Occurrence of Rabies Suspected cases in Humans and Knowledge, Attitude and Practices of Individuals Visiting Jimma Town Health Center due to Bite of Animals Suspected of Rabies in Jimma Zone and Surrounding areas, South West Ethiopia

BY:

TADELE KABETA YADESSA

May, 2013

Jimma, Ethiopia

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APPROVAL SHEET

Jimma University
College of Agriculture and Veterinary Medicine
School of Veterinary Medicine

As thesis research advisors, we hereby certify that we have read and evaluated this thesis prepared under our guidance, by Tadele Kabeta Yadessa entitled: "Occurrence of Rabies Suspected cases in Humans and Knowledge, Attitude and Practices of Individuals Visiting Jimma Town Health Center due to Bite of Animals Suspected of Rabies in Jimma Zone and Surrounding areas South West Ethiopia" We recommend that it be subjected as fulfilling the thesis requirement.

Worku Tigre (MSc) _____ _____
Major advisor Signature Date

Benti Deressa (MSc) _____ _____
Co-advisor Signature Date

As members of the board of examiners of the M.Sc. thesis open defense examination, we certify that we have read, evaluated the thesis prepared by Tadele Kabeta Yadessa and examined the candidate. We recommended that the thesis be accepted as fulfilling the thesis requirement for the Degree of Master of Science in Veterinary Public health.

_____ _____ _____
Chairman Signature Date

_____ _____ _____
Internal Examiner Signature Date

_____ _____ _____
External examiner Signature Date

Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the Council of Graduate Studies (CGS) through the Departmental Graduate Committee (DGC) of the candidate's major department.

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BIOGRAPHICAL SKETCH

Tadele was born in March 13/1985 (G.C) from his father Kabeta Yadessa and his mother Kuli Merga in Seka chokorsa peasant association, Seka Chokersa district, Jimma Zone, of Oromia Regional State, Southern-Western Ethiopia. He attended his primary school in Geta Shawa primary school from 1993 to 1998, Agarro junior and secondary school from 1999 to 2002 and high school in Jimma prepatory school from, 2003 to 2004. After he completed his high school, he joined Jimma University College of Agriculture and Veterinary Medicine in 2005, School of Veterinary Medicine and graduated with Doctor of veterinary Medicine (DVM) in 2010. After graduation, he has been working in Jimma Zone of Omo Nada district in Livestock Development, Resource and Animal Health Agency Office as office worker for six month and private college as instructor for past few years. He joined to Jimma University College of Agriculture and Veterinary Medicine to study his Master Science in Veterinary Public Health from October 2012 to date.

DEDICATION

Dedicated to my late adviser Dr. Worku Tigre who passed suddenly without seeing my graduation and whom I miss every day, a man critical thinker and courageous young academician!!

DR. Worku! You are in my heart forever!

ABBREVIATIONS

ABLV Australian bat lyssavirus
CARPC **C**ompendium of animal's rabies prevention and control
CDC Center of disease control
CFSPH Center of food safety and public heath
CNS Central nervous system
CI Confidence interval
CSA Centrally statistics authority
CSF Cerebrospinal fluid
DD/MM/YY Day/Month/Years
DALYs Disability adjusted life years
DNA Deoxyribonucleic acid
EBLV European bat lyssaviruses
EHNRI Ethiopian Health and Nutrition Research Institute
FLI Friedrich-Loeffler-Institute
HRIG Human rabies imminoglobin
JTHC Jimma Town Health Center
KAP Knowledge, attitude and practice
ID Intradermal
IDRV Intradermal rabies vaccine
OIE Office of international des epizootic/World Animals' Health Organization
OPD Outpatient department
ORV Oral rabies vaccine
OR Odd ratio
PEP Post exposure prophylaxis
Pt ID Patient identity card
RABLIS Rabies and Australian bat lyssavirus information sheet
RMGL Rabies Management Guide Line
RNA Ribonucleic acid
SD Standard deviation
TVR Trap-vaccinate release
US United State
WHO World Health Organization
WSR World survey of rabies

DECLARATION

I, the under signed, declare that the thesis is my original work and has not been presented for Msc degree in any university.
Name _____
Signature _____
Date of Submission _____
This has been submitted for examination with our approval as University advisor
Dr. Benti Deressa _____

ABSTRACT

Rabies, an acute viral disease of the central nervous system, is widespread in many regions of the world and affects all warm-blooded animals including humans. A cross-sectional questioner survey and retrospective studies were conducted from July 2012 to March 2013 in Jimma town health center to address the occurrence of rabies suspected case in humans and assess knowledge, attitude and practice (KAP) of the individuals visiting the health center due to bite of rabies suspected animals from Jimma zone and surrounding areas. According to the retrospective data collected from the health center between 2009 and 2012, 2302 post-exposure prophylaxis (PEP) were given during this period. The highest (20.4%) and the lowest (0.7%) number of cases were recorded from Jimma town and Nonno Benja district of Jimma zone respectively. Most of these cases (90.4%) were due to bite of dogs; and the majorities (52.6%) of the victims were children with less than 15 years and 71.8% of cases were from rural areas. There were statistically significant (P=0.001) variation in the occurrence of the cases with respect to age category, season, residence and districts of Jimma zone. No statistically significant variation (p>0.05) was observed in the incidence of the suspected cases between sex. From, 384 individuals visiting the health center due to bite of suspected rabid animals, 91.7% of them had heard of rabies before exposure, but only 20.1% were able to mention germs as causes of rabies. Most (92%) of the respondents estimated incubation period of rabies in humans and animals to be less than 40 days. More than 90% of the respondents mentioned abnormal behavior, lack of fear and aggressiveness, and excessive salivation as clinical signs of rabid animals. Moreover, altered mental status (nervous signs), headache and hydrophobia were mentioned as clinical sign of rabies in human by 98.4%, 72.4% and 63.8% of the respondents, respectively. Almost all the respondents (99%) mentioned that source of rabies for human is rabid dog; and 76.3% and 71.1% of them mentioned that rabies can also be acquired from the bite of rabid cat and farm animals respectively. Avoiding animals' bite and stray dogs, and confining dogs were mentioned by the majority of the respondents as a means of rabies prevention. All the respondents believe that rabies is a health risk; and about 75% of them agree that the disease is preventable and traditional healer cure rabies. The greater proportion (57%) of respondent wash wound with water and/or soap as first aid, 53.4% immediately kill dogs, which bite human, and 34.6% slaughter and eat food animals bitten by suspected rabid animals. Forty eight percent of the respondents own one or more dogs and/or cats. However, they rarely vaccinate their pets. Most of the owners (91.4%) kept freely roaming dogs and this might contribute to the widespread occurrence of canine rabies in the area. Though some socio-demographic factors significantly (P<0.05) influenced some knowledge, attitude and practice of respondents, none of these factors has consistently affected all of the KAP parameters considered in this study. The number of rabies suspected cases in retrospective study may be below the actual magnitude of the cases of study areas in the study period. The respondents were aware of the clinical sign of rabies both in animal and human, its means of transmission, and prevention measures to be taken. Most of the respondents had positive attitude as to the public health impact of the disease, but the actual practice in place is not good for the prevention and control of the disease. To this end, it is of paramount importance to work on further awareness creation, assess and map the zonal picture of rabies.

Keywords: Attitude, Dog, Jimma, Knowledge, Practice, Rabies

1. INTRODUCTION

Rabies is acute, progressive, fatal viral disease of the central nervous system that affects all warm-blooded animals and human. It is caused by a lyssavirus (Rupprecht *et al.*, 2004; Deressa *et al*., 2010). It is one of the oldest known and most feared fatal zoonotic diseases recognized since the early period of civilization (Bernard and Hattwick, 1985). Moreover, persistent problem throughout the developing world where it spreads primarily by domestic dogs (Katie *et al.*, 2007). Canine rabies is geographically widespread and continues to represent a significant public health threat, particularly in developing countries (WHO, 1998: Thraenhart, 2004) and dog-mediated rabies contributes to more than 99% of all human rabies cases (Thomas &Mettenleiter, 2011).

Rabies is prevalent and endemic in domestic and wild animals and humans in many African countries (Kitala *et al*., 1997; Yimer *et al*., 2002; WHO, 2010a). The World Health Organization notes that more than 95% of human deaths occur in Africa and Asia due to rabies (WHO, 2005). Most of the global human population especially in the developing world lives in canine rabies-endemic areas and is considered at risk of contracting rabies (Thomas & Mettenleiter, 2011). Rabies is a prime example of a neglected tropical disease that mostly affects poor communities, children and elderly people suffering from inequitable health care, (Agarvval & Reddaiah, 2003).

Rabies is a deadly disease but mostly preventable. Most of the deaths are due to ignorance and lack of awareness and access to proper services. More than 3 billion people, about half the world's population, are living in countries/territories where dog rabies still exists and are potentially exposed to rabies. Canine rabies remains common in Africa, Asia, the Middle East and Latin America. There are an estimated 55,000 human deaths annually from rabies worldwide WHO (2005), with about 31,000 in Asia, and 24,000 in Africa. However, it is agreed that the disease is grossly under-reported, both in dogs and in human, and the extent of underreporting may also be on the increase due to a variety of factors. If rabies is to be effectively controlled in the developing counties, it is important that its occurrence is well- documented, its epidemiology is well-understood, and its impact is carefully quantified in order to attract the appropriate level of financial and logistical support from governments, donor agencies and local communities. Nevertheless, it does not attract as much attention as it should either from the government or

from the public (WHO, 2008).

In developing countries, where the dog population is increasing at the same rate as the human population, the problem of dog bite from possibly rabid dogs was found to rise with alarming rate (Ali, 2003). Dog rabies has been reported with apparent increasing incidence in the eastern and southern African region over the past many years, and many countries are currently documenting record numbers of confirmed cases (Brian, 1992).

In Ethiopia, rabies is an important disease that has been recognized for many centuries (Pankhrust, 1990) domestic dog being the most important vector of human exposure (Wandeler *et al*., 1993). According to the reports of the Ethiopian Health and Nutrition Research Institute, a total of 488 human deaths had occurred in years between 1964 and 1975 (Mebatsion *et al.*, 1992). The incidence of human post exposure treatments and human rabies cases per million population of Ethiopia were 73.6 and 12.6, respectively (Bogel and Matschwiller, 1986). In Africa, the highest recorded human death due to rabies for the year 1998 was reported from Ethiopia. Despite the lack of sufficient information to scale the magnitude of rabies in dogs and humans in the country as a whole, during the period 1990-2000, dogs contributed to 95% of the total fatal human rabies cases and 96% of the total animals examined after being incriminated in biting of humans (Yimer *et al*., 2002). During the year 2000, a total of 1540 people received post exposure anti-rabies treatment in Addis Ababa and its surroundings of which 1443 (93.70%) were due to dog bites. Hence, dogs are considered as the major biting animals and most important sources of the disease to humans in Ethiopia.

Rabies was reported to be one of the public health concerns that need formulation of intervention strategy in Ethiopia. Information on knowledge, attitudes and practices (KAP) of the community and occurrence of the rabies and associated risk factors in a given locality/community is crucial to plan and implement appropriate control measures. Though, rabies was reported to be endemic in most parts of the country, there is no study conducted on occurrence of the disease, associated risks and community's knowledge, attitudes and practices towards the rabies in Jimma zone and the surrounding areas, by taking these facts in to account a health center based cross-sectional and retrospective study was undertaken in Jimma town health centers with the following general and specific objectives:

General objective

To assess the occurrence of suspected rabies cases in humans and knowledge, attitudes and practices of individuals visiting Jimma Town Health Center due to bite of animals suspected of rabies in Jimma zone and its surrounding.

Specific objectives

To assess the occurrence of suspected rabies cases in humans and associated risk factors in Jimma zone and surrounding areas

To assess the knowledge, attitudes and practices of individuals visiting Jimma Town Health Center due to bite of animals suspected of rabies in Jimma zone and surrounding areas on public health risk and prevention strategies of rabies

2. LITERATURE REVIEW

2.1. Etiology

The rabies virus is a genus lyssavirus, in the family *Rhabdoviridae*, order *Mononegavirales* (Tordo*et al.,* 1998). These viruses are enveloped and have a single-stranded RNA genome with negative-sense. Lyssa is the Greek word for madness, and for most of antiquity, rabies has been associated with "mad dogs" and the potential encephalopathy that could ensue in a person if bitten by a rabid animals. The Lyssavirus genus includes seven genotypes: rabies virus (RABV, genotype 1), Lagos bat virus (genotype 2), Mokola virus (genotype 3), Duvenhage virus (genotype 4), European bat lyssavirus 1 (EBLV-1, genotype 5), European bat lyssavirus 2 (EBLV-2, genotype 6), and Australian bat lyssavirus (ABLV, genotype 7) (Arai *et al*., 2003). Rabies virus is classified as genotype 1. There are many strains of the rabies virus; strain AVO1, strain CVS-11, strain ERA, strain Ontario skunk and strain Ontario fox (WHO, 1973). Each strain is maintained in particular reservoir host. The reservoir host is sometimes used as an adjective to describe a strain's origin. A virus that is maintained in dog populations would be called canine rabies. Occasionally, a virus adapted to one species becomes established in another species (CFSPH, 2009).

Rabies and the rabies-related lyssaviruses have been classified into 2 phylogroups, based on how closely they are related. Phylogroup I contain the rabies virus, Duvenhage virus, EBLV1, EBLV2 and Australian bat lyssaviruses virus, while phylogroup II consists of Lagos bat virus and Mokola virus (Finnegan *et al*., 2002). Other lyssaviruses appear four lyssa viruses Aravan virus, Khujand virus, Irkut virus, and West Caucasian bat virus, which have been isolated from Eurasian bats, and have recently been ratified as new lyssavirus species. All lyssaviruses tested to date cause clinical disease indistinguishable from classical rabies. Conserved antigenic sites on the nucleocapsid proteins permit recognition of all lyssaviruses with modern commercial preparations of anti-rabies antibody conjugates used for diagnostic tests on brain tissue (Hanlon *et al*., 2005). The viruses causes rabies is classified under genotype 1 viruses have a worldwide distribution and are generally found in terrestrial animals (Jessica *et al.,* 2010). From different lyssavirus species, four of which (Genotypes 1 - 4) occur on the African continent, are presently

recognized. These viruses cause rabies, the burden of which is highest in the developing world, where routine laboratory diagnosis is often not available (Jessica *et al.*, 2010).

2.2. Epidemiology of Rabies

2.2.1. Transmission and Maintenance cycles of rabies

Rabies is maintained in two epidemiological cycles known as urban and sylvatic cycles. In the urban rabies cycle, dogs are the main reservoir host and this cycle predominates in areas of Africa, Asia, and Central and South America where the proportion of unvaccinated and semi-owned or stray dogs is high. Urban rabies cycle has been virtually eliminated in North America and Europe; although sporadic cases occur in dogs infected by wild animals, the urban cycle is not perpetuated in the canine population (CFSPH, 2009).

The sylvatic (wildlife) cycle is the predominant cycle in Europe and North America. It is also present simultaneously with the urban cycle in some parts of the world. The epidemiology of wildlife cycle is complex; factors affecting it include the virus strain, the behavior of the host species, ecology and environmental factors. The disease pattern in wildlife can either be relatively stable, or occur as a slow moving epidemic. Recent examples of epidemics include a fox rabies epidemic that moved slowly west in Europe, and a raccoon rabies epidemic that moved north along the east coast of the U.S (CFSPH, 2009).

The rabies virus is readily transmitted between mammals, whether they are the same or different species. Most animals can be infected by the virus and can transmit the disease to humans. The virus is carried mainly by carnivores and, in the final stages of the disease, they excrete the virus in their saliva and transmit the disease to other animals when they bite them (Christine, 2009). The rabies virus is usually present in the nerves and saliva of a symptomatic rabid animal. This virus is usually spread in the saliva, when an infected animal bites another, then spread to the salivary glands or other parts of the body. The virus may also enter the body if the mucous membranes (the wet part of the eyes, nose, or mouth) or a scratch or break in the skin have contact with saliva containing the rabies virus. Less often, an animal or person is infected by

contact with infectious saliva or neurological tissues, through mucous membranes or open wound and breaks in the skin with infectious material like saliva, neural tissue, and CSF. The rabies virus is not transmitted through intact skin (CFSPH, 2009).

Human-to-human transmission of rabies has been described only in rare isolated cases after transplantation. The cases of rabies transmission through corneal transplants have been reported (CDC, 1981). A few cases have been reported after transplantation of organs, pancreas, kidneys and liver. The transmission of rabies virus through transplantation of organs, to at least three recipients in Germany has been reported. These patients had received lung, kidney, and kidney/pancreas transplants (Hellenbrand, *et al.,* 2005). In 2004, transmission of rabies virus from a common organ donor (with unrecognized rabies virus infection) through the transplantation of solid organs and vascular material was reported in the United States and in this case, bat rabies has been implicated in the transmission (Srinivasan *et al*., 2005).

Rabies is a fatal disease, despite being a highly fatal disease, which might threaten the survival of a host species, rabies virus has been able to survive because of limiting factors, such as transmission restricted to biting, which is not always efficient, and long incubations, allowing the virus to persist in a population temporally (Mantovani and Marabelli, 2004).

Movement of dogs between rabies-endemic and rabies-free countries carries the inherent risk of introducing the disease into the free areas (Nicholas *et al*., 2011). The major risk pathway of rabies transmission in rabies free countries are imported animals exposed to infection contacts in the country of origin and infection is not detected before their entrance into the free countries (Tony *et al*., 2006).

2.2. 2. Host range and their susceptibility to rabies virus

Any warm-blooded animal including humans may become infected by rabies, but major primary hosts for disease perpetuation encompass bats and mammalian carnivores. The dog is the global reservoir, and important wild carnivores include foxes, raccoons, skunks, mongoose and jackal and cat and they develop symptoms, although birds have only been known to be infected in experiments (Rupprecht *et al.*, 2004; Gough *et al.*, 2009). The virus has even been adapted to

grow in cells of poikilothermic ("cold-blooded") vertebrates (Wong, 2009). Rabid dog throughout the world affect human being, due to its close association with human, and its ability as a carnivore to transmit the virus through bite wounds, the dog is the most common vector of human rabies (Wandeler, 2004).

There are many strains of the rabies virus; each strain is maintained in particular reservoir hosts. Important maintenance hosts include members of the Canidae (dogs, jackals, coyotes, wolves, foxes and raccoon dogs), Mustelidae (skunks, martens, weasels and stoats), Viverridae (mongooses and meerkats), and Procyonidae (raccoons), and the order Chiroptera (bats). Cat-adapted rabies variants have not been seen, although cats are often infected with rabies viruses from other hosts, and they can readily transmit the virus (CFSPH, 2009).

Animals capable of being infected by rabies and transmitting the disease, can be divided into four risk categories based on the epidemiological situation. Rabies in insectivorous and fructiferous bats: rabies in bats is increasingly under scrutiny it appears that lyssavirus infection may be found in populations of bats in most countries, such as in north and South America, Europe, and even Australia. As a result, there is an increasing awareness of bats as a source of infection to human and other animals. Rabies in rural wildlife**:** In countries where there is rabies in rural populations of wildlife, for example, red foxes in North America, bats in South America, and red foxes and raccoon dogs in some countries in Europe, red foxes and golden jackals in the Middle East and red and arctic foxes, raccoon dogs, mongooses and jackals are hosts for the virus in parts of Asia. In Africa, there is evidence that the virus may be maintained in jackals, foxes, mongooses, genets and other species. Rabies in urban wildlife: In countries where wildlife may exist in urban areas and be infected with rabies, for example foxes in some parts of Europe and raccoons in USA, domestic animals, particularly pets, are more likely to come into contact with rabid animals than when wildlife are restricted to rural locations (Tony *et al*., 2006).

Dog-mediated rabies: Canine rabies continues to be a significant problem in areas of Africa, Asia, the Middle East, and Latin America. In countries where rabies is endemic in feral, stray and roaming dogs, there is the greatest possibility of pets and other domestic animals becoming infected with rabies. While there may be more than one epidemiological situation in a country, the overall level of risk depends overwhelmingly on the highest risk scenario present, due to the

increase in risk between each of the four epidemiological situation is large within these four broad categories, risk will vary depending on amount of disease in the country(Tony *et al*., 2006)

2.2.3. Temporal patterns of dog rabies

There was a distinct seasonality of rabies occurrence in China which was correlated to the geographical settings which was more obvious in the higher latitude areas. The nation-wide incidence of rabies was low in February. The peaks fell in summer and autumn, especially in August (Zhonghua and Bing, 2012)

A secondary data of eleven years (1986-1996) of wildlife-and domestic-rabies data from the agriculture stock-ranching area of central Namibia were studied. There were, the incidences of rabies for all species did not change significantly over the whole study period. However, seasonal variations with an increase in the number of cases between June and November of each year, as well as 3-4 years cyclical fluctuations were identified in domestic ruminants and black-backed jackals. The rainfall seasonality combined with the seasonal reproductive pattern of the black-backed jackal appeared to be plausible explanations for the seasonal variations of rabies. However, there was no overall significant correlation between the cyclical weather fluctuations and the 3-4 years cyclical rabies variations (Courtin *et al*., 2000).

