PREVALENCE AND ANTIBIOTIC SUSCEPTIBILITY OF BACTERIAL UROPATHOGENS AMONG PATIENTS OF URINARY TRACT INFECTION

M. Sc. THESIS

ADUGNA FEYISSA BEDADA

OCTOBER, 2016
HARAMAYA UNIVERSITY

Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection Visiting Hasasa Health Center, GedabHasasa*Woreda*, West Arsi Zone, Ethiopia

A Thesis Submitted to the Postgraduate Program Directorate
Department of Biology
HARAMAYA UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN BIOLOGY

By

AdugnaFeyissaBedada

October, 2016
Haramaya University

HARAMAYA UNIVERSITY

Postgraduate Program Directorate

We hereby certify that we have read and evaluated this thesis titled *'Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection Visiting Hasasa Health Center, GedabHasasaWoreda, West Arsi Zone, Ethiopia'*prepared under our guidance by AdugnaFeyissa. We recommended that it be submitted as fulfilling the thesis requirement.

AmehaKebede (PhD) _____ _____
Major Advisor Signature Date

SissayMenkir(PhD) _____ _____
Co-Advisor Signature Date

As members of the Board of Examiners of the Final M. Sc. Thesis Open Defense Examination, we certify that we have read and evaluated the Thesis prepared by AdugnaFeyissa, and examined the candidate. We recommended that the thesis be accepted as fulfilling the Thesis requirement for the degree of *Master of Science in Biology (*M. Sc. in Biology*)*.

_____ _____ _____
Chairperson Signature Date

_____ _____ _____
Internal Examiner Signature Date

_____ _____ _____
External Examiner Signature Date

DEDICATION

I dedicate this thesis manuscript to my grandmother and sister whom I lost within one month during this work.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my bonafide work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements of M.Sc. degree at the Haramaya University and is deposited at the University 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 School of Graduate Studies 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.

Name: AdugnaFeyissaBedada Signature: ……

Place: Haramaya University, Haramaya

Date of Submission: _____

LIST OF ACRONYMS AND ABBREVIATION

BA	Blood Agar
CAUTI	Catheter Associated Urinary Tract Infection
CLSI	Clinical and Laboratory Standards Institute
GBS	Group B *Streptococcus*
ESBL	Extended Spectrum Beta Lactamase
HPA	Health Protection Agency
MHA	Mueller Hinton agar
MOE	Ministry of Education
MRSA	Methicillin Resistant *Staphylococcus aureus*
MSU	Mid-Stream Urine
NUTI	Nosocomial Urinary Tract Infection
SPP	Species
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
UPEC	Uropathogenic *E. coli*
UTI	Urinary Tract Infection
VRE	Vancomycin Resistant *Enterococci*

BIOGRAPHICAL SKETCH

AdugnaFeyissa was born in Arsi Zone, Oromia Region, Ethiopia. He attended the elementary and secondary school education at Bekoji Elementary andBekoji high school respectively. After completion of his high school education, in 2004/5, he joined Ambo University and graduated in July 2005 as *Biology Laboratory Technician*with diploma. After graduation, he served as Biology teacher and BiologyLaboratoryTechnician in Hasasa Preparatory School. In 2008, he joined Addis Ababa University and upgraded his education to B.Ed. degree in Biology with Great Distinctionthrough summercontinuing program. Again, in 2011 he joined the School of Graduate Studies of Haramaya University to pursue a study leading to M. Sc. degree in Biology through a financial support from MOE.

ACKNOWLEDGMENTS

I would like to thank my major advisor AmehaKebede (Ph.D.) for his valuable advice, supervision, and encouragements throughout this research.

My acknowledgment is further extended to my co-advisor,SissayMenkir (Ph.D.) for his valuable comments and support on my research work.

My deepest thanks also go to Asella Referral and Teaching Hospital for providing me with the necessary laboratory media, reagent, and other laboratory facilities. I would like to give special thanks to the study participants of this research, data collectors, and health professionals serving in Hasasa Health Center and Asella Referral and Teaching Hospital for their cooperation during data collection and laboratory work.

