TESTS OF ZOONOTIC DISEASES

A- DIAGNOSTIC TEST OF RABIES

Detection of antigen

RABV antigen were detected using the direct fluorescent antibody(DFA) test of skin biopsy specimens, touch impression of corneal epithelial cells, or fresh brain tissue as described(CDC,2006).Skin biopsy specimens were taken from the nuchal area of the neck

where viral antigen can be present in hair follicles containing cutaneous nerves(Noah,1998).

Serology

RABV antibody testing for cases reported before 1973 utilized the mouse neutralization test (Jackson,2003).After 1973 ,serology was determined using the rapid fluorescent focus inhibition test (RFFIT) or the indirect fluorescence assay(IFA),as described previously(Noah,1998).The RFFIT measures RABV neutralizing antibodies while the IFA detects serum reactive with RABV antigen in infected cell cultures. Antibodies in serum were considered diagonistic if there was no history of rabies immunization prior to sample collection .Antibodies in cerebrospinal fluid (CSF)were considered diagnostic regardless of rabies immunization history.

Virus isolation

RABV was isolated through intracerebral inoculation of suckling mice or by addition of suspensions of brain or saliva specimen to culture mouse neuroblastoma cells (Noah,1998).

RNA detection

Viral nucleic acids were obtained using standard extraction procedures and reagents. Samples used for nucleic acid extraction included saliva, fresh brain paraffin-embeded brain, and nuchal skin. Reverse transcription polymerase chain reaction (RT-PCR) was performed using primers targeting the sequence of the nucleoprotein gene. Standared dideoxynucleotide sequencing methods were utilized to determine the nucleotide sequences of all PCR products obtained (Noah,1998).

Identification of rabies virus variants

RABV variants were identified through antigenic and/or molecular typing. Antigenic typing uses a reference panel of monoclonal antibodies directed against the nucleoprotein to determine the variant of RABV isolates. Molecular typing methods identify the RABV variant by comparing the nucleotide sequence obtained by RT-PCR with a database of sequences from known reservoirs within the United State as well as foreign countries throughout the world.

B-Diagnosis of anthrax

Bacteriologic Tests

Bacillus anthracis is a large, gram-positive, aerobic, spore-forming bacillus that measures 1.0 to 1.5 µm by 3.0 to 10.0 µm (Table 6, Figure 2). Methylene blue stained smear of CSF, blood, pleural fluid shows long and thick bacilli, surrounded by amorphous purplish area representing the capsular material (the McFadyean reaction).3 A part of the B. cereus group of bacilli, B. anthracis is easy to differentiate from other members of the B. cereus group by observing the morphologic features of the colony ona blood-agar plate. Colonies of most B. anthracis isolates are non-hemolytic and are white to gray, often looking like ground glass. It is non motile, is non hemolytic on sheep's-blood agar, grows readily at a temperature of 37°C, and forms large colonies with irregularly tapered outgrowths (a "medusa head" appearance generally seen with the low power objective of the microscope where the tangled bacilli appear like the serpents on the mythological medusa head).5In vitro it grows as long chains, but in the host it appears as single organisms or chains of two or three bacilli. It forms mucoid colonies an exhibits a prominent capsule when grown on nutrient agar (containing 0.7 percent sodium bicarbonate in the presence of 5 to 20 percent carbon dioxide). It is identified as B. anthracis by standard biochemical reactions. the culture of tissue grows B. anthracis; however, all cutaneous samples may not be positive for the bacteria. Nevertheless, other samples like blood, pleural fluid, CSF grow large number of encapsulated bacilli. the bacteria may be dismissed as contaminant by laboratory staff unless physician specifically requests testing. 3 blood cultures in cases of systemic anthrax infection are almost always positive, because of the large numbers of bacterial cells in the circulation. Cultures of tissue from skin lesions, however, are not useful diagnostically, because the rate of does not exceed 60 to 65 percent, probably owing to the microbicidal activity of local antagonistic skin flora

Serologic and Immunologic Tests

The major immunogenic proteins of B. anthracis appear to be capsular antigens and the exotoxin components. Specific enzyme-linked immunos or bent assays (eLIsAs) that show a quadrupling of the titer of antibodies against these components are diagnostic of past infection or vaccination. the most reliable indicators are the titers of antibody to protective

antigen and to capsular components. In studies of the measurement of antibody titers by eLIsA, the sensitivity of possible indicators was as follows: 72 percent for protective antigen, 95 to 100 percent for capsule antigens, 42 percent for lethal factor, and 26 percent for edema factor. Indirect microhemagglutination gives results similar to those obtained with eLIsA but has certaindrawbacks, including the short shelf life of antigen-sensitizedred-cell preparations, the limited reproducibility of the test, and longer preparation times.

C-DIAGONSTIC TEST OF BRUCELLOSIS

Microscopic examination

Microscopic examination of smears from affected tissues, secretions and exudates, using modified Ziehl-Neelsen (Stamp) staining, may aid in a presumptive diagnosis. Brucellae are not truly acid-fast, but they are resistant to decolorization by weak acids, and stain red. They appear as coccobacilli or short rods, usually arranged singly but sometimes in pairs or small groups. Other organisms such as Chlamydia abortus and Coxiella burnetii can resemble Brucella.

Culture and other bacteriological methods

Brucellae may be isolated from aborted fetuses, the placenta, vaginal swabs, milk, semen, lymph nodes and affected tissues. Blood can be useful in B. canis-infected dogs, which may have prolonged bacteremia. Brucellae can be cultured on a variety of nonselective media, or on selective media such as Farrell's, Thayer-Martin’s or CITA medium. Enrichment techniques can also be used. Most species of Brucella grow slowly, and some isolates do not grow well on certain selective media. However, some of the recently described organisms, including B. microti and B. inopinata, exhibit rapid growth on many media and can be mistaken as organisms other than brucellae. These rapidly growing species are often misidentified as members of the genus Ochrobactrum by commercial bacterial identification systems. Commercial ystems have also been reported to occasionally misidentify other species of Brucella. Brucellae can be isolated by inoculation into guinea pigs or mice, but this is rarely done. Brucellae can be identified to the species and biovar level by phenotypic methods (phage typing and cultural, biochemical and serological characteristics) or genetic techniques. Due to issues such as the high genetic similarity

among brucellae, the expertise of a reference laboratory may be needed to identify an organism or confirm its identity. Genetic tests that may be used in identification include various genus or species-specific PCR tests (including multiplex assays such as the Bruce-ladder orolder AMOS tests), single nucleotide polymorphism (SNP) typing and matrix-assisted laser desorption/ionization time -of-flight mass spectrometry (MALDI-TOF MS). Among its other uses, MALDI-TOF MS is reported to be valuable for identifying the brucellae found in frogs. While PCR is mainly used to identify organisms in culture, some laboratories may employ it directly on clinical samples. Techniques such as multiple-locus variable number tandem repeat analysis (MLVA) can be used in epidemiological investigations of outbreaks. Antigen detection techniques, such as immunostaining/ immunohistochemistry, are sometimes employed in research, but they are not used routinely for diagnosis.

Serology and brucellin skin tests

The brucellae found in domesticated animals and marine mammals are divided into two serological groups, one that has "smooth" lipopolysaccharide (LPS) in the cell wall and another that has "rough" LPS. A number of serological tests have been developed for the smooth brucellae, which include B. abortus, B. melitensis, B. suis, B. ceti and B. pinnipedialis. These tests cannot, however, distinguish reactivity to different organisms within this group. They also cross-react with a number of other bacteria. Other tests are used to recognize antibodies to B. ovis and B. canis, which both have rough LPS. Serology can help diagnose clinical cases or screen herds in most species; however, it is not considered to be reliable for diagnosis in individual pigs .There are no established serological tests yet for some of the more recently recognized brucellae. A brucellin skin test can be used to test pigs for B. suis, or unvaccinated small ruminants and cattle for B. melitensisand B. abortus, respectively. A skin test was employed in Bactrian camels in the former USSR. Skin tests are useful as herd tests, but they are not sensitive enough to be detect infections in individual animals.

D- Diagnosis of bovine TB

Differential diagnosis

The differential diagnosis includes contagious bovine pleuropneumonia, Pasteurella or Corynebacterium pyogenes pneumonia, aspiration pneumonia (which is often secondary to chronic wasting disease in cervids), traumatic pericarditis, caseous lymphadenitis or melioidosis in small ruminants, and chronic aberrant liver fluke infestation.

