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Study on knowledge, attitudes and behavioral practices of animal and human antimicrobial usage and antimicrobial resistance amongst people in Bishoftu town,Ethiopia.

MVSc THESIS

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Addis Ababa University, College of Veterinary Medicine and Agriculture, Department of Clinical Studies

June, 2017

Bishoftu, Ethiopia

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A Thesis submitted to the College of Veterinary Medicine and Agriculture of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of Sciencein Veterinary Epidemiology.

Addis Ababa University, College of Veterinary Medicine and Agriculture, Department of Clinical Studies

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As members of Examining Board of the final MVSc Open defense, we certify that we have read and evaluated the thesis prepared by **Mulugeta Tesfaye Alemayehu**, entitled: **Study on knowledge, attitudes and behavioral practices of animal and human antimicrobial usage and antimicrobial resistance amongst people in Bishoftu, Ethiopia.** And recommend that it be accepted as fulfilling the thesis requirement for the degree of Master of Science in Veterinary Epidemiology.

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STATEMENT OF AUTHOR

First, I declare that this thesis is my *bonafide* work and that all sources of material used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for (MSc) degree at Addis Ababa University, College of Veterinary Medicine and Agriculture and is deposited at the University/College library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate. Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however permission must be obtained from the author.

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LIST OF ABBREVIATIONS

$	USA Dollar
AAU	Addis Ababa University
AM	Antimicrobial
AMR	Antimicrobial resistance
AMU	Antimicrobial use
CDC	Center for Disease Control and Prevention
CVMA	College of Veterinary Medicine and Agriculture
ESBLs	Spectrum beta-lactamases
EU	European Union
EUR	Euro
FDA	Food and drug control authority
ICU	Intensive care unit
IRB	International research Board
KAP	Knowledge, attitudes and practices
KPCs	*Klebsiella pneumoniae* carbapenemases
MBLs	Metallo-beta-lactamases
MRSA	Methicillin-resistant *Staphylococcusaureus*
MSSA	Methicillin-susceptible *Staphylococcusaure*
NCSU	North Carolina State University
OIE	Office International Dis Epizootics
Spp	Species
URTIs	Upper Respiratory Tract Infections
US	United State
VRE	Vancomycin-resistant enterococci
WHO	World Health Organization

ABSTRACT

This study was conducted to assess public level of knowledge, attitudes and behavioral practice regarding antimicrobial use and resistance among publics and to assess factors influencing for self-medication. A cross sectional pre-tested structured questionnaires survey was conducted with 384 prospective participants by researchers using simple random sampling in four Kebele administrates in Bishoftu. Descriptive statistics, Chi square tests and multinomial logistic regression were used to correlate the associations of knowledge, attitude, and practice with socio-demographic characteristics. Of 384 subjects, 157/40.9% were female, 144/37.5% married,64.5% below secondary school,37.5% government employer, 57.35% animals owners, 53.4% had used some medication in the past 3 months and the mean age was 34(SD±12.5) years. Of the respondents, 35.4% believed that Antimicrobials are effective against viruses, 30.2% thought that Antimicrobials are effective against common cold and flu, 26% did not recognize the use of antimicrobial for bacterial infection and 62% and 29.7% knew that overuse or unnecessary use and using for animals of antimicrobial can cause them to lose their effectiveness. The attitude of respondent indicates more than 45% not complete the course of Antimicrobial, 22.9% prefer to by AM without prescription, while 34.4% literally miss some doses carelessly and 23.7% commonly used AM as food. Most respondents also has negative attitude towards self-medication. 20.3% of subjects search AM from relative/friends, 34.6%keeps unused AM for future use and 34.4% prefer to use AM for minor ailment. Approximately 14.8% were never consult the physician before start taking AM and 61.7% always check the expiry date of AM before using it. There are significant positive associations between knowledge and attitude towards antimicrobial usage resistance with (OR=27.7, p=0.000). These result indicated that respondents with higher knowledge were more likely to have positive attitude than others. Knowledge level are negatively associated with practice with (OR= 0.742, p= 0.605). On the other hand there are positive correlation between practice and attitude regarding antimicrobial use. According to this study respondents who have positive attitude (OR=14.2) were more likely develop good practical behavior ($p < 0.000$). According to result obtained from Multivariate analysis persons with low educational status (no formal education, p= 0.035; and primary school, p= 0.013) and non-govern mental employer (NGO), p= 0.000 were independently associated with inadequate knowledge. Persons with low educational status (no formal education, p= 0.000;

primary school p=0.000 and secondary school, p=0.000) and inadequate knowledge were independently associated with poor attitude. As we found, a higher educational level has been associated with better knowledge and attitude adequate knowledge of appropriate Antimicrobial use was also a predictor for a good attitude. On the whole, respondents who had inadequate knowledge scores were more likely to have a poor attitude toward antimicrobial use and resistance. More respondents with inadequate antimicrobial knowledge than those with adequate knowledge abuse antimicrobial and contributing for the development of AMR. An inappropriate belief on Antimicrobial related aspects was observed and inappropriate behavior was noticed, which are reflections of insufficient knowledge and wrong beliefs. Interventions must be put in place to educate the public on appropriate Antimicrobial use. Further research is needed to advance understanding of factors associated with KAP regarding antimicrobials use, and to inform strategies to improve the appropriateness of their use.

Keywords: *knowledge, attitudes, behaviors, Antimicrobial use, Education, Public and Bishoftu*

1. INTRODUCTION

The introduction of antimicrobial agents (antimicrobials and related therapeutics for medicinal use) early in the twentieth century markedly improved the clinical management of infectious diseases caused by microbes (a broad term including bacteria, fungi, parasites and viruses) that were previously untreatable and often fatal. This success also helped engender a sense of control on the part of clinicians and public health professionals over host–pathogen interactions. Despite these concrete advances in prevention and treatment of infectious diseases, a parallel surge in resistance to antimicrobials is seriously compromising the gains made over the past century; and this resurgence has been directly associated with the overuse (or misuse) of antimicrobials (Sosa *et al.*,2010).

More than 50% of all medicine worldwide are prescribed, dispensed, or sold inappropriately and not in the principle of rational drug use. More than 50% of patient fails to take them correctly. This inappropriate dose results in increasing morbidity and mortality particularly for childhood infectious disease and chronic disease (Zintzaras and Ioannidis, 2003). Various studies conducted in developed as well as developing countries regarding the safe and effective use of antimicrobials showed that, irrational antimicrobials use is a global problem and about 75% of antimicrobials are prescribed inappropriately (DACA, 2002).

Several factors may contribute to inappropriate antimicrobial usage, including doctors' knowledge and experiences, uncertain diagnosis, patients' expectations, pharmaceutical marketing influences, and unregulated antimicrobial dispensing (Suaifan *et al.,* 2012).Despite continuous efforts to improve antimicrobial prescribing and address issues such as self-prescribing, unnecessary use for viral infections, dosing errors, and excessive treatment durations, rates of antimicrobial resistant infections continue to rise globally (Reichert *et al.,* 2000; Sahlan *et al.,* 2008). The development and implementation of wide ranging educational programs for both physicians and the general population are among the commonly recommended strategies to help address those concerns (Belongia and Schwartz, 1998).

Antimicrobial resistance (AMR) has long been a major and prevalent public health concern in the international community, and continues to be expressed, by major public health entities such as the World Health Organization (WHO), as an area that needs to be addressed: the WHO recently issued an international call for action to raise awareness and halt the spread of antimicrobial resistance. In an effort to tackle the problem, the WHO also presented six major factors that drove antimicrobial resistance, with overuse of antimicrobials for diseases that do not require them and underuse due to insufficient doses, duration or use of antimicrobials of substandard potency being one of these factors (WHO, 2011).

Increasingly, AMR and drug resistant infections are being recognized as a crosscutting threat to global health. High rates of resistant infections have been documented in healthcare and community settings, in all regions, and for a broad range of microorganisms. The increasing prevalence and geographic distribution of AMR threatens to undermine decades of progress in effective prevention and control of high-priority infectious diseases. A reliable evidence base that accurately describes and characterizes the global burden of AMR will be essential to addressing this challenge and will inform global and national priority setting, public health actions, and treatment decisions. Social determinants of health like poverty, education, infrastructure and access to health services are an important driver of antimicrobial usage and a comprehensive understanding of these issues would aid intervention programs (WHO, 2015).

Human infections caused by pathogens that have become resistant to medical drugs impose a large burden of illness and death and cause enormous costs. The use of antimicrobials in animal agriculture and their potential impact on human health has been widely debated. In recent years, there is increasing consensus that there are links between veterinary drug use and drug resistance in human pathogens, and that it is desirable to reduce antimicrobial use in agriculture. Animal infections caused by antimicrobial resistant pathogens of greatest threat to human health are zoonotic pathogens (including: non-typhoidal *Salmonella*, *Campyolobacter* and toxigenic *Escherichia coli*) transmitted through food and by direct contact. One estimate states that drug resistant infections will cause 10 million extra deaths a year and cost the global economy up to $100 trillion USA dollar by 2050 (Grace, 2015).

The transmission of antimicrobial-resistant strains between individuals is further exacerbated by the high urbanization rate in many developing countries, but also worldwide (Dugger 2007). Even in developed countries, the spread of resistant microbial strains has been shown to occur not only through hospital settings but also via community-acquired infections (Bancroft, 2007). In the United States, a study on methicillin-resistant Staphylococcus *aureus* (MRSA) demonstrated that more than one in four invasive infections could be associated with community- onset infections (Klevens *et al.*, 2007).

In developed countries, agriculture is the primary user of antimicrobials in terms of total quantities, much agricultural use results in sub-therapeutic exposures for bacteria, drugs of every important clinical class are utilized and humans exposed to resistant pathogens via consumption of animal products and via widespread release into the environment. Some of these factors are likely to be true for developing countries. Reducing agriculture associated AMR requires reducing the quantity and/or improving the quality of antimicrobial use. There is limited accurate information on the levels of antimicrobial use (in humans and animals) in many low-income countries, including Ethiopia. One of the underlying drivers for antimicrobial use and the development of AMR is the livestock revolution (Grace, 2015).

A quarter of world's population is concentrated in developing countries and has access only to small proportion of world's drug product (UNPF, 1998). These resource-constrained countries bear 95% of the global infectious disease burden and rely on effective antimicrobial medicines to treat these diseases. Many infectious diseases, once easily curable, are becoming increasingly difficult and costly to treat as resistance and multi-drug resistance grows. Some diseases which are difficult to treat even with effective medicines become even more complicated and expensive to cure. Additionally, life-saving medical technologies, such as organ transplants, which are dependent on antimicrobials to prevent surgical site infections, are threatened by AMR (Laxminarayan and Malani, 2007)

Resistant strains can be traced from the community to the hospital and vice versa, indicating that drug resistance is no longer confined. Fuelled by increasing antimicrobial use, the frequency of resistance among different bacteria has escalated, especially in developing countries where

antimicrobials have been readily available without prescription. Resistance rates in almost all types of bacteria are much higher in developing than in developed countries (Collignon, 2012).

As microbial resistance is not limited by borders this problem is also the problem of Ethiopia. Infectious diseases are major causes of morbidity and mortality in the country and together with nutritional problems account for 60-80%of the health problems. Less large scale studies done on the extent of antimicrobial usage and resistance in Ethiopia, but existing reports indicate that it is a growing problem and irrational use of antimicrobials was identified as one of the major problems contributing to antimicrobial resistance (DACA, 2002).

According to various studies have indicated, because of lack of knowledge and information many people take and use their medication incorrectly or inappropriately. This in turn leads to loss of efficacy and an inefficient use of the considerable resources which are spent annually on drugs (Stewart, 2000).One population-based study aimed at examining common knowledge and beliefs about antimicrobial use of people in an urban area of Indonesia found that numerous misconceptions regarding antimicrobial use existed and that appropriate knowledge regarding antimicrobial use is required to address misuse (Widayati, 2012). Studies have also demonstrated that providing information on rational drug-use informtion to farmers have improved their knowledge and management of diseases (Grace, 2008).

For any intervention to be successful and for the changes to be sustained, it should change the knowledge, attitudes and practices (KAP) of the target group (Brown, 2002). So that the purpose of this study is to investigate the knowledge, attitudes and behavioral practices (KAP) of antimicrobial usage and antimicrobial resistance amongst people in Bishoftu, Ethiopia. To our knowledge, this is the first study undertaken in Ethiopia.

Therefore the objectives of this study were;

General objective

To assess knowledge, attitude and behavioral practices of community towards human and animal antimicrobial usage and resistance in Bishoftu town, Ethiopia.

Specific objectives

- To assess knowledge, attitude and practice of urban dwellers regarding to human and animal antimicrobial usage and resistance.
- To assess public knowledge, attitude and practice towards antimicrobial self-medication.
- To identify predictive factors for antimicrobial usage and resistance.

2. LITERATURE REVIEW

2.1.History ofantimicrobials

Before the early 20th century, treatments for infections were based primarily on medicinal folklore. Mixtures with antimicrobial properties that were used in treatments of infections were described over 2000 years ago (Lindblad, 2008). Many ancient cultures, including the ancient Egyptians and ancient Greeks, used specially selected mold and plant materials and extracts to treat infections (Forrest, 1982; Wainwright, 1989). More observations made in the laboratory of antibiosis between micro-organisms led to the discovery of natural antibacterial agents produced by microorganisms. Louis Pasteur observed, "If we could intervene in the antagonism observed between some bacteria, it would offer perhaps the greatest hopes for therapeutics" (Kingston, 2008).

Antagonistic activities by fungi against bacteria were first described in England by John Tyndall in 1875 (Kingston, 2008). Synthetic antimicrobial chemotherapy as a science and development of antibacterials began in Germany with Paul Ehrlich in the late 1880s (Calderon and Sabundayo, 2007). Ehrlich noted that certain dyes would colour human, animal, or bacterial cells, while others did not. He then proposed the idea that it might be possible to create chemicals that would act as a selective drug that would bind to and kill bacteria without harming the human host. After screening hundreds of dyes against various organisms, he discovered a medicinally useful drug, the synthetic antibacterial Salvarsan now called Arsphenamine (Calderon and Sabundayo, 2007; Limbird, 2004; Bosch and Rosich, 2008). After this initial chemotherapeutic compound proved effective, others pursued similar lines of inquiry, and in 1928, a Scottish scientist called Fleming serendipitously found that his *Staphylococcus* plate culture was contaminated by blue-green mould. A halo of inhibition of bacterial growth was found around the blue-green mould. He concluded that the mould could release materials which could inhibit the growth of bacteria. He tried to develop a pure culture of the mould, which was later discovered as *Penicillium rubens* (Houbraken *et al.,* 2011). With the help of chemists, Fleming isolated what he named “penicillin”. At that time, penicillin was urged on by the necessities of war. The discovery of

penicillin by Fleming in 1928 and the later purification and synthesis of this compound were historic milestones and the beginning of a new era of therapeutics in the fight against infectious disease (Bennett and Chung, 2001).

In the following 30 years, the golden age of antimicrobials, scientists developed a wide range of antimicrobials, given physicians a numbers of treatment options for most infectious diseases. In general, the methods of discovery of new agents were observation of natural compounds and chemical modification of existing agents. The new classes of antimicrobials, which defined as a new drug with completely new mechanism, discovered mainly from 1935 (Sulfonamides was discovered) to 1968 (Trimethoprim, the last antimicrobial introduced in 20th century) (Philippon *et al.,* 2002).

From 1968 to 2000, there is a big gap of new agent invention. Even though a lack of new class of antimicrobial agents, new agents were introduced within the existing classes. For beta-lactamases, a large family included penicillins, cephamycins, and carbapenems, has lots of members. Some of them were more effective in curing the specific diseases and pathogens which are resistant to their previous "generation". These kinds of new agents are chemical modification of the existing agent, they shared some similar characteristics, and also easy to have relatively resistance (Philippon *et al.*, 2002).

From late 20th century, the indications of antimicrobials were no longer the most fatal diseases. Publics and pharmaceutical industries' attention are always focused on the diseases which are threatening the health of human. For the pharmaceutical industries, the profit is also very important. For the drug manufacturers, the whole companies are supported by several "blockbuster drug". Recent years, "blockbuster drug" are mainly the drugs for chronic diseases, like mental disorder or hypertension, bring huge profit for their manufacturers. The cost of developing a new drug is incredibly high; they have to think carefully about their research planning. But antimicrobial is different with other drugs for chronic diseases which are self-limited, only effect on the human cells. The benefit or harm effect are limited in the patients' body, instead of spread to the community. Antimicrobials are used on the microorganism, which will infect the susceptible population and cause spread in the community. If we give up the

development of new antimicrobial, we will lose the control of infectious diseases, the consequence will be very serious. The discovery of these infectious agents in the late 19th century stimulated the search for appropriate preventative and therapeutic regimens; however, successful treatment came only with the discovery and introduction of antimicrobials half a century later. Antimicrobials have revolutionized medicine in many respects, and countless lives have been saved; their discovery was a turning point in human history. Regrettably, the use of these wonder drugs has been accompanied by the rapid appearance of resistant strains. Medical pundits are now warning of a return to the pre antimicrobial era; a recent database lists the existence of more than 20,000 potential resistance genes (r genes) of nearly 400 different types, predicted in the main from available bacterial genome sequences (Calderon and Sabundayo, 2007).