The study on the prevalence of rabies was conducted on a retrospective data gathered from EHNRI rabies diagnostic laboratory Addis Ababa, in the years 1979-1987. The prevalence rates of rabies were found to be higher soon after dogs' breeding seasons. Such an observation indicates that among dogs infection, transmission through biting is significant during the breeding season (Girma *et al.*, 2002).

According to, Ali *et al*, report of (2010) there is statistically significant difference was observed in mean number of confirmed rabies cases among 12 calendar months in and around Addis Ababa. More number of animal rabies cases was confirmed in June, July, August and September; seasonal increase starting in May and reaching a peak in July. On the other hand, there was no significant peak in the monthly distribution of rabid dogs. So that dogs appear to bite people at a constant rate throughout the year with constant risk of contracting rabies by humans from the bite of these dogs. The number of people treated every month in Addis Ababa

in 1941 because of bite by rabid dogs was about a hundred that increased to more than 3000 people in 1956 (Schaller, 1972 cited by Yimer *et al*., 2002). During the period 1964 " 1975 on the average about 5230 people received post exposure anti rabies treatment annually all over the country (Fekadu, 1982 cited by Yimer *et al*., 2002). An average of about 2200 people received post exposure anti rabies treatments annually in Addis Ababa during 1990 " 2000 is however, considered as an underestimate of the actual problem (Yimer *et al*., 2002).

2.2.4. Geographical Distribution

Rabies virus is widely distributed throughout the world and is present in all continents. It is present in the animal populations of almost every country in the world, except in some countries (WHO, 2007). The rabies virus survives in widespread, varied, rural fauna reservoirs. In all endemically infected countries the virus is maintained in a population of domestic or wild carnivores or bats. True rabies in bats is confined to the Americas (Swanepoel, 2004) but infections of bats with related lyssaviruses occur in Europe (Fooks *et al.,* 2003), Africa (Swanepoel, 2004), and Australia (Thompson, 1999). Rabies remains an important yet neglected disease in Africa and Asia. Disparities in the affordability and accessibility of post-exposure treatment and risks of exposure to rabid dogs result in a skewed distribution of the disease burden across society, with the major impact falling on those living in poor rural communities, especially in Africa and Asia and it is particularly a problem affecting children (Knobel *et al*. 2005).

Austria**:** Australia was reported to be free of canine rabies and for the sustainability of this freedom all imported animals are subjected to strict quarantine requirements, including vaccination for dogs and cats from all affected countries (King & Fooks, 2004).

America: Between 1993 and 2002, the number of human and canine rabies cases in the Americas region fell by approximately 80%. There were 39 human cases in 2002, 63% of them transmitted by dogs. In the USA, rabies is common among wild animals and wild life, accounts for almost all reported cases (98% in 2009) and domesticated animals account for less than 10% of all cases documented annually in the U.S.A. with most cases seen in cats, cattle and dogs. The epidemiology of rabies has changed from predominance in domestic animals to predominance in wild animals (CDC, 2011). Due to a high public awareness of the virus, efforts at vaccination of

domestic animals and curtailment of feral populations, and availability of post-exposure prophylaxis, incidents of rabies in humans are very rare. However, human rabies transmitted by wildlife, mostly by bats, is a risk to inhabitants in many countries in the region (Belotto *et al*., 2005).

Europe: Rabies in Europe is predominately sylvatic rabies, with wildlife species accounting for approximately 80% of all rabies cases. Of these, more than 80% are red foxes; a member of the canidae family (Thomas & Mettenleiter, 2011). Rabies in companion animals has largely been controlled in Europe, except in the Russian Federation and Turkey. In some countries, like those in Western Europe and Oceania, rabies is considered to be prevalent among bat populations only (CFSPH, 2009). The canine rabies remains in certain countries as well as borders of Europe, while rabies in domestic animals and wild carnivores has become extremely rare in Western Europe (Wandeler, 2008). There are also reports on the reemergence of rabies in some regions of Europe (Central and Eastern) that were previously designated rabies-free, which demonstrates the need for continual vigilance and the adoption of strict control measures for extended periods. Rabies has been eliminated from terrestrial mammals (principally the red fox) in The Netherlands (1991), Switzerland (1999), France (2000), Belgium and Luxembourg (2001), the Czech Republic (2004), Germany (2008) and Austria (2008). In 2009, Italy was re-infected by fox rabies. Consequently, these countries have been declared rabies free by OIE (King & Fooks, 2004). Of the 8,155 cases of rabies that were recorded in Europe in 2000, 72.1% were in wild animals (foxes 83.4%; raccoon dogs 10.5%). Six hundred and thirty cases of bat rabies were reported in Europe in 2000 from which three were human cases (King and Haagsma, 2004).

Asia: Turkey forms a critical land link between Europe and Asia. European Turkey is the only European country with dog-mediated rabies where it is increasingly seen as an urban rather than a rural problem. There are some human cases of rabies in Lebanon each year, which are considered to be due to exposure to infected dogs, cats and rats (Akkoca *et al.,* 2004). In India, about 20,000 human rabies deaths are estimated to occur each year. In Israel, rabies cases in dogs, cattle, sheep, jackal, foxes, and other) were reported in 1999 and in Jordan, rabies is principally dog-mediated and followed by cattle (Yakobson and David, 2004). In China, much of rabies occurrence is associated with the dog population (Chen & Liao, 2004). The number of

dog-mediated rabies cases in China has increased exponentially over long period; the number of human deaths has also been high, primarily in poor, rural communities. China introduced the "one-dog policy" in the city of Beijing in November 2006 to control the problem (Tang *et al.* 2005). Rabies is dog-mediated in the Philippines (Fishbein *et al.*, 1991). In South Korea, there were more rabies cases in cattle than in dogs, suggesting that the disease is transmitted by a sylvatic cycle (Kim & Hwang, 2005).

Africa: Rabies is a widespread disease in African domestic dogs and certain wild canine populations (Kitala *et al*., 1997). Domestic dogs are the principal reservoir of rabies throughout most of Africa (Katie *et al*., 2007). In Algeria the main reservoir of rabies virus is the dog followed by other species causing exposure to human in order of incidence are: cats, donkeys, cattle and horses. Wildlife such as, monkeys and jackals were also found to be affected by rabies virus in Algeria. Dog-mediated rabies is reported from all parts of Egypt. Despite attempts at stray dog control, the stray dog population remains stable and only small numbers of owned dogs are vaccinated. No cases of animal or human rabies have been reported from Libya and Malta for many decades (Matter *et al.*, 2004). In Tunisia the dog is the reservoir and principal vector of rabies and in Morocco, there are reports of rabies in dogs, herbivores and wildlife (Matter *et al.*, 2004). In South Africa, there is a reservoir of rabies infection in the domestic dog population; there is also wildlife-mediated rabies, of which a principal host species is the jackal (Bingham, 2005). An outbreak of rabies in endangered wild dogs in 2000 was associated with feeding on the carcass of a rabid jackal in South Africa (Hofmeyr *et al*., 2004). In Zimbabwe, dog-mediated rabies virus is endemic for the domestic dog and side-striped jackal (Sabeta and Randles, 2005). Dog rabies has been reported with apparent increasing incidence in the eastern and southern African region over the last several years. In general it appears that dogs make up a higher proportion of rabies cases in eastern Africa that in southern Africa; in southern Africa various wildlife species play a significant role in certain areas (Bingham, 2005). Map showing the global distribution of rabies is presented in Figure 1.

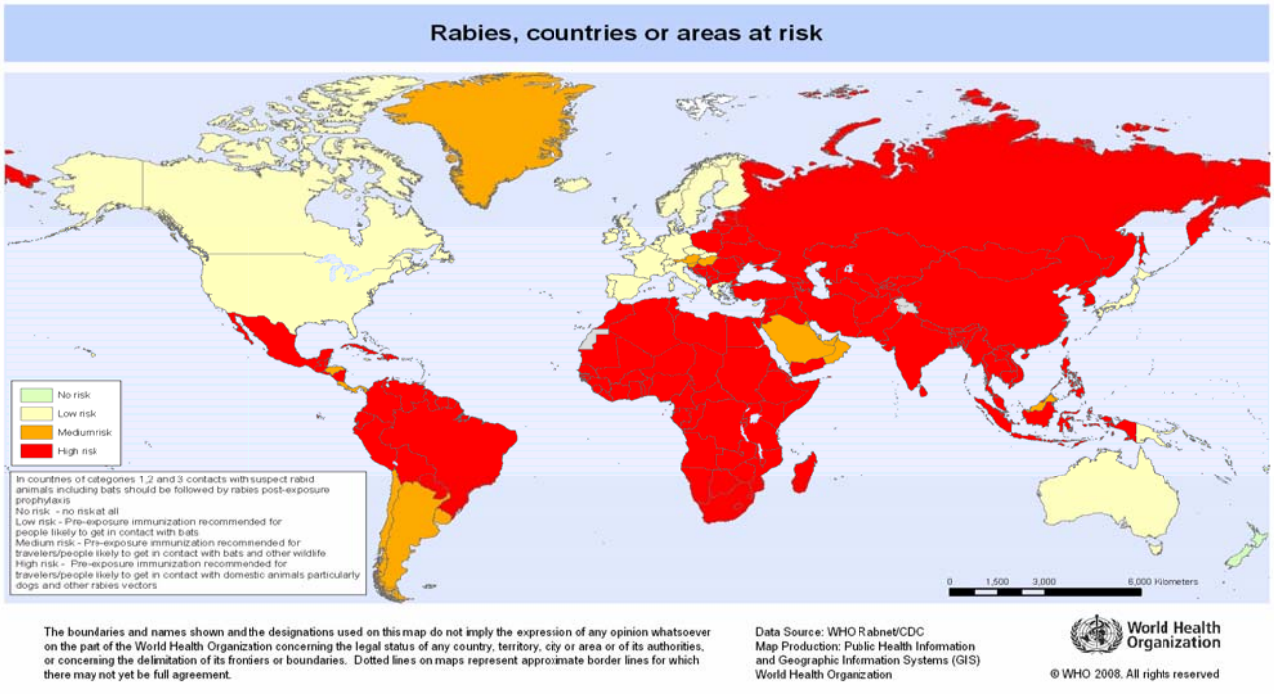

Figure 1.Rabies, countries or areas at risk (Source: WHO, 2008)

2.2.5. Status of rabies in Ethiopia

In Ethiopia it is an important disease that has been recognized for many centuries. The treatments recommended for people bitten by rabid animals mainly dogs have been recorded in many Ethiopian medical books since the early 17th century (Sterleyn 1968 cited by Fekadu, 1982). The first rabies epidemic record was from Addis Ababa that was reported in August 1903 by Lincoln De Castro, a physician at the Italian legation. Rabies is a widespread disease in Ethiopia. It is one of the public health concerns and the dog is the species most responsible for human exposure, with over 98% of the human cases and vaccinations due to the bite of rabid or suspected rabid dogs. Most of the treatments are due to stray dogs that bite, escape and are not available for observation. Most of the people who die of rabies are under 40 years of age and, among adults, the majority of these are males, suggesting that the close contact the young men have with dogs causes them to have a higher exposure rate and more deaths from rabies (Fekadu, 1982).

Although rabies was primarily reported in dogs, other animals like cats, cattle, sheep, goats, hyena, jackal, mongoose, cheetah and cerval cat are also involved. Indicating that the existence of both domestic and wild forms of the problem in the country. Natural infection occurs in almost all domestic animals in the country. Most people are at increased risk of being exposed to rabies, as human-dog contact is very common, as result many people receive post exposure anti-rabies treatment annually all over the country (Yimer *et al,* 2002). There were two unusual human rabies patients, a 41 year old woman and a 5 year old boy. The only known source of exposure for both patients was to family members who died of rabies. The clinical histories of these two patients suggest the possibility of naturally occurring human-to-human transmission of rabies (Fekadu *et al*., 1996).

From the total of 7749 animals from central part of Ethiopia and examined for rabies during the years 1996 to 2000, 1086 (75.57%) were positive for rabies. Dogs accounted for 95.5% of the total animal species examined and represented 88.44% of the total laboratory confirmed positive rabies cases. The study demonstrated that the importance of rabies as a public health problem in the country (Yimer *et al,* 2002). From the data analyzed to determine the occurrence of rabies in Addis Ababa was gathered at the zoones laboratory of Ethiopian Health and Nutrition Research Institute (EHNRI) for two years (2001-2002). Of the total of 2875 people who were given post exposure (PEP), 90.9% were due to dog bites. During the same period, 12 human rabies cases were recorded and 2% of PEP was due to contacts made with rabid human subjects. The remaining 7.1% of PET was due to cat, wild animal (hyena, jackal) and domestic animal bites and contacts excretion before onset of clinical signs (Bethlehem *et al.*, 2012). During the years 2001 to 2009, 3,460 animal brains investigated in the laboratory with FAT, 75% were confirmed as rabies positive. The proportion of dog bite cases and fatal human cases were increasing during the observation period. In fact, the actual number of positive rabies cases is expected to be higher when for example to the large number of stray dogs roaming around in the streets of Addis Ababa. Moreover, it is difficult to estimate the prevalence and incidence of rabies at national level due to the absence of laboratory diagnosis and recorded data at different health facilities of the Country (Deressa *et al.*, 2010).

Studies on dog ownership pattern and awareness of rabies in Addis Ababa showed that 90.7% of the dog owners manage dogs for the safeguarding of their properties from theft out of which 52% of them are without regular vaccination (EHNRI, 1997). They have knowledge of the risk of

rabies transmission through dogs' bites and rabies prevention measures upon human exposure. However, dog vaccination is poorly practiced. Rabies is prevalent in Addis Ababa and the sources of infection to human's dogs and most post exposure antirabies treatments given to humans are primarily to dog bites, but also the number of stray dogs in Addis Ababa is very large and those owned are not tied for the whole day. Christians keep dogs more than the Muslims in Addis Ababa. There is no regular vaccination of dogs and cats in Addis Ababa and most of them aware of the dangers of rabies. The data show the importance of rabies as an increasing public health problem in Addis Ababa (Yimer *et al*., 2012). The study to ascertain the principal epidemiological features of rabies and its impact on livestock owners found that rabies was considered the zoonosis of greatest risk to public health in both high and lowland areas of Ethiopia, in occurred with higher frequency in highland areas and subsequently affected more livestock in these parts. The death of infected livestock species was found to have numerous social and economic implications and the ramifications of this are made greater by the perception that the highest incidence of clinical disease being in areas of greatest livestock density. The underestimation of the burden of disease by central bodies is likely to influence the economic rationale behind effective rabies control in the future (Okell *et al.,* 2012).

Dog density in the Bale region is increasing in both urban and rural areas with the some rate of human populations (Cleaveland and Dye, 1996). As the human population has expanded into areas of prime wolf habitat and it is likely that for wildlife in the Bale region and Ethiopian wolves in particular, rabies is a human associated problem that is increasing. The high rate of mixing of the dog population and the degree of overlap and contact between domestic dogs and wolves means that the probability of rabies and other canid diseases invading the Ethiopian wolf population is significant. These suggested that the Bale Mountains' wolf populations were very likely to become extinct within 50 years when rabies epidemics occurred at a frequency of 1 every 7 years on average. With a lower frequency of rabies epidemics, the wolf population was less likely to become extinct (Karen *et al*., 1997). Strict registration and control of stray dogs is strongly recommended in Ethiopia (Bethlehem *et al.,* 2004). The recorded data in Ethiopia showed the underestimate of rabies diagnosis, post exposure prophylaxis and fatal human cases, which could be attributed due to the absence of national rabies surveillance system (Deressa *et al.,* 2010).

2.3. Incubation Period and Clinical Signs of Rabies

2.3.1. Incubation period and Clinical signs of rabies in animals

Time between exposure and first appearance of clinical signs of disease has been said to range from days to years, but the majority of incubation periods observed after experimental inoculation are between 3 and 6 weeks (Wandeler, 2004). The incubation period varies with the amount of virus transmitted, virus strain, site of inoculation (bites closer to the head have a shorter incubation period), dose of virus, age of animal, host immunity, nature of the wound and many other host factors. In cattle, an incubation period from 25 days to more than 5months has been reported in vampire bat-transmitted rabies. In dogs and cats, the incubation period is 10 days to 6 months; most cases become apparent between 2 weeks and 3 months. Swanepoel (2004) describes incubation periods of two to four weeks in dogs. Although the incubation period for rabies virus in dogs is generally between two and 12 weeks post-infection, longer incubation periods have been reported (Kennedy, 1998). While there are occasional reports of much longer incubation periods, they appear to be rare and may be due to later, unobserved infection. Length of incubation is inversely related to amount of virus injected, and depends on virus variant. In foxes and most domestic animals; there is usually no measurable immune response to rabies during incubation (Wandeler, 2004).

The clinical signs are rarely definitive, and it may be difficult to distinguish the furious and dumb forms. The most reliable signs are behavioral changes and unexplained paralysis. The initial clinical signs are often nonspecific and may include apprehension, restlessness, anorexia or an increased appetite, vomiting, a slight fever, dilation of the pupils, hyperreactivity to stimuli and excessive salivation. Animals often have behavior changes and may become either unusually aggressive or uncharacteristically affectionate (friendly). These signs usually last for 2 to 5 days, and maybe followed by a phase in which either the paralytic or the furious form of rabies predominates (WHO, 2004).

The paralytic (“dumb”) form of rabies is characterized by progressive paralysis as result of peripheral nerve dysfunction is responsible for weakness in paralytic rabies. In this form, the

throat and masseter muscles become paralyzed; the animal may be unable to swallow and it can salivate profusely. There may be facial paralysis or the lower jaw may drop. Ruminants may separate from the herd, become somnolent or depressed, and rumination may stop. Ataxia, incoordination and ascending spinal paresis or paralysis is also typical of this form. In paralytic rabies biting is uncommon. Death usually occurs within 2 to 6 days, as the result of respiratory failure ((WHO, 2004: CFSPH, 2009).

The furious form is associated with infection of the limbic system and is the predominant form in cats. It is characterized by restlessness, wandering, howling, polypnea, drooling and attacks on animals, people or inanimate objects. Animals with this form often swallow foreign objects such as sticks, stones, straw or feces. Wild animals often lose their fear of humans, and may attack humans or animal species they would normally fear (e.g., porcupines). Nocturnal animals may be seen in the daylight. Cattle may appear unusually alert. Death sometimes occurs during a seizure but in most cases, incoordination and ascending paralysis are seen late in the disease. Eventually, the patient experiences peripheral vascular collapse, convulsion, coma, and death occur without intensive care, within a few days (1–5 days) of the development of neurological signs (WHO, 2004: CFSPH, 2009).

Laryngeal paralysis can cause a change in vocalizations, including an abnormal bellow in cattle or a hoarse howling in dogs. Some animals may die within a day, without marked clinical signs. Horses and mules are often distressed and extremely agitated, which may be interpreted as colic. Survival is extremely rare once the clinical signs appear (Finnegan *et al*., 2002: RMGL, 2005; CFSPH, 2009).

2.3.2. Incubation period and Clinical signs of rabies in humans

In humans, the incubation period is a few days to several years. Most cases become apparent after 1 to 3months (Swanepoel, 2004). The early symptoms may include nonspecific prodromal signs such as malaise, fever or headache, as well as discomfort, pain, pruritus or sensory alterations at the site of virus entry. After several days, anxiety, confusion and agitation may appear, and progress to insomnia, abnormal behavior, temperament changes, hypersensitivity to

light and sound, delirium, hallucinations, slight or partial paralysis, hypersalivation, difficulty swallowing, pharyngeal spasms upon exposure to liquids, and convulsions and coma (Finnegan *et al*., 2002 : RMGL, 2005).

With encephalitic (furious) rabies, patients present with episodic delirium, psychosis, restlessness, hyperexcitability, autonomic dysfunction, thrashing, muscular fasciculation, seizures, and aphasia. Hydrophobia and aerophobia are pathognomonic for rabies and occur in 50% of patients. Attempting to drink or having air blown in the face produces severe laryngeal or diaphragmatic spasms and a sensation of asphyxia. This may be related to a violent response of the airway irritant mechanisms. Even the suggestion of drinking may induce hydrophobic spasm (RMGL, 2005). Hydrophobia is experienced by 17% to 80% of rabies patients. In this stage there is forceful, painful muscle spasms of the throat, which expel any liquids administered orally. It is suspected that this is an exaggerated protective reflex of the respiratory tract. In addition, the patient's difficulty in swallowing results in frothy saliva which drools from the patient's mouth because of growing muscular weakness. Eventually, a variety of stimuli (the mention of water, a tactile sense or scent of water, the thought of water, etc.) can cause uncontrollable spasms and drool. Acute respiratory failure occurs within 1 week of neurologic symptoms. Wide variations in blood pressure, cardiac arrhythmias, and hypothermia ensue in coma. A paralytic (dumb) form characterized by generalized paralysis, may predominate. The peripheral nerve dysfunction is responsible for weakness in paralytic rabies. Death usually occurs within 2 to 10 days; survival is extremely rare ((WHO, 2004: RMGL, 2005).