Laboratory tests

In live cattle, tuberculosis is usually diagnosed in the field with the tuberculin skin test. In this test, tuberculin is injected intradermally; a positive test is indicated by a delayed hypersensitivity reaction (swelling). The tuberculin test can be performed using bovine tuberculin alone, or as a comparative test that distinguishes reactions to M. bovis from reactions to environmental mycobacteria. The U.S. uses the caudal fold (bovine tuberculin) test for the preliminary screening of cattle; reactors are re-tested with the comparative cervical test. The single cervical test is used for preliminary screening of cervids. A comparative cervical test is used for the initial screening of cattle in Europe. False negative responses are sometimes seen soon after infection, in the late stages of the disease, in animals with poor immune responses and in those that have recently calved.

3. Methods and Materials.

3.1. Study Area

The research was conducted in Sibu-Sire district, East Wollega Zone of Oromia Regional State, Southwestern Ethiopia (Figure 2). Sibu Sire is one of the districts in East Wollega Zone and is located at 281km southwest Addis Ababa City. It is located east of Nekemte, the administration town of east Wollega Zone at 50 km. This district is bordered in the east with Gobo Sayo, in the west with WayuTuka, in the south with Wama Hagalo and Bello Boshe and in the north with Gudeya Bila and Guto Gida districts. The district has 23 kebeles; of these 19 are rural and 4 urban kebeles.

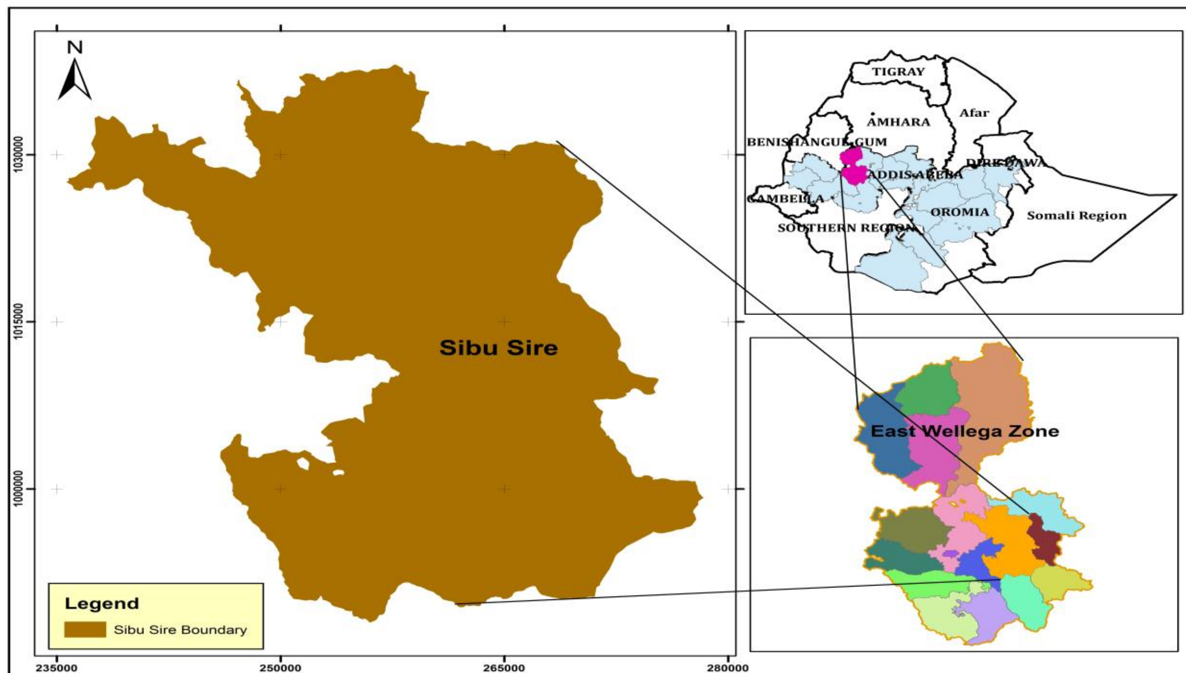


Fig 2. Map of study area

3.2. Demographics

The study area has a total population of 124,304 and of these there were 6,744 and 6,954 urban male and female dwellers, respectively, while the numbers of male and female rural dwellers were 54,920 and 55,686, respectively. The number of house hold farmers is 14990 Sibu-Sire district has an estimated population density of 27.8 people per square kilometer (SSDA, 2013). The number of high school and preparatory students is 3,969. The numbers

of teachers and house hold farmers were 642 and 14,990, respectively. There were 37nurses.

3.3. Topography and Climate

The altitude of the district ranges between 1360 masl to 2500 masl. This district geographically lies between $9^{0}19''$ N latitude and $36^{0}52'60''$ E longitudes. There are 3 agro-ecological zones in this district. The majority (74.3%) of the district is classified as mid-land followed by lowland (18-27%) and highland (7.53%). The minimum, maximum and mean temperatures of this area were 14.09^{0}C, 27.30C and 22.55^{0}C, respectively. The highest temperature occurs in February and March. The lowest temperature occurs in July and August. The annual average rain fall of the district is 1295 mm (RLEPOSSD, 2013).

3.3.1. Health

Sibu-Sire district has 1 hospital, 4 health centers, and 22 health posts. From the 22 health posts- 19 of them are rural and 3 of them are urban. There were 37 nurses,28 health officers, 12 laboratory technicians,3 environmentalists (environmental health professionals), 8 pharmacists, 43 extension workers,10 midwifery and 9 medical doctors who are currently working in these different health care facilities. Each health posts were staffed by two Health Extension Workers (HEWs) providing health care service on 16 selected 'health packages'.

3.3.2. Agriculture

The total area of Sibu-Sire district is 1047.44 km^2. Out of these, 83.49% of the land was cultivable, 8.35% was for grazing, 5.79% was area of infrastructure like home construction area,1.85% was forest and 0.52% was swampy. Sibu- Sire has different agro-ecological zones that help to produce different crops. The main crop produced was maize (55.6%), sorghum (16.8%), teff (12%), finger millet (9.6%) and 6 % was other different cultivated crops. A cash crop like coffee was also produced in small quantity. There were 237,700 cattle, 55,498 sheep, 54,222 goats, 20,142 donkeys, 14,700 horses, 1794 mules and 98,528 chickens in the Sibu Sire district (SSAO, 2018).

3.3.3. Study population and design

A cross sectional study was conducted by using a closed ended questionnaire. The study was focused on assessing public's conception and practices of One Health Approach in preventing zoonotic diseases in Sibu-Sire district, west Wollega Zone, Oromia Regional State. The study population was residents of Sire town and its surrounding *kebeles.* The questionnaire was administered to selected 13 teachers, 79 students, 299 farmers and 37 nurses. Farmers who couldn't read and write were interviewed using Afaan Oromo. The questionnaire included questions that can evaluate the knowledge of One Health Approach and zoonotic diseases. Besides this, it also included questions to assess some practices that can exposes the public to zoonosis. The Afaan Oromo (local language) and English were used in the questionnaire.

3.3.4 Determination of sample size and Sampling techniques

Stratified random sampling method was used for the data gathered. The respondents were in four groups, namely house hold farmers (n=14990), teachers (n=642), high school and preparatory students (n=3969) and nurses (n=37).

Total sample size was determined by the following formula Yamane,(1967)

$$n = \frac{N}{1+N(e)^2} = \frac{19638}{1+19638(0.0025)} = 392$$

Where n- total sample
N total population
e- Is the level of precision (0.05)

The sample size of each stratum was determined by the following formula

nh = (Nh / N) * n   Where nh is the sample size for stratum h, Nh is the population size for stratum h, N is total population size, and n was total sample size.

For farmers $nh = \frac{(14990)}{19638} \times 392 = 299$

For students $nh = \frac{(3969)}{19638} \times 392 = 79$

For teachers nh= $\frac{(642)}{19638}$ X 392 = 13

For nurses nh= = $\frac{(37)}{19638}$ X 392 = 0.73

According to this formula sample of nurses is very negligible so that the total workers will be considered. Accordingly, 299 farmers, 13 teachers, 79 students and 37 nurses were included for this study. The 299 farmers which were selected from the total house hold farmers (14990) using the above formula were divided and distributed for the 23 kebeles of the district (wereda), accordingly 13 farmers were interviewed per kebele (Ganda). Further this 13 farmers in each kebele are distributed to the different zone (subkebele) .The 79 students which were selected from 3969 total high school and preparatory students in the district were divided and distributed for four schools based on the number of students each school possesses .The 13 teachers which were selected were distributed for the 13 schools in the district. Since the sample size obtained for the nurses using the above formula was negligible the total number of nurses in the district (wereda) was utilized.