2.1.1. The development of super bugs

Emergence of super bugs

In March 1942, a woman who was dying due to streptococcal sepsis, finally recovered by using a newly discovered drug, that was what we known as penicillin later. In 2008, 66 years after her amazing recovery, an old man with endocarditis caused by vancomycin-resistant Enterococcus faecium (VRE) was dying in San Francisco. But this time, doctors failed to control the sepsis even with the best antimicrobials available against VRE, the old man still died (Arias *et al.*, 2009). With the frequently use of antimicrobials worldwide, public health threat of emerging of drug resistant bacterial strains is increasingly recognized. Numerous studies supported that the evolution and spread of resistance can be attributed to the use, or overuse of antimicrobials (Lipsitch, 2001; Regoes*et al.,* 2006).

2.1.2. The mechanism of antimicrobials resistance emergence

Once the antimicrobials are used, the pressure of antimicrobials drives the emergence of antimicrobials resistance strain. Studies indicated that, the antimicrobial resistance actually reduces the growth rate or infectiousness of some pathogens (Lipsitch, 2001; Regoes *et al.,* 2006; Ferguson *et al.,* 2003). This is called “fitness cost”, will be offset by the adequately strong

selective force due to the use of antimicrobials (Lipsitch *et al.*, 2007). The volume of antimicrobials use is expected to be positive related to the prevalence of resistance strains(Lipsitch, 2001). The combination of antimicrobials prescription for infectious diseases are expected to be effective in delaying the emergence of drug resistance by the mathematical model (Lipsitch *et al.*, 2007).

Actually, it is possible to completely eradicate the resistance strain if all the antimicrobial use stopped. In 1968, a neurosurgical intensive care unit in London had an outbreak of nosocomial infections, about 20% of their patients were infected with a multidrug resistant Klebsiella *aerogenes*. At that time, there was no effective therapy for this pathogen. The nosocomial infection rate of this intensive care unit was 50%, the medical staffs of that institution faced with a very big problem. In July 1969, after had tried lots of intervention, they made an incredible decision: stop all the antimicrobials used in that ICU, both therapeutic and prophylactic. After that, the multidrug resistant Klebsiella *aerogenes* disappeared from that unit; the overall infection rate also had a considerable reduction (Price *et al.*, 1972) this phenomenon may be due to the disappearance of selective force. The volume of antimicrobials use is expected to be positive related to the prevalence of resistance strains, (Lipsitch, 2001) and the resistance pathogens could be eradicated if the antimicrobials were stopped to use (Price *et al.*, 1972).

2.2. Antmicrobial use and misuse

Antimicrobials are the most needed drugs throughout the world. The current demand for them exceeds supply and the number of professionals trained to disburse antimicrobials does not meet the current need. A weak and unregulated supply chain promotes imprudent drug use and drug distribution from unsanctioned providers. There are several documented examples of antimicrobial overuse or misuse by health professionals, unsanctioned providers as well as patients. One Nigerian study recorded 96.7% of inpatients and 50.3% of outpatients as receiving at least one antibacterial drug (Chukwuani *et al.*, 2002).

Antimicrobials are widely used for the treatment of both life threatening and trivial infections like bacterial, protozoan infections and are also effective against several Parasites Rickettsiae,

Chlamydia, Mycoplasma, and also Spirochaetes. But they lack activity against viruses and some fungi. Secondary fungal infections are often common following antimicrobial therapy as a result of the destruction of the 'normal' protective microbial flora (Michalova *et al.,* 2004).

In clinical practice, a group of antimicrobials was used for the treatment of intra-amniotic infections to improve pregnancy outcomes and reduce neonatal morbidity and mortality rates in humans (Romero *et al.,* 1992; Smorgick *et al.,* 2007). As well as they used in prevention of infection when there is surgical wound and for dental prophylaxis (Wilson *et al.,* 2007; Zadik *et al.,* 2008).

Antimicrobial have been utilized broadly in the last 50 years in animal's industry to treat, prevent, or control infectious illness or to enhance efficiency of feed utilization and weight gain. Approximately 50%of all antibacterial agents used annually in the EU are given to animals fortherapy, prevention of bacterial infections as well as growth promoters(Anthony *et al.,* 2000). However, the uses of antimicrobial in animals are under increasing scrutiny due to concerns over potential risk to human health from increasingly widespread AM resistance (Smith *et al.,* 2002; Anderson *et al.,* 2003). Moreover, there was strong evidence that antimicrobial-resistant bacteria can be transferred from livestock to humans (Barton, 2000; Van den Bogaard and Stobberingh, 2003).

AMR is directly linked to the way in which patients and prescribers use antimicrobial agents. The inappropriate use of these agents (e.g. taking antimicrobials for wrong reasons or incorrectly) is driving the emergence and selection of drug resistant microbes. Promoting the appropriate or prudent use of antimicrobials from the doctor and the pharmacist to the patient is the determinant in reversing the increasing rates of AM.As the inappropriate use of the antimicrobial will lead to continuing emergence, development and spread of antimicrobial resistance, the promotion of rational use of antimicrobial is necessary and urgent. In the recent years, the misuse and overuse of antimicrobial is quite serious. As the estimation by WHO, more than 50% of all the medicine are prescribed, dispended, or sold inappropriately. 50% of the patients fail to take the medicine in a proper way (WHO, 2002). The inappropriate use of antimicrobials is more common in developing countries than developed countries, due to freer marketing of antimicrobials and

higher frequency of specific infectious diseases (Tünger *et al.*, 2000). Inappropriate use like self-prescription of antibacterial and their use as growth promoters in agriculture are additional examples of misuse (Larson, 2007). Many antibacterial are frequently prescribed to treat symptoms or diseases that do not respond to antibacterial therapy or are likely to resolve without treatment, or incorrect or suboptimal antibacterial are prescribed for certain bacterial infections (Slama *et al.*, 2005; Larson, 2007).

The overuse of antibacterial, like penicillin and erythromycin, has been associated with emerging antibacterial resistance since the 1950s (Pearson, 2007; Hawkey, 2008). Widespread usage of antibacterial drugs in hospitals has also been associated with increases in bacterial strains and species that no longer respond to treatment with the most common antibacterial (Hawkey, 2008). Common forms of antibacterial misuse in humans include excessive use of prophylactic antimicrobials in travellers and failure of medical professionals to prescribe the correct dosage of antibacterial on the basis of the patient's weight and history of prior use. Other forms of misuse include failure to take the entire prescribed course of the antibacterial, incorrect dosage and administration, or failure to rest for sufficient recovery. Inappropriate antibacterial treatment, for example, is the prescription of antibacterial to treat viral infections such as the common cold. One study on respiratory tract infections found "physicians were more likely to prescribe antimicrobials to patients who appeared to expect them" (Ong*et al*., 2007).

2.2.1. Agriculture use of antimicrobial

Antimicrobial is not only applied on human, but also animal. A huge amount of antimicrobials are used to protect the health of animals in the form of food supply. The use of antimicrobials inevitably introduces the emergence of antimicrobials resistance. The resistant genes not only exist in the pathogens, but also probably exist in the commensal bacteria. Those drug resistance strains of commensal bacteria may contaminate the meat or milk (from food-producing animals) or transfer the resistance genes to zoonotic bacteria, thus cause infection of human via directly contact or food intake (van den Bogaard *et al.*, 2000). Every year, about half of all the antimicrobial agents used in European Union are given to animals (FEDESA, 1998). The use of antimicrobials is not limited in bacterial infection therapy or prevention, but also as growth

promoter to be continuously added into the animals' feeds. The antimicrobial used as this purpose are also called antimicrobial performance enhancers, occupies about 30% of all the antimicrobials use in European annually (FEDESA, 1998) A study conducted in Sudan indicated that the farmers who received lower education, poorer knowledge were significantly related to higher rate of antimicrobial misuse, antimicrobial resistance and zoonotic infections (Eltayb *et al.,* 2012).

2.2.2. Antimicrobial misuse of patients in the community

The common irrational antimicrobials use of patients could be: 1. patients fail to finish the whole course of antimicrobials, 2. patients take the antimicrobials by themselves without the prescription and advice of doctors, 3. patients take the antimicrobials left by previous visit to physician, 4. patients share antimicrobials with families, etc. The low compliance of patients may due to lack of attention. Some patients do not have the knowledge about the proper use of antimicrobials, but they should have. The more inappropriate use of antimicrobials, the more serious the antimicrobials resistance will be. Some studies have demonstrated that, the people who lack of the awareness of dangers of inappropriate antimicrobials use were more likely to have antimicrobials misuse behavior (Jodi VandenEng *et al.,* 2003; Chan *et al.,* 2012;Eltayb *et al.,* 2012). A study was conducted to assess whether patient education was effective in decreasing the antimicrobials misuse, but disappointingly found that the education intervention demonstrate little, if any impact on promoting proper use of antimicrobials. The antimicrobials misuse continues increasing before and after intervention implement, although the increase rate was significantly lower in the intervention groups contrasted with the control group (Mainous *et al.*, 2000).

2.2.3. Antimicrobial misuse by prescription from medical professionals

Irrational use of antimicrobial by doctors is commonly presented as inappropriate use, both in choice or dosage. Studies to investigate the physician irrational antimicrobials use generally implement in hospital or community site. In the hospital setting, the studies mainly focus on the antimicrobials prescription for inpatients. A study in Turkey indicated that in a university

hospital, the irrational use rate of antimicrobials was high, special in surgical ward. The irrational use rate in medical ward was 44.9% and 73.7% in surgical ward. Among the patients who prescribed antimicrobials, only 4.7% were based on the result of therapeutic culture. Most of the antimicrobials prescriptions were empiric decisions (71.4%) and for prophylactic use (23.9%). But the rational use rate of these two antimicrobials prescriptions were significantly lower than when it prescribed based on microbiological diagnosis (rational use rate: 1. based on microbiological diagnosis: 72.7%, 2. empiric use: 48.5%, 3. prophylactic use: 32.1% (p- value: 0.019) (Tünger*et al.,* 2000).

The pathogen isolation results showed that, from whom were receiving antimicrobials therapy, the bacterial pathogen isolation rates for different indications were 55.3% (infection), 11.8% (prophylaxis), 22.5% (empirical use). According to the results list above, more caution should be given to role of prophylactic and empirical use of antimicrobials in the emergence of antimicrobials resistance. Overuse/ misuse of antimicrobials in the hospital and the community settings are unnecessary and a great wastage of resource, presenting a major threat to public health. Implementation of restricted policy on antimicrobial use had been demonstrated significantly reduced consumption and expenditure of antimicrobials without infection and mortality rate increase (Ozkurt *et al.,* 2005). The reason of the irrational use in hospitals may be the fear of nosocomial infection. But this fear increases the possibility of resistance emergence. It is a vicious circle that we need to break by advocating for appropriate stewardship is antimicrobials use in the hospital setting and the community (Sabuncu *et al.,* 2009).

It is important and necessary to control the irrational antimicrobials prescription for outpatients, special for the community outpatient clinic, which is also the most available source for people to get antimicrobials (except for over-the-counter antimicrobials available in some area). Physicians who work for community clinic are relatively more independent, have more freedom in prescription in contrast with their peers in hospital. Many studies were conducted to investigate the reasons for general practitioners irrationally prescription of antimicrobials. In a study which was conducted to investigate the non-biomedical reasons of physician to over-prescribe antimicrobials, over 50% of the respondents thought that they would trend to prescribe antimicrobials for the patients with Upper Respiratory Tract Infections (URTIs) in order to

satisfy the patients or fear of medico legal issue (Lam & Lam, 2003). URTIs represent the most common cause of antimicrobials use, but most of such infections are caused by virus thus antimicrobials are useless in symptom relief or recover of URTIs (WHO, 2001).

Several studies were conducted to reveal the reasons why physicians prescribe antimicrobials for patients even though it was unnecessary. Results showed that, physicians were more likely to prescribe antimicrobials for patients when they perceived the patients expected antimicrobials. Physicians trend to satisfy their patients with URTIs via antimicrobials prescription (Mangione-Smith *et al.,* 1999; Stivers *et al.,* 2003; Lam & Lam, 2003). But in one of the studies, it was found that physician seemed to misunderstand their patients in most of the cases (Mangione-Smith *et al.,* 1999; Himmel *et al.,* 1997). For this case, Stivers *et al.,* find that the some communication behaviors applied by patients' caregivers such as "candidate diagnoses" and "resistance to the diagnosis" during problem presentation increased the likelihood that physicians would perceive them as expecting antimicrobials (Stivers *et al.,* 2003) Sometimes the patients or their caregivers did not expect antimicrobials prescription, but their physician thought they wanted to have. What's more, the prescription of antimicrobials did not significantly relate to the satisfaction of patients. It was found that satisfaction was only significantly related to fulfillment of expectations regarding communication events during the visit, instead of antimicrobials prescription. The satisfaction of patients who did not receive antimicrobials did not decrease (Mangione-Smith *et al.,* 1999). A study conducted to investigate the relationship between the fulfillment of patients' expectation and satisfaction of medical visit found that, there was no significant relationship between them (Hamm *et al.,* 1996; Himmel *et al.,* 1997).

The motivations for the physicians' over- or inappropriate- prescription behavior have been concerned by many researchers. The real clinical practice is quite complex, the reasons that drives the physician to make the irrational prescription behavior are complex, involving the patient-doctor relationship and doctor-hospital relationship, clinical workload, financial pressure etc. (Mangione-Smith *et al.,* 1999; Himmel and Stivers, 2003).

2.3. Antimicrobial Resistance

In 2000, the World Health Organization cautioned that infectious disease may become untreatable because of the high levels of resistance of many human pathogens to the available drugs (WHO, 2000). Even though, the use of antimicrobials combined with improvements in sanitation, nutrition and immunization has led to a dramatic decrease in deaths and a major gain in human life expectancy (WHO, 2002). However, with the increased use of antimicrobials, antimicrobial resistance (AMR) has emerged as one of the greatest threats to human health security (WHO, 2007). And a most pressing public health problem of serious concern to public health, animal health and also food safety authorities (O'Brien, 2002; Courvalin, 2005; Talbot *et al.,* 2006; Tenover, 2006).

The increase in AMR has narrowed the potential uses of antimicrobials for the treatment of infections in humans and animals (Angulo *et al.,* 2004). As a striking example, the Centers for Disease Control and Prevention (CDC), estimated that the total of Methicillin Resistant *Staphylococcus* Infections (MRSI) in US hospitals and communities has increased from 2 % in 1974 to almost 63% in 2004 (CDC, 2010). Similarly, with *Salmonella* being an important cause of food-borne diarrheal disease in human beings (CDC, 2008; Hanning *et al.,* 2009; Kang *et al.*, 2009), the reduction in the number of antimicrobials available for effective treatment of *Salmonella* related infectious diseases in humans and animals has become a serious concern (Angulo *et al.,* 2004). The frequency and extent of the resistance to antimicrobials by *Salmonella* vary based on the antimicrobial usage in humans and animals and the ecological differences in the epidemiology of *Salmonella* infections (MCDermott, 2006). Globally, *Salmonella* exhibits extensive resistance profiles which have been associated with higher rates of morbidity and mortality (Kariuuki *et al.,* 2003; Martin *et al.,* 2004) and the use of antimicrobials in food producing animals (Angulo *et al.,* 2004).

Similarly the important commensal bacteria of animals, *Escherichia coli* (Gram-negative) and *Enteroccus* (Gram-positive) also result in infectious diseases in man. With their ability to transfer resistancegenes to human pathogens (van den Bogaard *et al.,* 2000; Poppe *et al.,* 2005), these bacteria pose a more serious global threat for humanhealth than selection pressure (Boerlin,

2008). Furthermore, the level and degree of resistance that occur incommensal bacteria is linked to the amount and class of antimicrobial agents used in animal industry (Parveen *et al.,* 2007) which varies from country to country (Aarestrup, 2005).

The increasing threat of antimicrobial resistance is largely the result of the overuse and misuse of antimicrobials in human health as well as in agricultural and food production settings (Gillor *et al.,* 2004). Approximately one third of all hospitalized patients receive antimicrobials and at least half of these prescriptions are unnecessary, poorly chosen, and/or incorrectly administered (van Houten *et al.,* 1998). In the agricultural industry, the use of antimicrobials for prophylactics and growth promotion has contributed significantly to the emergence of resistant bacteria in animals (Barton and Hart, 2001). In addition, the almost exclusive reliance on broad-spectrum antimicrobial agents is a contributing factor to the rapid emergence of multidrug resistant pathogens (Solomon *et al.,* 2001). As novel mechanisms of antimicrobial resistance emerge in the pool of microbial pathogens, the frequencies of resistance have increased, although there is evidence that reduction in the use of broad spectrum antimicrobials may result in improved microbial susceptibility (Melander *et al.,* 2000; Tan, 2003; Vlahovic- Palcevski *et al.,* 2001).

2.3.1. Antimicrobial resistance in Human medicine

Antimicrobial drugs have provided physicians with the ability to treat and prevent many infectious diseases, but, unfortunately, there has been a dramatic increase of antimicrobial consumption with the growing size of the human population. Not all consumption is controlled by physicians. Nonprescription antimicrobial use has occurred worldwide, and outside of Northern Europe and North America it has been estimated to account for 19% to 100% of the use (Morgan, 2011).