2.4. Pathogenesis

Immediately after infection, the rabies virus enters an eclipse phase during which it is not easily detected. Its incubates at the inoculation site for a period ranging from 5 days up to several years, depending on the size of the inoculums and the severity and location of the wound. During this phase, it replicates in non-nervous tissue such as muscle cells (classic form) or in the epidermis and dermis (bat variant rabies virus). It does not usually stimulate an immune response at this time, but it is susceptible to neutralization if antibodies are present. After several days or months, the virus then attaches to nerve endings and moves centripetally from the periphery to dorsal root ganglia and on to the central nervous system by retrograde flow in the axons transport. The

spread of the virus in the central nervous system is relatively rapid (48 to 120 hours) (RMGL, 2005).

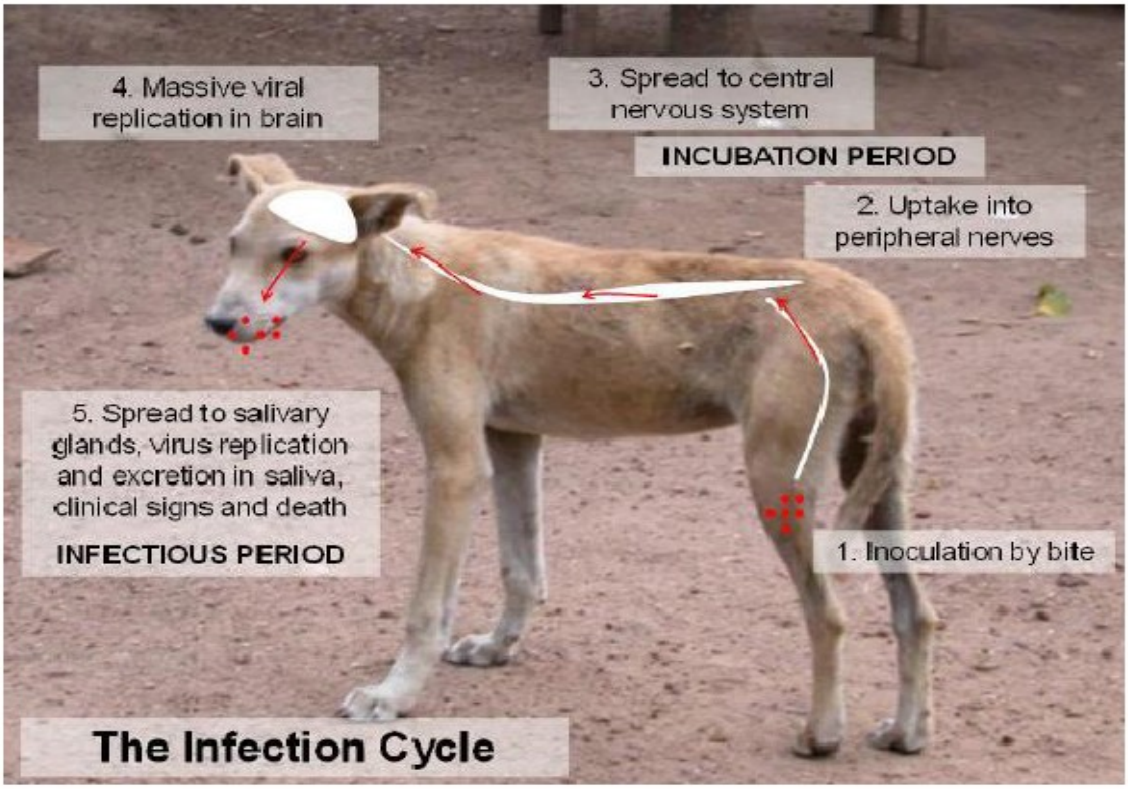

Figure 2: Diagram showing rabies pathogenesis, whereby the virus moves from the site of bite to the central nervous system then replicates in the brain, **Source:(Sambo, 2012).**

After dissemination within the CNS, the virus has a predilection for the brain stem, thalamus, basal ganglia, and spinal cord, where it selectively replicates intraneuronally, producing encephalomyelitis, and clinical signs develop as the neurons are infected and eventually the virus is distributed to highly innervated tissues via the peripheral nerves centrifugally along neural pathways to multiple organ and tissue sites (Burton *et al.*, 2005). The virus spreads to the salivary glands at about the stage that there is generalized dissemination of infection in the brain. It then multiplies in the salivary glands and is excreted in the saliva. Most of the virus is found in nervous tissue, salivary glands, saliva and cerebrospinal fluid (CSF), which should all be handled with extreme caution. Some virus has also been detected in other tissues and organs, including the lungs, adrenal glands, kidneys, bladder, heart, ovaries, testes, prostate, pancreas, intestinal tract, cornea, germinal cells of hair follicles in the skin, sebaceous glands, tongue papillae and the brown fat of bats. The rabies virus is contained within the neurons, and handling most body fluids or intact organs is thought to carry a low risk of infection. However, a puncture could

theoretically pierce a neuron, and health care personnel are given post-exposure prophylaxis after a needle stick or other puncture wound received while caring for a rabies patient (RMGL, 2005: CFSPH, 2009).

2.5. Public Health and Socioeconomic Importance of Rabies

2.5.1. Public health importance of rabies

Rabies is a fatal viral zoonotic disease and serious global public health concern (Alexander and Graham, 2012). More than 3 billion people, about half the world's population, are living in countries/territories where dog rabies still exists and are potentially exposed to rabies. Rabies remains a looming threat to public health in developing and transitioning countries, and the indigenous threat of rabies continues in developed countries because of wildlife reservoirs (Dodet & Meslin 2001).

People most at risk live in rural areas where human vaccines and immunoglobulin are not readily available or accessible. Canine rabies remains common in Africa, Asia, the Middle East and Latin America. There are an estimated 55,000 human deaths annually from rabies worldwide (WHO, 2005), with about 31,000 in Asia and 24,000 in Africa. Most of the victims are children; 30 to 50% of the reported cases of rabies. Mostly deaths occurred in children under 15 years of age and 100 million people are treated with rabies post-exposure prophylaxis. On average 40 % of post-exposure prophylaxis regimens are given to children aged 5–14 years, and the majority is male (WHO, 2006).

The epidemiology of human rabies is a reflection of both the distribution of the disease in animals and the degree of human contact with these animals (Daniel and Robinson, 1993). Travelers with extensive outdoor exposure in rural high-risk areas where immediate access to appropriate medical care may be limited should be considered at risk regardless of duration of their stay. Children living in or visiting rabies-affected areas are at particular risk. Anyone in continual, frequent or increased danger of exposure to rabies virus – either by nature of their residence or occupation is also at risk (WHO, 2011).

This zoonosis is entirely preventable, but by focusing solely upon rabies prevention in humans, this "incurable wound" persists at high costs. Although preventing human deaths through canine rabies elimination is feasible, dog rabies control is often neglected, because dogs are not considered typical economic commodities by the animal health sector (Lembo *et al.,* 2010)**.** Most countries do not have the capacity for laboratory confirmation of rabies cases, and most suspected rabies victims do not die in hospital, so rabies is underreported (WHO, 2010a).

In general we have seen broad geographic spread of rabies threaten public health in the world (Hanbson *et al*., 2011). The WHO notes that more than 95% of human deaths occur in Africa and Asia (WHO, 2010a). Most of the developing countries in Asia are the victims of rabies. According to the WHO global vaccines research forum, over 30,000 people die every year due to rabies in Asia. One Asian dies every 15 minutes where 15% are likely to be the children under 15 years. India has been reported as having the highest rate of human rabies in the world; high death rate was experienced in 2004, primarily because of stray dogs and estimated the annual number of post-exposure treatments at approximately 1, 000, 000 (Dugan, 2008). In India, 20 000 rabies deaths (that is, about 2/100 000 population at risk) are estimated to occur annually) (WHO, 2011). As of 2007, Vietnam had the second-highest rate, followed by Thailand; in these countries the virus is primarily transmitted through canines (feral dogs and other wild canine species) (Denduangboripant *et al.,* 2005).

African countries are considered to be at particular risks of rabies infections. Rabies causes at least 24,000 human deaths per year in Africa (WHO, 2011). The high death rates were reported in poor rural communities and children. The rabies mortality is highest in children in United Republic of Tanzania (Cleaveland *et al.,* 2002), Ethiopia (Ayalew, 1985). As in previous years, most of the reported human deaths from rabies (91%) were still diagnosed on clinical grounds only. The main sources of exposure were dogs (WSR, 1998). There have been frequent outbreak reports of rabies throughout the Southern Africa; this could probably be an indication of inadequacy in the control of the disease at local levels. Moreover, the success and opportunism of rabies in Southern Africa is a reflection of the emergence and radiation of rabies in new host species and locales throughout the larger continent as a whole (Coetzee and Nel, 2007).

In Ethiopia, rabies is endemic throughout the country; most domestic animals are highly exposed to the disease as a result of which man is in continuous danger of contracting the disease. Epidemiology Division in 1977 suggested that the total number of rabies cases in humans in Ethiopia might reach more than 1000 each year (EHNRI, 2001). In general, the data on fatal human rabies cases is an underestimate of the actual mortality rate considering countrywide distribution since most deaths occur deep into peasant villages and case are neither properly diagnosed nor recorded (Yimer *et al,* 2002).

According to EHNRI, (2001) report during the period 1996-2000 a total of 153 fatal human rabies cases was recorded. To that effect post-exposure anti rabies treatment was given to 9593 people. The fatal human cases during the years from 2001 to 2009 of study were 386 humans with annual range of 35 to 58. The overall post exposure treatment for humans was 17,204 within and around Addis Ababa (Deressa *et al.,* 2010). Due to the uncontrolled rabies in domestic animals especially in the canine population in Ethiopia, the risk of rabies infection to humans is quite high (EHNRI, 2001; Deressa *et al.,* 2010). Dogs contributed to 91.6% of the fatal human rabies cases and 91.6% of the human rabies post exposure cases that necessitated post exposure anti-rabies treatments. Cats are the second most important sources of rabies for humans next to dogs and contributed to 2.73% of humans that took anti rabies post-exposure treatments in Ethiopia (EHNRI, 2001).

2.5.2. Socio-economic impact of rabies

The public health burden of rabies is not limited to mortality or disability-adjusted life years lost to disease (Cleaveland *et al.,* 2002). In addition to human death tolls and mounting healthcare costs related to rabies, there are numerous other linkages between diseases, health, socioeconomics, and international affairs that should also be considered (Burgos-caceres, 2011). There are additional arguments in favour of increasing the resources available for rabies control (Wandeler, 1997). The high cost of human post- exposure treatment is a major economic burden on public health budgets and fear of the disease causes considerable psychological trauma in communities (Cleaveland *et al.,* 2002). Poor people are at a higher risk, as the average cost of rabies post-exposure prophylaxis after contact with a suspected rabid animal is US$ 40 in Africa

and US$ 49 in Asia, where the average daily income is about US$ 1–2 per person (WHO, 2011). Since entry, exposure and consequence assessments are non-negligible, the risk estimate for rabies is non-negligible and it is classified as a hazard in the commodity. There are no suitable diagnostic tests that can be used to diagnose rabies during the incubation period. International standards exist for the management of the risk of rabies in domestic ruminants. Animals could be imported from countries that are considered free from rabies according to the criteria defined by OIE (OIE, 2006). The OIE recommends that animals should be kept for the 6 months prior to shipment in an establishment where the separation from wild and feral animals is maintained and where no cases of rabies had been reported for at least 12 months (Christine, 2009). Tourists are generally unaware of the danger of importing potentially rabid animals and of the rules governing the movement of pets. This situation imposes heavy social and economic costs and impedes rabies control in some continent (Philippe *et al.,* 2011).

In general, rabies has a significant impact on health system costs, both for animal rabies control and for human post exposure treatment. Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, exceeding $300 million annually. These costs include the vaccination of companion animals, animal control programs, maintenance of rabies laboratories, and medical costs, such as those incurred for rabies post exposure prophylaxis (PEP) (Jackson, 2002).

2.6. Prevention and Control of Rabies

One of the drivers of rabies is the increasing interactions of animals (pets and free-roaming dogs) with the pathogen in multiple environments and settings. Many countries having the status of high-risk areas around the globe gained the status of rabies free territories. This shows that rabies can be successfully ruled out from the high-risk areas by taking preventing measures. The advent of scientific medicine also makes rabies control possible (Muhammad Zubair *et al.*, 2012). The elimination of canine rabies is epidemiologically and practically feasible through mass vaccination of domestic dogs; and that domestic dog vaccination provides a cost-effective approach to the prevention and elimination of human rabies deaths (Lembo *et al.,* 2010). Although rabies is preventable, it is often neglected particularly in developing countries in the face of many competing public and veterinary health priorities. Several reasons have been

identified for the lack of effective canine rabies control in Africa. The four common reasons given were: a low priority given for disease control as a result of lack of awareness of the rabies burden, epidemiological constraints such as uncertainties about the required levels of vaccination coverage and the possibility of sustained cycles of infection in wildlife; operational constraints including accessibility of dogs for vaccination and insufficient knowledge of dog population sizes for planning of vaccination campaigns; and limited resources for implementation of rabies surveillance and control (Belotto *et al.,* 2005: Knobel *et al.,* 2005: Coetzee and Nel, 2007: Rupprecht *et al.,* 2008 and Lembo *et al.,* 2010).

However, elimination of these canine rabies will be achieved in Africa countries, if the country gives that (1) rabies substantially affects public and animal health sectors, hence regional and national priorities for control ought to be higher, (2) for practical purposes domestic dogs are the sole maintenance hosts and main source of infection for humans throughout most of Africa and Asia and sufficient levels of vaccination coverage in domestic dog populations should lead to elimination of canine rabies in most areas, (3) the vast majority of domestic dog populations across sub-Saharan Africa are accessible for vaccination with community sensitization being of paramount importance for the success of these programs, (4) improved local capacity in rabies surveillance and diagnostics will help evaluate the impact of control and elimination efforts, and (5) sustainable resources for effective dog vaccination campaigns are likely to be available through the development of intersecteral financing schemes involving both medical and veterinary sectors (Lembo *et al.,* 2010). WHO (2008), Working to overcome the global impact of neglected tropical diseases.

On the other hands, efforts to eliminate stray dogs in order to control dog-mediated rabies have often been unsuccessful, particularly in developing countries. This is because the so-called stray or feral dogs are often owned by an individual or group but not controlled. They are perceived to be useful for their guard role and, because they eat a wide range of organic matter, for their garbage removal and sanitary control. Thus, there is frequently resistance to their elimination. Non-selective elimination of stray dogs to reduce the reservoir population is no longer recommended as a strategy against rabies by WHO, since it increases population turnover and decreases herd immunity (Matter and Daniels, 2000), while public opposition to dog removal can lead to the failure of rabies control programs (Beran, 1991). Nevertheless, the indiscriminate

mass culling of dogs is still used in certain countries as the principal measure to combat dog rabies and prevent associated human rabies the WHO wishes to reiterate the recommendations of the Expert Consultation on Rabies held (WHO, 2005). Moreover, dog destruction alone is not effective in rabies control. There is no evidence that removal of dogs alone has ever had a significant impact on dog population densities or the spread of rabies. However, the targeted and humane removal of unvaccinated, ownerless dogs may be effective when used as a supplementary measure to mass vaccination (Dodet & Meslin, 2001).

Human rabies can be controlled by controlling the disease in domestic and wild animals, including the use of vaccination programs (McGettigan, 2010). Animal rabies can be controlled by proper induction of herd immunity, humane removal of stray animals, promotion of responsible pet ownership through education, and enactment of leash laws, among many other measures (Jackson & Wunner, 2007). Others believe that the control of rabies largely depends on the prevention of infection of dogs by vaccination in endemic areas and the control of their movement, quarantine and vaccination (Weldehiwot, 2002).

Some scholars believe that with sustained international commitments, global elimination of rabies from domestic dog populations, the most dangerous vector to humans, is a realistic goal (Hampson *et al*., 2009). If the medical infrastructure is strengthened by educating more healthcare and veterinary workers and improving the availability of safe and effective biological products, especially animal vaccines and human rabies post-exposure prophylaxis, the world would be able to drastically reduce human rabies (Burgos-Cáceres & Otte, 2009). The development of integrated control measures involving public health, veterinary, wildlife conservation and animal welfare agencies is needed to ensure that control of canine diseases becomes a reality in Africa and Asia. The tools and delivery systems are all available all that is needed is the political will to free the world from the ongoing tragedy of these diseases (Cleaveland *et al*, 2006). Additionally by using alternatives method, the One Health approach, based on intersectoral collaboration has been promoted worldwide by intergovernmental organizations such as the WHO, FAO and OIE. Integrated control of zoonotic diseases, such as rabies based on the horizontal approach since it recommended improving cost-effectiveness. Although these approaches enable resource sharing through inter-sectoral collaboration and integrated control, they are generally not applied in reality due to the difficult logistics and the

lack of structural and policy frameworks that bridge the gaps between the various sectors involved. Developing countries must consider alternatives that enable them to save and share resources such as the One Health approach or the horizontal approach, which is a pilot program aiming at controlling rabies in an endemic area using the existing structures and resources at the local level. The project enabled collaboration between several relevant departments and significant financial contributions that allowed cost sharing (Kachani, 2012).

Quarantine has been completely successful in stopping the entry of rabies into the country via pets. However, in some country, yet to be validated indicated that in cases of canine rabies resulting from either illegal introduction of dogs during the incubation period (Bicout and Artois) .Infected animals placed in strict isolation for 6 months, with vaccination of dogs, cats and ferrets upon entry into isolation or 1 month before release. Home quarantine may apply to animals such as search and rescue, police and military dogs which are returning from work in another country (Tony *et al.,* 2006).

2.6.1. Dog population management and mass immunization

The dog control programmes incorporate three basic elements, with priorities varying according to the prevailing social, cultural and economic factors in places. The basic elements are: mass vaccination, dog population control and epidemiological surveillance (Ichhpujani *et al.,* 2010).
The WHO has recommended the use of a classification system for dogs' control, based on their level of dependence on humans for food, shelter and companionship, and on the level of restriction or supervision imposed. This system is designed to provide the classification that can be used for the improved management targeting of rabies control measures to specific components of the dog-owning population (WHO, 1988). The restricted dogs and the family dogs are highly accessible for immunization. Under the condition of full restriction; Dog is physically separated from the rest of the population on a permanent basis and given all of its essential needs intentionally by humans, while in semi-restriction; Dog has access to the rest of the population some of time and given a proportion of its essential needs intentionally by humans. On the other hand in the case of no restriction; Dog has free access to the population at all time and given none of its essential needs intentionally by humans, but may also be the target

for dog removal if not immunized in a vaccination programme (WHO, 1988). Moreover, WHO (1992) describes four methods of dog population control that may be used as adjunct procedures to control rabies. These are confinement, habitat control, reproductive control and removal. Although confinement measures, in the form of tie-up orders, have been used in the past in most of the region, they are rarely applied now, and the only measure in fairly widespread use is dog removal. However, dog removal is rarely applied effectively.

A straying dog may be a feral dog, an abandoned or lost animal or merely a free-roaming family dog. The effective control of these stray dog populations is a key element in a successful rabies control or eradication programme, along with the appropriate use of vaccines proven to be effective against rabies. a) The promotion of responsible dog ownership through legislation, education and public awareness campaigns, b) identification and registration of owned dogs, c) controlling reproduction in dogs is obviously important to prevent an increase in the stray dog population, (d) dog breeders and dealers can play an important role in responsible pet ownership. Unhealthy dogs and those that are difficult to manage are more likely to be abandoned. e) Reduction in dog-bite incidence, public awareness and education campaigns aimed at the general public, dog owners and children are an effective means for reducing the rate of dog-associated problems, including bites. f) Euthanasia is used according to the general principles of the Terrestrial Code (Article 7.7.6). The choice of euthanasia methods should ensure operator and public safety and all efforts should be made to avoid unnecessary animal pain and suffering (OIE, 2011).