3.4. Data collection and analysis

The data which was collected through questionnaire and interview was properly coded and analyzed using statistical packages for social sciences (SPSS) software version 21. Descriptive statistics (percentage) was used to summarize the results. The collected data were interpreted using Tables, Figures and pie charts. A p-value was considered to represent a significant difference at 5%.

4. RESULTS

4.1. Demographic characteristics

The total number of participants consisted of 428 from Sibu-Sire district of eastern Wollega Zone, Oromia Regional State, south western Ethiopia (table 1). The study groups were four namely teachers (3%), students (18.5%), farmers (69.9%) and nurses (8.6%). Males (n=316) accounted for 73.8 % and female (n=112) 26.2% of the respondents. Among the study groups 83.4% were rural residents and the rest 16.6% urban dwellers. Around 73% of them were married. A total of 251 (58.6%) of the study subjects were illiterate, whereas 41 of them (9.6%) had basic education .The rest 32% (n=137) of the respondents attended from primary school to university education (Table 1).

Table -1 Socio-demographic characteristics of the respondents

		Count	Column N %
Sex of respondent	Male	316	73.8
	Female	112	26.2
age of respondents	13-22	79	18.5
	26-35	13	3.0
	36-45	27	6.3
	46-55	83	19.4
	56-65	158	36.9
	66 and above	68	15.9
marital status	Married	316	73.8
	Unmarried	91	21.3
	Divorced	11	2.6
	Widow	10	2.3
Educational status	Illiterate	250	58.4
	basic education	41	9.6
	primary school	8	1.9
	high school	36	8.4
	preparatory school	43	10.0
	Diploma	17	4.0
	university degree	33	7.7
	masters and above	0	0.0
occupation of respondents	Teacher	13	3.0
	Student	79	18.5
	Farmer	299	69.9
	Health worker	37	8.6
residence location	Urban	71	16.6
	Rural	357	83.4

4.2. Knowledge of One Health Approach

The result revealed that only 27.4% of farmers and 36.7% of students knew about One Health, on the other hand 10/13 of teachers and all nurses are aware of One Health Approach. A significant number of farmers (217/299) were not aware of the interdependency of health of human, animal and the environment (One Health)(table 2). This study shows that a considerable number of farmers (166/299) didn't know whether

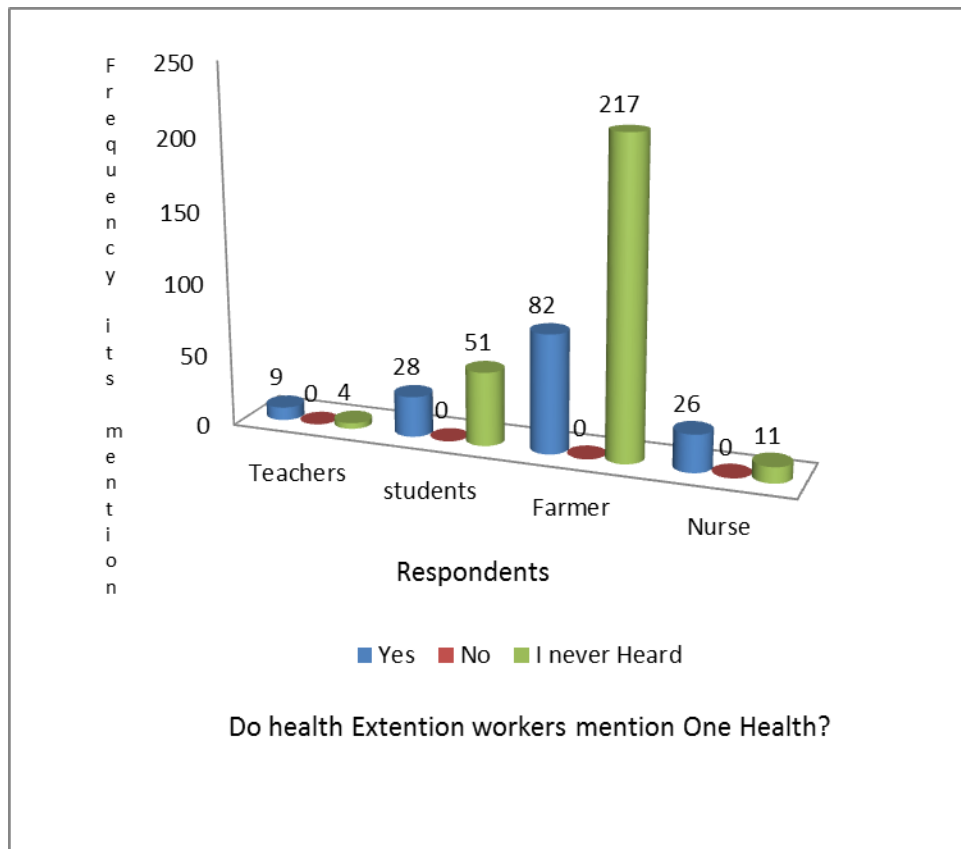
zoonosis can be prevented through One Health Approach or not. Similarly, 63.3% of students didn't know if this new approach can tackle the problem of zoonosis. On the other hand 10/13 teachers and all nurses knew One Health Approach could prevent zoonosis (Table 2).

Table 2 knowledge about one health approach and occupation of respondent

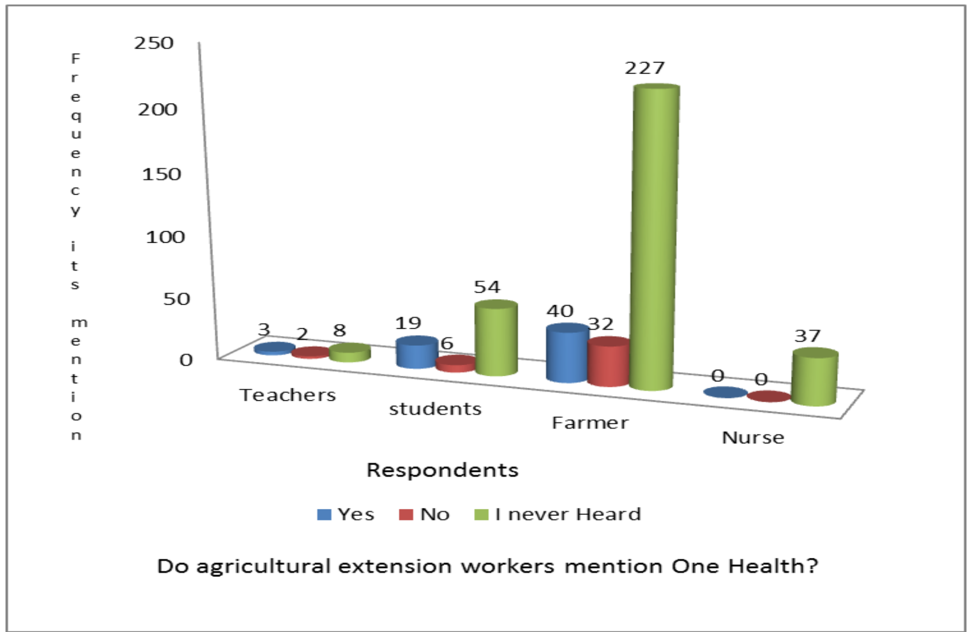
		occupation of respondent								p-value
		Teacher		Student		Farmer		health worker		
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %	
knowledge of one healthy strategy	no I don't	3	23.1	50	63.3	217	72.6	0	00.0	0.000
	yes I do	10	76.9	29	36.7	82	27.4	37	100.0	
one health includes	human health only	3	23.1	50	63.3	217	72.6	0	0.0	0.000
	animal health only	0	0.0	0	0.0	0	0.0	0	0.0	
	environmental health only	0	0.0	0	0.0	0	0.0	0	0.0	
	human, animal and environmental health	10	76.9	29	36.7	82	27.4	37	100.0	
Do you believe One Health prevent zoonosis	yes I do	10	76.9	29	36.7	82	27.4	37	100.0	0.000
	no I don't	0	0.0	0	0.0	51	17.1	0	0.0	
	I don't know	3	23.1	50	63.3	166	55.5	0	0.0	

4.3. Training on One Health Approach and frequency of its mention by diverse professionals/officials.

The respondents were asked about One Health Approach and frequency of its mention by diverse professionals (Fig 3). The result revealed that 9/13 of teachers, 28/79 of students, 82/299 of farmers and 26/37 of nurses said that the health extension workers mention about the importance of keeping the health of human, animal and the environments (One Health).None of the respondents said that One Health Approach was mentioned by the kebele leaders and environmentalists .According to this study a considerable amount of teacher (8/13), student(54/79), farmers(227/299),and all nurses said that we never heard when the agricultural extension workers mention about One Health Approach in the study area(Fig 3).