Drug-resistant bacteria appeared initially in hospitals, where most antimicrobials were being used (Levy, 1998). Penicillin-resistant *Staphylococcus aureus* appeared in London civilian hospitals very soon after the introductionof penicillin in the 1940s (Barber, 1948). Similarly, *Mycobacterium tuberculosis* with resistance to streptomycin emerged in the community soonafter the discovery of this antimicrobial drug (Crofton, 1948). Multi-drug resistancewas first detected

among enteric bacteria, namely *Escherichia coli*, *Shigella* and *Salmonella* in the late 1950s to early 1960s (Watanabe, 1963; Levy, 2001). Over the last two decades, MRSA (methicillin-resistant *Staphylococcus aureus*) and VRE (vancomycin-resistant enterococci)have emerged worldwide as important causes of nosocomial infections(Top*et al*., 2008).

In the last few years, the frequency and spectrum ofinfections caused by antimicrobial resistant bacteria have increased in bothhospitals and the community, and scientists have predicted that multi-drugresistance will override single-drug resistance in the present decade.With the passage of time, different antimicrobial resistance mechanisms connectedwith different classes of antimicrobials have emerged and become combined.The problem with multi-resistant strains is twofold: they are usuallyvery difficult to treat and several classes of antimicrobials will select them.Thus, they are extremely difficult to get rid of. The enzymes that drive thisdevelopment are primarily different types of beta-lactamases, including extendedspectrum beta-lactamases (ESBLs), *Klebsiella pneumoniae* carbapenemases(KPCs), and metallo-beta-lactamases (MBLs). Strains carryingthese enzymes are clinically challenging and cost lives, particularly in developingcountries. Resistant strains can be traced from the community to the hospital and vice versa, indicating that drug resistance is no longer confined. Fuelled by increasing antimicrobial use, the frequency of resistance among different bacteria has escalated, especially in developing countries where antimicrobials have been readily available without prescription. Resistance rates in almost all types of bacteria are much higher in developing than in developed countries (Collignon, 2012).

Resistant bacteria move readily from person to person, from hospital to hospital, and from country to country, showing that resistant bacteria recognize no geographic boundaries. The extent of the dissemination of antimicrobial resistant bacteria is so wide, that even healthy humans in the remote Peruvian Amazon carry bacteria with resistance to the oldest antimicrobials, i.e. ampicillin, tetracycline, sulfamethoxazole and streptomycin (Bartoloni, 2009). The ultimate result of the spread of antimicrobial resistance will be increased mortality, morbidity, prolonged hospital stays, higher medical costs and additional toxicity (Collignon, 2012).

2.3.2. Antimicrobial resistance in Veterinary practices

The veterinary use of antimicrobials is directed towards farm animals, pets, wildlife and animals raised in aquaculture. Apart from therapy and prophylaxis, antimicrobials are consumed to increase growth and feed efficiencies. Data about the antimicrobial consumption are not publicly available, rendering it difficult to determine the quantities consumed and for what purposes. However, based on extrapolations and indirect methods, it has been estimated that 27.5 million pounds of antimicrobials are used for "non-therapeutic" purposes (growth promotion and disease prophylaxis), and another 2 million pounds are used for therapeutic purposes in animals (Mellon, 2001). In February of 2000, according to a survey of the members of the Animal Health Institute, 17.8 million pounds of antimicrobials were used in animal production in 1998; 14.7 million pounds (83%) for prevention and treatment of disease, and 3.1 million pounds (17%) for growth promotion (Animal Health Institute, 2000).

Nine classes of antimicrobials are exclusively used in animals (Pagel and Gautier, 2012), but several classes are commonly prescribed in both veterinary and human medicine: penicillin, cephalosporin, tetracycline, chloramphenicol, aminoglycosides, macrolides, nitrofuranes, nitroimidazoles, sulphonamides, trimethoprim, polymyxins and quinolones (Prescott, 2000). However, concerns about the selection and dissemination of antimicrobial resistance between animals and humans, have led to the concept of 'critically important human antimicrobial agents. These agents should be reserved for human use. The use of penicillin, tetracycline, macroilides and aminoglycosides is pronounced in veterinary medicine, and it has been so for more than 50 years (Pagel, 2012).

Bovine mastitis, pneumonia in calves, metritis in cows, and erysipelas in pigs are commonly treated with penicillin. Streptomycin has been useful in the treatment of mastitis, leptospirosis, pneumonia, intrauterine infections and dysentery in pigs. Tetracycline have been an important and successful part in prophylaxis and therapeutics for several diseases like bovine pneumonia, foot rot, metritis, mastitis in sheep and goats, scours in pigs and calves, and colibacillosis and pasteurelosis in poultry. Several studies have shown that the highest frequency of antimicrobial resistance and selection pressure occurs in calf, swine and poultry processing (Prescott, 2000). In

human medicine, antimicrobial treatment strategy is based on individual patient health status. In veterinary medicine, with the exception of companion animals and horses, much more attention is paid to the flock or herd of livestock. This is particularly true for production animals which are kept in groups on the basis of age or sex. A survey published in 2005 by the OIE (World Organization for Animal Health) revealed that some countries have no regulations controlling the use of antimicrobial agents in livestock. However, the majority of the countries do have laws and regulations governing the approval and use of veterinary medicines (Valacher and Chevance, 2006).

Even in developed countries, such as the United States, many antimicrobials are readily available to the livestock farmers without any prescription (Green, 2010). Without any doubt, the introduction and use of antimicrobial agents in veterinary medicine had an enormous impact on the health and welfare of animal species. Antimicrobial resistance is a complex phenomenon, especially in veterinary medicine, because of the number of animal species, the diversity of rearing environments, the differences in the range of pathogenicity mechanisms and complex epidemiology (Acar and Moulin, 2012). Although antimicrobial resistance is a concern for animal health, little is known about the magnitude of this problem. A wide variety of animal pathogens have been reported to be resistant against different antimicrobial compounds, e.g. *E. coli* of calves, pigs, and poultry; *Pasteurella multocida* and *Mannheimia (Pasteurella) haemolytica* from cattle, and *Actinobacillus pleuropneumonia* and *Streptococcus suis* from pigs (Noble, 1992; Cote,1991; Lee, 2000). Long-term fecal shading of resistant bacteria can occur if the animals are treated with sub therapeutic doses of antimicrobials (Williams, 1978). Generally, the diversity and magnitude of resistance is highly variable among animal pathogens in different geographic areas (Dargatz, 2000; Wells, 2001).

Antimicrobial use in animals contributes to the selection and spread of resistant bacteria among animals, between herds and also between countries (McEwen, 2002). From animals, the resistant bacteria can be transmitted to humans through direct contact, via food, etc. (Levy, 1976; Martins, 2013), and eventually, the environment and water supply can become contaminated (Chee-Sanford, 2001).

2.4. Factors contributing for AMR

The causes of AMR are hypothesized to include the abuse and misuse of antimicrobials in both human and animals (Aarestrup, 2005). These practices include: over-prescription of broad spectrum antimicrobials when a narrow-spectrum oral agent would be more appropriate (Louie *et al.,* 2002); self-medication with antimicrobials (Dryden *et al.,* 2009); low patient compliance (Kardas, 2002); and the combination of highly susceptible patients in hospital settings, with the intensive and prolonged antimicrobial use resulting in nosocomial infections with highly resistant bacterial pathogens (Levin *et al.,* 2007).

In humans, WHO has identified several underlying causes for the increased need of antimicrobials and consequently their misuse stemming from an increase in infections due to a) urbanization with overcrowding and poor sanitation, b) pollution, environmental degradation and changing weather patterns, c) increased exposure of the elderly to nosocomial infections, d) the spread of infectious diseases and resistant microorganism between continents due to booming global trade and travel, and e) massive use of antimicrobials in food-producing animals and poultry flocks (WHO, 2002).

The presence of AMR bacteria in primary animal production represents a high risk for humans since AMR bacteria of animal origin can be transmitted from animals to humans through the food supply (food-borne pathogens), water or direct contact with animals (Swartz, 2002; Ramchandani *et al.,* 2005; Funk, 2006). In farms, factors that can influence bacterial resistance vary depending on herd or flock health status, farm management and environment (Acar, 2006). These practices include over-prescription of broad spectrum drugs by veterinarians instead of narrow-spectrum drugs, feeding of low doses of antimicrobials for growth promotion (Hammerum *et al.,* 2007; Mathew *et al.,* 2007; Prescott *et al.,* 2008), and use of non-approved drugs or drugs used in extra-label manner are believed to contribute to the development of antimicrobial resistance (Sharma *et al.,* 2005; Weese, 2006). Although widespread use of antimicrobials in the primary sector has benefits for producers, it also contributes to the increasing emergence of AMR bacteria (Aarestrup and Pires, 2009).

2.4.1. Antimicrobial usage and practices.

Antimicrobial use in the community has been directly linked to resistance (Melander *et al.*, 2000). For example, in a survey of urban poor, individuals reporting antimicrobial use during the previous 12 months were significantly more likely to be colonized with MRSA (Charlebois, 2002). Among college-age women attending an emergency clinic, current use of any antimicrobial was significantly associated with resistance of urinary tract isolates (Wright, 1999). High antimicrobial use in geographically defined areas of Sweden was significantly correlated with the frequency of penicillin-resistant pneumococci isolated from children living in those areas (Melander *et al.*, 2000). An Icelandic study reported that antimicrobial consumption by geographic area and individual use of antimicrobials was significantly associated with carriage of resistant strains of pneumococcus (Arason *et al.*, 1996). Not only is antimicrobial resistance prevalent among persons taking antimicrobials, but also antimicrobial use by one person in close living quarters (e.g., child care centers, military barracks) leads to the transmission and colonization of resistant organisms to others (Baran, 2002). Despite some improvement, antimicrobial misuse and overuse continue to be problems (Ladd, 2005). Antimicrobial misuse occurs in the community either because the clinician prescribes antimicrobials inappropriately for viral infections, for infections likely to resolve without treatment, or because an individual self-prescribes antimicrobials. Despite the fact that treatment guidelines exist for conditions such as otitis media (Cober and Johnson, 2005), clinician overprescribing for viral upper respiratory infections continues. Similarly, in large segments of the U.S. population self-medication with antimicrobials is common, particularly among those who have emigrated from countries where antimicrobials are available without prescription (Corbett *et al.*, 2005; Larson *et al.*, 2004; Larson *et al.*, 2006).

Even when free medical care and drugs were available, for example, Okeke (Okeke, 2005) reported that 72% of Nigerian students self-medicated for diarrhea. Eighty percent of them took an antimicrobial, and 45% took more than one. Reasons for antimicrobial misuse include the perception among clinicians that patients expect an antimicrobial, the belief among the public that they can determine when an antimicrobial is needed, a belief that antimicrobials are useful to treat viral upper respiratory infections, and disincentives and barriers such as access, financial

constraints, long waiting periods to see a provider, or a feeling of disrespect from the health care provider (Larson *et al.,* 2006; Corbett *et al.,* 2005). Multiple interventions have been conducted to improve clinician prescribing patterns and self-medication with antimicrobials within the community (Arnold *et al*., 2000).

The Centers for Disease Control and Prevention (CDC) has launched a public media campaign to improve the judicious use of antimicrobials but almost certainly a community-wide, multilevel ecological approach, recognizing the reciprocal influence of individual behavior and environments will be needed to have a major impact on this problem (Weissman and Besser, 2004).

Self-medication

Self-medication is the key determinant of improper antimicrobial use. Self-medication is practiced widely, and appears to be by far the most common medical response (Harbarth and Samore, 2005). Prevalence of resistance is positively correlated with prescribed outpatient drug use on a national level (Goossens *et al.,* 2005; Albrich *et al.,* 2004). However, actual consumption of drugs may also include self-medication, i.e., using drugs obtained without prescription. Other sources of self-medication may include leftover drugs from treatment courses prescribed earlier or drugs obtained from relatives or friends. Use without medical guidance is inappropriate because using insufficient dosages or incorrect or unnecessary drugs increases the risk of the selection of resistant bacteria and the spread of antimicrobial drug resistance (Albrich *et al.,* 2004). In the United States, several studies indicate considerable use of leftovers drugs obtained from a family member, a pharmacy, or a source outside the country (Larson *et al.*, 2003).

Such self-medication can lead to antimicrobial resistance because of the inappropriate use of antimicrobials for viral illness, the inappropriate choice of medication for the specific organism, and the inappropriate dose or duration of therapy. Unfortunately, such practices are probably more widespread than realized. (Larson *et al.,* 2003) reported that, in a largely Hispanic neighborhood in Manhattan, antimicrobials were readily available over the counter at local *bodegas* (small stores). They also reported the sharing of antimicrobials among family members

or between friends. In one survey of emergency room patients, 17% reported taking "leftover" antimicrobials for upper respiratory infection symptoms (Richman *et al.*, 2000).

Some people with low income may purchase discounted drugs via the internet. This contributes to antimicrobial resistance through the use of suboptimal- quality drugs. Between 1992 and 1994, 51% of counterfeit drug cases uncovered by the World Health Organization carried no active ingredient, 17% contained the wrong ingredient, and 11% contained less than the recommended concentration of active ingredient. Furthermore, 70% of these counterfeiting cases were discovered in developing countries (WHO, 2000). In the summer of 2003, the Food and Drug Administration examined 1153 shipments that arrived at Miami, New York, and 2 California mail facilities. Of these, 88% contained unapproved drugs from various countries; 16% were from Canada, 14% were from India, 14% came from Thailand, and 8% came from the Philippines (Hart and Kariuki, 1998) Restricting over-the-counter dispensation of antimicrobials without a prescription will eliminate a large source of antimicrobial usage; studies indicate that more than 50% of antimicrobials dispensed in developing countries are done without a prescription (Hossain *et al.*, 1990).

2.4.2. Use of antimicrobials in agriculture

Although the use of antimicrobials in animals to treat infection is necessary (Shryock, 2005), the indiscriminant use of antimicrobials among animals and in agriculture is one factor in the spread of antimicrobial resistance and has serious public health consequences (Alanis, 2005; Anderson, 2005). At least 17 classes of antimicrobials are approved for animal feed and growth promotion in the United States (Anderson, 2005). Despite recommendations from the WHO, multiple studies have demonstrated that exposure to animals that have been fed antimicrobials, either by direct contact or through the food chain, results in human colonization and sometimes serious, life-threatening infection with the same or related drug-resistant strains (Levy *et al.*, 1976; Kassenborg *et al.*, 2004; Molbak, 2004). Use of antimicrobials in food animals has been a subject of discussion for 30 years (Shryock, 2005). Several decades ago the use of antimicrobials as growth promoters was banned in Sweden (Greko, 1999.) and has been similarly banned in a number of other European countries. The ban in Denmark has resulted in a 60% reduction in

antimicrobial use among animals (Sundberg, 2002); across Europe the discontinuation of antimicrobials as animal growth promotants has been accompanied by a decrease in antimicrobial resistance in animals, foods, and humans without any detectable negative impact on profits or animal health (Aarestrup *et al.,* 2001; van den Bogaard *et al.,* 2002).

2.4.3. Community factors

Antimicrobial resistance is often described in the context of the health care setting, particularly in hospitals and long-term care facilities, because such settings bring together seriously ill individuals who often require antimicrobial therapy, are also in close proximity to each other, and are touched by people who go between them. These factors increase the risk of the emergence and subsequent transmission of resistance within and between patients. In the past decade, antimicrobial resistance has been increasingly identified in the community. Although community factors are also important in the spread of resistance (Levy *et al.,* 2003; Levy and Marshall, 2004; Klugman and Lonks, 2005).

2.4.4. Hygiene and infection-control practices.

Hygiene plays an important role in the prevention of community spread of resistance because many of the infecting organisms are more common among the indigent and homeless and those who are immune compromised or in institutional settings such as military camps, prisons, sports teams, and day care centers (Kazakova *et al.,* 2005; Mathews *et al.,* 2005; Nguyen *et al.,* 2005). The common theme seems to be close contact and sharing of towels, toys, clothing, and other fomites. A highly resistant infection caused by *Pseudomonas aeruginosa* was recently reported following ear self-piercing (Vargas *et al.,* 2005). Simple infection-control measures to prevent sharing of potentially contaminated items are becoming increasingly important in the prevention of cross-transmission within the community, particularly in crowded settings or when contact items are shared. Theoretical concerns have been raised regarding the widespread use of certain antimicrobial ingredients, particularly triclosan, in over-the-counter products such as soaps, cutting boards, and many other devices for household use (Aiello *et al.,* 2005).

Recent reports have demonstrated that companion animals and pets may serve as reservoirs of MRSA, and cross-species sharing of resistant strains from animals such as dogs, cats, and horses has been confirmed (van Duijkeren *et al.,* 2005; Weese, 2005). This organism joins the ranks of others such as *Salmonella*, *Shigella*, *Vibrio*, and *Escherichiacoli*, which are now associated with antimicrobial resistant strains in pets or in animals used for food (San Martin *et al.,* 2005; Wright, 2005). Public health implications are clear: careful hand hygiene when handling pets or farm animals and thorough cooking of meats. For vaccine-preventable bacterial infections, vaccination is the best mechanism to reduce antimicrobial resistance by preventing disease requiring antimicrobial treatment (Harbarth and Samore, 2005).

Poor infection prevention and control

Poor infection control leads to increased transmission of disease, more illness and thus more need to antimicrobial use leading to increased selection pressure. Additionally, increased transmission aids in the sharing of resistance genes between species. Common modes of transmission include hands and medical devices such as catheters and ventilators (Mulligan *et al.,* 2004).