Mass canine vaccination campaigns have been the most effective measure for controlling canine rabies. High vaccination coverage (70% or higher) can be attained through comprehensive strategies consisting among others of well-designed educational campaigns, intersectoral cooperation, community participation, local commitment in planning and execution (Sudarshan *et al.,* 2005). Canine vaccination against rabies has been shown to dramatically reduce the number of cases in dogs, the incidence of human animal-bite injuries (and hence the demand for costly post-exposure prophylaxis) and the likely number of human cases, primarily in children. Further benefits, include the mitigation of the psychological consequences of rabies in a community, improved attitudes towards animals and animal welfare and reduced livestock losses

from canine rabies (Cleaveland *et al,* 2006).

Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, ferrets, cattle, sheep and horses and remove strays and unwanted animals (Muhammad Zubair *et al,* 2012). Both inactivated and modified live vaccines are effective, but rare cases of post-vaccinal rabies have been reported with the modified live vaccines in dogs and cats. Conventional rabies vaccines do not seem to protect animals against rabies-related viruses in phylogroup II these viruses have caused fatal disease in vaccinated animals. Rabies vaccines seem to provide some degree of cross-protection against rabies-related lyssaviruses in phylogroup I (CFSPH, 2009). Today, rabies DNA vaccines have shown good efficacy in preventing rabies in some experimental animal models (Ertl, 2003).

2.6.2. Wild life immunization and management

Vaccinations to reduce diseases among wildlife species becomes a contested alternative given a number of complex issues associated with economics and practicality, scientific debate regarding effectiveness, conservation ecology, and public perception. For over many years, it has been shown that oral-route vaccination could generate protective immune responses in domestic and wild animals (dogs and foxes). This was the finding that led to the success of rabies wildlife vaccine usage, and it should continue (Thomas & Mettenleiter, 2011). Despite the progress observed and the absence of substantive adverse environmental or health effects, oral vaccination is not a cure-all, and should be viewed as an important adjunct to traditional prevention and control techniques in human and veterinary medicine. Trap-vaccinate-release (TVR) programs targeted reservoir species are live-trapped and manually injected with liquid vaccine (paraenteral vaccination (Hanlon *et al*., 1999). ORV is more economically and technically feasible alternative for use on a large scale and less invasive to individual animals than TVR. ORV is delivered via baits. Baits can be made of many different materials (e.g. fishmeal, dog food, meat, cheese, fermented egg products, cornmeal (Rosatte *et al.,* 1998). Aerial distribution preferably by aircraft or by helicopter is the most efficient way in baits (Thomas & Mettenleiter, 2011). Mass vaccination has recently been used in the conservation management of wild carnivore populations threatened by transmission of rabies virus from domestic dog populations. Vaccination of wildlife hosts directly may also provide an option for mitigating infectious

disease threats (Cleaveland *et al.*, 2006).

Surveillance is a management approach that tracks rabies variants in populations providing spatial and temporal distribution information that describes differences in behavior and population dynamics and structure among the major wildlife reservoirs, when deemed appropriate, control programs applied to wildlife populations may be used to limit the spread of a rabies epizootic, prevent the introduction of the disease into a particular area, or eliminate the disease in enzootic or epidemic areas (Wandeler, 1991).

General approaches to controlling rabies in wildlife are: elimination of the reservoir species, elimination of rabies in the reservoir species, or protection of victim species from rabies infection via a reservoir (Rupprecht *et al*., 2001) and also must be warranted and well designed to be efficacious, cost effective, be public supported, and have negligible negative impact (on wildlife, humans, and landscapes). If control programs for exotic rabies are considered for parklands, park managers should be active participants in the planning, implementation, and evaluation of the program and should reserve decision-making authority (Bruce and Margare, 2001). Control of rabies in wildlife species seems prudent as a public health measure (Rupprecht *et al.*, 2001). A cost benefit study of eradication of rabies in wildlife has been made highly difficult in developing country and failure to control rabies in fox population, since studies on fox etiology have shown the relative ineffectiveness of the systematic destruction of the species for control of rabies in this reservoir host, and as a result, the disease highly spread in many parts of country by this reservoir host (Aubert *et al*., 2004).

2.6.3. Human immunization

People at high risk of exposure to rabies or whose activities bring them into frequent contact with rabies virus, such as veterinarians, animal handlers, rabies laboratory workers, cavers, rabies biologics production workers and international travelers who are likely to come in contact with animals in parts of the world where rabies is common are should be offered rabies preventive vaccine. Currently pre-exposure immunization has been used in both human and nonhuman populations, whereas in many jurisdictions domesticated animals are required to be,

vaccinated (CARPC, 2007).

The WHO recommended pre-exposure vaccine, first dose may be given at any time, the second dose should be given seven days later, the third dose should be given 21 or 28 days after the first dose and booster doses of vaccine are recommended every two years for those individuals who continue to be at increased risk of contracting rabies to maintain protective antibody levels. People that work with live rabies virus in laboratory settings should be tested every six months to ensure that they have adequate rabies antibody level (CDC, 2008: CDC, 2009: WHO, 2010b).

Anyone who has been bitten by an animal, or who otherwise may have been exposed to rabies, should clean the wound and see a doctor immediately. A person who is exposed and has never been vaccinated against rabies should get 4 doses of rabies vaccine intramuscularly- one dose right away and additional doses on the 3rd, 7th, and 14th days. They should also get another shot called Rabies Immune Globulin. A person who has been previously vaccinated should get 2 doses of rabies vaccine - one right away and another on the 3rd day. Rabies Immune Globulin is not needed. For adults the intramuscular vaccination is given in the deltoid area not gluteal area, which has been associated with vaccination failure due to injection into fat rather than muscle; for children, it may be given in the anterolateral aspect of the thigh (Sudarshan *et al.,* 2005: CDC, 2008: CDC, 2009: WHO, 2010b). The immunoglobulin dose should not exceed 20 units per kilogram body weight. HRIG is expensive and constitutes the vast majority of the cost of post-exposure treatment, ranging as high as several thousand dollars. As much as possible of this dose should be infiltrated around the bites, with the remainder being given by deep intramuscular injection at a site distant from the vaccination site (CDC, 2008: CDC, 2009: CFSPH, 2009: WHO, 2010b). Intradermal two commercial products are today considered safe and efficacious when administered according to this regimen. They include a human diploid cell vaccine produced by Aventis Pasteur and a purified chick embryo cell rabies vaccine produced by Chiron Vaccines (Sudarshan *et al.,* 2005**)**. In cases of Fermi type anti-rabies vaccine produced at EHNRI a dose of 5 cc subcutaneous injections around the umbilicus for fourteen consecutive days and a booster dose of 5 cc within ten days interval was used as a prescription (Hurisa, 2012).

Post-exposure prophylaxis (PEP) is highly successful (100% effective) in preventing the disease if immediate wound cleansing and disinfection, administered promptly rabies vaccine, in general

within ten days of infection and the administration of human rabies immunoglobulin (RABLIS, 2012). Among persons who had been bitten by an animal that was proven to be rabid and who received both HRIG and a full course of one of these modern rabies vaccines there have been no cases of rabies (Jordan, 2008: CDC, 2008). In the case in which there has been a significant delay in administering PEP, the treatment should be administered regardless of that delay, as it may still be effective. Thoroughly washing the wound as soon as possible with soap and water for approximately five minutes is very effective in reducing the number of viral particles. "If available, a veridical antiseptic such as povidone-iodine, iodine tincture, aqueous iodine solution, or alcohol (ethanol) should be applied after washing. Exposed mucous membranes such as eyes, nose or mouth should be flushed well with water" (Willoughby, 2009). The rabies virus can be inactivated by lipid solvents (soap solutions, ether, chloroform, and acetone), 1% sodium hypochlorite, 2% glutaraldehyde, 45-75% ethanol, iodine preparations, quaternary ammonium compounds, formaldehyde or a low pH. This virus is also susceptible to ultraviolet radiation or heat of 1 hour at 50°C. It is rapidly inactivated in sunlight, and it does not rabies vaccine it is deposition of approved modern rabies vaccine (antigen) in the layers of dermis of skin. The immune response induced by IDRV is adequate and protective against rabies. Only survive for long periods in the environment except in a cool dark area (CFSPH, 2009).

Mammalian neural tissue vaccine has been in use worldwide for many years. However, nervous tissue vaccine (Fermi type) vaccines have the disadvantage of causing severe adverse reactions, at a rate estimated 0.3-0.8 /1000 patients, WHO has recommended that Fermi type vaccines should be replaced by cell culture based (immunogenic and, more importantly, safer) vaccines. Unfortunately, the cell culture rabies vaccines are expensive and not readily available to individuals living in developing countries where, rabies is endemic in dogs. The old nerve-tissue-based vaccinations that require multiple painful injections of anti rabies vaccine, into the abdomen (umbilicus) with a large needle at a dose of 5 cc subcutaneous for 14 consecutive days and a booster dose of 5 cc within ten days interval for three days are cheap, these sheep brain derived Fermi type vaccine is still being manufactured and utilized by majority of exposed patients in Ethiopia, even though WHO discouraged its use. The high costs of tissue culture vaccine and inertia have been the main barrier to the replacement of Fermi type vaccine (Hurisa, 2012).

2.6.4. Community awareness

Awareness of community was a basis to prevent and control of communicable zoonotic disease. Thus, lack of awareness is one of the biggest deficiencies in rabies control. There is definitely a gap in people's knowledge, attitude, and practices about dog bite and its management. Community awareness of all aspects of rabies is generally lacking or limited, be it first aid or management of animal bites, pre- and post-exposure prophylaxis, responsible pet dog ownership, dog population management, laboratory diagnosis, etc. Regarding the immediate measures to be carried out after a bite exposure, there is inadequate knowledge of the crucial need to wash wounds with soap and running water and apply antiseptics. Practices such as the application of chillies and other pastes on the wound are common. Knowledge of post-exposure prophylaxis and where vaccine is available is also limited. People may also contact local traditional healers for treatment, thus losing precious time and increasing the danger of infection and death. In addition, the full course of vaccine may not be taken because of financial constraints or other reasons. There is also a belief that bites by small puppies are not harmful or are less so. The lack of responsible Ownership of community dogs is an important issue that is often overlooked (WHO, 2004).

From the Community of Gujarat who is interviewed all of the individuals were aware about rabies and 98.6% people knew about its transmission by dog bite. But only 31.1% of total would like to apply first aid measure and 36.4% would visit the doctor, others either will do nothing or do some religious practices, although these practices were dependent upon their educational status. 86.6% of individuals were aware about anti-rabies vaccine and 24.4% knew that pet dogs need vaccine against rabies (Singh, and Choudhary, 2005). Majority (72.5%) of victims did not even wash their wounds with soap and water. This is quite alarming and this calls for concerted health education of people through mass media. Another factor which causes concern is that (52.6%) bite victims had applied indigenous products like chilli powder; snuff etc. which are harmful (Shah *et al*., 2012). The level of awareness of rabies and the level of receptiveness to rabies control measures are high in community of Japan. There is a difference in the attitudes and pet care practices relevant to rabies control between urban and rural areas. Pet owners tend to be more cooperative to rabies control activities. The attitudes and practices of the respondents may

reflect the inaccessibility of facilities and the lack of services that would enable community participation in rabies control (Matibag *et al,* 2007).

Rabies is endemic in Tanzania. However, knowledge about rabies in limited, an indication that those who were more knowledgeable of rabies claimed to practice better rabies control and prevention overall the need for sustained surveillance and institution of control measures among dog population and awareness creation particularly among general public and children whom are at high risk of contracting rabies because of their close contact with dogs (Swai *et al,* 2010: Sambo, 2012).

Rabies was well known by community members in Bale, with 93% reporting that they were aware of rabies as a public health and economic problem (Karen *et al*., 1997). The majority of animal and human exposures to rabies can be prevented by raising awareness concerning: rabies transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Human rabies prevention is most important and can be prevented either by eliminating exposures to rabid animals or by providing exposed persons with prompt local treatment of wounds combined with the administration of human rabies immune globulin and vaccine. Approximately 85% of interviewees in Bale Mountains National Park area, including owners and non-owners of dogs, thought it would be good to try to control rabies in the areas by dog vaccination, although many people did not know that vaccination was a rabies control method before being interviewed, nor understood how vaccination worked either in humans or animals. They asked how rabies in these wild species could be controlled, as, in their understanding, controlling the disease in dogs would not completely protect their cattle (Karen *et al*., 1997).

A cross-sectional study was undertaken on 315 inhabitants of the Addis Ababa city at house-hold level among dog's owners and inhabitants of Addis Ababa to determine KAP of the community. From these majorities of the household (91%) have the knowledge of rabies and only 26.9% dog owner's exercise regular dog vaccination. Among all interviewed house-holds, 71% were considered themselves at risk of rabies. Even though the majority of the communities have good KAP about rabies, very few have got their dog vaccinated keeping the community at the verge of risk (Bethlehem *et al.,* 2012).

3. MATERIALS AND METHODS

3.1. Description of the study area and period

The health center based cross-sectional on knowledge, attitude and practice (KAP) and retrospective studies were conducted from July 20, 2012 to March 12, 2013. The KAP study was performed on the individuals visiting Jimma Town Health Center (JTHC) due to bite of animals suspected of rabies and retrospective study on suspected rabies cases in humans recorded in JTHC. Jimma Town Health Center is located in Jimma Zone of Oromia National Regional State of Ethiopia. This is located in the Southwest part of the country. Jimma Town, the capital of Jimma zone is located at 352 Km Southwest of Addis Ababa at latitude of $7^0$13'-$8^0$56'N and longitude of $35^0$52'-$37^0$37'E and an elevation ranging from 880 meters to 3360 meters above sea level. The study area receives mean annually rainfall of about 1637mm. The minimum and maximum temperature is 9^0c to 30^0c respectively with hot and humid weather condition. Human population of Jimma zone is estimated at 343,148 from these 171,975 male and 171,173 female (CSA, 2011). JTHC is the only center providing services for post exposure prophylaxis for humans bitten by animals suspected of rabies in the Jimma zone and surrounding areas continuously throughout of the year, while the other health centers provide anti-rabies vaccine at time of outbreak of the case.

3.2. Study design

Health center based cross-sectional and retrospective study design were used.

3.3. Study population

3.3.1. Study population for retrospective data

A four years data (from January 2009 to Decem. 2012) of suspected human rabies cases recorded in Jimma Town Health Center after exposure to bite of rabies suspected and/or rabid animals was reviewed. Jimma and the surrounding zone who were reviewed. Data like date of bite,

address/residence, age, and sex of victims, species of the biting animals and site of bite were recorded (Annex, 2).

3.3.2. Study population for the KAP of individuals visiting Jimma Town Health Center due to bite of animals suspected of rabies

All sampled individuals were an individual's visiting Jimma Town Health Center due to bite of animals suspected of rabies.

3.4. Inclusion and Exclusion criteria

Volunteer individuals who visiting JTHC due to bite of animals suspected of rabies were included in the assessment of KAP of the community, while those case admitted in Health Center and complete record were included in the retrospective study. A questioner survey was made among the individuals bitten by suspected rabid animals and the families of bitten individuals for under 15years age young children, who cannot well express their ideas.

3.5. Sample Size Determination and Data collection

3.5.1. Sample Size Determination

Numbers of individuals visiting JTHC due to bite of animals suspected of rabies for assessment of knowledge, attitudes and practices (KAP) were calculated on the basis of the 50% expected prevalence. Since, no study has been done related to rabies in Jimma areas. So by using a 95% confidence interval (CI) and 5% level of precision as follows: $N > (1.96^2(P_{exp} (1- P_{exp}))/d^2$ where: Where, N = minimum sample size required, P_{exp} = expected prevalence and d^2 = desired absolute precision (5%) (Thrusfield, 2007). Accordingly, the overall sample size for KAP assessment was 384 individuals.

For the retrospective study, the sample size was determined by number of cases documented during the indicated period; the review was made on total 2302 patients recorded at JTHC

for anti-rabies vaccine during January 2009 to December 2012.

3.5.2. Data Collection

To gather relevant information pertinent for the assessment of KAP of the study participants on individuals visiting JTHC due to bite of animals suspected of rabies, face to face interview was made by using structured questionnaire specifically developed for this purpose (Annex 1). The sampled individual is a person visiting JTHC due to bite of animals suspected of rabies. The bitten individuals or families of the bitten individuals in the cases aged below 15 years were interviewed. Demographic details (age, sex, address/residential, educational status, religion and occupation) of the respondent were covered by the questionnaire. The respondents were also be asked questions which explore their knowledge concerning the disease, its means of transmission to humans and their treatments, their attitudes on the public health risk of the rabies and its managements and their practices on activities used for prevention and control of the disease. For the retrospective study, recorded data on the cases recorded or admitted for post exposure treatment at the JTHC was collected. Review was made on data compiled for each individual: dates of examination and secondary data collection (DD/MM/YY), age, sex and address of the patient, source of exposure and site or body part affected and etc was recorded by using checklist developed for this purpose (Annex 2).

3.6. Study Variables

3.6.1. Independent Variables

Socio-demographic variables of the study participants such as age, sex, residence, religion, occupation and educational status of the respondents were the independent variables considered in this study.

3.6.2. Dependent variables

Knowledge, Attitude and Practice of the respondents with regard to rabies and its different

aspects (its causative agent and clinical signs, public health risk, associated risk factors and management, and control methods) were the dependent variables.

3.7. Data quality control and quality assurance

The quality of the data was assured via careful development of the questionnaire format for data collection after a through literature review. The questionnaire was first prepared in English, translated into Afaan Oromo, and re-translated back by other translator into English to check its consistency. The questionnaires were formatted was validated using a pre-test on 5% of the sample size that were on the study site and appropriate modification were made.

3.8. Data Analysis

The collected raw data was entered into Microsoft excel and analyzed using SPSS version 16.0 statistical software package. Descriptive statistics were computed as appropriate (Chi-square and mean). Occurrence of suspected rabies cases in humans was analyzed by descriptive statistics. Outcome variables (awareness on rabies and associated risk factors, perceptions towards the public health risk and its prevention strategies and their practices on the major prevention and control activities of the disease) were dichotomized. The associations of the proportions on knowledge, attitudes and practices of the study participants with age, sex, address/residence, educational status and occupation was assessed based on logistic regression. Univariable and multivariable logistic regression models were fitted containing the appropriate independent variable (s) with 95% confidence interval and less than 0.05 level of precision.

3.9. Operational definition

Attitude: The perception of the community to word the disease. Data was dichotomized in to positive and negative attitude and analyzed.

Knowledge: Information concerning the respondent's awareness on disease, virus and means of transmission was assessed by asking knowledge question. Appropriate proportions for correct and incorrect answers were determined.

Practice: A numbers of questions were presented on practice of individuals visiting JTHC due to bite of animals suspected of rabies on prevention and control measure of the disease and appropriate proportion for incorrect and correct practices were determined.

Rural: is referred setter living outside of capital town of zone and district administration.

Urban: is referred setter who resides in the major of zone and district town administration.

3.10. Ethical consideration

A letter was obtained from the School of Veterinary Medicine in Jimma University College of Agriculture and Veterinary Medicine and sent to the Jimma Town Health Center. This study were cleared by the health center director in every study class and in each office were asked for permission prior to starting work in each department by discuss on purpose of the study and confidentiality of the data. All the study participants interviewed were informed about the purpose of study and their written consent was obtained before interviewing. The information given by each individual was kept confidential. For absolute confidentiality, the names of the respondents were not kept and individual's responses were not reported. For the record review, names of the patients were not kept, while record on only information relevant for the study purpose was reviewed and kept for analysis. The dissemination of the study results refers the general study population but not to the specific respondents and suspected case.

4. RESULTS

4.1. Results on the retrospective study

From 2302 human rabies suspected cases recorded between 2009 and 2012 collected from Jimma Town Health Center, 52.6%, 28.5%, 13.9% and 5% were aged between 1-14, 15-30, 31-50 and greater than 50 years old respectively. The majority 1416(61.5%) of the suspected cases were males living in rural 1653(71.8%) areas. From the total 2302 record of suspected cases of human rabies, 2082(90.4%) were due to dog bite. The trend of rabies is fluctuating among these four years. Most of the patients 2015(87.5%) were bitten on their legs compared to the other body parts. There were statistically significant variation (p=0.001) between residences and among sources of exposure. Summary on the frequency of suspected cases of human rabies with associated risk factors is presented in Table 1.

Figure 3. Card used for secondary data (2009-2012) study in Jimma Town Health Center.

Table 1. Frequency of suspected cases of human rabies with associated risk factors in Jimma zone and surrounding areas between the years 2009 and 2012.