(a)



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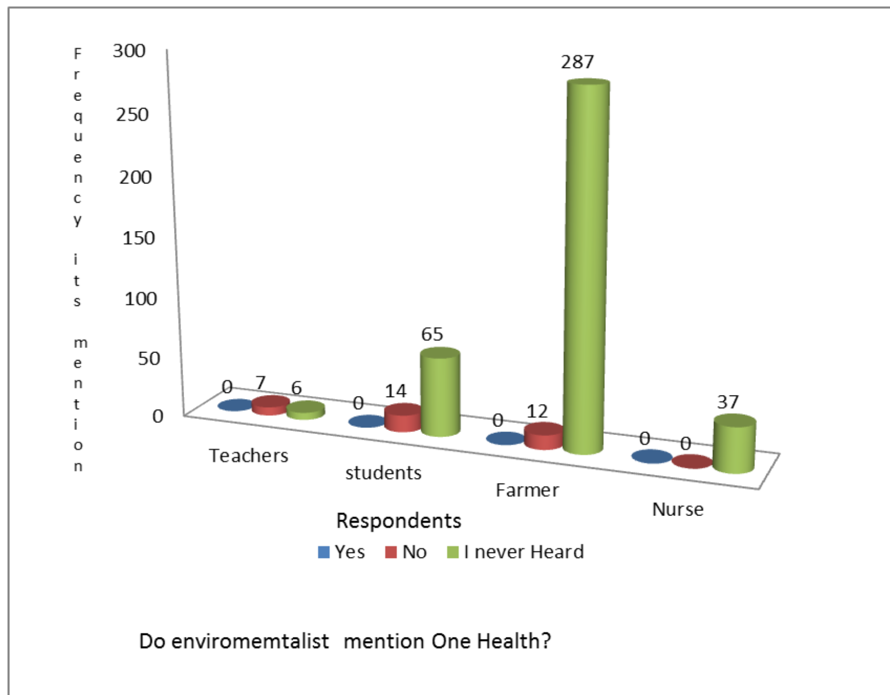

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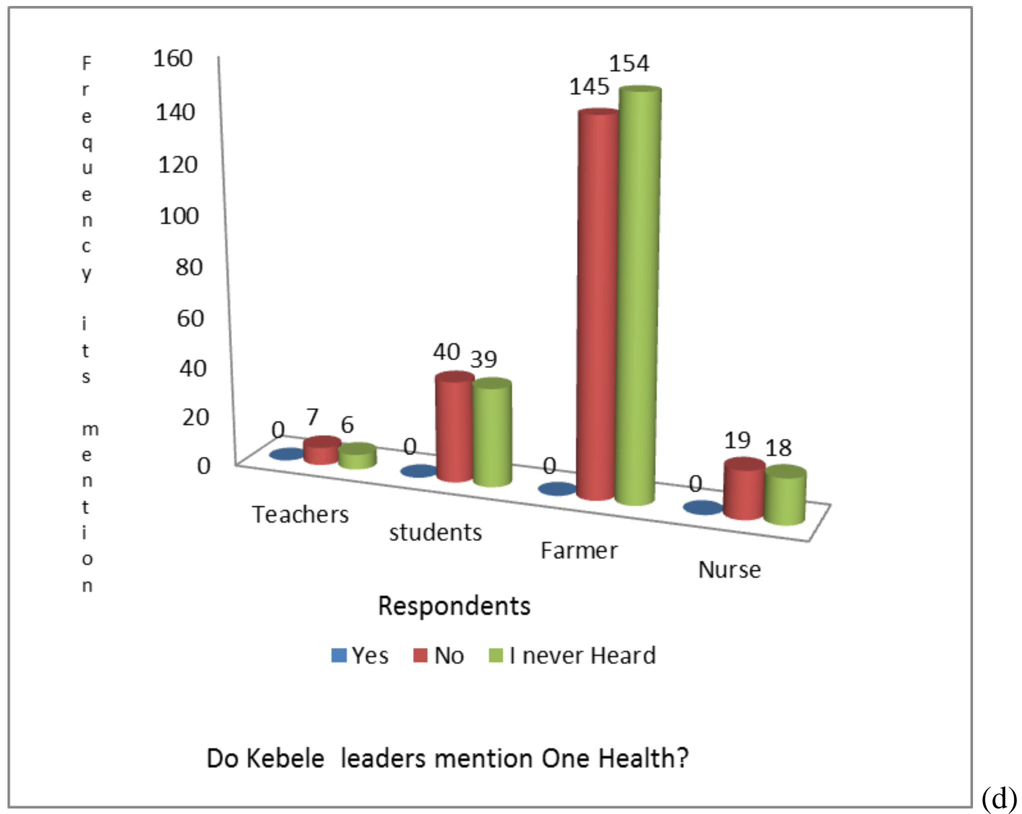

(d)

Fig 3. Training on One Health Approach and frequency of its mention by diverse professionals/officials.

Table 3. The effort of the respondents in preventing zoonosis using OHA

	Frequency	Percent
Nothing is done	**100**	**23.4**
A lot is done	**5**	**1.2**
Little is done	**283**	**66.1**
I don't know	**40**	**9.3**
Total	**428**	**100.0**

4.4. Awareness of common Zoonotic Diseases

The respondents were asked about the common Zoonotic diseases in the study area (Table 4). The results reveal that the most unfamiliar zoonotic disease among the respondents was brucellosis. All of the farmers, teachers, students and nurses have no information about it. Concerning bovine TB 62.2 % of farmers do not have information, they only heard it. Only 10.7% of them knew both the sign and mode of transmission of bovine TB, the other 25.8% knew only its mode of transmission. To the contrary, 61.5%, 43.1%, 100% of teachers, students, nurses respectively knew both the sign and mode of transmission of bovine TB. The most familiar disease among farmers was rabies, 99.1 % of them knew either its sign or mode of transmission or both. Rabies was also well known among other stratum in this study. On the other hand 8/13,45/79,139/299,37/37 of teachers, students, farmers and nurses respectively knew both sign and mode of transmission of anthrax (table 4).

Table- 4 Knowledge level of stratum on common zoonotic diseases

Knowledge about		occupation of respondent								p-value
		Teacher		Student		Farmer		Health worker		
		Count	%	Count	%	Count	%	Count	%	
Rabies	no information	0	0.0	0	0.0	1	0.2	0	0.0	0.000
	only heard of	0	0.0	0	0.0	3	0.7	0	0.0	
	Know only signs	2	15.4	0	0.0	3	1.0	0	0.0	
	Know only transmission mode	4	30.8	43	54.4	164	55.3	0	0.0	
	know sign & mode of transmission	7	53.8	36	45.	128	42.8	37	100.0	
B.Tuberculosis	no information	0	0.0	0	0.0	4	1.3	0	0.0	0.000
	only heard of	0	0.0	16	20.2	186	62.2	0	0.0	
	Know only signs	0	0.0	0	0.0	0	0.0	0	0.0	
	Know only transmission mode	5	38.5	29	36.7	77	25.8	0	0.0	
	know sign & mode of transmission	8	61.5	34	43.1	32	10.7	37	100.0	
Brucellosis	no information	13	100.0	79	100.0	299	100.0	37	100.0	0.728
	only heard of	0	0.0	0	0.0	0	0.0	0	0.0	
	Know only signs	0	0.0	0	0.0	0	0.0	0	0.0	
	Know only transmission mode	0	0.0	0	0.0	0	0.0	0	0.0	
	know sign & mode of transmission	0	0.0	0	0.0	0	0.0	0	0.0	
Anthrax	no information	0	0.0	0	0.0	1	0.3	0	0.0	0.000
	only heard of	2	15.4	0	0.0	64	21.4	0	0.0	
	Know only signs	0	0.0	0	0.0	0	0.0	0	0.0	
	Know only transmission mode	4	30.8	34	43.1	95	31.8	0	0.0	
	know sign & mode of transmission	8	53.8	45	56.9	139	46.5	37	100	

4.5. Practices that can exposes to zoonosis

Over 77% of the respondents eat raw meat in spite 13/13,75/79,246/299 and 37/37 of teachers, students, farmers and nurses knew zoonosis could come through consumption of food like raw meat(Table 5 and6). According to the study groups 81% of the public in this study also drank raw milk (Table 5). Among the study groups only 13.1% of them did wash their hands with soap after touching animals to prevent the transmission of zoonoses (Table 5). Over 69% of the respondents threw away dead cattle on the field. The others (11.45%) used it for pets. Only 19.39 % buried or burnt dead animals (Fig 4).Over 79% of the respondents said that domestic animals share house with people in the study area(Table 5).