2.4.5. Poor regulation and enforcement

The control of supply, distribution, and sales of antimicrobials can go a long way in ensuring appropriate use of quality medicines. Antimicrobials sold by street venders or over the counter without a prescription are often used unnecessarily, thus promoting resistance. Many countries have laws in place requiring prescriptions for antimicrobials; however they are often poorly enforced (Mulligan *et al.,* 2004).

2.4.6. Poor quality antimicrobial products

Counterfeit and substandard drugs contribute to resistance by delivering sub-therapeutic levels of the active ingredient in antimicrobial medicines. This means that even if prescriber, dispenser and patient use are all appropriate, they are still undermined by substandard drugs and resistance can develop. The US Food and Drug Administration estimates that 10% of drugs worldwide are fake and in many parts of Africa it is as high as 30% (IMPACT, 2006).

Lacks of surveillance

There are two parts to surveillance for AMR: monitoring resistance levels and trends, and monitoring antimicrobial use. Without functional surveillance systems in place, locally effective, focused, and evidence-based strategies cannot be implemented or measured. This also includes pharmacovigilance, which increasingly is being seen as including AMR as a part of therapeutic ineffectiveness (Mulligan *et al.*, 2004).

Weak pharmaceutical management

Weak pharmaceutical management system typically manifests itself as inappropriate selection and use (due to lack of policies, guidelines, standard treatment guidelines, essential medicines lists, pre-service and in-service training), undependable supply (stock-outs, etc.), and poor storage practices (Levy, 2005).

2.4.7. Traditional medical practitioners

Traditional medical practitioners generally practice without formal supervision. They often lack access to medical technology or other diagnostic services and they rarely receive training in antimicrobial prescribing. Their information on indications, contraindications and side effects of drugs tends to come from informal, non-medical sources or sometimes from pharmaceutical representatives. Some traditional healers apply western medicine, including the use of antimicrobials (Wolffers, 1987; Singh and Raje, 1996). Competition with western doctors may be stiff and the ability to prescribe antimicrobials is believed to attract patients. For example, an ayurvedic healer in India used penicillin injections in the treatment of serious infections, such as skin ulcerations, pulmonary tuberculosis, abscesses and conjunctivitis. Because his patients demanded antimicrobials, the ayurvedic healer was unable to eliminate penicillin from his practice (Burghart, 1988).

2.4.8. Drug development pipeline.

Even if the use of antimicrobials were entirely appropriate, resistance would still occur (FDA, 2000). Hence, the continued development of new pharmaceuticals and antimicrobial agents is

essential. Unfortunately, development of new antibacterial agents has slowed consistently over the past few decades of 89 new drugs under development in 2002; none were antimicrobials (IDSA, 2004). Although scholars agree that development of new antimicrobials is vital in light of increasing resistance (Leeb, 2004; Norrby *et al.*, 2005), major disincentives exist. The timeline for development of a new agent may be 10 years or more, only ~1 in 1000 candidate drugs reach licensure at a cost of $800 million to $1.7 billion per drug, and the Food and Drug Administration (FDA) approval process is extremely cumbersome, costly, and slow. Then, the life of a drug is limited by relatively short periods before patents expire and by the emergence of resistance, so the return on investment is poor (IDSA, 2004; Leeb, 2004; Norrby, 2005; Spellberg, 2004). Because of the public health significance of this problem, a number of suggestions have been made to facilitate new drug development. Many of these potential facilitators, however, would require congressional action and federal involvement, so the Infectious Diseases Society of America recommends that concerned professionals and citizens help to make this issue visible to policy makers (IDSA, 2004).

2.5. Mortality, Morbidity and Economic Impact of AMR

The impact of AMR on individuals and society can be staggering. To the individual, a resistant infection means an increased likelihood of treatment failure and prolonged illness and pain, side-effects from second- or third line-drugs, psychological harm from the knowledge of having a superbug, increased financial burden and greater risk of mortality. Societal costs include burdens on the health system like loss of effective medicines, increased hospital costs (due to increased cost of medicine, more complicated dosing and longer hospital stays), and costs associated with formally switching the first-line treatment for a disease. Costs to the larger society include increased mortality, loss of productivity, and longer period of infectivity, and thus spread, of AMR pathogens (Grandmann, 2006).

Another often overlooked consequence of AMR is the loss of life-saving medical technologies that rely on antimicrobial medicines for their effectiveness. Procedures such as chemotherapy, transplants, and other invasive surgery may become too risky to perform if antimicrobials are not available to ward off infections following them (Laxminaraya, 2007). A subset of drug-resistant bacteria is responsible for about 25,000 human deaths annually. In addition to avoidable death,

this also translates into extra healthcare costs and productivity losses of at least EUR 1.5 billion. In healthcare settings, AMR notably represents a threat of particular concern, i.e. infections acquired from exposure in a hospital or a healthcare service unit. Approximately 4 million patients are estimated to acquire a healthcare associated infection in the EU every year. Common bacteria causing e.g. diarrhea or respiratory infections in severalanimal species have become more resistant to commonly used veterinary antimicrobials causing increased suffering and mortality in animals, and consequently, production losses and extra costs as well as occupational hazardsto animal keepers (ECDC, 2009)

2.5.1. Impact of antimicrobial resistance on morbidity

According to WHO, infections with resistant organisms are more often fatal and lead to prolonged illness (WHO, 2000). Due to the prolonged illness, there is greater risk of spread of the infection to other people. Costs are increased, not only because of the use of more expensive antimicrobials, but also because of longer duration of care and hospitalization. Prompt treatment with appropriate antimicrobials is essential to prevent serious complications and death, particularly in serious infections such as bloodstream infections (Cosgrove, 2006).

Frequently, duration of hospital stay is used as a proxy for morbidity. It is intuitive that inappropriate chemotherapy would lead to more suffering for the patient. Several studies have documented an association between increased duration of hospital stay and infections with resistant bacteria. The duration of hospital stay significantly ($p<0.001$) increases if *S. aureus*surgical site infections are caused by methicillin resistant strains (Cosgrove, 2006). In economically developed countries, cost and morbidity are more sensitive measures of resistance than its impact on mortality (Cosgrove, 2006). In many low-income countries, the surge in antimicrobial resistance is seen as potentially disastrous because of the lack of resources for purchasing expensive second-line drugs (Okeke*et al.,* 2005).

2.5.2. Impact of antimicrobial resistance on mortality

A subset of drug-resistant bacteria is responsible for about 25,000 human deaths annually. In addition to avoidable death, this also translates into extra healthcare costs and productivity losses

of at least EUR 1.5 billion (ECDC, 2009). Similarly mortality has also been found to be much higher with MRSA than with MSSA (21% compared to 8%) (Dancer, 2005). Chloroquine resistance in Africa is considered by some to be the most important single factor behind the doubling of malaria specific mortality in the last 15 years. Studies on bacteremia caused by S.*aureus*found that patients with MRSA had increased risk of fatal outcome compared to those with methicillin-sensitive S. *aureus* (Whitby *et al*., 2001; Cosgrove *et al*., 2003).

2.5.3. Cost implications of antimicrobial resistance

The most tangible cost of AMR is the financial impact on individuals and health systems. There are several estimates and anecdotes which suggest that the financial cost of resistance is crippling. The costs associated with AMR in the out-patient settings in the U.S. have been estimated to be between US$400 million and US$18.6 billion; the costs among in-patients are likely to be several times more (Okeke, 2005). The Canadian Committee on Antimicrobial Resistance developed a model that suggested resistant infections add $14 to $26 million in direct hospitalization costs to health care cost in Canada–about $9 to $14 million more than those infections would have cost had they been drug susceptible. Additional containment measures, such as patient screening and infection control added another $26 million (CCAR, 2003).

Second-line treatments, that are often more expensive, are one of the largest parts of the additional cost. In addition to the increased cost of the medicines, there are other costs associated with providing these new drugs that might include the need for more sophisticated monitoring systems, better trained staff, and readiness to act on the increased potential for adverse effects from the use of these powerful medicines. Several studies have found that the total cost of treating MRSA compared to methicillin-sensitive *S. aureus* (MSSA) to be up to 3-times more expensive (Dancer, 2005).

The cost of treating patients with infections caused by resistant bacteria increases due to the higher cost of second-line drugs and the longer duration of hospital stay. Significant association between infection with resistant causative microbe and higher cost has been shown for penicillin-

resistant pneumococci (Rowland and Turnidge, 2000), methicillin-resistant *S.aureus* bacteremia (Reed *et al.*, 2005) and ESBL-producing *E. coli* and *Klebsiella*spp (Rowland *et al.*, 2001).

3. MATERIALS AND METHODS

3.1. Study area

The study was conducted in Bishoftu town, central Ethiopia. Bishoftu town is situated between $8^{o}43'$-$8^{o}45'$N and $38^{0}56'$–$39^{o}01'$ E latitude and longitude, respectively. It is located at a distance of 47 km south east of Addis Ababa and 52 km from Adama to the southwest. As 2009 data the total area of the town covers 14,500 hectares. The town is divided into 9 administrative kebeles and 3 special administrative sub towns. The elevation of the town ranges from 1800-1995 meter above mean sea level. It is very important to note that the town is a part and parcel of the rift valley. The altitude of the town ranges from 1900-1995m above sea level. Thus, it belongs to *woina-dega* (agro climatic Zone). Its average temperature and rainfall are 18^{0}C and 816mm, respectively. May is the hottest month of the year, while November is the coldest month in the town. December and July are the driest and most rainy months of the year in the town with 2mm and 204 mm of rainfall, respectively. The human population in the area is 108,809 (CSA, 2009).

3.2. Study design

A cross-sectional study design was used to assess the level of knowledge, attitudes, and behavioral practices regarding antimicrobial use and resistance in Bishoftu, Ethiopia. A questionnaire were consists of 4 parts i) demographic characteristics, ii) usage of antimicrobial, iii) knowledge of antimicrobial, and iv)attitude towards antimicrobial usage. The questionnaire was translated to local language and pre-tested and piloted with key informants from local community.

3.2.1. Study population and sample

The study area (Bishoftu) were selected and from Bishoftu town four kebeles were selected by simple random sampling methods and from each kebeles the house-hold and the individual subjects within house hold were selected by using simple random sampling method.

The Sample size was calculated using the formula described by (Thrusfield, 2005). The considerations during the sample size determination were 95% confidence interval and 5% precision. There were 384, adults of both genders; 18 years age old and over living in four kebeles of Bishoftu town. The total sample size was 400 subjects.

$$n = \frac{1.96^2 X\, Pexp(1 - Pexp)}{d^2}$$

Where n= sample size

Pexp= expected prevalence

d = desired absolute precision

3.3. Data collection and analysis

3.3.1. Data collection

Data collection was conducted from March to June 2016, using anonymous self-administered questionnaire in amharic and oromifa language. Participants in this study were provided with verbal information to inform them the purpose of the study, that participation is entirely voluntary, they were free to leave the interview at any time and all data would be kept securely. Verbal informed consent was obtained prior to collection of data. Verbal information and verbal informed consent is deemed appropriate due to the expectation of relatively low literacy levels among participants. Concent was documented for each participant (Annex: 4) by a tick box on an information sheet that was read to each potential participant and which was ticked in the presence of the participant.

3.3.2. Measurement tool

Self-administered structured questionnaire was presented and used for this study (Annex1-3). It was developed with the help of literature review on how to conduct KAP survey, worldwide studies regarding antimicrobials. The questionnaire items were internally reviewed for content

validity by two experts in the field of epidemiology and public health. Modifications of questionnaire items were made based on expert feedback and recommendations to suit the local population.

The pretest was conducted with 15 eligible adults aged 18 years and over with approximately the same level of socio-demographic characteristics of the study participants. The pretest results were used to adapt and develop the questionnaire. Minor changes and improvement in questionnaire items were made following the pilot test. The questionnaire was composed of four parts with most of the questions being close-ended.

Socio-demographic data

There were ten questions in this part. The social demographic data comprises; sex, age, marital status, level of education, experience of illness, house condition, occupation, animal ownership, house hold size, and status of respondents in the house hold.

Knowledge on antimicrobial usage and resistance

There were thirteen questions in this part and asked to know the knowledge of antimicrobial usage and resistance of the community in the house hold level. Eight of the questions were likert scale while five was an open ended question that allows respondents to express their perception. A correct answer for each close ended questions was given 3 score, 2 uncertain and 1 score for a wrong answer. The score varied from 8-24 points and was classified into 3 levels according to the Blooms' (1956) cut off point, 60-80% as follows:
High level (80-100%) 19-24 scores
Moderate level (60-79%) 15-18 scores
Low level (less than 60%) 8-14 scores

Attitude on antimicrobial usage and resistance

This part includes the attitude of people who live in Bishoftu, towards antimicrobial usage and resistances. There were a total of nine questions, one positive and eight negative statements with Likert scale options of choice ranging from agree to disagree. The rating scale was measured as knowledge scale. The scores varied from 9 to 27 and all individual answers were summed up for total and calculated for means. The scores were classified in to 3 levels (Positive Attitude, Neutral Attitude and Negative Attitude).
Positive Attitude 21-27 scores (80%-100%)
Neutral Attitude 16-20 scores (60%-79%)
Negative Attitude 9-15 scores (Less than 60%)

Practice on antimicrobial usage and resistance

Twelve questions have been included in this part. Of 12 questions there were nine likert scale, one yes/no and one multi choice questions and totally eleven closed ended questions and one open ended questions were encompassed in this part. The rating scale of responses was measured as previous one. The scores in measuring the practice of antimicrobial usage and resistance was varied from 9 to 27, and were classified into 3 levels according to the Bloom's cut off point, 60-80% (Bloom 1956). The levels of practice were:
Good (80-100%) 21-27 scores
Fair (60-79%) 16-20 scores
Poor (Less than 60%) 9-15 scores

Data analysis

The completed questionnaires were transferred to a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA, USA) and coded as appropriated to the analysis. Statistical software, the Statistical Package for Social Sciences (SPSS® 16.0, USA) was used for the analysis. Descriptive statistics of study participants' socio-demographic characteristics was reported. Numerical data was expressed as mean±standard deviation or percentage as appropriate. The test

for association on knowledge, attitude and practice was done by using Chi square ($\chi 2$) and multinomial logistic regression were used to identify the most contributing demographic factor. The data was interpreted as significant when p-value is less than 0.05.

Ethical approval

This study was reviewed by NCSU Institutional Review Board for the Protection of Human Subjects in Research (IRB) and the research Ethics Board of CVMA, AAU and the study proposal and questionnaire were sent to experts for the Ethics Review Committee for health Research involving Human Subjects of Oromia Health bureau, Addis Ababa, to approve for ethical aspects before initiate data collection. Necessary changes and revision were carried out as per the feedback from the committee board before moving ahead with the data collection. The Ethics Review Committee for health Research Group, of Oromia Health bureau approved this study on 2, June 2016 (Annex5).

4. RESULTS

4.1. Respondents socio-demographic characteristics

The questionnaires were addressed for a total of 400 individuals from house hold. Among the distributed questionnaires, data were collected from the people of Bishoftu town from which 384 of them were completed whereas 16 were incomplete for most of the survey questions. According to Burns & Grove (2011), subjects must be excluded from the analysis when data considered essential to that analysis are missing. As a result, 16 subjects were excluded from the analysis of the study. Therefore, the data analysis and discussion was made based on the feedback from a sample of n = 384 respondents.

As shown in Table 1 below, from total of respondent's 227(59.1%) were males and the rest 157 (40.9%) were females.The mean and standard deviation, of age of the study subjects was 34 and 12.470 years respectively with minimum age of 18 and maximum age of 72 years. Most of the respondent's 213(55.5%) were married and 144 (37.5%) were unmarried, while divorced and widowed respondent's encompassed 11(2.9%)& 16 (4.2%) respectively. 29 (7.6%) did not receive any level of education. The highest fraction of respondents (33.1%) and (26.3%) were secondary school and college/university graduates, respectively. While vocational and primary school covers 9.6% and 23.4% respectively. It is clear from the table that individuals with different levels of education were reasonably (randomly) represented. 144 (37.5%) of the participants were government employer, 12(3.1%) in non-government (NGO) while 98(25.5%) private worker, 68(17.4%) of the respondents were students and 63 (16.4%) had no definite work. The household size also considered as one of the demographic factor. 188(49%) had four to six family lead by less than three members 136(35.5%) while the smallest number were registered for large family member which was greater than six 60(15.6%).Our data indicate that 150(39.1%) of respondents had one or two species of animal while 79(18.2) of them had three and above species. One hundred sixty four 164(42.7%) of respondents had no animal in their campaign (Table1).