Variables	Numbers (%) of suspected cases by years of registration						
	2009	**2010**	**2011**	**2012**	**Total**	P -V	X^2
Age groups							
[1-14]	279(12.1)	188(8.2)	297(12.9)	446(19.4)	1210(52.6)		
[15-30]	166(7.2)	110(4.8)	126(5.5)	254(11.0)	656(28.5)		
[31-50]	71(3.1)	47(2.0)	78(3.4)	124(5.4)	320(13.9)	0.001	**9.97**
>50	26(1.1)	20(0.9)	32(1.4)	38(1.7)	116(5.0)		
Sex							
Male	337(14.6)	225(9.8)	337(14.6)	517(22.5)	1416(61.5)	0.65	1.62
Female	205(8.9)	140(6.1)	196(8.5)	345(15.0)	886(38.5)		
Address (zone)							
Jimma	454(19.7)	314(13.6)	486(21.1)	703(30.5)	1957(85.0)		
Illuababor	44(1.9)	20(0.9)	11(0.5)	33(1.4)	108(4.7)		
Keffa	29(1.3)	14(0.6)	28(1.2)	54(2.3)	125(5.4)		
Dawurro	13(0.6)	8(0.3)	6(0.3)	28(1.2)	55(2.4)		
Bench Majji	2(0.1)	8(0.3)	2(0.1)	25(1.1)	37(1.6)	-	-
Yemmi special woreda	0(0.0)	1(0.0)	0(0.0)	19(0.8)	20(0.9)		
Residence							
Urban	94(4.1)	136(5.9)	196(8.5)	223(9.7)	649(28.2)	0.001	68.01
Rural	448(19.5)	229(9.9)	337(14.6)	639(27.8)	1653(71.8)		
Source of exposure							
Dog	484(21.0)	343(14.9)	477(20.7)	778(33.8)	2082(90.4)		
Cat	27(1.2)	12(0.5)	45(2.0)	44(1.9)	128(5.6)		
Wildlife (fox and hyena)	12(0.5)	2(0.1)	5(0.2)	13(0.6)	32(1.4)	0.001	40.0
Bovine	12(0.5)	6(0.3)	2(0.1)	10(0.4)	30(1.3)		
Equine	6(0.3)	2(0.1)	2(0.10	5(0.2)	15(0.7)		
Human	1(0.0)	0(0.0)	2(0.1)	12(0.5)	15(0.7)		
Body part affected							
Leg	471(20.5)	340(14.8)	477(20.7)	727(31.6)	2015(87.5)		
Arm/hand	49(2.1)	20(0.9)	45(2.0)	106(4.6)	220(9.6)	0.001	24.63
Others	23(1.0)	5(0.2)	11(0.5)	29(1.3)	68(3.0)		
Overall Total	542(23.5)	365(15.9)	533(23.2)	862(37.4)	2302(100)		

Others: Multiple sites bitten of the body
P-V= p-value

Rabies virus is widely distributed in all woredas of Jimma zone, some woredas of Illubabor zone and South Nations, Nationalities and Peoples Regional State of Ethiopia. However, the highest proportion 469(20.4%) of rabies suspected cases were recorded from Jimma town and followed by Limmu Kossa 255(11.1%), where as the smallest cases were recorded in Nonno Benja 15(0.7%) district of Jimma zone (Table 2). There were statistically significant variation (P=0.001) among different districts of Jimma zone.

Table 2. Distribution of suspected cases of rabies in different districts of Jimma zone, South West Ethiopia between 2009 and 2012.

Years	Numbers (%) of suspected cases by district distribution																		
	Jimma Town	Mana	Goma	Gumay	Gera	Sigimo	Sentema	L.Kosa	L. Seka	N. benja	C.Botor	TiroAfata	Sokoru	OmoNada	Kersa	Dedo	Seka	Sh.Sombo	Total
2009	57 (2.5)	40 (1.7)	32 (1.2)	14 (0.6)	28 (1.2)	9 (0.4)	12 (0.5)	44 (1.9)	26 (1.1)	7 (0.3)	7 (0.3)	11 (0.5)	10 (0.4)	36 (1.6)	49 (2.1)	23 (1.0)	23 (1.0)	24 (1.0)	452 (19.3)
2010	116 (5.0)	16 (0.7)	18 (0.8)	5 (0.2)	10 (0.4)	4 (0.2)	6 (0.3)	19 (0.8)	15 (0.7)	4 (0.2)	3 (0.1)	8 (0.3)	10 (0.4)	28 (1.2)	13 (0.6)	13 (0.6)	14 (0.6)	12 (0.5)	314 (13.6)
2011	155 (6.7)	31 (1.3)	43 (1.9)	1 (0.0)	11 (0.5)	3 (0.1)	18 (0.8)	101 (4.4)	27 (1.2)	0 (0.0)	2 (0.1)	7 (0.3)	7 (0.3)	30 (1.3)	20 (0.9)	10 (0.4)	9 (0.4)	11 (0.5)	486 (21.1)
2012	141 (6.1)	86 (3.7)	57 (2.5)	10 (0.4)	15 (0.7)	7 (0.3)	8 (0.3)	91 (4.0)	41 (1.8)	4 (0.2)	10 (0.4)	5 (0.2)	13 (0.6)	48 (2.1)	89 (3.9)	10 (0.4)	30 (1.3)	38 (1.7)	703 (30.6)
Total	469 (20.4)	173 (7.5)	150 (6.5)	30 (1.3)	64 (2.8)	23 (1.0)	44 (1.9)	255(11.1)	109 (4.7)	15 (0.7)	22 (1.0)	31 (1.3)	40 (1.7)	142 (6.2)	171 (7.4)	56 (2.4)	76 (3.3)	85 (3.7)	1955 (84.9)

NB: C=Cora; L= Limmu; N=Nonno; Sh=Shabe

With regard to month of case recorded, more number (35.4%, N=816) of rabies suspected cases were recorded in Winter (Bega) and then followed by Summer (Kiremt) 588(25.5%), Spring (Belgi) 486(21.1%) and Autumn (Tseday) 412(17.9%). There were statistically significant variation (X^2= 86.27; P=0.001) in seasonal distribution of rabid suspected case. From the total recorded cases, the highest (862) of rabies suspected cases occurred in the year of 2012, while smallest (365) of cases were recorded in the year 2010 as shown in figure 4.

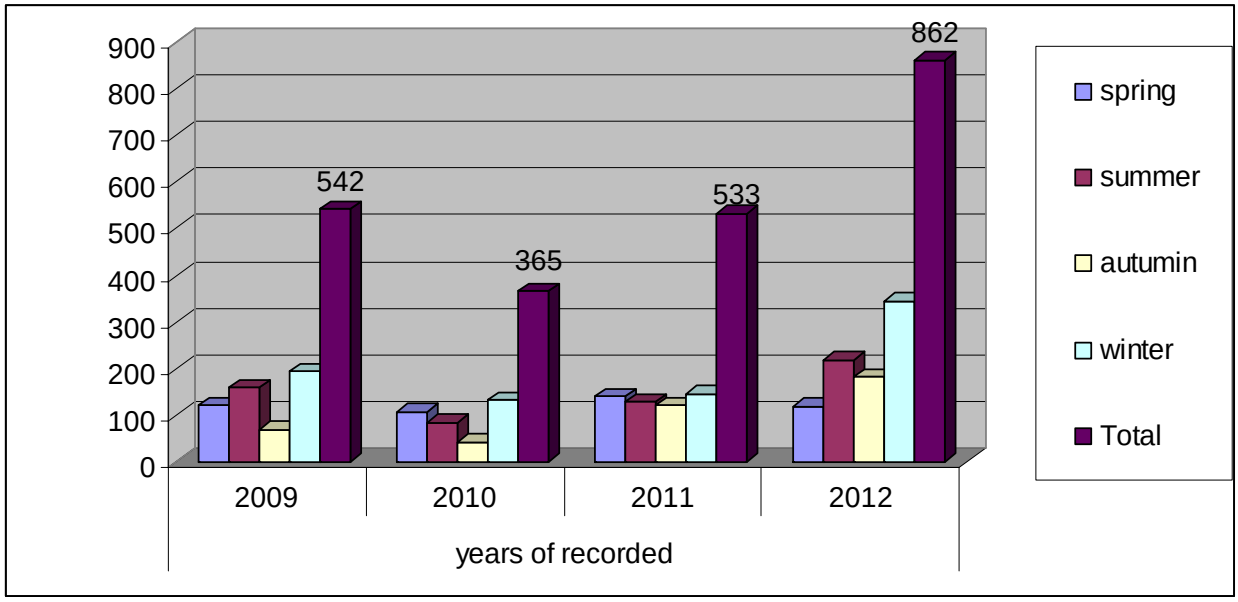

Figure 4.Temporal trend of rabies occurrence in the years of 2009-2012.

4.2. Results on Knowledge, attitudes and practices (KAP) of individuals visiting Jimma Town Health Center due to bite of animals suspected of rabies

4.2.1. Demographic characteristics of the respondents

From 384 respondents, 85 (22.1%) were from urban, while 299 (77.9%) were rural residents. The respondents age range from 15 to 81years with mean of 29.8 ±13.03. The majority 264 (68.8%) of the respondents were male. Among respondents the higher proportion were farmers 214(55.7%) by occupation; 266(69.3%) of the respondents attends school whereas 118(30.7%) were non-educated (Table 3).

Table 3. Socio-demographic characteristics of study participants in Jimma zone and the surrounding areas, 2012/2013.

Variables	Number (%)of respondents by their residence		
Address (zone)	**Urban**	**Rural**	**Total**
Jimma	73(19.0)	236(61.5)	309(80.5)
Illubabor	1(0.3)	17(4.4)	18(4.7)
Keffa	3(0.8)	18(4.7)	21(5.5)
Dawuro	8(2.1)	8(2.1)	16(4.2)
Benchi majji	0(0.0)	6(1.6)	6(1.6)
Yemii special woreda	0(0.0)	14(3.6)	14(3.6)
Age groups			
[15-30]	51(13.3)	177(46.1)	228(59.4)
[31-50]	27(7.0)	100(26.0)	127(33.1)
>50	7(1.8)	22(5.7)	29(7.6)
Sex			
Male	44(11.5)	220(57.3)	264(68.8)
Female	41(10.7)	79(20.6)	120(31.2)
Educational status			
Non-educated	24(6.2)	94(24.5)	118(30.7)
[1-8]	37(9.6)	160(41.7)	197(51.3)
[9-12]	11(2.9)	29(7.6)	40(10.4)
>12	13(3.4)	16(4.2)	29(7.6)
Religion			
Orthodox	45(11.7)	121(31.5)	166(43.2)
Protestants	11(2.9)	43(11.2)	54(14.1)
Muslims	29(7.6)	135(35.2)	164(42.7)
Occupation			
Farmers	17(4.4)	197(51.3)	214(55.7)
Students	15(3.9)	56(14.6)	71(18.5)
Employee	53(13.8)	46(12.0)	99(25.8)
Marital status			
Married	53(13.8)	159(41.4)	212(55.2)
Single	31(8.1)	136(35.4)	167(43.5)
Divorced	1(0.3)	3(0.8)	4(1.0)
Widowed	0(0.0)	1(0.3)	1(0.3)
Total on residence for each	85(22.1)	299(77.9)	384(100)

4.2.2. Knowledge of the respondents

Summary on the selected variables on knowledge of the respondents from Jimma zone and the surrounding areas is shown in Table 4. From the total of 384 respondents, 91.7% had heard about rabies before exposure or incidence. The majority (83.9%) of the respondents were heard of rabies from their family only 20.1% respondents were able to mention the germ as causative agent of rabies.

Figure 5.Questionnaire survey made with a person bitten by suspected rabid animals in Jimma area

From the total interviewed peoples about their awareness on the clinical signs of rabid animals, abnormal behavior, (lack of fear, aggressiveness, disoriented and attempt to biting nothing (air)), excessive salivation, tail dropping, hydrophobia, pawing at ground, and photophobia were mentioned by (98.2%, 97.4%, 91.9%, 87.0%, 56.8%, 47.1%, and 14.8%) of respondents, respectively. In humans suspected of rabies, clinical signs like altered mental status (nervous sign), headache, hydrophobia, photophobia and muscle pain were mentioned by (98.4%, 72.4%, 63.8%, 44.3%, and 41.9%) of the respondents, respectively.

Regarding on means of prevention of rabies, avoiding stray dogs, avoiding being bitten by animals, confining and vaccinating dogs and cat were mentioned by (72.4%, 64.6%, 53.9% and 41.7%) of the respondents, respectively. In relation to incubation period of humans suspected of rabies majority (92.7%) of the respondents, predict less than 40 days, while 7.3% did not know. About 51% of respondents had seen persons exposed to or died of rabies. According to these respondents, 66.0% of them replied, the victims died when attending traditional healers, while 3.6% of them respond the died victims visit health center after manifestation of clinical signs of the disease.

Table 4. Selected variables on knowledge of the respondents on rabies and associated risks in Jimma zone and the surrounding areas, 2012/2013.

Knowledge Question	**Number & % of respondents**	
When did you have heard of rabies?		
Before exposure	352	91.7
After exposure	32	8.3
From where you heard of rabies		
Family members (friends)	322	83.9
Others source (mass media and/or school)	62	16.1
What do you think the cause of rabies		
Germs	77	20.1
Unknown	201	52.3
Others *	106	27.6
Clinical signs of rabid animals		
Abnormal behavior	377	98.2
Lack of fear, aggressive, attempt to biting nothing (air)	374	97.4
Excessive salivation	353	91.9
Tail dropping	334	87.0
Hydrophobia	218	56.8
Pawing at ground	181	47.1
Photophobia	57	14.8
Clinical signs of rabid humans		
Altered mental status (nervous)	378	98.4
Headache	278	72.4
Hydrophobia	245	63.8
Photophobia	170	44.3
Muscle pain	161	41.9
Person who knew persons exposed and died of rabies	197	51.3
Treatment used by persons affected and died of rabies		
Modern treatment from the health center	7	3.6
Treatments by traditional healers	130	66.0
Unknown	60	30.4

Humans and animals acquire rabies		
Due to bite (lick) by rabid dogs	380	99.0
Due to bite (lick) by rabid cats	293	76.3
Due to bite (lick) by rabid farm animals	273	71.1
Due to bite (lick) by rabid wildlife	183	47.7
How could you prevent yourself from acquiring rabies?		
Avoiding stray dogs	278	72.4
Avoiding being bitten by animals	248	64.6
Confining dogs	207	53.9
Vaccinating dogs and cats	160	41.7
How long is the incubation period of rabies in humans?		
Less than 40 days	356	92.7
I don't know	28	7.3
How long is the incubation period of rabies in animals?		
Less than 40 days	350	91.1
I don't know	34	8.9

***fox and hunger**

The greater proportion 83.1% of the respondents mentioned dogs as source of exposure. From the 319 persons bitten by dogs suspected of rabies, 45.8%, 29.2% and 25.1% were bitten by dogs owned by neighborhoods, unknown free roaming dogs and family owned dogs, respectively (Table 5).

Table 5. Sources of exposure and status of animals suspected of rabies at time of interview, in Jimma zone and surrounding areas, 2012/2013

Variables	Status of animal suspected of rabies that exposed person for bite victim(n%)				
	Quarantined	Died of disease	Killed	Do not know	Total
Dogs	64(16.8)	33(8.6)	167(43.5)	55(14.3)	319(83.1)
Cats	7(1.8)	4(1.0)	12(3.1)	3(0.8)	26(6.8)
Bovine	1(0.3)	11(2.9)	1(0.3)	0(0.0)	13(3.4)
Equine	4(1.0)	1(0.3)	2(0.5)	3(0.8)	10(2.6)
Wildlife	0(0.0)	0(0.0)	1(0.3)	2(0.5)	3(0.8)
Human	0(0.0)	13(3.4)	0(0.0)	0(0.0)	13(3.4)
Dogs ownership					
Owned by family	25(7.8)	11(3.4)	39(12.2)	5(1.6)	80(25.1)
Neighbor	39(12.2)	14(4.4)	81(25.4)	12(3.8)	146(45.8)
Unknown	0(0.0)	8(2.5)	47(14.7)	38(11.9)	93(29.2)

Figure 6. Child severely injured by suspected dog bite in Seka Chokorsa district of Jimma zone in 2013.

4.2.3. Attitude of the respondents

All the respondents believe that rabies is an important health risk to them. About 95.6% respondents believe that any person exposed to rabies (exposed to animal suspected rabies) should seek for medical evaluation in modern health center as soon as possible, while the remaining 4.4% respondents did not believe this. On the other hand, 75.8% of the study participants believe that traditional healers or herbal medicine cure rabies. Summary of the selected variables on attitudes of the study participants towards the health risk and management of rabies is given on table 6.

Table 6. Attitude of the respondents on rabies and associated risks in Jimma zone and surrounding areas, South-West Ethiopia, 2012/2013

Attitude Questions	Number of respondent (%)	
	Yes	**No**
Rabies is health risk to you?	384 (100)	0 (0.0)
Exposed individuals immediately seek medical evaluation in modern health center	367 (95.6)	17 (4.4)
It impossible to live without keeping pets?	99 (25.8)	285 (74.2)
Keeping free roaming dogs is no harm?	28 (7.3)	356 (92.7)
Rabies is preventable?	288 (75.0)	96 (25.0)
Traditional healers or herbal med. cure rabies?	291 (75.8)	93 (24.2)

4.2.4. Practice of the respondents

Of the 384 study participants, 53.9% immediately kill animals suspected of rabies, while 38.8% tie up or quarantine and kill after proving that animals are affected by rabies based on the clinical signs of the disease. About 34.6% respondents often slaughter food animals suspected of rabies and eat their meat usually by considering the meat from such animals have medicinal value. On the other hand, 65.4% of the respondents kill and avoid the body of animals bitten by suspected rabid animals by fearing that rabies is transmitted through animal's products. The majority (57%), of the respondents wash wound with water and/or soap, while 43% do nothing on wound

as first aid after being bitten by suspected animals. About 48% of the respondents had pets (dogs and/or cats) of which only 4.8% reported to give vaccination occasionally for their pets. From those who owned pets 91.4% of them keep non-restricted dogs and cats (Table 7).

Table 7. Practice of the respondents on rabies and associated risks in Jimma zone and surrounding areas, South-West Ethiopia, 2012/2013

Practices questions	**No & % of respondents**	
	Number	Percent
Measure (s) taken on animals suspected of rabies		
Tie up & killed after proving that animal was rabid	149	38.8
Report the incident to veterinary clinic in the areas	28	7.3
Immediately killed the animals	207	53.9
Slaughter and eat the animals suspect of rabies	133	34.6
Kill and avoid animals suspect of rabies	251	65.4
First aid often given to persons affected by animals suspected of rabies		
Wash wound with water and/or soap	219	57.0
Nothing is given (done)	165	43.0
Person, who keep pets	186	48.4
Give vaccination for their pets	9	4.8
How frequent		
Occasionally	7	77.8
Only once in life	2	22.2
How do you keep your pets?		
Keep totally restricted /confined dog (s)	16	8.6
Keep dogs cohabiting with family or free roaming dog(s)	170	91.4

No= numbers

4.2.5. Knowledge, attitude and practice of the respondents influenced by different socio-demographic factors

The highest proportion of male (91.3%) and females (92.5%) had awareness of rabies before exposure. The same proportion of male and female had awareness that humans and animals acquire rabies due to bite or lick by rabid dogs, cats and wild animals. The larger proportion of females (74.2%) responded that humans and animals acquire rabies by bite or lick of rabid farm animals (bovine, equine and small ruminants) as compared to males (69.7%) participants (Table 8). Females respondents were (OR=0.45) less likely to mention excessive salivation as clinical signs of rabid animals, but 1.85 more likely to know persons exposed and died due to rabies as compared to male's participants (Table 12). However, there were no statistically significant variation (P>0.05) on the awareness level of male and female participants with regard to hearing rabies before exposure, germs as a cause rabies, clinical sign of rabies in animals like lack of fear, aggressiveness, disoriented and attempt to bite nothing (air), pawing at ground and hydrophobia (Table 8).

Farmers respondent were twice (RO=2) have awareness about hydrophobia as a clinical sign of rabid animals and humans to students. The farmers level of awareness is almost twice (OR= 2) of the students with regard to rabies transmission through bite or lick by rabid farm animals and rabid cat. Students were more likely (OR=1.86) have awareness when compared to farmers as to the importance of avoiding being bitten by animals as a means to prevent acquiring rabies (Table 12).

Non-educated respondents were more aware (OR=2.5) than grade 9-12 educated respondents as to the transmission of rabies by bite or lick of rabid farm animals and photophobia as clinical sign of rabid human. Moreover, illiterate respondents have at least three times more (OR=3.8) awareness on rabies caused by germs as compared to greater than grade 12 educated respondents. Additional non-educated participants were more aware (OR=1.8) on photophobia as clinical sign of rabid humans as compared to grade 1-8 educated peoples (Table 12).

Adults (31-50) and old (>50) respondents were more aware about the fact that the bite of rabid

wildlife could infect humans and animals with OR of 1.84 and 2.76 as compared to the younger (15-30) respondents respectively. There were no statistically significant variation (P>0.05) on the awareness level of rural and urban respondents on knowledge variables (Table 12).