Table 5. practice of hand washing, animals' products consumption habits and sharing house with pets by the respondents

		Count	%
Do you eat raw meat?	yes I do	**330**	**77.1**
	no I don't	**98**	**22.9**
Do people eat meat of diseased animals?	yes they do it always	**247**	**57.8**
	no they don't	**0**	**0.0**
	yes they do it some times	**180**	**42.2**
Do people drink raw milk ?	no they don't	**78**	**18.2**
	yes they do	**350**	**81.8**
Do you wash your hand with soap to prevent zoonosis after touching animals?	yes I do it always	**56**	**13.1**
	no I don't	**58**	**13.6**
	yes I do it sometimes	**14**	**3.3**
	I wash only when i eat food	**300**	**70.1**
Do domestic animals share house with people?	yes they do	342	79.9
	no they don't at all	11	2.6
	yes they do in some few cases	75	17.5

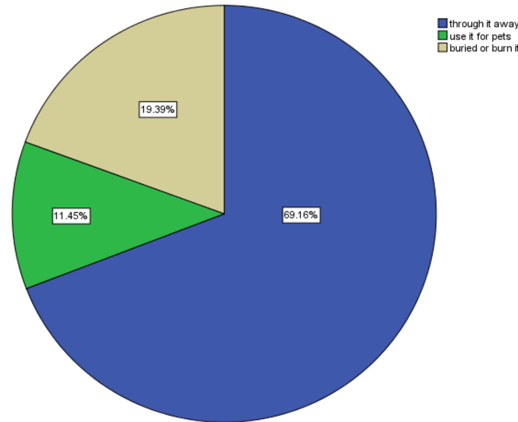

Fig-4 Handling of died cattle by the respondents

4.6. Knowledge level of respondents concerning mode of transmission of zoonotic diseases

According to this study, all of the respondents (n=428) knew that zoonotic disease can be caused by the bite of infected animal (Table 6). According to this study 100%, 94.9%, 82.2%, 100% of teachers, students, farmers and nurses, respectively knew that zoonosis could be caused through eating foods like raw meat. In spite of this fact 77.1% (n=330) of the respondents eat raw meat (table 5). Only 4.3% of farmers agreed that zoonosis could be caused through inhalation. To the contrary, all the nurses and a large number of teachers (76.9%) agreed that zoonosis could be caused through inhalation. About half (49.4%) of the students did not know that zoonotic diseases could be caused through inhalation. This study further revealed that very few farmers (25.7%) knew that zoonosis could be transmitted through handling animals with cut or wound. On the other hand a good proportion of teachers (10/13), students (62/79) and all nurses knew that zoonosis could be caused through handling animals with cut or wound. (Table 6).A significant number of the farmers (62.9%) did not believe that zoonotic diseases could be caused by sharing a living room with animals (Table 6).Among the four stratum (10/13),(54/79),(129/299) of teachers, students, farmers respectively and all nurses knew the transmission of zoonosis through direct contact with blood and secretion from animals (Table 6). Over 86.6% of farmers and 68.4% of students did not know vectors could cause zoonosis. A considerable number of

the farmers (81.3%) did not know that wildlife could be a source of zoonotic diseases. Over 45.6% of the students included in this study had no idea whether wildlife could be a source of zoonotic diseases or not (Table 6).

Table 6. knowledge of respondents concerning mode of transmission of zoonotic diseases

Mode of transmission of Zoonotic diseases.		occupation of respondent								P value
		Teachers		Students		Farmers		Health workers		
		Count	%	Count	%	Count	%	Count	%	
Bite from infected animal	Agree	13	100.0	79	100.0	299	100.0	37	100.0	
	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	
Inhalation	Agree	10	76.9	40	50.6	13	4.3	36	100.0	0.000
	Disagree	3	23.1	39	49.4	286	95.7	0	0.0	
Direct contact with blood & secretion from animal	Agree	10	76.9	54	68.4	129	43.1	37	100.0	
	Disagree	3	23.1	25	31.6	170	56.8	0	0.0	0.000
Handling animal with cut or wound	Agree	10	76.9	62	78.5	77	25.7	37	100.0	
	Disagree	3	23.1	17	21.5	222	74.2	0	0.0	0.000
Through vectors	Agree	7	53.8	25	31.6	40	13.4	18	48.6	
	Disagree	6	46.2	54	68.4	259	86.6	19	51.4	0.000
Through food like raw meat	Agree	13	100.0	75	94.9	246	82.2	37	100.0	
	Disagree	0	0.0	4	5.1	53	17.8	0	0.0	0.000
sharing same room with animals	Agree	13	100	43	54.4	111	37.1	37	100.0	
	Disagree	0	0.0	36	45.6	188	62.9	0	0.0	0.000
Wildlife health can affect human health?	strongly agree	1	7.7	19	24.1	0	0.0	0	0.0	
	Agree	9	69.2	17	21.5	22	7.4	37	100.0	
	strongly disagree	0	0.0	0	0.0	0	0.0	0	0.0	0.000
	Disagree	0	0.0	7	8.9	34	11.4	0	0.0	
	I have no idea	3	23.1	36	45.6	243	81.3	0	0.0	

5. DISCUSSION

Transforming One Health Approach into action is helpful to reduce the threat caused by zoonosis because this approach plays a significant role in the prevention and control of zoonoses. In spite of this fact the awareness creation about One Health Approach in the study area is low. According to this study 72.6% of farmers and 63.3% of students did not know One Health Approach and did not take any training on it. These groups of the public were not aware of the health of animals and the environment could affect their own health. There are different indications that show the occurrence of infectious diseases in different forms will continue to be significant global concern (Graham et al., 2008). Every day, thousands of children and adults die from under diagnosed diseases that have arisen at the human–animal–environment interface, especially diarrheal and respiratory diseases in developing countries (WHO 2006, 2009). One Health concept provided lessons for the development of a new approach to global health system. The aim of One Health is to improve health and well-being through the prevention of risks and the mitigation of effects of crises that originate at the interface between humans, animals and their various environments (One Health Global Network, 2015). In fact, zoonotic pathogens account for the majority of emerging infectious diseases in people (Taylor LH, 2001), and more `than three-quarters of emerging zoonoses are the result of animal origin pathogens (Jones k, 2008).

In this study area One Health awareness creation effort done by the agricultural extension workers was poor, about 227/299(75.91%) of farmers and 54/79(68.4%) of students said they never heard One Health Approach being mentioned by them. The public prevention effort of zoonosis control through One Health Approach in the study area is found to be low. None of the teachers, students, farmers and nurses heard One Health Approach being mentioned by local government officials like kebele/Gote leaders in the study area. Even though it was not satisfactory, some work had been started by Health extension workers, only 82/299(27.4%) of the farmers and 28/79(35.4%) of students mentioned that the health extension workers taught us the importance of keeping the health of animal and environment to solve human health problem (One Health). In general, this study revealed

that there is a gap on educating the public about One Health Approach. There is no collaborative work among different stake holders. The job done by agricultural extension workers, environmentalist and kebele leaders to this regard is poor. The leaders in the area did not mention about this new health prevention approach at public gatherings. To tackle the problem posed by zoonosis, coordinated multispectral action that brings together those working on human, animal and ecosystems health is needed (FAO, 2008). We need to establish One Health clubs in our schools to bring an effective approach in bring the needed awareness creation both at school and community level.