Table1: Respondents socio-demographic characteristics

Demography	N%	Demography	N%	Demography	N%
Gender		Marital status		Ill/sick in 3month	
Male	227/59	Married	144/37.5	Yes	184/48
Female	157/41	Unmarried	213/55.5	No	200/52
Age		Divorced	11/2.9	Education	
18-25	111/29	Widowed	16/4.2	No formal edu.	29/7.6
26-30	134/35	Occupation		Primary	90/23.4
31-45	77/20	Gov't	144/37.5	Secondary	127/33.1
>45	62/16	NGO	12/3.1	Vocational	37/9.6
Kebele		Student	67/17.4	Coll/university	101/26.3
02	85/22	Private	98/25.5	House hold size	
03	81/21	No work	63/16.4	Three	136/35.4
05	104/27	A. owner		Four to six	188/49
09	114/29	None	164/42.7	>6	60/15.6
		1 or 2 spp	150/39.1		
		3 or more	70/18.2		

4.2. Public knowledge regarding antimicrobial use and resistance in Bishoftu town.

Respondents answered a total of eight close-ended, multiple choice questions regarding antimicrobial usage and resistance. Each correct response was given three marks and 1 mark for wrong answers, with a total of twenty four marks. As shown in Table 2 below, the mean knowledge score for the respondents was 17.7% out of possible 24 points (SD=2.8). Seven of the respondents were able to answer all the questions correctly while two respondents attained the minimum knowledge score of eleven. Most of the community members, who participated in the study (n=148, 38.5%) had "high knowledge" and 50.5% (n=194) of them had "moderate knowledge" while forty two (10.9%) of respondent had "low knowledge" regarding antimicrobial use and resistance.

Table 2: Distribution of community knowledge on antimicrobial usage and resistance

Level		Frequency	Percentage
High		148	38.5
Moderate		194	50.5
Low		42	10.9
Total		384	100
Minimum = 11	Maximum =24	Mean =17.77	Std. deviation =2.81

Responses for all questions of knowledge part of the questionnaire were summarized in (Table 3) below. Most of the respondents (58.3%) of the respondents knew that as single antimicrobials cannot cure different diseases. 63.7% of them also knew that antimicrobials are effective against bacteria. Less than half of the respondents were agree as antimicrobials are effective against internal and external bacterial infection. Around half (45.1%) of the respondents were disagree for the questions talk as antimicrobial speed up recovery from cold. Similarly only 35.5% of the respondents knew that as antimicrobials has no effect against virus but the rest the respondents believe as it has effect. One hundred eight one (47.1%) of the respondents was agreed to stop taking antimicrobial while they encounter side effect to the drugs. Sixty two present of respondents were correctly answer (Agree) for the question about using of antimicrobial can increase the chance for microbes to develop resistance to them. The questions with the least number of correctly answered were 29.7%, regarding using of antimicrobial in animal can reduce its effect while using for human (knowledge item 8).

Table: 3. Knowledgeaboutantimicrobial usage and resistance

Knowledge questions	Agree	Unctn	Disagr	Tota	Mean±SD
A single type of antimicrobial can be used to cure different diseases?	101 26.3	59 15.4	224 58.3	384 100	2.32 ±.864
Do you think antimicrobials are effective against bacteria?	244 63.7	59 15.4	80 20.9	384 100	2.43 ±.815
Do you think antimicrobials can kill the bacteria that live on the skin and in the gut?	191 49.6	93 24.2	100 26	384 100	2.24 ±.839
Do you think antimicrobials speed up the recovery from common cold?	116 30.2	95 24.7	173 45.1	384 100	2.15 ±.856
Do you think antimicrobials are effective against viruses?	136 35.4	90 23.4	158 41.1	384 100	2.06 ±.874
If you get adverse effects during a course of antimicrobial treatment do you stop taking it?	181 47.1	49 12.8	154 40	384 100	2.07 ±.933
Do you think that the use of antimicrobials can increase the resistance of bacteria to them?	238 62	60 15.6	86 22.4	384 100	2.4 ±.83
Do you think that the use of antimicrobials in animals can reduce the effect of it in humans?	114 29.7	104 27.1	166 43.2	384 100	2.14 ±.844

NB: K1-K8 denotes the knowledge questions listed on Table (3). The data is clearly shows where the knowledge gap is apparent in regards to antimicrobial usage and resistance.

4.3. Attitude of people live in Bishoftu town towards AM & AMR

Attitude to a given a drug usage by the community is known to influence the course and outcome of a given therapeutic regimen. To evaluate this, respondents were asked to answer a total of nine Likert-scale questions with a total score of 27. Distribution of respondents' attitude towards antimicrobial usage and resistance is shown in (Table 4). As is indicated in the table, more than half (n=204, 53.1%) of the community are found to have a "positive attitude" and 31% (n=119) of them had "neutral attitude" while 15.9% (n=61) had "negative attitude" towards AMU &AMR.

The mean attitude score for all respondents were 20.4 out of a possible 27 points (SD=4.8). The minimum and maximum range of attitude score was 9 and 27, respectively.

Table 4: The level of community attitude on antimicrobial usage and resistance.

Level of attitude		Frequency	Percentage
Positive		204	53.1
Neutral		119	31
Negative		61	15.9
Total		384	100
Minimum = 9	Maximum =27	Mean =20.4	Std.deviation = 4.872

The data shown on Table 5 below shows that more than three-fourth of the people who participated in the study were in a position of correct answer or neutral with the entire attitude questions; implied they had a positive attitude towards AMU and AMR. Total 59.6% (with 53.9% agree and 5.7% uncertain) of the respondents agreed with a statement "to complete the course of treatment with AM even if they feel better. Seventy eight (20.3%) of respondents were agreed for searching antimicrobials from relatives or friends rather than seen by health care providers, more than half of respondents were refusing (Disagree) these statement while eleven (2.9%) doesn't decided to one side (Uncertain). Two hundred eighty (72.8%) of respondents were have positive attitude (Disagree) for the statement said "I prefer to be able to buy antimicrobials from the pharmacy without a prescription and eighty eight (22.9%) of respondents were agreed to do so while sixteen (4.2%) of respondents were remain uncertain.

According to this data 36.2%, 10.4% and 53.4% of respondents were agreed, uncertain and disagreed for the statement discuss about "Antimicrobial treatment should be stopped as soon as the patient feels better" respectively. For the statement said "The effectiveness of antimicrobials are better if they are newer and more costly (New brand than the common one and more expensive than the usual antimicrobials), 135(35.2%) were agreed, 63(16.4%) were uncertain and 186(48.4%) were disagreed this also indicate as most of the people who participated in the study

had positive attitude. Ninety one (23.7%) of the respondents were believed (Agree) as" Antimicrobials are safe drugs and can be commonly used", however 64(16.7%) and 229(59.6%) were responds uncertain and disagree for the statement. Many number of respondents 133(34.6%) were prefer to put leftover drugs in the house, and forty one (10.7%) were uncertain, while higher number 210(54.7%) of the study participants were refusing (disagree) the statement. For the statement said "When I have a minor illness, I prefer to use an antimicrobial and feel better quickly". One hundred ninety eight (51.6%) were not agree (Disagree),54(14.1%) were uncertain while 132(34.4%) were agreed. According to different literature completion of antimicrobial had direct effect on curing from the illness.However the present study indicate that 132(34.4%) of the participants were believed negatively, 57(14.8%) were uncertain while 195(50.8%) were have positively (disagree) responded for the statement "Missing one or two doses does not alter the effectiveness of antimicrobials".

Table 5: Public response for each attitude questions regarding to antimicrobial usage and resistance

Attitude questions	Agree	Uncrtn	Disagree	Tota	Mean ±SD
I always complete the course of treatment with antimicrobials even if I feel better	207 53.9	22 5.7	155 40.3	384 100	2.14 ± .963
It is good to be able to get antimicrobials from relatives/friends without seen by medical doctor	78 20.3	11 2.9	295 76.8	384 100	2.57 ± .809
I prefer to be able to buy antimicrobials from the pharmacy without a prescription	88 22.9	16 4.2	280 72.9	384 100	2.5 ± .843
Antimicrobial treatment should be stopped as soon as the patient feels better	139 36.2	40 10.4	205 53.4	384 100	2.17 ± .932
The effectiveness of antimicrobials are better if they are newer and more costly.	135 35.2	63 16.4	186 48.4	384 100	2.13 ± .906
Antimicrobials are safe drugs and can be commonly used	91 23.7	64 16.7	229 59.6	384 100	2.36 ± .84
I prefer to keep unused antimicrobials at home in case there may be a need for them	133 34.6	41 10.7	210 54.7	384 100	2.2 ± .925
When I have a minor illness, I prefer to use an antimicrobial and feel better quickly.	132 34.4	54 14.1	198 51.6	384 100	2.17 ± .912
Missing one or two doses does not alter the effectiveness of antimicrobials	132 34.4	57 14.8	195 50.8	384 100	2.16 ± .909

4.4. Practice of respondents regarding to AMU &AMR

In the survey questionnaire, there were twelve questions that asked the practice behavior of community towards AM &AMR. Of the twelve questions, nine items were analyzable in terms of practice frequency that each response was ranked 1 to 3 with a total of 27 marks and the overall score was classified in to three levels of practice as, poor, fair and good (Table 6). The mean

practice score of the community who participated in this study, was 17.7 out of possible 27 points (SD=5.38). As presented in Table below, most of the respondents (n=198, 51.6%) had "good practice" and 31.5% (n=121) of them had "fair practice", while 65(16.9) had "poor practice" on AMU & AMR. The Range of respondents' practice scores was 9-27.

Table 6: Distribution of level of community practices on antimicrobial usage and resistance

Level of practice		Frequency	Percentage
Good		198	51.6
Fair		121	31.5
Poor		65	16.9
Total		384	100
Minimum = 9	Maximum =27	Mean =17.77	Std. deviation =5.38

The data shown on (Table 7) and Figure below shows that more than half of the people who participated in the study were in a position of correct answer of questions; implied they had a good practice towards AMU and AMR. Total 85.2% (with 47.7%: always and 37.5% sometimes) of the respondents were consult the doctors before they start antimicrobial therapy. However, 57(14.8%) of participants were took antimicrobial without any consultation of health care professionals. Most of the participants 237(61.7%) and 100(26%) were responds as they always and sometimes check for the expiry date of the drug, respectively. While 47(12.2%) were never check for the expiry date. For the question said “After taking some of the doses and starting to feel better, do you stop taking the further treatment of your prescription?” 94(24.5%) and 114(29.7%) of respondents were drop taking medicine always and sometimes whenever they feel better, respectively. However almost half 176(45.8%) (Never) of the participants were complete the full course of the prescribed medicine even if they feel better. From the total number of study sample asked about “After taking 2–3 doses and start feeling better, do you give the leftover antimicrobials to your friend/roommate if they get sick?”, Two hundred and seven respondents (53.9%) were responds as they never stop taking of medicine while 75(19.5%) were always and

102(26.6%) sometimes stop taking and gave the left over medicine for others. Out of participants in the study 186(48.8%) were always they complete the full course of their treatment whenever they took antimicrobial and 94(24.5%) sometimes. While 104(27.1%) were never complete. From out of two hundred and nineteen animal owners participated in the study 186(48.4%) respondents were always completely give antimicrobials for their animal, 94(24.5%) were sometimes and 104(27.1%) were never completing the prescribed antimicrobial. Almost all 163(74.4%) animal owners were never practice treating their animal with antimicrobial prescribed for human. However 15(6.8%) and 41(18.7%) respondents were always and sometimes treat their animal by antimicrobial prescribed for human being. For the question said "Do you take your animals to Vet clinic for diagnosis? Two third of the respondent were practice this always 29(13.2) and 111(50.7%) sometimes, while 79(36.1%) were never do it.

Table 7: Public response for each practice questions regarding to antimicrobial usage and resistance.

Practice questions	**Always**	**Sometimes**	**Never**	**Total**	**Mn±SD**
Do you consult a doctor before starting an antimicrobial?	183 47.7%	144 37.5	57 14.8	384 100	2.33 ± .720
Do you check the expiry date of the antimicrobial before using it?	237 61.7	100 26	47 12.2	384 100	2.49 ± .704
After taking some of the doses and starting to feel better, do you stop taking the further treatment of your prescription?	94 24.5	114 29.7	176 45.8	384 100	2.21 ± .812
After you start feeling better, do you save the remaining AMs for the next time you get sick?	84 21.9	107 27.9	193 50.3	384 100	2.28 ± .802
After taking 2–3 doses and start feeling better, do you give the leftover antimicrobials to your friend/roommate if they get sick?	75 19.5	102 26.6	207 53.9	384 100	2.34 ± .786
Do you complete the full course of treatment each time you take antimicrobials?	186 48.4	94 24.5	104 27.1	384 100	2.21 ± .843
Do you treat your animals with antimicrobials prescribed for humans by your decision?	15 6.8	41 18.7	163 74.4	219 100	2.68 ± .598
Do you take your animals to Vet clinic for diagnosis?	29 13.2	111 50.7	79 36.1	219 100	1.77 ± .666
If you purchase antimicrobials for your animals, do you complete the full course?	124 56.6	55 25.1	40 18.3	219 100	2.38 ± .777

Among the nine questions of practice items in the questionnaire, three were asking about the animal drug use practice by each respondent (P7– P9).

4.5. Association between socio-demographic variables and AMU & AMR knowledge, attitude and practice.

Socio-demographic variables of respondents; gender, age, marital status, education level, occupation, animal ownership, weather get ill, house hold size, were tested to see the association they might have with the knowledge, attitude and practice behavior of the respondent towards AMU & AMR. The result shown in (Table 8 to 10) below and it indicated that statistically significant association was found between knowledge, and Educationχ^2=32(p=0.000), get ill χ^2=10.7(p=0.005) and gender χ^2=8.4(p=0.015). Similarly attitude level of respondents were significantly associated with education χ^2=34.5(p=0.000), occupation and get ill χ^2=25.1(p=0.000) and also the practice level of the study participant were significantly associated with education level χ^2=32.2(p=0.000), house hold responsibilitiesχ^2=18.6(p=0.046), animal ownership χ^2=24.2(p=0.000) and get ill χ^2=10.9(p=0.000). While the rest independent factor shows significant association.

Table 8: Multinomial logistic regression output which shows the association between socio-demographic variables with knowledge

knowledge[a]		B	Wald	df	Sig.	Exp(B)	95% Exp(B)	
							Lower	Upper
High	Intercept	5.509	4.463	1	.035			
	No formal education	-3.258	8.7	1	.003	.038	.004	.336
	Primary school	-1.510	6.2	1	.013	.221	.068	.723
	NGO	17.719	47.5	1	.000	4.9E7	9.555	2.7E8
	No previous illness	-1.041	6.5	1	.011	.353	.159	.786

Table 9: Multinomial logistic regression output which shows the association between socio-demographic variables with attitude

Atittude[a]		B	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
Positive	Intercept	5.076	6.228	1	.013			
	No formal education	-3.139	12.205	1	.000	.043	.007	.252
	Primary school	-2.247	14.895	1	.000	.106	.034	.331
	Secondary school	-1.949	12.234	1	.000	.142	.048	.424
	No previous illness	-1.821	21.527	1	.000	.162	.075	.349

Table 10: Multinomial logistic regression output which shows the association between socio-demographic variables with practice

		B	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
Practice[a] Good							Lower	Upper
	Intercept	1.460	.528	1	.467			
	Young adult	-1.640	4.947	1	.026	.194	.046	.823
	Adult	-1.540	4.703	1	.030	.214	.053	.862
	No formal education	-2.369	6.482	1	.011	.094	.015	.580
	Primary school	-2.456	20.057	1	.000	.086	.029	.251
	Married	2.286	3.903	1	.048	9.837	1.018	95.032
	Have no animal	-2.537	12.245	1	.000	.079	.019	.328
	No previous illness	-1.246	10.000	1	.002	.288	.133	.623
	Husband	2.282	4.664	1	.031	9.791	1.235	77.647

4.6. Association between community knowledge, attitude and practice of AMU & AMR

From the results of bivariate association test between knowledge, attitude and practice behavior of the community towards AMU & AMR, significant difference ($\chi2$=43.12, p=0.000) was found between knowledge and attitude,($\chi2$=12.827, p=0.037) was found between knowledge and practice,($\chi2$=69.30, p=0.000) was found between attitude and practice of respondents. The following tables (Table11 to 13) provide details of these tests.

Knowledge had highly statistically significant association with level of attitude towards AMU &AMRamong the respondents (p=0.000). As level of knowledge increases proportion of respondents with positive attitude increases (Table 11).

Table 11: Association between knowledge and attitude level of AMU &AMR

		knowledge				Chi- s	df	P-value
		High	Moderate	Low	Total			
	Level	N (%)	N (%)	N (%)	N (%)			
Attitude	Positive	104(51)	91(44.6)	9(4.4)	204(100)	43.12	4	0.000
	Neutral	36(30.3)	64(53.8)	19(16)	119(100)			
	Negative	8(13.1)	39(63.9)	14(23)	61(100)			
	Total	148(38.5)	194(50.5)	42(10.9)	384(100)			

The statistic($\chi2$=12.827, p=0.012) in (Table 12) indicated that significant association was found between knowledge and practice behavior of respondents in the study. It implied that, while the level of knowledge on AMU & AMRwas increases, proportion of respondents with good practice increases among participants of the study.

Table 12: Association between knowledge and practice level of AMU & AMR

		knowledge				Chi-sq	df	p-value
		High	Moderate	Low	Total			
	Level	N (%)	N (%)	N (%)	N (%)			
Practice	Good	84(42.4)	94(47.5)	20(10.1)	200(100)	12.827	4	0.012
	Fair	51(42.1)	55(45.5)	15(12.4)	121(100)			
	Poor	13(20)	45(69.2)	7(10.8)	65(100)			
	Total	148(38.5)	194(50.5)	42(10.9)	384(100)			

The finding of this study indicated that (Table 13) ,while the level of the attitude increases the level of good practice regards to AMU & AMR increases significantly at the test result ($\chi 2$= 69.30, p=0.000). This indicate that the attitude level of the community directly determine their practice level.