Orthodox respondents were more aware on pawing at ground as clinical sign of rabid animals as compared to protestant and Muslim. There were no statistically significant variations in knowledge between religious groups with regard to the causes of rabies and some means of prevention of rabies in animals and human (Table 12).

The majority (80.3%) of rural respondents believe that traditional healers (herbal medicine) cure rabies as compared to urban peoples (Table 10). Orthodox respondents were more (OR=1.86) believe rabies is preventable disease as compared to Muslim. There were no statistically significant variation (P>0.05) on the attitude of farmers, students and employee on other attitude variables (Table 12).

Practice of the respondents were no statistically significant variation (P>0.05) by their residence, but the major proportion seven (8.2%) of urban participants were practice vaccinate their pets as compared to their counter part of pets owner from rural two (0.7%) dweller (Table 11). Grade 9-12 educated participants were (OR=2.36) more likely practices slaughter and eat the animals suspect of rabies than illiterate. There were no statistically significant variations among religion category on practice variables (Table 12).

Table 8.Sex, occupation and education level of respondents and their awareness on rabies, in Jimma zone and surrounding areas, south-west Ethiopia, 2012/2013

Variable	**Sex and number (%)**		**Occupation and numbers (%)**			**Education level and number (%)**			
	Male	Female	Farmers	Student	Employe	Illiterate	1-8	9-12	>12
Have you heard of rabies before exposure									
Yes	241(91.3)	111(92.5)	198(92.5)	62(87.3)	92(92.9)	112(94.9)	177(89.8)	36(90.0)	27(93.1)
No	23(8.7)	9(7.5)	16(7.5)	9(12.7)	7(7.1)	6(5.1)	20(10.2)	4(10.0)	2(6.9)
Rabies is caused by germs									
Yes	71(26.9)	26(21.7)	50(23.4)	20(28.2)	27(27.3)	23(19.5)	49(24.9)	11(27.5)	14(48.3)*
No	193(73.1)	94(78.3)	164(76.6)	51(71.8)	72(72.7)	95(80.5)	148(75.1)	29(72.5)	15(51.7)
Clinical sign of rabies in animal									
Absence of fear, aggressive,									
Yes	258(97.7)	116(96.7)	207(96.7)	68(95.8)	99(100)	116(98.3)	191(97.0)	38(95.0)	29(100)
No	6(2.3)	4(3.3)	7(3.3)	3(4.2)	0(0.0)	2(1.7)	6(3.0)	2(5.0)	0(0.0)
Excessive salivation									
Yes	248(93.9)	105(87.5*	201(93.9)	65(91.5)	87(87.9)	108(91.5)	181(91.9)	37(92.5)	27(93.1)
No	16(6.1)	15(12.5)	13(6.1)	6(8.5)	12(12.1)	10(8.5)	16(8.1)	3(7.5)	2(6.9)
Pawing at ground									
Yes	123(46.6)	58(48.3)	102(47.7)	31(43.7)	48(48.5)	53(44.9)	93(47.2)	22(55.0)	13(44.8
No	141(53.4)	62(51.7)	112(52.3)	40(56.3)	51(51.5)	65(55.1)	104(52.8)	18(45.0)	16(55.2
Hydrophobia									
Yes	144(54.5)	74(61.7)	124(57.9)	31(43.7)*	63(63.6)	76(64.4)	105(53.3)	21(52.5)	16(55.2)
No	120(45.5)	46(38.3)	90(42.1)	40(56.3)	36(36.4)	42(35.6)	92(46.7)	19(47.5)	13(44.8
Clinical signs of rabies in humans									

Hydrophobia									
Yes	168(63.3)	77(64.2)	138(64.5)	34(47.9)*	73(73.7)	74(62.7)	127(64.5)	22(55.0)	22(75.9)
No	96(36.4)	43(35.8)	76(35.5)	37(52.1)	26(26.3)	44(37.3)	70(35.5)	18(45.0)	7(24.1)
Photophobia									
Yes	116(43.9)	54(45.0)	102(47.7)	27(38.0)	41(41.4)	64(54.2)	79(40.1)*	14(35.0)*	13(44.8)
No	148(56.1)	66(55.0)	112(52.3)	44(62.0)	58(58.6)	54(45.8)	118(59.9)	26(65.0)	16(55.2
Altered mental status									
(nervous)	260(98.5)	118(98.3)	212(99.1)	70(98.6)	96(97.0)	116(98.3)	194(98.5)	40(100)	28(96.6)
Yes	4(1.5)	2(1.7)	2(0.9)	1(1.4)	3(3.0)	2(1.7)	3(1.5)	0(0.0)	1(3.4)
No									
Do you know person exposed to rabies									
Yes	148(56.1)	49(40.8)*	118(55.1)	37(52.1)	42(42.4)	58(49.2)	111(56.3)	16(40.0)	12(41.4)
No	116(43.9)	71(59.2)	96(44.9)	34(47.9)	57(57.6)	60(50.8)	86(43.7)	24(60.0)	17(58.6)
Humans and animals acquire rabies due to									
Bite by rabid dogs									
Yes	263(99.6)	117(97.5)	213(99.5)	69(97.2)	98(99.0)	116(98.3)	195(99.0)	40(100)	29(100)
No	1(0.4)	3(2.5)	1(0.5)	2(2.8)	1(1.0)	2(1.7)	2(1.0)	0(0.0)	0(0.0)
Bite by rabid cats									
Yes	204(77.3)	89(74.2)	171(79.9)	48(67.6)*	74(74.7)	90(76.3)	149(75.6)	30(75.0)	24(82.8)
No	60(22.7)	31(25.8)	43(20.1)	23(32.4)	25(25.3)	28(23.7)	48(24.4)	10(25.0	5(17.2)
Bite by rabid wildlife									
Yes	126(47.7)	57(47.5)	106(49.5)	31(43.7)	46(46.5)	60(50.8)	91(46.2)	14(35.0)	18(62.1)
No	138(52.3)	63(52.5)	108(50.5)	40(56.3)	53(53.5)	58(49.2)	106(53.8)	26(65.0)	11(37.9)
Bite by rabid farm animals									
Yes	184(69.7)	89(74.2)	163(76.2)	43(60.6)*	67(67.7)	91(77.1)	138(70.1)	23(57.5)*	21(72.4)
No	80(30.3)	31(25.8)	51(23.8)	28(39.4)	32(32.3)	27(22.9)	59(29.9)	17(42.5)	8(27.6)

How could you prevent community and yourself from acquiring rabies?									
Avoiding being bitten by animals	167(63.3)	81(67.5)	135(63.1)	54(76.1)*	59(59.6)	70(59.3)	137(69.5)	26(65.0)	15(51.7)
Yes	97(36.7)	39(32.5)	79(36.9)	17(23.9)	40(40.4)	48(40.7)	60(30.5)	14(35.0)	14(48.3)
No									
Vaccinating dogs and cats									
Yes	116(43.9)	44(36.7)	94(43.9)	28(39.4)	38(38.4)	53(44.9)	72(36.5)	17(42.5)	18(62.1)
No	148(56.1)	76(63.3)	120(56.1)	43(60.6)	61(61.6)	65(55.1)	125(63.5)	23(57.5)	11(17.9)
Avoiding stray dogs									
Yes	192(72.7)	86(71.7)	166(77.6)	43(60.6)*	69(69.7)	88(74.6)	138(70.1)	29(72.5)	23(79.3)
No	72(27.3)	34(28.3)	48(22.4)	28(39.4)	30(30.3)	30(25.3)	59(29.9)	11(27.5)	6(20.7)
Confining dogs									
Yes	142(53.8)	65(54.2)	114(53.3)	34(47.9)	59(59.6)	67(56.8)	96(48.7)	24(60.0)	20(69.0)
No	122(46.2)	55(45.8)	100(46.7)	37(52.1)	40(40.4)	51(43.2)	101(51.3)	16(40.0)	9(31.0)

*there was statistically significant association for odds ratio

Table 9.Age, residence and religion of respondents and their awareness on rabies, in Jimma zone and surrounding areas, south-west Ethiopia, 2012/2013

Variable	Age and number (%)			Residence and number (%)		Religion and number (%)		
	15-30	31-50	>50	Urban	Rural	Orthodox	Protestant	Muslims
Have you heard of rabies before exposure								
Yes	203(89.0)	122(96.1)*	27(93.1)	78(91.8)	274(91.6)	151(91.0)	47(87.0)	154(93.9)
No	25(11.0)	5(3.9)	2(6.9)	7(8.2)	25(8.4)	15(9.0)	7(13.0)	10(6.1)
Rabies is caused by germs								
Yes	59(25.9)	28(22.0)	10(34.5)	22(25.9)	75(25.1)	37(22.3)	14(26.4)	45(27.4)
No	169(74.1)	99(78.0)	19(65.5)	63(74.1)	224(74.9)	129(77.7)	39(73.6)	119(72.6
Clinical sign in animals								
Lack of fear, aggressive								
Yes	221(96.9)	124(97.6)	29(100)	85(100)	289(96.7)	165(99.4)	50(94.3)	158(96.3
No	7(3.1)	3(2.4)	0(0.0)	0(0.0)	10(3.3)	1(0.6)	3(5.7)	6(3.7)
Excessive salivation								
Yes	207(90.8)	118(92.9)	28(96.6)	74(87.1)	279(93.3)	154(92.8)	45(84.9)	153(93.3)
No	21(9.2)	9(7.1)	1(3.4)	11(12.9)	20(6.7)	12(7.2)	8(15.1)	1(6.7)
Pawing at ground								
Yes	112(49.1)	59(46.5)	10(34.5)	39(45.9)	142(47.5)	91(54.8)	19(35.8)*	71(43.3)*
No	116(50.9)	68(53.5)	19(65.5)	46(54.1)	157(52.5)	75(45.2)	34(64.2)	93(56.7)
Hydrophobia								
Yes	129(56.6)	76(59.8)	13(44.8)	55(64.7)	163(54.5)	99(59.6)	25(47.2)	93(56.7)
No	99(43.4)	51(40.2)	16(55.2)	30(35.3)	136(45.5)	67(40.4)	28(52.8)	71(43.3)
Clinical signs in humans								

Hydrophobia								
Yes	147(64.5)	75(59.1)	23(79.3)	60(70.6)	185(61.9)	106(63.9)	37(69.8)	101(61.6)
No	81(35.5)	52(40.9)	6(20.7)	25(29.4)	114(38.1)	60(36.1)	16(30.2)	3(38.4)
Photophobia								
Yes	91(39.9)	66(52.0)*	13(44.8)	37(43.6)	133(44.5)	72(43.4)	20(37.7)	77(47.0)
No	137(60.1)	61(48.0)	16(55.2)	48(56.5)	166(55.5)	94(56.6)	33(62.3)	87(53.0)
Altered mental status								
Yes	226(99.1)	123(96.9)	29(100)	82(96.5)	296(99.0)	163(98.2)	52(98.1)	162(98.8)
No	2(0.9)	4(3.1)	0(0.0)	3(3.5)	3(1.0)	3(1.8)	1(1.9)	2(1.2)
Humans and animals acquire rabies due to								
Bite (lick) by rabid dogs								
Yes	227(99.6)	124(97.6)	29(100)	84(98.8)	296(99.0)	163(98.2)	54(100)	163(99.4)
No	1(0.4)	3(2.4)	0(0.0)	1(1.2)	3(1.0)	3(1.8)	0(0.0)	1(0.6)
Bite (lick) by rabid cats								
Yes	169(74.1)	104(81.9)	20(69.0)	63(74.1)	230(76.9)	131(78.9)	40(74.1)	122(74.4)
No	59(25.9)	23(18.1)	9(31.0)	22(25.9)	69(23.1)	35(21.1)	14(25.9)	42(25.6)
Bite by rabid wildlife								
Yes	93(40.8)	71(55.9)*	19(65.5)*	42(49.4)	141(47.2)	78(47.0)	22(40.7)	83(50.6)
No	135(59.2)	56(44.1)	10(34.5)	43(50.6)	158(52.8)	88(53.0)	32(59.3)	81(49.4)
Bite by rabid farm animals								
Yes	153(67.1)	97(76.4)	23(79.3)	61(71.8)	212(70.9)	113(68.1)	39(72.2)	121(73.8)
No	75(32.9)	30(23.6)	6(20.7)	24(28.2)	87(29.1)	53(31.9)	15(27.8)	43(26.2)
How could you prevent community and yourself from acquiring rabies?								
Avoiding being bitten by								

animals								
Yes	146(64.0)	84(66.1)	18(62.1)	57(67.1)	191(63.9)	101(60.8	31(58.5)	115(70.14
No	82(36.0)	43(33.9)	11(37.9)	28(32.9)	108(36.1)	65(39.2)	22(41.5)	9(29.9)
Vaccinating dog and cats								
Yes	90(39.5)	56(44.1)	14(48.3)	31(36.5)	129(43.1)	71(42.8)	28(52.8)	61(37.2)
No	138(60.5)	71(55.9)	15(51.7)	54(63.5)	170(56.9)	95(57.2)	25(47.2)	103(63.8
Avoiding stray dogs								
Yes	162(71.1)	96(75.6)	20(69.0)	63(74.1)	215(71.9)	121(72.9)	35(66.0)	122(74.4
No	66(28.9)	31(24.4)	9(31.0)	22(25.9)	84(28.1)	45(27.1)	18(34.0)	42(25.6)
Confining dogs								
Yes	127(55.7)	66(52.0)	14(48.3)	52(61.2)	155(51.8)	100(60.2)	24(45.3)	82(50.0)
No	101(44.3)	61(48.0)	15(51.7)	33(38.8)	144(48.2)	66(39.8)	29(54.7)	82(50.0)

*There was statistically significant association for odds ratio

Table 10. Residence, occupation and Religion of respondents and their attitude on rabies, in Jimma zone and surrounding areas, south-west Ethiopia, 2012/ 2013.

Variable	**Residence and numbers %**		**Occupation &numbers %**			**Religion and number %**		
	Urban	**Rural**	**Farmers**	**Students**	**employees**	**Orthodox**	**Protestants**	**Muslim**
Exposed individual immediately seek medical evaluation in modern h. center								
Yes	83(97.6)	284(95.0)	202(94.4)	67(94.4)	98(99.0)	160(96.4)	52(96.3)	155(94.5)
No	2(2.4)	15(5.0)	12(5.6)	4(5.6)	1(1.0)	6(3.6)	2(3.7)	9(5.5)
It is impossible to live without keeping pets.								
Yes	20(23.5)	79(26.4)	58(27.1)	15(21.1)	26(26.3)	45(27.1)	10(18.5)	44(26.8)
No	65(76.5)	220(73.6)	156(72.9)	56(78.9)	73(73.7)	121(72.9)	44(81.5)	120(73.2)
Keeping free roaming dogs is no harm.								
Yes	5(5.9)	23(7.7)	11(5.1)	11(15.5)	6(6.1)	12(7.2)	4(7.4)	12(7.3)
No	80(94.1)	276(92.3)	203(94.9)	60(85.5)	93(93.9)	154(92.8)	50(92.6)	152(92.7)
Preventable								
Yes	63(74.1)	225(75.3)	165(77.1)	51(71.8)	72(72.7)	116(69.9)	40(74.1)	132(80.5)*
No	22(25.9)	74(24.7)	49(22.9)	20(28.2)	27(27.3)	50(30.1)	14(25.9)	32(19.5)
Traditional healers cure rabies.								
Yes	51(60.0)	240(80.3)	174(81.3)	53(74.6)*	64(64.6)	118(71.1)	46(85.2)*	127(77.4)
No	34(40.0)	59(19.7)	40(18.7)	18(25.4)	35(35.4)	48(28.9)	8(14.8)	37(22.6)

*there was statistically significant association for odds ratio

Table 11. Residence, religion and educational level of respondents and their practice on rabies, in Jimma zone and surrounding areas, South-West Ethiopia, 2012/2013.

Variable	Residence and NO%		Religion and numbers %			Educational level and numbers %			
	Urban	Rural	Orthodox	Protest.	Muslim	Illiterate	1-8	9-12	>12
Do you slaughter and eat the animals suspect of rabies									
Yes	22(25.9)	111(37.1)	56(33.7)	19(35.2)	58(35.4)	48(40.7)	70(35.5)	9(22.5)*	6(20.7)
No	63(74.1)	188(62.9)	110(66.3)	35(64.8)	106(64.6	70(59.3)	127(64.5)	31(77.5)	23(79.3)
Do you wash wound with detergent and water as first aid									
Yes	50(58.8)	169(56.5)	97(58.4)	27(50.0)	95(57.9)	66(55.9)	120(60.9)	17(42.5)	16(55.2)
No	35(41.2)	130(43.5)	69(41.6)	27(50.0)	69(42.1)	52(44.1)	77(39.1)	23(57.5)	13(44.8)
Do you have pets									
Yes	47(55.3)	139(46.5)	96(57.8)	25(46.3)	65(39.6)	45(38.1)*	98(49.7)	22(55.0)	21(72.4)*
No	38(44.7)	160(53.5)	70(42.2)	29(53.7)	99)60.4)	73(61.9)	99(50.3)	18(45.0)	8(27.6)
Do you vaccinate your pets?									
Yes	7(8.2)	2(0.7)	6(3.6)	1(1.9)	2(1.2)	0(0.0)	4(4.1)	1(4.5)	4(19.0)
No	40(47.1)	137(45.8)	90(54.2)	24(44.4)	63(38.4)	45(100)	94(95.9)	21(95.5)	17(81.0)
Do you totally restricted pets									
Yes	7(8.2)	9(3.0)	8(4.8)	2(3.7)	6(3.7)	3(6.7)	8(8.2)	0(0.0)	5(23.8)
No	40(47.1)	130(43.5)	88(53.0)	23(42.6)	59(36.0)	42(93.3)	90(91.8)	22(100)	16(76.2)

*there was statistically significant association for odds ratio

Table 12. Reference table on odd ratio (OR) of factors affecting levels of knowledge, attitude and practice about rabies in Jimma zone and surrounding areas, South West Ethiopia 2012/2013

Independent variable	Dependent variables	Numbers (%)	OR	95% CI	P-value
Age					
	Rabies acquired by bite (lick) of rabid wildlife	71(55.9)	1.84	1.19-2.85	0.001
31-50	Heard of rabies before exposure	122(96.1)	0.33	0.12-0.89	0.02
	Photophobia as clinical of rabid humans	66(52.0)	1.63	1.05-2.52	0.02
>50	Rabies acquired by bite (lick) of rabid wildlife	19(65.5)	2.76	1.23-6.20	0.01
Sex					
	Excessive salivation as clinical sign in animals	105(87.5)	0.45	0.22-0.95	0.03
Female	Knew persons exposed and died due to rabies	49(40.8)	1.85	1.19-2.86	0.001
Education					
>12 grade	Rabies caused by germs	14(48.3)	0.26	0.11-0.61	0.001
	Do you have pets	21(72.4)	0.24	0.17-0.58	0.001
1-8	Photophobia as clinical sign of rabies in human	79(40.1)	0.56	0.36-0.89	0.01
	Do you have pets?	45(38.1)	0.62	0.39-0.99	0.04
9-12	Photophobia as clinical sign of rabies in human	14(35.0)	0.45	0.22-0.96	0.03
	Rabies acquired by rabid farm animals	23(57.5)	0.40	0.19-0.86	0.01
	Slaughter and eat rabid food animals	9(22.5)	2.36	1.03-5.41	0.04
Religion					
Protestants	Pawing at ground in rabid animals	19(35.8)	0.45	0.24-0.85	0.01
Muslim	Pawing at ground in rabid animals	71(43.3)	0.63	0.41-0.97	0.03
	Rabies is preventable	132(80.5)	0.56	0.34-0.94	0.02
Occupation					
Students	Hydrophobia as clinical sign of rabid humans	31(43.7)	0.51	0.29-0.87	0.01
	Hydrophobia as clinical sign of rabid animals	34(47.9)	0.56	0.33-0.97	0.03
	Avoiding being bitten by animals	54(76.1)	1.86	1.01-3.43	0.04
	Avoid stray dogs	43(60.6)	0.44	0.25-0.79	0.001
	Rabies acquired by rabid farm animals	43(60.6)	0.48	0.27-0.85	0.01
	Rabies acquired by rabid cat	48(67.6)	0.53	0.29-0.96	0.03
Employee	Traditional medicine cure rabies	64(64.6)	2.38	1.39-4.18	0.001

NB. The variables not indicated in the table is used as reference in binary logistic regression T**hus**: **Age**: 15-30 years, **Sex:** male; E**ducation**: illiterate; **Religion**: orthodox; and **Occupation**: farmer were used as reference.