One Health is intended and has great potential to benefit the health of all species. It is a movement capable of mobilizing multiple sectors. Wildlife-associated disease has been a long-time and persistent concern in the world, but in many developing countries, wildlife-associated disease had not been widely perceived by the public. Wildlife-associated disease awareness, has grown in the wake of the evidence that 75% of all Emerging Infectious Diseases (EIDs) are zoonotic, most originate in wildlife, and EID incidence has continued to increase since 1940 (Jones et al. 2008). However, the general public may still have limited awareness or concern about wildlife diseases (Hanisch-Kirkbride et al. 2013). The level of awareness of the public about zoonotic diseases that originate from wildlife particularly among the farmers in this study was poor since 81.3% of the farmers included in this study said that they didn't know whether wildlife could be a source of zoonosis or not. Similarly, about 45.6% of students had no idea about wild life zoonosis. On the other hand, nurses and teachers had better knowledge regarding wildlife zoonosis. This study shows that there is a knowledge gap in relation to wildlife zoonosis among farmers and students that strongly needs awareness creation on negative impact of zoonosis originating from wildlife with increasing prevalence from time to time.

The One Health movement is intended to improve the health of multiple species and the environment, and it has great potential and promise in this regard. One Health messages must resonate with wildlife, human, and domestic animal health professions. This is perhaps best achieved by collaboration of these allied fields in message development and communication design efforts. Communication and coordination is needed in One Health Approach to ensure consistency and effectiveness.

According to this study most people living in the study areas were not aware of the danger of zoonotic diseases or what can be done to reduce it. Zoonotic transmission can be exacerbated by common animal husbandry and food and water handling practices (Cleaveland et al., 2003). Many studies have shown that unclean animals can be a source of contamination. Majority of the farmers did not aware about zoonotic diseases associated with animals. Farmers were found to have very poor awareness about the importance of hygienic practices related to handling animals. A large number (83.7%) of the respondents said that they did not wash their hands right after touching animals or during eating food. This condition would put them at risk for contracting zonotic diseases. Zinsstag et al.,(2007) have suggested that General Hygienic Practices and zoonotic disease control programmes need to be integrated in order to avert transmission of diseases from animals and animal products since most of the zoonotic pathogens are maintained in animal reservoirs.

Similarly, a considerable number of the respondents (69.16%) used to throw away dead diseased cattle on the field. This result reminds us the public in the study area lack awareness about the relationship between environmental health and occurrence of zoonosis. This can tell us there was poor One Health awareness creation activity was held to the public. It is crucial for the public to recognize that zoonotic pathogens are wide spread in our environment causing mortality and morbidity to our rural and urban communities and can be tackled better through One Health Approach. To uphold the public health, exhaustive One Health Approach awareness creation activities should be undertaken in the area.

About 81.8% of the public consume raw milk .Raw meat consumption in the area is also wide spread. Around 77% (n=330) of the respondents eat raw meat in spite of the fact that 100%,94.9%,82.2%,100% of teachers, students ,farmers and nurses knew that raw meat could be source of zoonosis. More or less similar awareness was observed with regarding the meat borne zoonotic diseases as compared to a study conducted by Amenu et al (2010), who indicated that 96.3% of the Respondents knew that contaminated meat and raw meat were vehicles for disease transmission to humans. This might put the public in the study area Vulnerable as far as zoonotic diseases are concerned. The level of raw meat

consumption in the different educational level groups was not significantly different in the study area. This could be due to the deep rooted culture of consuming raw meat in the different social groups of the area, even by highly educated individuals including teachers and nurses. This is similar with the work of (Abunna et al., 2008). From this practice it is imminent that there is high probability of getting zoonotic infection like anthrax. Raw meat consumption is practiced in some parts of the world as a cultural heritage passed through many generations. Countries like Russia, Cuba and many social groups on the African continent are known to consume raw and/or undercooked meat (Sua´rez and Santizo, 2005). It seems there is deep rooted culture of raw meat consumption in the study area. To safe guard the public, an intensive awareness creation programs should be undertaken in the area regarding the danger of raw meat consumption which can predispose to food borne pathogens like anthrax and bovine tuberculosis. The low level of awareness about the zoonotic importance of anthrax in the area is of concern given that the disease is endemic in most part of the country. As a zoonosis anthrax's fatality rate is very high both in humans and animals. The wide spread culture of raw meat consumption combined with the lower level of awareness about anthrax seems to put the public at a greater risk of contracting the disease.

Brucellosis is the least known zoonotic disease in the study area .Let alone the sign and mode of transmission, no one even knew it as a zoonotic disease. The level of awareness of brucellosis in this study area is even lower than that of Mihiret-ab (2012) who reported that 5.6% of the respondents in Dire Dawa were aware of the zoonotic importance of brucellosis. The lack of hygienic measures in animal husbandry and in food handling partly account for brucellosis remaining a public health hazard. Over 53.8% of teachers and 45% students knew both the sign and mode of transmission of rabies, the remaining knew either only its sign or only its mode of transmission. Therefore relatively rabies is the most known zoonosis in the area. Globally, about 55,000 persons die annually due to rabies where rabid dog bites account for 99% of the infection (WHO, 2011), so the awareness level of the public in the study area regarding rabies was promising to protect the danger coming out of it. On the other hand around 61% of teachers and 43.1% of student knew both sign and transmission of bovine TB. Similarly both sign and mode of transmission of anthrax were

known by 53.8% of teachers and 43.1% of students. Brucellosis, rabies, bovine tuberculosis (BTB) and anthrax are listed as endemic zoonoses of concern (WHO, 2006). In developing countries they constitute an important threat to human health (Wastling et al., 1999). There was a significant association between Knowledge of zoonotic tuberculosis and, anthrax with educational status of the participants ($P<0.005$) where teachers, students and nurses had the highest awareness and farmers had the lowest awareness.

The absence of awareness among farmers in the present study area might be due to poor awareness creation activities that should have been given by the public health bureau of the area and the veterinary department. Public's awareness about some common zoonotic diseases and their means of transmission especially bovine tuberculosis, anthrax and brucellosis was very low.

In this study the knowledge of the public regarding the mode of transmissions of zoonosis is quite different. In general the level of awareness of farmers is low as compared to the other stratum. For instance 95.7% of farmers do not know the occurrences of zoonosis through inhalation, this awareness is lower than that of Singh et al.,(2015) in india who reported 55.6% of farmers did not know that zoonosis could be caused through inhalation. This knowledge gap in the two settings could be because of awareness creation activity difference in the two area. On the other hand in sibu sire 56.8% of farmers did not know direct contact with animals could cause zoonosis , this result is inline with that of Singh.,(2015)

who reported that 51.2% of farmers did not know if zoonotic diseases could be caused through contact. Around 74% of these farmers did not know handling animals with cut and 62.9% of them sharing the same room with animals could cause disease to human. Similarly 86.6% of the farmers did not know whether human could be infected by zoonotic diseases through vectors-These results are similar with that of Tebug *et al.,* (2015) who reported 6.8% of farmers in Senegal knew at least one mode of transmission.

This low level of awareness is likely to expose them to an increased risk of contracting zoonoses, as they are unlikely to take proper hygienic practices when dealing with abortions

or calves with diarrhea and during on-farm activities like milking, cleaning the cowshed or slaughtering cattle. Awareness should be created on One Health Approach to protect the public from the common zoonotic diseases in the area. The districts public health department should give due emphasis for public educating and awareness creation on preventive measures through One Health Approach to minimize the risk of zoonotic diseases in the area. The health extension workers, agricultural extension workers, wild life experts and environmentalist need to work together to educate and convince the community that One Health Approach is good means to create healthy environment for human survival.

6. Conclusion and Recommendation

6.1 Conclusion

From the obtained results, it is possible to conclude that

1. Knowledge of One Health Approach is poor particularly among farmers and students.
2. Knowledge of respondents on common zoonotic diseases with the exception of rabies is very low in the area.
3. The awareness of the farmers and students regarding domestic animals and wild life zoonosis is very low.
4. There is no co-ordinate awareness creation activity on One Health Approach and zoonotic diseases.