Table 13. Association between attitude and practice level of AMU & AMR

		Attitude				Chi-sq	df	P-valu
		Positive	Neutral	Negativ	Total			
	Level	N (%)	N (%)	N (%)	N (%)			
Practice	Good	144(72.7)	41(20.7)	13(6.6)	198(100)	69.30	4	0.000
	Fair	46(38)	45(37.2)	30(24.8)	121(100)			
	Poor	14(21.5)	33(50.8)	18(27.7)	65(100)			
	Total	204(53.1)	119(31)	61(15.9)	384(100)			

4.7. Source of drugs for animal and human

In the survey questionnaire, there were six and four questions were asked to assess the source of medicine which is provided for animal and humans respectively. All of the questions were analyzable. In terms of frequency that each response was ranked 1 to 3 with a total of 18 & 12 marks and the overall score was classified in to three levels as, poor, fair and good source. The mean score of the community who participated in this study, was 14.9 out of possible 18 points (SD=2.826) as presented in (Table 21) below. Most of the respondents (n=106, 59.9%) access from "good source" and 33.9% (n=60) of them had "fair source", while 11(16.2%) had "poor source" of AM for animals. While the mean score for human antimicrobial source were 10.9 and standard deviation 1.51. Almost all respondents were get their medicine from good and fair source (313/81.8 and 66/17.2), respectively while only one percent (4) of respondents were from poor source (Table14).

Table 14: Distribution of antimicrobial sources for animal and humans

Source of drug for animals	**Alway**	**Somtim**	**Never**	**Total**	**Mean±SD**
I purchase drugs for my animals from	32	48	107	187	2.40
open market	17.1	25.7	57.2	100	± .765
I purchase drugs for my animals from	18	45	124	187	2.57
local traders	9.6	24.1	66.3	100	± .664
I Purchase drugs for my animals from	26	56	106	187	2.43
district veterinary clinic/Pharmacy	13.8	29.8	56.4	100	± .724
with prescription					
I always purchase drugs for my	21	42	124	187	2.55
animals from district Veterinary	11.2	22.5	66.3	100	± .689
Pharmacy without prescription					
My animals are treated by district	33	72	82	187	2.26
clinic vet after thorough diagnosis	17.6	38.5	43.9	100	± .741
I treat my animals with traditional	8	38	142	188	2.71
medicines/by traditional healers	4.3	20.2	75.5	100	± .540
Source of drug for humans	Alway	Sometime	Neve	Tota	Mean ±SD
I purchase drugs based on clinical	19	81	284	384	2.69± .560
symptoms without prescription.	4.9	21.1	74	100	
I purchase drugs based on clinical	18	50	316	384	2.78
symptoms from local drug traders	4.7	13	82.3	100	± .518
I always consult Health post to take drugs	19	89	276	384	2.67
	4.9	23.2	71.9	100	± .567
We consult our traditional healers for	17	59	308	384	2.76
medication	4.4	15.4	80.2	100	± .522

5. DISCUSSION

Antibiotics are among the most commonly prescribed medicines in both human and veterinary medicine. They are used in humans for prophylaxis and treatment of diseases and for prevention of post-operative complications. In animals they are used for prevention and treatment of diseases and as growth promoters (Levy, 2002; Turnidge, 2004). In despite of the benefits, misuse of antibiotics may lead to bacterial resistance and spread of resistant strains to humans and animals. Antibiotic resistance is one of the biggest threats to global health; it can affect anyone, of any age, in any country (Goforth, 2000).

Knowledge about antibiotics therapy among the residents of many countries including, Ethiopia has only been studied to a limited extent. This study done to assess the knowledge, attitude and behaviors of the Bishoftu population regarding antimicrobial issues and to determine if there were factors with these main outcome of interest and in the study, different age groups were represented and both genders were included to give a fair reliable result. The results of our study show that knowledge of when and how antibiotics should be used as well as the risk of antibiotic resistance, which is fairly good and acceptable.

In the present study from the total sample 213(55.5%) mention as they know what antimicrobials are, however only 61(28.6%) were correctly knew that what they are used for. This evidence indicates some superficiality in knowledge about antimicrobial among the participants. The result on antimicrobial use demonstrates fifty three percent (53.4%) of respondents were utilizes them with in the past three months and the most mentioned antibiotic was Amoxicillin. Educated ($\chi2$=70.1, p=0.000), married ($\chi2$=54.1, p=0.000) and peoples who get ill within those three months ($\chi2$=50.84; p=0.000) were more use the drug with statistically significance level. These indicate how frequently antimicrobials are seized by public with in this short time and these high levels of use may contribute for AMR problem as well as many people could impact in a short time frame if the antibiotics they are taking become increasingly ineffective. However the result is in line with the finding from research in Greece (Skliros *et al*., 2010) and the research in Indonesia (Widayati*et al*., 2011) recognizethat Amoxicillin was the most mentioned antibiotics

by the study participants. But the study in Sweden (Svensson *et al*., 2014) found that the most mentioned antibiotics medication were Penicillin.

The result of survey questions to assess respondent's knowledge on the rational use of antimicrobials indicates relatively high level of misunderstanding. For instance participants asked to their responses for the statement said single type of antimicrobial can be used to cure different diseases? Even if more than half of participants correctly (58.3%, disagree) thought the statement one quarter of respondents included in the survey negatively agree. These knowledge gaps were seen in male and married individuals. Significantly respondents knowledge to statements was associated with low level of education and in primary (p=0.005) and secondary (p=0.001) level of educational. Individuals with lower level of education are more likely utilize single antimicrobial for different infection regardless of its etiology. These results were indicating clear confusion among the public regarding whether antibiotics are effective against bacteria and virus. Actually, it was argued that many people do not understand the differences between bacteria and viruses and believed that antibiotics work against both (McKee *et al*., 1999).

Understanding which conditions can be treated with antibiotics is also important, as the use of antibiotics for conditions which are not in fact treatable with these medicines is another contributor to misuse, and therefore to the development of resistance (Widayati*et al.*,2011). In our study respondents had reasonable knowledge on correct indication of antimicrobials. Since the majority (63.7%) of them correctly identify which can be treated with antimicrobials, which is lower than that of reported in Malaysia by Oh *et al.* (2011) that the majority of the subjects (76.7%) could correctly identify as antibiotics are indicated for the treatment of bacterial infections. However, still one fourth of (20.9%) respondents are incorrectly thought the statements antibiotics are the medicine to treat bacterial infection.

On the other hand even if the appropriate utilization of antimicrobials were well recognized by most respondents there is inconsistency in terms of usage for the conditions in fact which cannot be antimicrobials had effect against them, notably virus (35.4%) and colds and flu (30.2%). The findings were comparable with the study from South Korea (Kim *et al.,* 2011) which indicated only 31% of the study subjects can correctly answered that antibiotics cannot kill virus. But lower

than the finding from Jordan (Shehadeh *et al.,* 2012) reported that 67.1% of the respondents believed antibiotics can treat common cold and cough. Evidence mentioned earlier demonstrates that such misconceptions regarding therapeutic effects of antibiotics do exist among the general public. These facts give evidence to confirm that people are not able to differentiate the types of causal agents of infectious disease, (e.g.: bacteria, viruses, fungal) and they have very limited knowledge regarding the basic mechanism of how the antibiotics work (Widayati *et al.,* 2012).

The confusion regarding antibiotics resistance is also continued. It is a well-known fact that the uncontrolled use of antibiotics could lead to substantial and serious problems with the emergence of resistant microbial strains, which is a worldwide problem (Hawkey, 2008). Resistance to antibiotics drugs has been linked to levels of consumption with evidence of a cause–effect relationship (Steinke and Davey, 2001). Obviously in this study, almost one quarter (22.4%) of the study participants were incorrectly demonstrate their knowledge about the usage of antimicrobial can cause resistance to them. This value are comparable with Shehadah *et al* (2012) who reported only 26.4% of Jordanian believed antibiotics are less likely to be effective in the future if taken too often and 36.0% did not agree that antibiotic resistance is due to unnecessary use. However, more than half (62%) respondents acknowledge that antimicrobials are less likely to be effective in the future if taken too often.

Whereas, forty seven percent (47.1%) respondents were more knowledgeable about antibiotic safety, since they agree to stop their medication at the time of encounter harmful effect of certain antibiotics. But which are thus important is forty percent (40%) of participants were incorrectly disagreeing with the statement and standing to continue their medication even with having side effects. These lacks of knowledge cause possible death by antimicrobial allergy. This in line with studies done elsewhere was 77.9% (Shehadan *et al.*, 2012) and lower than the studies reported from Macedonia, where 69.9% of parents were aware with the risk of antibiotic use such as an allergic reaction (Alzizi-Idrizi *et al*., 2014). These result was highlights that most of peoples participated in the study has considerable knowledge about the risk of using antimicrobials.

Antimicrobial have been utilized broadly in the last 50 years in animal's industry to treat, prevent, or control infectious illness or to enhance efficiency of feed utilization and weight gain

(Pakpour *et al.*, 2011). However, the uses of antimicrobial in animals are under increasing scrutiny due to concerns over potential risk to human health from increasingly widespread AM resistance (Smith *et al.*, 2002; Anderson *et al.*, 2003). Moreover, there was strong evidence that antimicrobial-resistant bacteria can be transferred from livestock to humans via consumption of animal products and via widespread release into the environment (Grace, 2015; Barton, 2000; Van den Bogaard and Stobberingh, 200). In our study, respondents were asked that the use of antimicrobials in animals can reduce the effect of antimicrobials in humans? But almost half (43.2%) of them are not recognized this fact. However, one in three individuals was correctly agreed with the statement. Antimicrobial use in animals contributes to the selection and spread of resistant bacteria among animals, between herds and also between countries (McEwen, 2002). From animals, the resistant bacteria can be transmitted to humans through direct contact, via food, (Martin, 2013), and eventually, the environment and water supply can become contaminated (Chee-Sanford, 2001).

In the recent years, the misuse and overuse of antimicrobial is quite serious. As the estimation by WHO, more than 50% of all the medicine are prescribed, dispended, or sold inappropriately. 50% of the patients fail to take the medicine in a proper way (WHO, 2002). The inappropriate use of antimicrobials is more common in developing countries than developed countries, due to freer marketing of antimicrobials and higher frequency of specific infectious diseases (Tünger *et al.*, 2000). Inappropriate use like self-prescription of antibacterial and their use as growth promoters in agriculture are additional examples of misuse (Larson, 2007).

In our study also the attitude of the participants with regard to antimicrobial use and resistance was inevitable and restrictive. More than half (53.9%) of respondents were acknowledge the importance of completing their prescribed medication even after they feel better. While forty percent of them did not complete their prescribed drug, most (36.2%) of them were believed as the patients should stopped their treatment as soon as they felt better. Significantly respondents misbelieving about interrupting the treatment were associated with age, level of education, previous illness and occupation. Younger/18-25yrs/, ($p=0.058$), people with lower level of education ($p=0.000$) and no has previous illness ($p=0.047$) were more likely develop negative attitude towards rational use of antimicrobial. This lower attitude level was comparable to that

studies done by Awad and his collegues (2015), who reported that 45% of Kuwaitians were stopped taking antibiotics before completing the course once they felt better but this value was slightly higher than studies reported by Napolitano *et al* (2013) and Azeem *et al* (2014) where about 25% and 34% of respondents fail to complete their medication after getting relief from illness, respectively.

In addition one third of respondents expressed negative attitude up on consequence of missing one or two doses per medication on the effectiveness of antimicrobial. However, half of them acknowledge this by manifesting positive attitude by disagreed to the statement. On the other hand twenty three (23.7%) percent of respondents had negative attitude, since they believed that antimicrobials are safe drug and used commonly without any negative outcome. This attitude level were statistically associated with level of education (p=0.052), house condition (p=0.000) and responsibilities in the house hold (p=0.000). This result indicated respondents with lower level of education (lower than secondary school) p=0.000, and who live in the other than own house were more likely to use drugs enormously since they believed antimicrobials are safe drugs.

On the other hand this study investigated that individuals who have beliefs of missing some doses of medication was statistically associated with lower level of education (p=0.000) and people who don't experienced with disease (p=0.000). However the result obtained in our study was lower than that of reported studies from India by Khan *et al* (2013) 15.5% and 30.9% of respondents were utilize antimicrobial as safe drug as well as they believed skipping some dose has no effects on the development of antimicrobial resistance. This misconception in the antimicrobial use and resistance may put the public at risk of developing resistance microorganism and suffering by infection which not responds to a given antimicrobial. It is widely believed that inadequate dosing, incomplete courses, and indiscriminate drug use have contributed to the emergence and spread of antibiotics resistance, which is the problem of Bishoftu as well (Awad and Al-saffar, 2010).

Self-medication with antibiotics is defined as the acquisition of antibiotics and self-administering them with the aim of treating a preserved infection (Awad *et al*., 2005). This practice is a common phenomenon in both developed and developing countries (Ameko *et al*., 2012). In the

present study more than three in four (76.8%) of study populations had positive attitude as they never taken antimicrobials without consulting their health care provider. However, one quarter of them was not developing such kind of attitude and they prefer to consult and get antimicrobials from somewhere else. Theses result are comparable to those reported by Awad and his friend, where 23.3% sample of Kuwaitians participated in the study search antibiotics from relatives or friends without advice from a physician(Awad and Abound, 2015). One study from Macedonia, also reported large proportion of (47%) respondents demonstrate negative attitude as they use antibiotics between siblings (Alili-idrizi *et al*., 2014). This is higher than that of our study.While about 12% of Australians share their antibiotics with other family members (Azeem *et al*., 2014). This was lower than our finding.

Differences in implementing drug regulations that affect the availability of antibiotics in different countries can play an important role in misconceptions about antibiotics (Belkina *et al*., 2014). Increased availability of over the counter antibiotics at the pharmacy is an important component contributing to self-medication with antibiotics. In our study, the attitudes towards antimicrobial use indicated that approximately twenty three percent (22.9%) respondents preferred the possibility of purchasing antimicrobials without a prescription of a physician. Our finding is considerably lower than that reported from other countries around the world. Notably Nambia (82%), Kuwait (31.6%), Jordan (30.5%), Australia (30%), and Macedonia (48%) (Dawn *et al*., 2015; Awad and Aboud, 2015; Shehadeh *et al*., 2012; Azeem *et al*., 2014; Alili-Idrizi *et al*., 2014) but lower than the value reported from Italy (18%) (Napoliton *et al*., 2013). These wrong opinions of respondents are indicator for the irrational usage of antimicrobial throughout the continent. Thus it is evident that the public hold inappropriate beliefs with respect to antibiotic use which could adversely affect the way they are used.

Studies have shown that antibiotic purchased without a prescription were mainly on the advice of the pharmacist (Belkina *et al*., 2014), however, the use of antimicrobial without medical guidance is inappropriate because using insufficient dosages or incorrect or unnecessary drugs increases the risk of the selection of resistant bacteria and the spread of antimicrobial drug resistance (Albrich *et al.*, 2004).

The leftover antibiotics medicine at home was among one of the major source of antibiotics which are stocked for emergency or future use issues were reported from many countries around the globe. This misconception expressed through different forms of malpractice. For instance, Tan *et al*.(2006) found out that 21.5% of the respondents used leftover antibiotics, and 31% used unfinished previously prescribed antibiotics first before they were going to see the doctor (Shehadeh *et al*., 2012) reported that 49% of the respondents used leftover antibiotics, and 28.5% kept some unconsumed antibiotics at home for emergency use.

In the present study almost one third of respondents agreed to keep unused antimicrobial at home this might be another indicator of antibiotic misuse. This proportion is much lower in Greece, where very few respondents (7.3%) declared they keep left-over antibiotics for future use. The other most contributing factor for self-medication with antimicrobial were utilizing medicines for minor ailments such as common cold, sore throat, and cough, all of which can be self-limiting with the appropriate medical and supportive care. This is validated by studies; For instance the KAP survey conducted on the parents of Kuwait reported that,(77%) parents were expecting antibiotics to speed up the recovery of their children from the common cold (Alili-Idrizi *et al*.,2014) evidencing general misconceptions among the public regarding the use of antibiotics for common infections, especially respiratory tract infections.In our study one in three respondents were searching for antimicrobial whenever they feel a minor discomfort. These findings are in line with Azeem *et al*.(2014) who reported one third respondents mainly used for respiratory tract infections.However, interestingly the majority of study subjects were develop concrete attitude for both keeping leftover antimicrobials and seeking it for negligible illness 54.7% and 51.6%, respectively.

Self-treatment has so many shortcomings like ineffective antimicrobial selection, inappropriate dosage which may add-on resistant organisms that are complicated to get rid of so the secondary cumulative effects are drug interactions, masked diagnoses, and super infection. Such wrong beliefs may lead to inappropriately high rates of antibiotic consumption, which can result in a corresponding increase in the bacterial resistance (Steinberg, 2000).

In the present study, significant associations were seen between self-medication and demographic characteristics of the respondents. Notably sharing of antimicrobial without physician consultation significantly associated with education (p=0.001), illness (p=0.032), age (p=0.042), and occupation (p=0.035). From those shows significant association respondents with low level education (illiterates, p=0.001and primary school complete, p=0.009) young age(p=0.041), and students (p=0.035) were more likely share medication with others and purchasing of AM without prescription also shows association with gender (p=0.002), occupation (0.051), education (p=0.032) and house condition (p=0.024) were revealed. The majority tends to be male (p=0.003) with low level of education (secondary school, p=0.034) and wife's (p=0.049) were more likely prone to buy antimicrobial from pharmacy and contribute for irrational use of antimicrobials. Upon respondents keep antimicrobials in their home, male (p=0.038), lower level education (secondary school, p=0.000)and not get sick (p=0.000) were develop more likely negative attitude towards the usage of antimicrobial for minor illness.