5. DISCUSSION

This study indicates that dogs play an essential role in maintaining as well as dissemination of rabies in Jimma zone and surrounding areas. There was statistically significant (P=0.001) variation in the source of exposure of rabid suspected case. Dogs were the primary cause (90.4%) for the human rabies post exposure prophylaxis in Jimma zone and surrounding areas. This finding is in agreement with (Yimer *et al*., 2002 and 2012) who reported that greater than 90% of humans who received post exposure anti-rabies treatments were due to dog bites in central Ethiopia. Similarly EHNRI, 2001: Deressa *et al.,* 2010 reported that dogs contributed to 91.6% of the fatal human rabies cases. Kitalaa *et al.,* (2000) reported that 97% of humans used post exposure treatments were due to dogs bite in Kenya. Wandeler (2004) also stated that rabid dog throughout the world affect human being, due to its close association with human, and its ability as a carnivore to transmit the virus through bite wounds.

In the present study, cats were the second most important sources of rabies for human although other domestic animals (cattle and equines) were also involved. In addition, wildlife (hyena and foxes) and humans were some of the incriminated source of exposure. This is in agreement with (WHO, 1999: Girma *et al.,* 2002: Yimer *et al*, 2002) who reported that rabies can infect and be maintained by several different host species. The same authors also argued that domestic dogs are the most important source of infection to these animals due to uncontrolled contact among dogs, other domestic and wild animals.

The occurrence of rabies in other domestic and wild animals could be due to spillover of infection from canine rabies and domestic animals might get infected with rabid wild life at grazing site. This study indicated that there is rabies in both domestic and wildlife in Jimma zone and its surrounding. This may be due to the fact that the Southwestern part of Ethiopia covered by forest and consist different species of wild life especially foxes, which might play crucial role in maintenance and spread of the virus among pets, other domestic animals and wildlife in the areas. Suspected human rabies cases bitten or

contacted by rabid humans were also recorded in this study. This finding was in line with the work of Fekadu *et al*, (1996), who reported possible human-to-human transmission of rabies in Ethiopia. Bethlehem *et al*, (2012) also reported that 12 human rabies cases and two percent of PEP given due to contacts made with rabid human subjects.

In this study, more number of rabies cases (35.4%) was recorded from December, to February and few (17.9%) cases recorded from September to November inclusive. Of the total recorded cases, the highest (862) of rabies suspected cases occurred being in the year of 2012, while smallest (365) of cases were recorded in the year 2010. There was statistically significant (P=0.001) variation in the seasonal (monthly) distribution of rabid suspected case. This finding is in agreement with (Ali *et al*., 2010) who reported a statistically significant difference in mean number of confirmed rabies cases among 12 months in and around Addis Ababa. This finding is explained by the proportion of dogs bite case and human rabies cases were fluctuating during the recorded period and probably related to the breeding season of dogs and also due to the peoples prefer to killing the free roaming dogs (either bite or not) as intervention method at the time of disease outbreak. Contrary with our reports, Courtin *et al.,* (2000) and Yimer *et al*., (2002) stated that there was no significant variation in the incidence of rabies with regard to months in Namibia and central Ethiopia respectively.

In this study, major numbers (52.6%) of human rabies cases, were recorded in children aged1-14 years, while small numbers in adult above 50 years old. This is in agreement with Deressa *et al.,* (2010) who reported that the most fatal cases (42%) were from the age group 0-14 category and the least (15.54%) were recorded in 50 years and above age category. Moreover, Yimer *et al.,* (2012), reported that the majority of the dog bite victims that sought the treatment were children less than 15 years of age. (WHO, 2005: WHO, 2006) also reported that, most (30 to 50%) of the victims of rabies reported from Africa and Asia are children. Mostly deaths occurred in children under 15 years of age and on average 40% of post-exposure prophylaxis regimens are given to children aged 5–14 years. This may be due to the fact that children usually enjoy handling and playing

with dogs and at time, they may aggravate them in to biting. In addition, children usually play on streets roads in our country where they can easily be exposed to rabid dogs and are not able to protect themselves. Elders are relatively well aware of the danger of rabies and may be curious if they saw for any behavior change of animals.

In this study, 61.5% of the people who used post-exposure treatment of rabies were males, suggesting that male were more affected than female in the area. This is in line with previous works (Fekadu, 1982: Yimer *et al.,* 2002: WHO, 2006: Deressa *et al,* 2010 and Shah *et al*., 2012) in other parts and outside of the country who reported the majority of cases and deaths in males as compared to females. This probably related to the males outdoor activities and their close contact with the dogs might have increased the risk of exposure.

In current study, 87.5% of the injured patients were bitten on their legs compared to the other body parts. This is in agreement with the reports of Agarvval and Reddaiah, (2003), where bites on legs were the commonest in rabid animals. Shah *et al.,* (2012) and Yimer *et al,* (2012) reported that the majority of victims were bitten on their lower limb.

Majority (71.8%) of recorded cases were from rural areas. This is agreement with report of different countries Tang *et al*., (2005) in China the number of dog-mediated rabies cases and human deaths has been increased exponentially over long period, primarily in poor, rural communities. Karen *et al.,* (1997) reported that significantly more people in rural than urban areas had seen animals with the disease. WHO, (2005) also reported that, people most at risk live in rural areas. There was statistically significant (P=0.001) variation in the incidence of rabies in different residence. This high numbers of cases might be due to absence of preventive interventions particularly vaccination and irresponsible dog ownership performed rather than inhumane killing of the dogs. The other explanation could be due to the high contact rate between domestic dogs and wildlife leading to increased risk of rabies occurrence and spread to the rural community. In most of these rural communities rabies is a well known as a killer disease but the

treatment option most commonly available to the people in these remote areas is herbal therapy with unknown efficacy and mostly not effective in preventing the development of the disease in humans.

A clear difference was observed between Jimma and neighboring zones in the number of individuals who took post exposure prophylaxis. About 85% recorded cases were from Jimma zone, while 15% of them were from the surrounding zones. This may be, the communities in Jimma zone relatively can easily get anti-rabies vaccine continuously from Jimma Town Health Center but the lower number of cases recorded from other zone could be due to the fact that they only come to JTHC when the vaccine is finished from their nearby health centers.

Rabies virus is widely distributed in all districts of Jimma zone. Of the total 85% cases recorded from the zone, the highest (20.4%) suspected cases were recorded from Jimma town, where as the smallest cases in Nonno Benja (0.7%) district of Jimma zone. There were statistically significant variation (P=0.001) in the incidence of the disease among different district of Jimma zone. Overall, the remotest districts from JTHC were registered small numbers of rabies suspected cases than the nearest woredas. These explain that as people from distant areas prefer to seek services from traditional healers instead of traveling long distance to Jimma Town, as a result, cases recorded at health center might underestimate the really figure of the disease in those areas. Deressa *et al.,* (2010) indicated that, the deep rooted traditional practice of pretending to treat rabies in the Ethiopia interferes with getting the real magnitude of the problem.

In general, the result of this retrospective study presents the first preliminary investigation of health center based occurrence of suspected rabies cases in human in Jimma zone and its surrounding. Though this result clearly showed the existence of public health risk of rabies, actual magnitude of the problem might be higher than the current report. As stated by Jimma zone health office, sometimes human's rabies cases may be vaccinated in other nearby health centers and also some victims of dog bite in the rural area have access to traditional healers prior

to the rabies post exposure prophylaxes in modern health center and died in the communities. In addition, such health center cases may not represent all rabies cases zonal picture because of the record filling and keeping problems in developing countries.

A questioner survey was made to assess the KAP of the individuals visiting JTHC due to bite of animals suspected of rabies. The age of the participants was within the range of 15 to 81years.

From the total of 384 respondents, 91.7% had heard of rabies before exposure and the majority (83.9%) of the respondents heard rabies from their family (friends), while 16.1% were heard from other source like media and/or teachers. This result is in agreement to the work of Sambo, (2012) who reported the most common source of information on rabies was from personal contacts (neighbors, parents and friends), in Tanzania. This study showed that there is good awareness regarding the presence of rabies in the areas. This good level of awareness as to the presence of the disease could be due to the repeated occurrence of the disease in the area. Dissemination of information from the government's side, mass media and teachers is very poor this could be due to the fact that the disease is neglected and is not considered as major public health importance in the areas.

In this study, only 20% respondents were able to mention germ as causative agent of rabies while 27% of respondent mention foxes and hunger as the causative factor of rabies. As to the cause of the disease, some of the respondents believe that scarcity of food lead to manifestations of abnormal behavioral (nervous sign) in dog as a result the dog bite human. They added that this is particularly common in summer (kiremt) when food is less available for dogs. However, association of rabies occurrence with hunger is difficult to justify scientifically. Some respondents suggested that contact of dog with foxes with unfamiliar barking sound is responsible for causing the disease. This could be related to true as the dog can get infected from rabid foxes. Seen dog contact in surrounding the home suggested that fox as a causative agent of rabies.

In this study, most of the respondents were able to mention the typical clinical sign of rabies listed in different textbooks both in animals and in humans. They mentioned abnormal behavior, (lack of fear, aggressiveness, disorientation and attempt to bite nothing), excessive salivation and hydrophobia as clinical signs of rabid animals (dogs). Headache, hydrophobia, photophobia and altered mental status (nervous sign) were the clinical signs mentioned for rabid humans. This is in line with the previous works of Karen *et al.,* (1997), Bethlehem *et al*., (2012), Yimer *et al.,* (2012) who reported that the majority of the interviewed households have knowledge on the clinical signs of the disease. This fact that the majority of the respondents were well aware of the clinical sign of rabies in the area may indicate that disease has long been known or endemic in the area.

More than 50% of the respondents seen persons exposed and died of rabies while attending traditional healers and visiting health center after manifestation of the clinical sign of a disease. During this study period, thirteen persons who were bitten and/or had contact of rabid human who died of the disease in the rural areas of Jimma zone were interviewed. The existing experience indicates that most human rabies victims in the rural areas come to health center after they observe the death of their family member or after trying traditional therapy fails. This means these victims come to the health center after the manifestation of clinical symptoms, which is inevitably fatal and cannot be reversed. Most of the deaths are due to deep rooted use of traditional remedy, ignorance and lack of awareness on modern treatment and easy access to proper health services particularly lack of human post-exposure treatment in nearby health center.

More than (70%) of the respondents were aware that rabies transmit through bites or lick by rabid dogs, cats and domestic animals (equine, bovine and small ruminants). The majority of them also knew that rabies could be prevented by avoiding being bitten by animals and stray dog and confining dogs. This in line with previous works, in Ethiopia and other countries who reported that most of the study participants have knowledge on the route of transmission of the disease to humans (bite, scratched or licked by rabid

dogs, cats and other animals) and also means of preventing it (Singh and Choudhary, 2005: Matibag *et al*, 2007: Muhammad Zubair *et al*, 2012: Yimer *et al.*, 2012).

Despite their good level of awareness on the disease, vaccinating dogs (the major source of exposure to human) and cat and confining dogs were poorly practiced in the areas. This could be partly due to disregard particularly absence of confining dogs and lack of easy access to pre-exposure animal's vaccine in Jimma zone and surrounding areas.

Greater than 90% of the respondents estimated the incubation period of rabies both in humans and in animals to be less than fourty days irrespective of the site and size of bite. This is consistent with the finding of, Agarvval and Reddaiah, (2003) who reported that the majority of the communities knew that dog bites could cause death but did not have the right knowledge on the incubation period of the rabies.

According to (Swanepoel, 2004: WHO, 2004: CFSPH, 2009) in humans the incubation period of rabies varies from a few days to several years but, most cases become apparent after one to three months and is not limited to 40 days. The incubation period of rabies in animals and humans are influenced by the site of the bite, the severity of the wound and the amount of virus introduced into the bite wound (Swanepoel, 2004: Wandeler, 2004). This lack of awareness on incubation period of the disease in this study may come from the misleading information coming from the traditional healers who are advising the victims not to cross-rivers and travel to health facilities in search of medical care before 40 days of exposure. According to the healers, if victim does not develop clinical sign of the disease during this period the dog bite cases are free of rabies.

This study indicated that, the main source of suspected cases of human rabies was dogs owned by neighborhoods and unknown free roaming dogs. This agrees with previous studies conducted in the Ethiopia and other countries (Fekadu, 1982: Shah *et al.*, 2012: Yimer *et al.*, 2012) who stated that dog is the species most responsible for human exposure and majority of PEP in humans were due to stray dogs that bite, escape and are not available for observation. In area where rabies is endemic in stray and free roaming

dogs, there is the greatest possibility of pets and other domestic animals to become infected with rabies (Tony *et al*., 2006).

More number of females knew persons exposed and died of rabies as compared to male respondents and the variation was statistically significant (P=0.001). However, there were no statistically significant variation (P>0.05) between sex on the awareness level of participants with regard to other knowledge variable assessed in this study and thus, both sexes have a good and comparable levels of awareness on presence of rabies in the community.

Farmer respondents were more (OR=2) likely to mentioned hydrophobia as a clinical sign of rabid animals and humans and correct rabies transmission route by bite of rabid farm animals and cat as compared to students. However, students have better (OR=1.8) awareness on importance of avoiding being bitten by animals as a means to prevent rabies when compared to farmers. There were no significant variation (P>0.05) on awareness level among farmers, students and employee participants on the other knowledge variables (Table 8). This may could be due to the higher impact and incidence of the diseases in rural areas where dog management and health care (vaccination) system is poor and the wildlife and uncontrolled dogs can easily contact each other and responsible for the virus circulation in their domestic animals.

Illiterate respondents were more likely (OR=1.8) aware as compared to grade 1-8, educated respondents on photophobia as clinical sign of rabid human. Non-educated respondents were more (OR=3.8) aware about the transmission of rabies by rabid farm animals as compared to grade 9-12 educated respondents. Moreover, non-educated participants more aware (OR= 2.5) on rabies caused by germs as compared to college graduate respondents (Table 12). The result indicate that, those respondents who attend relatively higher class of education were not found to have significantly high level of awareness than those who had low level of education or non-educated at all. This may could be due to no awareness creation activities performed either in teaching or public services centers. In contrary Sambo, 2012 showed that the odds of being knowledgeable

of rabies were higher among respondents with more education and individuals that had previously experienced suspect rabid bites in Tanzania.

Adults and old respondents were more aware about the fact that the bite of rabid wildlife could infect human and animals as compared to the younger (15-30) respondents (Table 12). Inline to work of Karen *et al.,* (1997) reported that, older inhabitants (> 50 years) were more aware the incidence of rabies was more common over their lifetime. This finding indicates, the older age group was more aware than younger due to the disease is long known in the areas. In general, age had no significant association on most of the knowledge variables (Table 9). This suggests that there is no difference in the flow of information and awareness creation on rabies from time to time.

Almost all the rural and urban respondents had some awareness on rabies before exposure. There were no significant variation (P>0.05) on the awareness level of rural and urban respondents on the clinical signs of rabies both in human and animals as well as in the means of transmission (Table 9). This study indicating that, most inhabitants are well aware to a similar level as to the dangers associated with rabies. This may be due to the wide spread occurrence of canine rabies in both settings as large number of free roaming dogs present in both area.

In the current study, all of the respondents had positive attitude towards the public health risk of rabies. This is in agreement with Sambo (2012) who reported that Tanzanians believe that rabies is a significant public health problem where the bite of an infected dog is the most common means of transmission. The majority of the respondents believe that any person exposed to rabies (animal suspected of rabies) should seek medical evaluation in health center promptly. This is a good attitude as CDC (2008 and 2009) recommends as anyone who has been bitten by an animal, or who otherwise may have been exposed to rabies should see a doctor immediately.

Majorities (75%) of the study participants believe that rabies is preventable disease. According to previous studies by (Weldehiwot, 2002: Jackson & Wunner, 2007:

McGettigan, 2010: Lembo, 2010), indicated that human rabies can be controlled by controlling the disease in domestic and wild animals, including the use of vaccination programs. Yimer *et al.*, (2012), report that 85.7% of the interviewed households suggested that the treatment of wound and vaccination of people bitten by rabid animals could prevent the occurrence of the disease.

The larger proportion (75.8%) of the respondents believes that traditional healers (herbal medicine) cure rabies. The greater proportions of these respondents with such a perception were rural respondents than urban people. This explained by herbal remedy commonly practiced in communities of the rural areas. Ayalew (1985) reported that the wide spread use of supposedly traditional anti-rabies herbal remedies in Ethiopia and he also added that some exposed individuals discontinue the vaccination regime to start these herbal remedies. Deressa *et al.*, (2010) stated that most fatal human rabies cases recoded at EHNRI were associated with herbal remedies where majority of human rabies cases helped exhaustively by traditional healers. Persons, used herbal medicine may be cure of rabies without receive any anti-rabies treatment, this may be due to most of the dogs may not be rabid, class of bite and bites above clothes.

About 92% of respondents believe that keeping free roaming dogs have harmful effect on their family health particularly with regard to rabies and 25.8% of them believed that it is impossible to live without keeping pets. This study showed that there is positive attitude of the risk of rabies transmission through free roaming dog's bites. However, dog management practice like feeding, housing and health care provision is very poor and increases the risk of disease occurrence and spread. There were no statistically significant variation ($P>0.05$) on the attitude of respondents among the different occupation group.

In this study, the greater number (53.9%) of respondents replied that they prefer immediate killing rabies suspected dog that bite humans to prevent further attacks. Only around 7.3% of them report the incident to a veterinary clinic for observation of behavioral change. This is similar to the work of Sambo, (2012), who stated that most of

his study participants reported they would kill the biting animal without informing livestock health officers in Tanzania. WHO (2004) reported that there is definitely a gap in people's knowledge, attitude, and practices about dog bite and its management. Such practices are contrary to WHO recommendation stating that suspected animals should be quarantined for 10 days (WHO, 1996), to decide either exposed individuals should be vaccinated or not.

The dogs bite people, might be due to aggressiveness, behavioral change of dogs during mating and breeding season, due to physiological reaction and female dogs that gave birth are aggressive to protect the newly born puppies and thus, all bites may not be due to rabies. In most of these cases, the communities kill the pets as soon as they bite humans. All these cases would require anti-rabies treatment. It is not a good practice, as many dogs may not be suffering from rabies and as a result, the communities incur unnecessary cost of treatment and transport and pain of multiple injections with large needle. In addition, it makes difficult to appreciate the scale of the problem and take appropriate steps to prevent further transmission because, pets were not quarantined and observed for development of clinical signs. If other rabies suspected domestic animals bite humans, they quarantine the suspected animals until its death; this is good practice we should also be extended to rabies suspected dogs to reduce psychological trauma and economic loss. There is a need for intensified education regarding management of biting dogs and providing post-exposure prophylaxis treatment in such cases to prevent rabies related mortality effectively.

About one third of the respondents, often slaughter food animals suspected of rabies and eat their meat as by considering that the meat from such animals have medicinal value. This habit exposed peoples for others threat and it is contrary to recommendation of OIE (2011) which state that care should be taken to ensure that carcasses are disposed of appropriately, when death due to rabies has been confirmed. On the other hand, two third of the respondents kill and avoid (throw away) the body of animals bitten by suspected rabid animals fearing that rabies is transmitted through animal’s carcass. Sambo, (2012),

reported that about one quarter of respondents claimed they would throw away the carcass of a rabid animal. This habit poses a risk for scavengers, which may feed on dead infected animals. In South Africa, an outbreak of rabies in endangered wild dogs in 2000 was associated with feeding on the carcass of a rabid jackal (Hofmeir and Hofmeyr, 2004). This necessitates the need for awareness creation that the carcasses of all animals died of rabies, should be burned or buried to stop the transmission of rabies to scavengers and other animals.

In this study, only 57% of the respondents replied that they wash the wound with water and/or soap as first aid. Maria and Lulu (2004), reported that only handful of their study participants who encountered animal bite victims were able to do correct first aid care. Shah *et al.,* (2012) also reported that the majority (72.5%) of victims did not wash their wounds with soap and water. WHO (2004) reported that there is inadequate knowledge on the need to wash wounds with soap and running water and apply antiseptics immediately after a bite exposure. Singh and Choudhary (2005) reported that only 31% of his respondents practice applying first aid measure, while majority of respondents either would do nothing or do some religious practices. Early and complete local treatment of all bite and scratches is important as they virus may remain within the area of the bite for an indefinite duration of time. All bite wound should be flushed thoroughly and cleaned with soap and water even if no soap or vaccine is available (WHO, 2005: Willoughby, 2009).

In this study almost half of the respondents had pets (dogs and/or cats and only 5% of them vaccinate their dog occasionally. The majorities (95%) of the owners do not vaccinate their dogs and are very susceptible and the disease could easily spread in the area. Yimer *et al.,* (2012) also reported the majority (76.7%) of the owners do not vaccinate their dogs. EHNRI, (1997) showed that 52% dog owners are kept dogs without regular vaccination in Addis Ababa where vaccine is relatively easily available. Therefore, dog owners should be advised to get their pets vaccinated regularly, so that the occurrence of the disease in pets and ultimately in humans would be minimized.