6.2. Recommendation

1. It is highly advisable to aware the public about One Health Approach and zoonotic diseases particularly farmers and students to facilitate disease prevention in the study area.
2. Disease prevention shall not be left to health workers only, the local political leaders like kebele officials need to mention the importance of One Health Approach at different gatherings. This can help the public to give more emphasis to zoonotic disease prevention programs.
3. There should be co-ordinate awareness creation activity among health extension workers, agricultural extension workers, wild life experts and environmentalists.

- One Health clubs should be established in schools. These students will be involved in a number of One Health activities such as brucellosis awareness campaign and environmental cleanings.

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QUESTIONNAIRES

APPENDIX 1

INFORMATION ABOUT PARTICIPANTS

A- Sex Male ☐ Female ☐ Age ☐

B- MARITAL STATUS

Married ☐ unmarried ☐ divorced ☐ widow ☐

C– Educational status

No formal education ☐ Primary education ☐ High school ☐

Preparatory school ☐ Diploma ☐ University degree ☐

C -Residence/Location

Urban ☐ Rural ☐

D - Occupation

Teacher ☐ Student ☐ Farmer ☐ Nurse ☐

E. Family size 1 ☐ 2-5 ☐ 6-9 ☐ 10 and above ☐

F. Monthly income 500-999 ☐ 1000-3000 ☐ 3001-5000 ☐

5001-8000 ☐ 9000 and above ☐

APPENDIX 2

I. CONCEPTION AND PRACTICES OF ONE HEALTH APPROACH

Choose the appropriate responses for the following questions.

1– Have you heard about One Health strategy?

A – No, I don't B – Yes, I do

2-What do you think that the One Health strategy includes?

A. Human health only B. Animal health only

C. Environmental health only D. Human, animal and environment health

3- Have you received training on One Health Approach?

A-Yes I do B-No I don't

4-Do you believe that One Health strategy can help to prevent Zoonosis?

A-Yes I do B-No I don't c-I don't know

APPENDIX 3

Choose the appropriate responses for the following questions.

5- Do the health extension workers in your area mention about One Health strategy?

A-Yes B-No C-I never heard of

6-Do the agricultural extension workers in your area mention about One Health strategy?

A-Yes B-No C-I never heard of

7- Do the environmental workers in your area mention about One Health strategy?

A-Yes B-No C-I never heard of

8- Do the Kebele leaders in your area mention about One Health strategy?

A-Yes B- No C- I never heard of

9-Do you believe that it is possible to prevent humans from Zoonotic disease that comes from pet?

A-No, nothing will be done about health of pets

B-Yes, by keeping our pets healthy

C-I have no idea

10- Zoonosis will be serious when animal-human link is poorly managed.

A –Strongly agree C-Strongly disagree

B –Agree D- Disagree

E-I don't know

11- If you strongly agree or agree to question number 10; do you think One Health approach strategy can improve this condition?

A-Yes it does

B-No I don't think so

C- I have no idea

12-Do the residents in your area have awareness about One Health Approach to prevent zoonosis?

A-No I don't think so C-Few is done

B-Yes, they have D-Nothing is done

13-How far do the communities try to prevent zoonosis through One Health approach?

A-Nothing is done B-A lot is done

C-Little is done D-I don't know

APPENDIX 4

PRACTICES

Choose the appropriate responses for the following questions

14-Do you eat raw meat? A-Yes I do B-No I don't

15-If yes for question number 14, don't you worry about Zoonotic diseases

A – Yes, I do B – No, I don't

16– Cattle could be a source of Zoonotic diseases.

A –Strongly agree C-Disagree

B – Agree D-Strongly disagree-EI don't know

17-Do people in your area eat the meat of diseased animal?

A – Yes they do it always

B – No they don't

C – Yes they do it some times

18-Do people in your community drink the milk of a diseased cow?

A – No they don't

B – Yes they do

19-If you see a dead animal nearby your home, what do you feel?

A – Not concerned

B – Somewhat concerned about bad smell

C – Very concerned about possible diseases

D – I don't care

20-Do you wash your hands with soap after touching animals to prevent zoonotic diseases?

A – Yes I do it always

B – No I don't

C – Yes I do it some times

D-I wash only when I eat food

21 - Wild life health can affect human health.

A –Strongly agree

B – Agree D-Disagree

C-Strongly disagree E-I have no idea

22-Do domestic animals in your community share house with people?

A – Yes they do.

B – No, they don't at all.

C – Yes, they do in some few cases.

23-If your answer to question number 22 is A or C do you worry about the health of these people?

A-Yes I do B. There is no reason to worry

24-When cattle die of disease, how do you handle?

A – Throw it away on the field

B – Use it for pets as food

C – Buried it or burn it

APPENDIX 5

IV. KNOWLAGE ABOUT MODE OF TRANSMISSION OF ZOONOSIS

- Please respond whether you agree or disagree with the following statements about zoonotic diseases by putting (√) mark.

25-How does human get infected by Zoonotic diseases?

HOW DOES HUMAN GET INFECTED BY ZOONOTIC DISEASES?	AGREE	DISAGREE
Eating of infected raw or under cooked meat.		
Drinking raw milk.		
Consumption of contaminated animal product food.		
Bite from infected animal.		
Inhalation.		
Direct contact with blood & secretion from animal.		
Handling animals with cut or wounds.		
Through vectors.		
Through food.		
Sharing the same room with animals can expose to zoonoses.		
Drinking of water contaminated with blood of infected animal.		
Drinking of water contaminated with infected animal feces.		
Ingestion of contaminated soil.		

APPENDIX 6

KNOWLAGE ABOUT MAJOR ZOONOTIC DISEASES

Choose the appropriate responses for the following questions. You can choose more than one for each question.

26-Do you know about Rabies?

A. No information. B-Only heard of

C- Know the signs D- Know mode of transmission

27-Do you know Bovine tuberculosis?

A-No information B-Only heard of

C-Know the signs D-Know mode of transmission

28-Do you know Brucellosis?

A-No information B-Only heard of

C-Know the signs D-Know mode of transmission

29-Do you know about Anthrax?

A-No information B-Only heard of

C-Know the signs D-Know both sign and mode of transmission

30-Do you think the above diseases/Rabies, Bovine TB, Anthrax and Brucellosis/can be prevented through One Health Approach?

A-Yes I believe so B-No I don't think so C-I have no idea

YUNIVERSIITII ADDIS ABABAA
KOLLEJJII SAAYINSII UUMAMAA
MUUMMEE BAAYOLOOJII

Waraqaan gaaffii kun kan qophaa'e hubannaa namootni tarsiimoo Fayyaan Tokko (One Health) dhukkuboota belada irraa gara namaatti daddarban ittisuuf qabu madaalu ilaalchisee akka aanaa Sibuu Sireetti, Godina Wallagga bahaa, Naannoo Oromiyaa, Itoophiyaa, ittiin fuunaanamu dha.

Maqaan keessan guca kana irratti hin barreeffamu,. Haa ta'u malee, gaaffilee hundaaf deebii cirri ta'e kennuun kaayyoo qorannoo kanaaf milkaa'ina ta'a.
Gaafii fi deebii kana xummuruuf daqiiqaa 32 qofa fudhata

APPENDIX 1

Bakka duwwaa Kutaa 1ffaa fi 3ffaa Siniif kenname irratti mallattoo (√) kana gochuun deebisaa.

ODEEFANNOO HIRMMATOOTA QUANNOO FI QORANNOO KANNA.
A-SAALA ☐ Dhiira- ☐ Dhalaa ☐
B-HAALA BARNOOTAA
Barnoota bu'uraa Kan hin qabnee ☐ Sadarkka tokkoffaa ☐
Sadarkaa lammaffaa ☐ ophainnaa ☐
Kollejii ☐ Digrii univarsitii ☐ - oli
C-TESSOO -Magaallaa ☐ -Baadiyaa ☐
D-HOJII -Qoote bulla ☐ -Barsiisaa ☐ Ogeessa fayyaa ☐ -Barataa ☐
E. Haala Gaa'elaa. kan fuudhe /heerumte ☐ Kan hin fuune/hin heerumne ☐
Kan hiikehiikte ☐
F. Baay'ina maatii. 1 ☐ 2-5 ☐ 6-9 ☐ 10 and above ☐
G. Galii Ji'aa. 500-999 ☐ 1000-3000 ☐ 3001-5000 ☐
5001-8000 ☐ 9000 and above ☐

APPENDIX 2

I. HUBANNOO WA'EE FAYYAA TOKKOO(ONE HEALTH)

DEEBII SIRII TA'EE FILADHU.