In terms of practice, there are inappropriate practices regarding antimicrobials use were recognized in some extents. However the majority of our participants (47.7%) always preferred to consult a doctor before starting of antimicrobials and most of them (48.4%) always completed the full course of prescribed medication. These values are significantly associated with age, education, occupation, marital status and responsibilities in the house. Adult p=0.046 and respondents with lower education (primary p=0.027 and secondary school p=0.026) are more likely take AM without consulting physician while respondents with young age (p=0.045), low level of education(no formal education, p=0.011, primary, p=0.000 and secondary school, p=0.001), married p=0.026, and NGO workers p=0.040, were more likely fail to complete their medication. These findings are comparable to what was reported from Omani (Jose *et al*., 2013) and India (Rekha *et al*., 2014). But it was lower than that of reported in studies from Farah *et al*.(2015) and Khan *et al.* (2013). Where almost all respondents were consulting their medical care providers as well as the majority of them complete their medication.

However, the contribution of respondents who don't complete their medication must be in consideration. Because such malpractices were one of the contributing factors for inappropriate use of antimicrobials, since they don't understand when to stop taking them. WHO advises that

patients should always take the full course of antibiotics prescribed to them by a certified health professional because a full course of antibiotics is required to kill all bacteria; stopping early favors those strains that have some resistance naturally (WHO, 2015). Even-if the majority of our respondents developed good practices; the malpractice among our study participants were not negligible. Since 14.8% took antimicrobial without receiving any advice and 27.1% fail to complete their prescribed medicine. The other improper practice was seen in the current study was twenty four percent of the study subject were always stopped taking antimicrobial when they feel better. These malpractices were significantly associated with education, house hold responsibilities, and family size. Respondents with lower education (no education p=0.000, primary school. p=0.001, secondary school p=0.001), being husband p=0.000 and wife p=0.009 were more prone to drop their medication. This finding is in line with what was reported from elsewhere around the world in many studies (Skliros *et al*., 2010; Khan *et al*., 2013; Rakeh *et al*., 2014). However it is significantly lower than the studies reported from Thailand (65.06%) and South Korea (77.6%) by Sirijoti *et al.,* (2014) and Kim *et al.,* (2011), respectively.

On the other hand there was inconsistency regarding to appropriate practice among the study participants towards checking the shelf life of antimicrobial. The value of these study investigated that 14.8% of respondents were never check the expiry date of the medicine they used. These malpractices were more likely performed by respondents with lower level education. The result is in line with the studies done in Thailand where, 18.19% of respondents were never read the manufacturing date and expiry date of the antibiotics they going to take (Sirijoti *et al.*, 2014). While it was higher than studies reported by (Khan *et al.,* 2013) where only 5% of Indians use the drugs without checking its termination date. However, in our study interestingly the large majority of respondents (61.7%) were always examining if the medicines they going to use is out of dated.

The other very important malpractice that our study pointed out, one quarter of respondents were always terminate the prescribed antimicrobial and put the remaining (leftover) antimicrobial in the home for emergency or future use issues. These may result in irrational and irresponsible use of antibiotics which could affect the patient's disease condition, contribute to bacterial resistance and sometimes result in usage of expired drugs. The value of this findings were significantly

associated with lower education level (no formal education, p=0.017; primary p=0.000 and secondary school p=0.03), occupation (p=0.046) and house hold size(p=0.047). There are many research findings that indicate such malpractice. For instance Skiros *et al*., (2010) stated that leftover antibiotics medicine at home was among one of the major source of antibiotics the study respondents were using. While 49% of Jordanian used left over antibiotics and 28.5% of them kept unconsumed antibiotics at home for emergency use (Shehadeh *et al*., 2012). These results were slightly higher than our findings. Another studies reported from South Korea and Thailand also indicate such malpractice (Sirijoti *et al*., 2014 and Kim *et al.*, 2011). Our findings are similar with the most authors' findings with considerable variation. Taking antibiotics that were prescribed for someone else can contribute to their inappropriate use, because it means that the person they were prescribed to did not finish their course of treatment, and also because the antibiotics may not necessarily be right for the friend or family member's with particular illness, or taken in the right dose or for the correct duration (WHO, 2015).

From the total number the study participants asked if they share the left over antimicrobial, approximately half of the respondents declared that always or sometimes provide the left over medicine for their relatives who were diseased with similar symptoms. These malpractices were reported from different studies around the world. For instance, in study conducted on parents in the Middle East region of Al-Ain, 21% had given their children antibiotics without a doctor's prescription and shared antibiotics among their children (Tenaiji *et al*., 2011). In addition, the Jordanian study reported over half of their respondents using antibiotics based on a relative's advice (Shehedah *et al*., 2012). These exhibiting the unhealthy practice of sharing antibiotics with other members of family or friends could result in misuse of antibiotics; this discouraging phenomenon requires special attention (Jose *et al*., 2013).

Generally the overall score of respondents towards knowledge, attitudes, and practices, and their correlation were revealed. Interestingly most of the study participants have considerably adequate knowledge and appropriate attitude. But their practices levels were not a mirror image of their knowledge and attitude. There are significant positive associations between knowledge and attitude towards antimicrobial usage resistance with (OR=27.7, p=0.000). These result indicated that respondents with higher knowledge were more likely have positive attitude than others.

However, those respondents were failing to change their understanding and beliefs in to practice. Thus, knowledge level are negatively associated with practice with (OR=0.742, p=0.605). On the other hand there were positive correlation between practice and attitude regarding antimicrobial use. According to this study respondents who have positive attitude (OR=14.2) more likely develop good practice (p=0.000). The study subjects who have higher knowledge score are more likely to have better practice regarding Antimicrobials use. There was moderate positive correlation between attitude and practice regarding Antimicrobials use (p=0.001).

Our results identified demographic groups with lower knowledge regarding antimicrobial use, including persons with low educational status (no formal education p=0.035, and primary school p=0.013) and non-govern mental employer (NGO) p=0.000. Groups with poor attitudes toward antimicrobial use included persons with low educational status (no formal education, p=0.000, primary school p=0.000 and secondary school p=0.000). As we found, a higher educational level has been associated with better knowledge and attitude

On the whole, respondents who had inadequate knowledge scores were more likely to have a poor attitude toward antimicrobial use and resistance. More respondents with inadequate antimicrobial knowledge than those with adequate knowledge were abuse antimicrobial and contributing for the development of AMR. Multivariate analysis also showed adequate knowledge of appropriate Antimicrobial use was a predictor for a good attitude.

In general, it could imply that educational qualification of the participants had a significant impact on the individual aspects of knowledge, belief and behavior towards AMU and AMR. This clearly indicates that educational interventions would be one of the best methods to employ in order to improve and promote rational use of antimicrobials. In the study conducted in Al-Ain, participants who received information about Antimicrobials had exhibited a higher behavior score.19 Correction of misconceptions among patients could reduce unnecessary Antimicrobial use (McFarlane *et al.*, 2002).

6. CONCULUSION AND RECOMENDATIONS

The results of this study demonstrate that the majority of the general public has misunderstandings and a lack of knowledge with regard to Antimicrobial use, that include thinking of Antimicrobials as useful in the treatment of virus and common cold, prone to access non-prescribed Antimicrobials and being ignorant of Antimicrobial effectiveness and resistance. Many also have inappropriate belief on Antimicrobial related aspects. However, the respondents with high educational level have a good knowledge and attitude toward Antimicrobial use. Most of respondents in appropriately utilize antimicrobial for conditions which notably have no effect. Thismalpractice was a reflection of insufficient knowledge and inappropriate belief towards judicious use of antimicrobial among public. The public involved in this survey generally had insufficiency in some important aspects related to judicious use of Antimicrobials and had negative attitudes toward sound use of Antimicrobials. A significant difference in the score based on respondent demographics was observed for certain characteristics of the respondents and areas of misconceptions and specific groups to be targeted for interventions regarding judicious use of Antimicrobials among the general public in Bishoftu were identified. It is therefore suggested that,

- Large scale education campaign should be undertaken to improve the appropriate use of Antimicrobials.
- Relevant health authorities should improve the regulatory enforcement among pharmacies on prescription only dispensing Antimicrobialsalong with public education to avoid Antimicrobial misuse.
- Another study is needed to further explore attitudes and practices to achieve better antimicrobial usage and control.

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7. ANNEX

Annex 1: English version of data collection materials (questioners)

Knowledge, attitudes and behavioral practices of animal and human antimicrobial usage and resistance amongst people in Bishoftu, Ethiopia.

Region_____

Zone_____

District/Wereda_____

Kebele_____

Agro- ecology_____

Location Lattitude_____Longitude _____ (With GPS).

Date of Interview (DD/MM/YY): _____ /_____/ 2016

Time Started:_____ Time Ended:_____

BASIC HOUSEHOLD INFORMATION

1. Participant ID Number _____
2. Sex ☐Male ☐Female
3. Age(years): ----------
4. Education background

☐Primary ☐Secondary school ☐vocational school ☐College/university

☐No formal education

5. Marital status

   □Married □Unmarried □Divorced □Widowed

6. Respondent's position in the household(with respect to the head)

   □Husband □wife □Daughter □Son □Relative living in a household

   □Other_____

7. Occupation _____

8. Animal ownership of the family?

   Cattle _____, sheep _____, goat_____, Dog____, Cat _____, poultry _____, Horse_____ Donkey _____, Mule ____.

9. House hold size

   □Less than3 □4- 6 □Greater than six 10. Ownership of house?

   □Own house □Rented □Host with family □Temporary shelter

   □Other p/s specify_____

11. Have you been ill/sick in the last 30 days? □ Yes □ No

12. Which age group of family members became ill/sick in the last 30days?

    □Less than 5years □ 5-10 years □10-18 years □ above 18years

KNOWLEDGE REGARDING ANTIMICROBIALS.

1. Do you know what antimicrobials are?

   What they are used for?

   _____

2. Can you name some antimicrobials you have used in the last 12 months (1year)?_____

3. For what purpose did you used the mentioned antimicrobials?_____

4. Can you name some antimicrobials you used for treatment of your animals? _____

5. Do you think antimicrobials are effective against bacteria?

□Disagree □Uncertain □Agree

6. Do you think antimicrobials can kill the bacteria that normally live on the skin and in the gut?

   □Disagree □Uncertain □Agree

7. Do you think antimicrobials speed up the recovery from common cold?

   □Disagree □Uncertain □Agree

8. Do you think antimicrobials are effective against viruses?

   □Disagree □Uncertain □Agree

9. If you get adverse side effects during a course of antimicrobial treatment do you stop taking antimicrobials?

   □Disagree □Uncertain □Agree

10. Do you think that the use of antimicrobials can increase the resistance of bacteria to them?

    □Disagree □Uncertain □Agree

11. Do you think that the use of antimicrobials in animals can reduce the effect of antimicrobials in humans?

    □Disagree □Uncertain □Agree

12. Can you name some antimicrobials you used for treatment of your household members? - _____

13. Can you name some antimicrobials you used for treatment of your animals? _____

    _____

ATTITUDES TOWARDS USE OF ANTIMICROBIALS AND RESISTANCE

1. I always complete the course of treatment with antimicrobials even if I feel better

   □Agree □uncertain □disagree

2. It is good to be able to get antimicrobials from relatives or friends without having to see a medical doctor.

   □Agree □uncertain □disagree

3. I prefer to be able to buy antimicrobials from the pharmacy without a prescription.

   □Agree □uncertain □disagree

4. Antimicrobial treatment should be stopped as soon as the patient feels better

   □Agree □uncertain □disagree

5. The effectiveness of antimicrobials are better if they are newer and more costly (New brand than the common one and more expensive than the usual antimicrobials).

   □Agree □uncertain □disagree

6. Antimicrobials are safe drugs and can be commonly used

   □Agree □uncertain □disagree

7. I prefer to keep unused antimicrobials at home in case there may be a need for them

   □Agree □uncertain □disagree

8. When I have a minor illness, I prefer to use an antimicrobial and feel better quickly.

   □Agree □uncertain □disagree

9. Missing one or two doses does not alter the effectiveness of antimicrobials

   □Agree □uncertain □disagree

PRACTICES REGARDING ANTIMICROBIALS

1. Can you mention for what purpose you took antimicrobials as a treatment? _____

   _____

2. Do you consult a doctor before starting an antimicrobial?

   □Always □Sometimes □Never

3. Do you check the expiry date of the antimicrobial before using it?

   □Always □Sometimes □Never

4. After taking some of the doses and starting to feel better, do you stop taking the further treatment of your prescription?

□Always □Sometimes □Never

5. After you start feeling better, do you save the remaining antimicrobials for the next time you get sick?

   □Always □Sometimes □Never

6. After taking 2–3 doses and start feeling better, do you give the leftover antimicrobials to your friend/roommate if they get sick?

   □Always □Sometimes □Never

7. Do you complete the full course of treatment each time you take antimicrobials?

   □Always □Sometimes □Never

8. During last 12 months, did you see any diseased animal on your farm? □Yes

   □No

9. Who provides treatment to your animals in case of sickness?

   □Myself □Relatives/neighbors □ extension support veterinarian □ Private Veterinarian □Community Animal Health Worker

10. Do you treat your animals with antimicrobials prescribed for humans by your decision?

    □Always □Sometimes □Never

11. Do you take your animals to Vet clinic for diagnosis?

    □Always □Sometimes □Never

12. If you purchase antimicrobials for your animals, do you complete the full course?

    □Always □Sometimes □Never

SOURCE OF DRUGS FOR ANIMALS

1. I purchase drugs for my animals from open market

   □Always □Sometimes □Never

2. I purchase drugs for my animals from local traders

   □Always □Sometimes □Never

3. I Purchase drugs for my animals from district veterinary clinic/Pharmacy with prescription

   □Always □Sometimes □Never

4. I always purchase drugs for my animals from district Veterinary Pharmacy without prescription

   □Always □Sometimes □Never

5. My animals are treated by district clinic vet after thorough diagnosis.

   □Always □Sometimes □Never

6. I treat my animals with traditional medicines/by traditional healers

   □Always □Sometimes □Never

SOURCE OF DRUGS FOR FAMILY MEMBERS

1. I purchase drugs based on clinical symptoms without prescription from pharmacy

   □Always □Sometimes □Never

2. I purchase drugs based on clinical symptoms from local drug traders

   □Always □Sometimes □Never

3. I always consult Health post to take drugs

   □Always □Sometimes □Never

4. We consult our traditional healers for medication

   □Always □Sometimes □Never

ANY OTHER INFORMATION

Is there anything you would like to tell us about antimicrobials? -

_____

_____

_____

Annex 2: Amharic version of data collection materials (questioners)

የቢሾፍቲከተማነዋሪዎችስለመድሀኒትአጠቃቀምእናበሽታአምጪተዋሲያንመድሀኒትንስለመለማመድያላቸውእውቀት፣ግንዛቤ እናልማዳዊድርጊት.

ክልል-_____

ዞን _____

ወረዳ _____

ቀበሌ _____

መጠየቁየተከናወነበትቀን----------

የተጀመረበትሰዓት----------የተጠናቀቀበትሰዓት----------

መሰረታዊየሆኑየቤተሰብመረጃዎች

1. መለያቁጥር_____
2. ጸታ □ወንድ □ሴት
3. የትምርትሁኔታ

□የመጀመሪያደረጃ□ሁለተኛደረጃ□የሙያትምህርት□ኮሌጅ/ዩኒቨርሲቲ□መደበኛትምህርትያልተማረ 4. እድሜ_____

_____

5. የትዳርሁኔታ □ያገባ/ች□ያላገባ/ች □የተፋታ/ች □የሞተችበት/ባት
6. መላሹበቤትውሰጥያለውደረጃ

□ባል□ሚስት □ሴትልጅ □ወንድልጅ □ዘመድ □ሌላ _____7. ስራ_____

_____

_____

8. እንስሳትአሎት _____? ያሎትንአንስሳቶችበአይነትእናበቁጥርቢገልጹልን

_____ የቀንድከብት _____በግ _____ ፍየል _____ ውሻ _____ ድመት _____ ዶሮ

_____ ፈረስ _____ አህያ _____ በቅሎ

9. የቤተሰብቁጥር

□ከ 3 በታች □4-6 □ከ6 በላይ10. የመኖሪያቤትሁኔታ

□የግል □የከራይ □የቤተሰብ □ግዜአዊመጠለያ

□ሌላ _____

11. ባለፉትሶስትወራትውስጥእርሶወይምከቤተሰቦአባልመካከልየታመመነበር _____
12. በየትኛውየእድሜክልልውስትያለውሰውነውየታመመው

□ከ 5 ዓመትበታች□5-10 ዓመት □10-18 ዓመት □ከ 18 ዓመትበላይ

ስለጸረተውሳክ/ረቂቅነፍሳት/ መድሐኒቶችየአጠቃቀምእናተውሳኮችመድሐኒቱንስለመላመድያሎትግንዛቤ

1. ጸረተውሳክ/ረቂቅነፍሳትመድሐኒትምንእንደሆነያውቃሉ

_____

ጥቅማቸውስምንድነው_____

2. ባለፉት 12ወራትከተጠቀሙአቸውጸረተውሳክመዳኒቶችመካከልየተወሰኑትንቢጠቅሱልን?