Pre-exposure animal vaccine should be made available by governments especially for pets in such disease endemic area, as inaccessibility of the pet's vaccine is a major obstacle of rabies control program.

In this study, only 9% of pet owners keep (restrict) their dogs tied up during the whole day. Most of these respondents who are keeping their dogs at home were mainly not due to the fear danger associated with rabies but to guard their compound and home. The remaining 91% of the dog's owner's untie their dogs; it cohabits with family and foraging everywhere. This contributes to the transmission and spread of the disease as there would be increased contact between susceptible and rabid dogs. This finding is in line with recent report that the majority of the owned dogs are not tied at all in Addis Ababa Yimer *et al.,* (2012). It is advisable to keep dogs in well-fenced compounds and at home with adequate provision of medical care including regular vaccinations in order to protect them from rabies. .

More urban respondents (8%) vaccinate their pets as compared to those from rural area where less than 1% vaccinate their dogs. According to Matibag *et al.,* (2007), there is a difference in the attitudes and pet care practices relevant to rabies control between urban and rural areas. Awareness on importance of vaccinating and restricting pets seems to increase with level of education as college graduates practice better and the illiterate do not at all.

The highest numbers of dogs were owned by orthodox followed by Muslim and Protestants participants. In agreement with Yimer *et al*., (2012) reported that, Christians keep dogs more than the Muslims in Addis Ababa.

Strength and limitation of the study

Strengths

- This study was relatively comprehensive and give a good picture on the status of rabies in Jimma zone
- To obtain reliable data and ensure confidentiality data were collected by researcher
- The data was collected by handling or searching each folder stored in record and registration room to get complete information and include all recorded case.

Limitation

- The data collected from only one health center may not represent the true picture of human's rabies at southern west part of Ethiopia.
- The retrospective data could underestimate the status of the disease in the past years due to problem of data recording and keeping and also occasionally some other health center not covered in this study may also give PEP
- Limited availability of literature on human rabies and KAP of the community on the disease and associated risk factors in the Ethiopia make difficult comparison of this study with findings from others parts of the country.

6. CONCLUSION AND RECOMMENDATION

Rabies, a viral disease that affects all warm-blooded animals and humans is widespread in many regions of the world. Rabies appears to be endemic in Jimma zone. The sources of exposure to humans were dogs, as most post-exposure anti-rabies treatments given to humans were primarily due to dog bites. The risk of Dogs' bite appears to be continuously throughout the year; and children were more exposed than other age groups. Most of the respondents were familiar with the clinical signs of rabies both in animals and in humans and with the routes of infection and means of its control. However, there is low level of awareness on the importance of first aid that is very important, inexpensive and readily available control option. Most of the respondents had positive attitude towards the public health risk of rabies but their actual practices particularly with regard to bite and dog management is poor and do not favor the control of the disease. Thus, such poor practices favor the persistence of the virus and continuous transmission of the disease among susceptible individuals in the area. The fact that majority of the respondents believe that herbal remedy cures rabies may lead to the underestimation of the burden of the disease, as most of these cases remain unreported to the health centers.

Based on this conclusion, the following recommendations are suggested:

- Further public awareness creation is still essential on multidimensional impacts of rabies, responsible pet ownership, managements of bitten animals, first aid treatment and on the use of traditional remedy

- Regular vaccination programme should be in place for effective prevention and control of rabies rather than mass destruction of dogs in case of outbreak, which is ineffective and inhumane as can be seen from this study,

- Suspected animals should be quarantined for 10 days and dogs that show clinical signs or bitten by a rabid animal should be destroyed and properly disposed and exposed human victims should get post exposure prophylaxis promptly

- Adequate vaccine for pet and human should be made available at district towns of southwest Ethiopia to reduce the impact of the disease in these areas.

- If a nation based rabies control strategy is to be initiated, further epidemiological surveillance is essential to assess and map the zonal picture of rabies. It also important to develop, enforce and implement appropriate collaborative policy (such as One Health policy) for efficient managements of rabies.

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8. Annexes

Annex 1.

Data collection instrument for the assessment of Knowledge, attitudes and practices of the individuals bitten by animals suspected of rabies in Jimma zone, southwestern Ethiopia

Confidentiality and informed verbal consent form before conducting interview and filling the questionnaire

Dear respondent, my name is _____. I am working as a facilitator or data collector in the study conducted by school of veterinary medicine of Jimma University**.** This is a study to assess Knowledge, attitudes and practices of the community on rabies and associated risk factors in Jimma Zone. In order to collect information pertinent for the understanding of the epidemiology of rabies and for development of appropriate strategies to prevent and control the disease, your honest and genuine participation is important and highly appreciable. The questionnaire will take about 15 minutes. To keep absolute confidentiality, there is no need to put your name and individual response will not be reported. It is your right to participate in the study or refuse it. If there is anything not clear, do not hesitate to ask the facilitator or interviewer for clarity.

Do you want to participate in the study? If yes, put this mark (X) on the blank space

Yes, I want to participate _____, Signature _____
Thank you for your cooperation!!

No, I do not want to participate _____

Thank you for your time!!

Questionnaire number: _____ Date of interview: _____

Section 1) Socio-demographic data: encircle the number in front of the response or fill in the blank spaces

S.No.	Questions	Response category	Skip
Q101	Address of the respondent	Zone:_____ Woreda: _____ Kebele: _____	
Q102	Place of residence	1. Urban 2. Rural	
Q103	Age of respondent	Write in years: _____	
Q105	Sex of respondent	1. Male 2. Female	
Q106	Marital status	1. Married 2. Single 3. Divorced 4. Widowed	
Q107	Educational status	Write the final grade: _____	
Q108	Religion	1. Orthodox 2. Protestant 3. Muslin 4. Catholic **5**.others	
Q109	Occupation	1. Vet. 2. Farmer 3. Abattoir worker 4. Others:	

Section 2): Knowledge of the respondent on rabies and associated risks

S. No	Questions	Response category	Skip
Q201	When did you have heard of rabies?	**1**. Before exposure **2**. After exposure	
Q202	From where you heard of rabies	**1**.Family member (Friends) **2.** Mass media **3**. Teachers 4**.**Others__	
Q203	What do you think is the cause of rabies?	**1**. Germ **2**. Evil eye 3. Satan **4.** Do not know 5. Others (specify): __	
Q204	Which animal exposed you to rabies?	**1**. Dog 2. Cat **3**. Bovine **4.** Equine **5**. Small ruminant (Goat or sheep) **6.** Wild animals (fox, hyena etc) **7**.humans	
Q205	If the animal exposed you was **dog**, what do you consider it?	**1**. Owned by family 2. Owned by neighbor **3**. Do not know the owner (it is stray dog)	
Q206	What is the current status of the animal that exposed you to rabies?	**1**. Under quarantine **2**. Died of the disease **4**. Killed (by community) **5**. Don't know 6.Others(Specify): _____	
Q207	Which are the clinical signs a rabid animal generally shows?	**1.** abnormal behavior **2**. Absence of fear, aggressive, disoriented, attempt to bite nothing (air) **3.** Photophobia **4**. Excessive salivation **5**. pawing at ground **6.** Hydrophobia **7**. Tail dropping **8**. Do not know **9**. others (specify_____	
Q208	How long the incubation period of rabies you suggest in human?	1. Less than 40days **2**. I don't know 3. Others:	
Q209	How long the incubation period of rabies you suggest in animals?	1. Less than 40days **2**. I don't know 3. Others:	
Q210	How do you think humans and animals acquire rabies?	**1**. Due to bite or lick by rabid dogs **2.** Due to bite or lick by rabid cat **3**. Due to Bite or lick by rabid wild canines (foxes, hyena etc) **4.** Bite or lick by rabid cows, oxen, horses,	

S. No	Questions	Response category	Skip
		donkeys, shoats etc **5**. others	
Q211	Do you know person (s) exposed to or died by rabies in your areas?	**1**. Yes **2**. No ⟶	**Q213**
Q212	If yes to Q 211, what was the treatment given to the person?	**1**. Modern treatment from health center **2**. Treated by traditional healers **3**. Do not know **4**. Others:_____	
Q213	What measure was given to you as first aid?	**1**.Wound washed with water and/or soap 2. Washed with soap and ethanol or iodine **2**. Nothing is given	
Q214	How could you prevent yourself and community from acquiring rabies?	**1**. Avoiding being bitten by animals (dogs) **2**. Vaccinating dogs and cats **3**. Avoiding stray dogs **4.** Confining dogs **5**. Do not know 6. others:	
Q215	Which are the symptoms of rabies in humans (check all that apply)	1. Headache 2**.** Muscle pain 3. Photophobia 4. Hydrophobia **5**. Altered mental status 6. Do not know **8.** Others(specify):____	

Section 3) Attitudes of the respondent on the risks of rabies and its management

S.No	Questions	Response category
Q301	Rabies is a health risk to you	1. Strongly agree **2**. Agree 3. Disagree **4**. Strongly disagree 5. Do not know
Q302	Anyone exposed to rabies should seek medical evaluation as soon as possible	1. Strongly agree **2**. Agree 3. Disagree **4**. Strongly disagree 5. Do not know
Q303	It is difficult and/or impossible to live without keeping pets	1. Strongly agree **2**. Agree 3. Disagree **4**. Strongly disagree
Q304	Keeping free roaming and unvaccinated dogs has no harm	1. Strongly agree **2**. Agree 3. Disagree **4**. Strongly disagree
Q305	Rabies is preventable	1. Strongly agree **2**. Agree 3. Disagree **4.** Strongly disagree 5. Do not know
Q306	Traditional healers and herbal medicine cure rabies	1. Strongly agree **2.** Agree 3. Disagree **4**. Strongly disagree 5. Do not know

Section 4) Assessment on practices of the respondent on rabies and risk managements

S. No	Questions	Response category	Skip
Q401	What measure should be taken suspected of rabies in animals?	1. Tie up or quarantined and then killed after proving that the animal was rabid 2. Report the incident to a veterinary clinic 3. Immediately killed the animal **4**. Nothing 5. Others (specify):_____	
Q402	What do you do if food animal bitten by animal's rabies suspected?	1. Slaughter and eating the meat 2. Kill the animals and avoid 3. others :_____	
Q403	Do you have pet (s)?	1. Yes 2. No ⟶	
Q404	If yes to Q403, how many pets do you own?	Write in number: Dogs _____, Cats_____	
Q405	How do you keep your dog (s)?	1. Restricted/confined **2**. cohabit with family 3. Foraging freely everywhere	
Q406	Did you give vaccination for your pet (s)?	1. Yes 2. No ⟶	
Q407	If yes to Q406, how frequent?	1. At three months of age and then periodically every three years 2.Occasionally 3. Only once in life **4**. After it is sick	

Annex 2. Gaaffilee afaan oromoon

Universiittii jimmaattii kooleejii qonnaa fi eegumsaa fayyaa beeyladaa
Unka odeeffannoo (daataa) bekumsaa, ilalchaa fi gochaa uumataa namoota dhukkubaa saree marattun cininamaan irraatti funnanuf qopha'e godinaa jimmaa fi naannoo ishee irra dhufaan

Icitiitti qabamuu odeeffanno funaanamuu fi waliigaltee nama odeeffannoo funanuu fi odeeffanno kennu giddutti osoo odeeffannoo funanuu hin eegaliin godhamuu

Halloo akkaam jirta, ani maqaan koo _____. Jedhama. Yeroo ammaan kannatti hojii qorannoo Universiitti Jimmaattin hojatamaa jiruuf kan faayaduu odeffannoo funaanuf (akkaa funnamuu gochaan) jira. Bu'uura qoraanno kannaas adeemsaaa eegumsaa faayya uumataa naannoof faayidaa guddaa qaba. Adeemsii odeeffannoo keennu fi funnaanu kun daaqiqaa 15-20 fudhataa. Icittti odeeffanichaa eeguuf maqaa keessan keennuu ykn himuun hin barbaachisuu. Odeeffannoon argamus sadarkaa namaa dhuunfattii hin gabaffamu. Isin qorannoo kana irratti hirmaachuu fi hirmaachuu dhisuuf mirgaa guutu qabdu. Wanti isinii hin galiin yoo jiratees gafachuu dandessu.

Qorannoo kana irraatti hirmaachuu ni feetuu? Yoo ni feetu ta'ee mallattoo(x) bakka duwwaa irratti guutaa ykn bareessaa.

Eeyyeen, nan hirmaadha: _____ mallattoo

Lakkii hirmachuu hin fedhu:_____

Wa'ee hirmaannaa keessaniif guddaa galatoomaa!!!!!

Unka oddeffannoon ittin funaanamu
Lakk.Gaaffii_____ Guyyaa_____

Kutaa 1ffaa: oddeeffannoo waliigalaa wa'ee nama sanaa: kan deebii ta'eetti mari ykn bakkaa duwwaaa irraatti guutti

S.No.	**Gaaffii**	**Gamaa deebi**	Otalli
Q101	Teessoo	Zonii:_____ Aanaa: _____, Ganda: _____	
Q102	Bakka jireenyaa	1. magaalaa 2. Baadiyyaa	
Q103	Umurii	Waggaa dhaan: _____	
Q105	Saala	1. Dhiira 2. Dhalaa	
Q106	Gaa'ilaa	1. kan fudhee 2. Kan hin fuune 3. Kan hikaan 4. kan abbaan warraa ykn haatii warraa du'aan	
Q107	Sadarkaa barumsaa	Sadarkaa isaa dhumaa: _____	
Q108	Amaantii	1. Ortoodoksii 2. Protestaantii 3. Musliimaa 4. kan biiraa:_____	
Q109	Gosaa hojii	1. Ogeessa eegumsaa fayyaa beeyladaa. 2. Qotee bulaa 3. Nama mana qalmaa hojjatuu 4. Baraataa 5. Kan biraa:_____-	

Kutaa 2ffaa: Beekumsaa nama sanaa dhukkubaa saree marattuu fi wa'ee Waliigalaa ta'an irratti

S. No	**Gaaffii**	**Gamaa deebi**	**Skip**
Q201	Waa'ee dhukkubaa saree marattuu yoom dhaagesse?	**1.** Cinaannamuun duraa **2.** Ergiin cininaame booda	
Q202	Eenyuu irraa dhageesse?	**1**. Hiriiyyaa **ykn m**atiii **4**. Barsiisaa **3.** Mass mediyya irraa **5.** Kan biraa__	
Q203	Dhiibbee kanaa kan nama qabsiisuu maalidha?	1. Rammoo **2**. Buddaa ykn seexanna **3.** Hin beeku 4. Kan biraa: __	
Q204	Dhiibbeen kun maliiraa namaatti darbaa?	**1**. Saree 2. Adurree 3. Hoorii **4.** Kotte dudaa 5. Busaa'ee **6.** beenensaa boosonna(sardiida, warabeessa) **7**. Nama	
Q205	Yoo kan sii cininnee saree ta'ee kan eenyuu taatti?	**1**. Kan manaa **2**. Kan ollaa **3**. abbaan hin beekamuu(saree jortuu)	
Q206	Bineensaa nama cininee sana malii gotan?	**1**. Hidhaamee jiraa **2**. Dhukubbaan du'ee **4**. Namootattuu ajeesse **5**. Hin beeku 6.kan birrraa: _____	
Q207	Beelaaydaa dhukkubaa saree marattuu dhukubsatee maltuu irratti mul'ata?	**1**. amala isaatu jijjiramaa **2**. wantaa hundaa sodachuu dhisaa **3.** ifaa aduu sodaata **4**. Ni goroorsaa **5**. Ukamaamee cisaa	

S. No	Gaaffii	Gamaa deebi	Skip
		6. Bishaan sodaata **7**. Eegee bussaa **8**. Hin beeku **9**. Kan biraa:_____	
Q208	Namnii cininamee tokkko guyyaa meeqa keessatti dhukubni irratti mul'ata?	1. hangaa guyyaa 40tti **2**.hin beeku	
Q209	Binensii cininamee tokkko guyyaa meeqa keessatti dhukubni irratti mul'ata?	1. hanga guyyaa 40tti **2**. hin beeku	
Q210	Haala kammin namni fi bineensii dhukkuba saree maratuun qabama?	**1**. yoo sareen maratuun cinintee **2.**yoo adurreen maratuun cinintee **3**. yoo bineensi baddaa maratuun cinintee **4.**yoo horiin mana maratuun cinintee **5**.kan birraa:_____	
Q211	Nama dhukkkuba sareen dhukkubsateee ykn du'ee argitee beekta?	**1**. eeyyee **2**. laakki →	**Q213**
Q212	Deebii lakk.211, eeyyee yoo ta'ee yaaliin godhameef malii?	**1**. buufata fayyaatti yaalamee/tti **2**. qorichaa aadaa fudhatee **3**. qorichaa fudhaatee/tti hin beeku/tu 4. kan biraa:_____	
Q213	Nama sareen marattuun cininte gaargaarsi duraa maltuu godhameef?	**1**.maddaa bishaan fi samunaan,ykn alkoollin miccuu **2**. maddaa bishaan qofaan miccuu **3**. homaayyu hin gonne	
Q214	Maatii keenya fi ofii keenyaa akkamitti dhukkuba kanaarra ittisu dandeenya?	**1**. akka bineensi nama hin cininee gochuun **2**. saree fi adurree kitibatti kennun **3**. saree jortuu dhabamsisuun 4, saroota hidhuun **5**. Hin beeku 6. Kan biraa:	
Q215	Nama dhukkuba saree maratuun dhukkubsatee mallattoo malituu irratti mul'ata?	1.mataa dhukkubii 2. dhukkubaa maashaa 3. Bishaan sodachuu 4. Ifa aduu sodachuu 5. Sallessa sammuu 7. hin beeku 8. Kan biraa:_____	

Kutaa 3ffaa: Ilaalchaa namooni dhukkubaa kana to'achuu irratti qaban

S.No	Gaaffii	Gamaa deebi
Q301	Dhukkubni saree marattuu fayyaa nama irratti rakkina fida?	1. sirrittan itti amana **2**.ittan amana 3.itti hin amanu **4**. Cimseen morma 5. hin bekuu
Q302	Namni dhukkuba kanaaf saxxilamee dafee mana yaalaa qaqqabuu qaba?	1. sirrittan itti amana **2**.ittan amana 3. itti hin amanu **4**. Cimseen morma 5. hin bekuu
Q303	Saree osoo hin guddisiin jiraachuun hin danda'amu?	1. sirrittan itti amana **2**.ittan amana 3.itti hin amanu **4**. Cimseen morma 5. hin bekuu
Q304	Saree jortuu fi kitibatii hin arganee eguun rakko hin qabuu ykn siriidha?	1. sirrittan itti amana **2**.ittan amana 3.itti hin amanu **4**. Cimseen morma 5. hin bekuu
Q305	Dhukkuba saree marattuu ittisuun ni danda'ama?	1. 1. sirrittan itti amana**2**.ittan amana 3.itti hin amanu **4**. Cimseen morma 5. hin bekuu
Q306	Qorichi aadaa dhukkuba saree marattuu kanaa ni fayyisa?	1. sirrittan itti amana **2**.ittan amana 3. itti hin amanu **4**. Cimseen morma 5. hin bekuu

Kutaa 4ffaa; Furmaata namootni rawwatan ykn godhaa jiraan dhukkubaa kanaa to'achuuf ykn hir'isuurrattti.

S. No	Gaaffii	Gamaa deebi	Skip
Q401	Murteee malii murteessita beelaydaa dhukkubaa saree maratuun shakkite?	1. Qobaatti basnee hinaa hangaa qullleesinutti 2. Clinic beelaydaatti gabaasa gonaa 3. Dafne ajjeesna **4**. Homaayuu hin gonee 5. kan biraa:_____	
Q402	Horii fooni yoo sareen marattuun nyaatee maal goota?	1.qalee foon nyaana 2. ajeesnee ganaa 3. Kan biraa	
Q403	Saree ykn adurree qabdaa?	1. Eeyyee 2. Lakkii ⟶	**Q406**
Q404	Yoo deebiin kee eeyyee ta'ee meeqa qabda?	Lakkofsaan bareessi: Saree_____, adurree_____	
Q405	Saree kee akkaammitti egdaa?	1. Ni hidhamtii 2. Matii wajjin jirratti 3. bakeerra joraa oltii	
Q406	Kittibatta keeniteef beekta?	3. Eeyyee 4. lakki ⟶	
Q407	Yoo deebiin kee eeyyee ta'ee si'a meeqa?	1.dhalattee ji'a saditti 2.akkumaa tassa 3. Si'a tokko qofa.	

Annex 2

Jimma University, School of Veterinary Medicine **Tools numbers_____**

Checklist for data collection on rabies in humans

Hospital or health centre name _____Date of data collection_____

S.No	Pt ID	Date of registrion	Age	Sex	Address		Residence		Source of exposure	Site of exposure
					Zone	Woreda	Rural	Urban		
1										
2										
3										
4										
5										
6										
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