1-wa'ee tarsimoo, FayyaaTokkoo (One Health) jedhamuu dhageesee beektaa? .

A-Eyeen B-Lakki

2-Tarsiimoon Fayyaa Tokkoo (One Health) maal faa qabataa?

A-Fayyaa namaa qofa B-Fayyaa belladaa qofa C-Fayyaa naannoo qofa

D-Fayyaa namaa, belladaa fi naannoo.

3- Wa'ee tarsimmooFayyaaTokkoo/One Health/ irratti leenjii fudhateettaa?

A-Eyeen B-Lakkii

4-Tarsiimoon Fayyaa Tokkoo (One Health) kun dhukkuboota bellada irraa dhufan to'achuuf ni gargaaraa jattee yaaddaa? A-Eyeen B-Lakkii

APPENDIX 3

5Hojattootni exteenshinii fayyaa nannoo keeti wa'ee Tarsiimoo Fayyaa Tokkoo (One Health) ni dubatuu?

A-Eyeen B-Lakkii C-Hoamaa iyyuu hin dhageengne

6-Hojattootni exteenshinii qonnaa naannoo keetii wa'ee Tarsiimoo Fayyaa Tokkoo (One Health) nidubatuu? A-Eyeen B-Lakkii C-Hommaa iyyuu hindhageengne

7-Hojjettootni exteenshinii Naannoo wa'ee Tarsiimoo Fayyaa Tokkoo (One Health) ni dubatuu?

A-Eyeen B-Lakkii C-Hommaa iyyuu hin dhageegne

8-Bulchitootni gandaa wa'ee Tarsiimoo Fayyaa Tokkoo (One Health) ni dubatuu?

A-Eyeen B-Lakkii C-Hommaa iyyuu hin dhageengne

9-Yoo deebiin kee gaafii 12ffaa eyeen ta'ee, karaa Tarsiimmoo Fayyaa Tokkoo (One Health) jedhamuun dhukkuboota kana ittisuun ni danda'amaa?

A-Lakkii wa'ee dhukkuboota kana hommaa gochuun hindanda'amuu.

B-Eyeen fayyaa isaaniif xiyeefannoon akka keenamuu taasiisuun. C-Hubannoohinqabuu

10- Yoo waliiti dhufeenyi namaa fi belladdaa of eegannoon ta'uu baate fayyaa namaaf rakkoo dha.

A-Eyeen B-Lakki C-Hubannoo hin qabuu D-Rakkoo inni fiduu hin jiruu

11-Deebiinkee gaafii 3 eyeen yoo ta'ee tarsiimoo FayyaaTokkoon/One Health/ fooya'udanda'a?

A-Eyeen B-Lkkii natiihin fakkaatu C-Hubannoo hin qabuu

12Hawaasni hubannoo gaha wa'ee Fayyyaa Tokkoo (One-Health) kana irratti akka qabaatuuf hojiin hojatameeraa jattee yaadaa?

A-Eyeen B-Lakki

13-Nammootni naannoo kee jiraatan taarsiimoo fayyaa naannoo fi belladaa eeguun fayyaa namaa eegsisu ni danda'a jedhuu kana (FayyaaTokkoo|One Health) hamam hojii irra olchaniruu?

A-Hoomtuu hinhoojatamne C-Xiqqoon hojatameerraa

B-Baay'een hojatameeraa D-Kana irratti hubannoo hinjiru

APPENDIX 4

GOCHAALEE

14-Foon dheedhii ni nyataa ? A-Eyeen B-Lakkii

15-Yoo deebiin kee gaafii 14 ffaa eeyeen ta'ee ,wa'een dhukkuboota bellada irraa gara namati darban siyaadeessaa?

A-Eyeen B-Lakkii

16-Loon keenya madda dhukkubootaa namaa ta'u danda'uu?

A-Eyeen B-Lakkii C-Hubannoo hinqabuu

17- Namootni naannoo kee jiraatan foon bellada dhukkubsatee ni nyaatuu?

A-Eyeen B-Lakkii

18- Namootni naannoo kee jiraatan aannan loon dhukkubsatoo ni fayyadamuu?

A-Eyeen B-Lakkii

19- Bineeladni du'ee dirree mana keetiitti yoo gatamee agartee maaltu sittii dhaga'amaa?

A-Hommaa iyyuu nayadeesu.

B-Xinnoo wa'een foolii isaa nayaadeessaa.

C-Wa'een dhukkuboota isa irraa ka'u danda'ani nayadessa.

20- Bellada erga harkaan tuqxee booda dhukkuboota tarii natty darbu danda'u jatee saamunaan dhiqataa?

A-Yeroo hundaan dhiqadhaa B-Itti yaade hindhiqadhu C-Yeroon yattaa qofa dhiqadha

21-Rakkon fayyaa belladootaa/wild life/ fayyaa namaa irrattii dhibbaa taasiisuu danda'a.

A-Eyeen B-Lakkii C-Hubannoo hinqabu

22-Naannoo atii jirraatutii belladni nama waliin mana tokkoo keessatti waliin jirachuun nimul'ataa?

A-Eyeen baayinaan ni mul'ataa. B-Eyeen darbee darbee ni mul'ataa

C-Lakkii gonkummaa iyuu hinmulatuu

23-Deebiin keegaafii 22ffaa A yookiin B yoota’ee, waa’een fayyaan nammota kanaa siyaadessaa?

A-Eyeen nayaddessaa. B- Waan nama yaddessu hinjiruu

24-Belladni maatii kee dhukkubsatee yoo du’ee, maal gootuu?

A-Ala dirreetti gatna B-Saroottaa fi adureef laatnaa C-Ni hawaalaa ykn nigubnaa

APPENDIX 5

II. BEKUMSA DADARBA DHUKKUBOOTA BELADA IRRAA GARA NAMMATI DHUFANII AGARSIISUU

25- NAMNI DHUKKUBOTA BELLADA IRRAA GARA NAMMATI DARBAN KANAAN AKKAMITII QABAMUU DAND’AA?

	EYEEN	LAKKI
Foon dheedhii nyaachuun.		
Bineensa dhukkubsateen ciniinamuun.		
Qilleensaan.		
Tutuqaa dhiigaan fi dhangala’ookeessan.		
Maddaa bellada dhukkubsatee qabuun.		
Karaa bookee fi baattoon.		
Aanan dhedhii dhuguun.		
Nyaataan.		
Horii waliin mana tokkoo keessa jiraachuun.		
Bishaan dhiiga belladaan faalamee dhuguun.		
Bishaan fincaanii fi boba’a bellada dhukkubsateen faalamee dhuguun.		
Biyyee dhukkubaan faalam’een.		

APPENDIX 6

V. BEEKUMSA MALLATOOLEE (CLINICAL SIGNS) DHUKKUBOOTA BELADA IRRAA GARA GARA NAMATI DADARBANII AGARSIISUU

-DEEBII.SIRRII TA'EE YADDU FILADHU. FILANNOO TOKKOO OL FILUUN NIDANDA'AMAA.

26-Waa'ee dukkuba saree maraatuu (rabies) beektaa?.

A-Odeefanno hin qabu. B-Maqaa isaa qofa dhaga'eeraa

C-Mallattoo isaas beekka D-Akkataa dadarbaa isaas beekka

27- Dhukkuba sombaa bellada irraa gara namaatti darbuu beekta?

A-Odeefannoo hin qabu. B-Maqaa isaa qofa dhaga'eera

C-Mallattoo isaas beeka. D-Akkaata dadarbaa isaa beekka

28-Wa'ee dhukkuba Gatachissa (Brucellosis) beektaa?

A-Odeefanno hin qabu. B-Maqaa isaa qofa dhaga'eera

C-Mallatto isaas bekka D-Akkaata dadarba isaas bekka

29-Wa'ee dhukkuba Abba sangga (Anthrax) beektaa?

A-Odeefanno hin qabu. B-Maqaa isaa qofaan bekka

C-Mallattoo isaas bekka D-Akkaata dadarbaa isaas beeka.

30-Rakkoo dhukkubooleen armaan olitti eeraman Kun fidan karaa tarsiimoo FayyaaTokkoo/One Health/ jedhamuun itti famuu danda'u?

A-Eyeen ni ittifamuu B-Lakkii natii hinfakkaatuu C-Hubannoo hin qabu