_____

_____

3. ከላይየጠቀሱአቸውንመድሐኒቶችበምንምክኒያትአንደተጠቀሙአቸውቢገልጹልን

_____

4. አንድአይነትየፀረተውሳክመድሐኒትየተለያዩበሽታዎችንለማዳንይጠቅማል

□እስማማለሁ□አላውቅም□አልስማማም

5. የፀረተውሳክመድሓኒቶችባክቴሪያዎችንበማስወገድፍቱንናቸውብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

6. የፀረተውሳክመድሓኒቶችአብዛኛውንጊዜበቆዳ/ውጫዊ/
እናውስጣዊሰውነትክፍሎችየሚገኙባክቴሪያዎችንይገድላልብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

7. የፀረተውሳክመድሃኒቶችከጉንፋንበሽታበአጭርጊዜለመዳንይረዳሉብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

8. የፀረተውሳክመድሓኒቶችቫይረሶችንበማስወገድፍቱንናቸውብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

9. የፀረተውሳክመዳኒትንእየተጠቀሙሳለየጎንዮሽጉዳትቢያጋጥሞመዳኒቱንመጠቀምያቆማሉ

□እስማማለሁ□አላውቅም□አልስማማም

10. የፀረተውሳክመድሀኒትንበተደጋጋሚመጠቀምባክቴሪያዎችመድሀኒቱንእንዲለማመዱትያደረጋልብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

11. የፀረተውሳክመድሀኒቶችንለእንስሳትመጠቀምለስዎችየሚሰጠውንየማዳንአቅምይቀንሰዋልብለውያስባሉ

□እስማማለሁ□አላውቅም□አልስማማም

12. ለቤተሰቦአባላትህክምናከተጠቀሙአቸውየፀረተውሳክመድሀኒቶችየተወሰኑትንቢጠቅሱልን

_____

_____

13. ለእንስሶችህክምናከተጠቀሙአቸውየፀረተውሳክመድሀኒቶችመካከልየተወሰኑትንቢጠቅሱልን

_____

_____

ስለጸረተውሳክመድሐኒቶችየአጠቃቀምእናተውሳኮችመድሐኒቱንስለመላመድያሎትአመለካከት

1. ሁሉንምበሀኪምየታዘዙልኝንመድሐኒቶችበሽታውቢሻለኝምበአግባቡእወስዳቸዋለው

□እስማማለሁ□አላውቅም□አልስማማም

2. ሀኪምቤትሄዶከመታከምይልቅመዳኒቶችንከቤተሰብወይምከጓደኛወስዶመጠቀምየተሸለነው

□እስማማለሁ□አላውቅም□አልስማማም

3. መድሀኒቶችንያለሀኪምትእዛዝከመድሃኒትመሸጫቤቶችመግዛትንእመርጣለሁ

□እስማማለሁ□አላውቅም□አልስማማም

4. በሀኪምየታዘዘውንየፀረተውሳክመድሐኒትታማሚውየህመምስሜቱእነደጠፋለትመድሐኒቱንመጠቀምማቆም አለበት

□እስማማለሁ□አላውቅም□አልስማማም

5. አዲስእናውድየሆኑመድሐኒቶችየማዳንአቅማቸውከፍተኛነው

□እስማማለሁ□አላውቅም□አልስማማም

6. የፀረተውሳክመድሐኒቶችንጂስላልሆኑብዙውንጊዜመጠቀምይቻላል

□እስማማለሁ□አላውቅም□አልስማማም

7. ተጠቅመንየተረፈንንመድሀኒትለሌላጊዜለመጠቀምበቤትውስጥማስቀመጥአስፈላጊነው

□እስማማለሁ□አላውቅም□አልስማማም

8. ቀላልህመምበሚሰማኝጊዜየፀረተውሳክመድሀኒትንስጠቀምጤነኝነትይሰማኛል

□እስማማለሁ□አላውቅም□አልስማማም

9. ከታዘዙልንመድሐኒቶችአንድወይምሁለትጊዜሳንወስድብንቀርየመድሀኒቱውጤታማነትላይየሚያመጣውችግርየለም

□እስማማለሁ□አላውቅም□አልስማማም

የፀረተውሳክመድሐኒቶችንበተመለከተልማዳዊድርጊቶች

1. የፀረተውሳክመድሐኒትንበምንህመምምክኒያትእንደወሰዱቢገልጹልን

   _____

2. የፀረተውሳክመድሐኒቶችንከመውሰዶበፊትሀኪምያማክራሉ

   □ሁልጊዜ□አልፎአልፎ□በጭራሽ

3. የፀረተውሳክመድሐኒትንከመጠቀሞበፊትየመጠቀሚያጊዜውማለፍያለመለፉንያረጋግጣሉ

   □ሁልጊዜ□አልፎአልፎ□በጭራሽ

4. ከታዘዘሎትመድሐኒትየተወሰነውንሲወስዱጤነኝነትቢሰማዎትየቀረውንመዳኒትመውሰድያቆማሉ

   □ሁልጊዜ□አልፎአልፎ□በጭራሽ

5. ከታዘዘሎትመድሀኒትየተወሰነውንሲወስዱጤነኝነትቢሰማዎትየቀረውንመድሐኒትወደፊትሲያሞትለመጠቀምሲሉያስቀምጡ ታል

   □ሁልጊዜ□አልፎአልፎ□በጭራሽ

6. የታዘዘሎትመድሐኒት 2ወይም3 ጊዜሲወስዱጤነኝነትቢሰማዎትየተቀረውንመድሐኒትየቤተሰቦአባልወይምጓደኛዎቢታመምእንዲጠቀምበትይሰጡታል

   □ሁልጊዜ□አልፎአልፎ□በጭራሽ

7. መድሀኒትበሀኪምበሚታዘዝሎትጊዜሁሉንምመድሀኒቶችእሰኪጨርሱይጠቀማሉ

8. ባለፉት 12 ወራትውስጥየታመመቦትእንስሳትነበሩ□አለ□የለም

9. ለታመመቦትእንሰሳህክምናማንሰጠው

   □እኔእራሴ □ጎሮቤት ‡ □የማህበረሰብእንስሳትጤናሰራተኛ

   □የግልየእንስሳትህኪም □የወረዳየእንስሳትሃኪም □ረዳትየእንሰሳትህኪም

10. ለሰውየታዘዘንመድሐሃኒትበእራሶትፍቃድለእንስሳትተጠቅመውያውቃሉ

    □ሁልጊዜ□አልፎአልፎ□በጭራሽ

11. እንስሳዎትንወደእንስሳትህክምናመስጫለምርመራወስደውያውቃሉ

    □ሁልጊዜ□አልፎአልፎ□በጭራሽ

12. ለእንስሳዎመድሃኒትሲገዙየታዘዘላቸውንመድሐኒቶችሙሉበሙሉእንዲወስዱያደርጋሉ

    □ሁልጊዜ□አልፎአልፎ□በጭራሽ

የእንስሳትመድሃኒትምንጮች

1. ለእንስሶቼመድሃኒትከገቢያእገዛለው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

2. ለእንስሳቶቼመድሃኒቶችንከአከባቢመድሀኒትነጋዴዎችእገዛለው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

3. ለእንስሳቶቼመድሃኒትከእንስሳትመድሃኒትመደብርበሀኪምማዘዣእገዛለው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

4. ለእንስሳቶቼመድሃኒትከእንስሳትመድሃኒትመደብር**ያለ**ሀኪማዘዣእገዛለው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

5. ለእንስሳቶቼህክምናየሚሰጣቸውበእንስሳትህክምናመስጫጣቢያነው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

6. እኔእንስሳቶቼንየማሳከመውበባህልሃኪሞችነው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

የሰውመድሃኒትምንጮች

1. መድሃኒትየምገዛውበሽታውበሚያሳየውምልክትአማካኝነትከመድሃኒትመደብርያለሀኪምማዘዣነው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

2. መድሃኒትየምገዛውበሽታውበሚያሳየውምልክትአማካኝነትከአከባቢመድሃኒትነጋዴዎችነው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

3. ምንጊዜምመድሃኒትከመውሰዴበፊትሀኪምአማክራለው

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

4. መድሐኒትለመውሰድየባህልሃኪሞችንአማክራለው.

□ሁልጊዜ□አልፎአልፎ□በጭራሽ

1. በተጨመሪስለፀረተውሳከመድሀኒትሊነግሩንየሚፈልጉትነገርካለ----------

Annex 3: Oromiffa version of data collection materials (questioners)

Nanno _____

Godinna _____

Anna _____

Ganda _____

Guyya itti guttame_____

Yerro itti jalqabbame _____ yerro itti dhumate_____

Gaffiwan bu'uura wa'ee matti ilalttu

1. Lakk. Adda_____
2. Sala Dhi Dhala
3. Sadarka barumssa

   Sadarkka tokkofa sadarkka lammafa kolleji/universitti barumsa manabarumsatti kan hin barranne
4. Umurii_____
5. Halla gaiila
6. Itti gafatamuma mana kessa qabu----------
7. Hojji_____
8. Lowwan qabdu? Yoo qabbatan lakkofsa sanni nuf barressa_____
9. Lakkofssa matti

   3 fi 3ol ☐ 4-6 ☐ 6-ol ☐
10. Haala mana jireenya

☐ Kan dhuunfaa ☐ kireeffachuudhaan ☐ dawoo yeroodhaaf ☐kan biro

11. ji'oottan sadan darbanitti isin ykn miseensa maatii keessanii keessa kan dhukkubsate jira turee?_____

12. umurii sadarkaa kam keessatti nama argamutu dhukkubsate

☐ Waggaa 5 gadii ☐ waggaa 5-10 ☐ waggaa 10-18 ☐ waggaa 18 ol

13. waa'ee itti fayyadama daawwaa lubbuu qabeeyyii xixxiqqoo /farra jarmilee fi jarmoonni dawwan wal dandamachuu hubannoo qabdan

1. Qorichi ykn daawwan farra jarmiilee ykn lubbuu qabeyyii xixxiqqoo maal akka ta'e beektuu?

_____

Fayyidaan isaaniis maal?_____

2. ji'oottan kudha lamaan darban keessaa dawwaa farra jarmiiwwanii kan fayyadamtan keesssa muraasa isaanii ibsaa._____

_____

3. daawwaa armaan olitti eeraman sababii maaliin akka fayyadamtan osoo nuuf ibsitanii

_____

4. daawwaan farra jarmiilee wal fakkaatan dhukkuboota adda addaa fayyisuuf ni fayyadaa

☐ Walii gale ☐ hin beeku ☐ walii hin galu

5. Daawwaan farra jarmiilee bacteeriyaa balleessuudhaan ni faayyisaa jettanii yaadduu

☐ Walii gale ☐ hin beeku ☐ walii hin galu

6. Qorichi farra jarmilee yeroo baayyee bakteeriyaa qaama alaa/gogaa , akkasumas kutaa qaama keessa tti argaman irratti ni ajjeesa jettenii yaadduu?

☐ Walii gale ☐ hin beeku ☐ walii hin galu

7. qorichi farra jarmiilee dhukkuba utaalloo irraa yeroo gabaaba kessatti fayyisuuf ni gargaara jettanii yadduu?

☐ Walii gale ☐ hin beeku ☐ walii hin galu

8. Qorichi farra jarmiilee vaayirasii balleessuuf furmaata jettanii yaadduu?

☐ Walii gale ☐ hin beeku☐ walii hin galu

9. otuu farra jarmilee fayyadamaa jirtanii ---------- osoo sin mudate daawwicha fayyadamu ni dhaabduu?

☐ Walii gale ☐ hin beeku☐ walii hin galu

10. Qoricha farra jarmiilee irra deddebi'uun fayyadamuun , bakteeriyaanonni qorichicha akka dandamatan ni gargaara jettanii yaadduu?

☐ Walii gale ☐ hin beeku☐ walii hin galu

11. qoricha farra jarmiilee beeyiladaaf fayyadamuun namootaaf kan kennamuu dandeettii fayyisuu isaa ni hir'isa jettanii yaadduu?

☐ Walii gale ☐ hin beeku☐ walii hin galu

12. miseensa maatii keesssan kessaa qoricha farra jarmiilee kan fayyadaman keessa muraasa isaanii osoo nuuf tarreessitani

☐ Walii gale ☐ hin beeku ☐ walii hin galu

_____

13. qoricha farra jarmilee keessaa beeyilada yaaluuf kan itti fayyadamtan muraasa isaanii tarreessaa

_____

_____-

Waa'ee itti fayyadama farra jarmiilee fi jarmileen qorichaan wal dandamachuu ilaalcha qabdan.

1. Qoricha ogeessan naaf ajajame hunda dhukubbiin yoo naaf fooyya'e illeee sirnaan nan fayyadama.

   ☐ Walii gale ☐ hin beeku☐ walii hin galu

   Mana yaala demanii yalamuu irraa qoricha maatii irraa ykn hiriyaa irraa fuudhanii fayyadamuu wayya.☐ Walii gale ☐ hin beeku ☐ walii hin galu
2. Qorichoota ajaja ogeessa yaala malee mana dukkaana qorichaatii bitachuun filadha

   ☐ Walii gale ☐ hin beeku☐ walii hin galu
3. Qoricha farra jarmiilee Ogeessa yaalaa fayyaatiin ajajame ,dhukkubsataan miirri dhukkubbii isaa akka dhaabbatuuf dawwaa fayyadamuu dhaabuu qaba.

   ☐ Walii gale ☐ hin beeku☐ walii hin galu
4. Qorichoonni haarafi gatiin isaanii qaalii ta'an dandeettii fayyisuu isaanii olaanaadha.

   ☐ Walii gale ☐ hin beeku☐ walii hin galu
5. Qorichoonni farra jarmiilee miidhaa waan hin qabneef yeroo baayyee fayyadamuun ni danda'ama.

   ☐ Walii gale ☐ hin beeku☐ walii hin galu
6. Qoricha farra jarmiilee itti fayyadamnee, kan nurra hafe immoo yeroo biraa fayyadamuuf mana keessaa ol ka'uun barbaachisaadha.

   ☐ Walii gale ☐ hin beeku☐ walii hin galu
7. Dhukkubbii salphaa yeroo natti dhagahamutti qoricha farra jarmiilee yeroon fayyadamu fayyamuun natti dhaga'ama.

   ☐ Walii gale ☐ hin beeku ☐ walii hin galu

10. Qoricha nuuf ajajame keessa tokko ykn lama otuu hin fudhatiin yoo hafe bu'aa qabeessummaa qorichaa irratti rakkina fidu hin qabu.

    ☐ Walii gale ☐ hin beeku ☐ walii hin galu

    Qoricha/dawaa/ farra jarmii ilaalchisee gochoota baratamaan

    1. Qoricha farra jarmi sababa maalittin akka fudhattan osoo nuuf ibsitanni.

☐ Walii gale ☐ hin beeku ☐ walii hin galu

2. Qoricha farra jarmi fudhachun dura ogeessa fayya ni mariyyachifttu
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

3. Qoricha farra jarmi fudhachun yeroon isa irradarbuuf dhissu isaa ni markaneeffattu.
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

4. Qorricha isiniif ajajame garrin yoomu fudhattan yoo fayyan isinitti dhaga'aamme qorricha fudhachu nni dhabdu.
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

5. Qorricha isiniif ajajame garrin yoomu fudhattan yoo fayyan isinitti dhaga'aamme dawaa hafe garra fuldurratti fayyadamuf ni olkeessuu
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

6. Qorricha isiniif ajajame yeroo 2 ykn 3 yoomu fudhattan yoo fayyan isinitti dhaga'aamme isa hafe maatif ykn hiriya keessanif ni olkeessu
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

7. Qorcha ogeess isiinif ajajje hangga xumurtanitti ni fayyadamttu
   ☐ Walii gale ☐ hin beeku☐ walii hin galu

8. Ji'ootta 12 darban keessatti horiin isin jalaa dhukkubsate jiraa

9. Horii issa dhukubsattef eenyuttu yaalumsa kennef

10. Qoricha namaaf ajajame fedhi keessaniin horiif fayyadamtanii beektuu
    ☐ Walii gale ☐ hin beeku☐ walii hin galu

11. Horri keessan gara kilinika fayya beyladdatti fayya issa qorrachisuf geessitanni beektu

☐ Walii gale ☐ hin beeku☐ walii hin galu

12. Beeyladaaf yeroo qoricha/dawaa/ bittan kan ajajameef hunda guutumaan guututtii akka fudhatan ni gottu

☐ Walii gale ☐ hin beeku☐ walii hin galu

Annex 4: Respondents consent form

Dear participant,

To ensure the rational use of antimicrobial and to control resistance to this drug in this region, examining the problem in detail is important. This survey is an investigation of Knowledge, attitude and behavioral practices of people in order to collect the base line data which is necessary to identify the point of intervention and to take the important measurement to prevent irrational antimicrobial usage and resistance. The results of this study will help public institutions in designing control strategies.

There is no need to tell your name to the enumerator; there are no correct or incorrect responses; we are merely interested in your point of view. All responses to this survey are completely confidential and no individual response will be reported.

Thank you for your participation in this study!

Annex 5. Ethical clearance