Finally, I would like to show my appreciation to my family (my mother, father, sisters, and brothers) for their continuous moral and financial support throughout this study and the whole duration of my graduate studies in Haramaya University.
Above all, I would like to thank the Almighty God everything He has done to me.

TABLE OF CONTENTS

Content	Page
DEDICATION	**iv**
STATEMENT OF THE AUTHOR	**v**
LIST OF ACRONYMS AND ABBREVIATION	**vi**
BIOGRAPHICAL SKETCH	**vii**
ACKNOWLEDGMENTS	**viii**
TABLE OF CONTENTS	**ix**
LIST OF TABLES	**xii**
LIST OF FIGURES	**xiii**
ABSTRACT	**xiv**
1. INTRODUCTION	**1**
2. LITERATURE REVIEW	**4**
2.1. Urinary Tract Infection	4
2.2. Biology of Urinary Tract	5
2.3. The Etiological Agent of UTI	5
2.4. Prevalence of UTI Caused by Bacterial Uropathogens	6
2.5. Characteristics of Uropathogens	7
2.6. Route of Infection	7
2.7. Clinical Manifestation of UTI	8
2.7.1. Cystitis	8
2.7.2. Urethritis	9
2.7.3. Prostatitis	9
2.7.4. Epididymitis and Orchitis	9
2.7.5. Acute and Chronic Pyelonephritis	10
2.7.6. Urosepsis	10
2.7.7. Renal Abscesses	11
2.8. Classification of UTI	11
2.8.1. Complicated and Uncomplicated UTI	11

Continue…

2.8.2. Recurrent UTI 11
2.8.3. Asymptomatic and Symptomatic UTI 12
2.9. Risk Factors to UTI 12
2.9.1. Catheters 12
2.9.2. Long Term Hospitalized Patients 13
2.9.3. Pregnancy 13
2.9.4. Diabetes 14
2.9.5. Other Factors 15
2.10. Emergence of Resistance among UTI Pathogens 15
2.11. Diagnosis 16
2.11.1. Urinalysis 16
2.11.2. Urine Culture 17
2.12. Treatment of UTI 17
2.13. Prevention 18
3. MATERIAL AND METHODS 19
3.1. Description of the Study Area 19
3.2. Design of the Study 19
3.3. Sampling Techniques 20
3.4. Inclusion and Exclusion Criteria 20
3.5. Urine Sample Collection, Handling and Transport 20
3.6. Culture and Identification 21
3.7. Retrospective Analysis of Clinical Records 21
3.8. Antimicrobial Susceptibility Testing 22
3.9. Data Analysis 23
4. RESULTS AND DISCUSSION 24
4.1. Overall Prevalence of UTI 24
4.2. Prevalence of UTI by Sex among Study Participants 24
4.3. Prevalence of UTI by Age in the Study Population 26
4.4. The Prevalence of Uropathogenic Bacteria Isolated in the Study Area 27

Continue…

4.5. Antibiotic Susceptibility Tests for the Isolated Uropathogens 28
4. 6. Trend of UTI in the Study Area from 2005 to 2014 31
5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS 33
6. REFERENCES 35
7. APPENDICES 46
8.ANNEX 50

LIST OF TABLES

Table	Page
1. Biochemical tests for bacterial isolates	21
1. Zone Reading Interpretive Chart of Susceptibility	23
3. The Overall Prevalence of UTI among the Study Participants.	24
4. Prevalence of UTI by Sex among the Study Participants.	25
5. Prevalence of UTI by Age Group among the Study Participants.	26
6. Bacteria Species Type and Frequency Isolated from the Study.	28
7. Antibiotic Susceptibility of Bacterial Isolates Identified in the Study (n=44).	29
8. Resistance of Each Bacterial Isolates against Eight Antibiotics	31

LIST OF FIGURES

Figure	Page
1. Map of Gedab Hasasa *Woreda*	19
2. Trend of UTI prevalence over the last ten years in the study area (2005- 2014)	32

Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection Visiting Hasasa Health Center, GedabHasasa*Woreda*, West Arsi Zone, Ethiopia

ABSTRACT

Urinary tract infection is one of the most prevalent infections caused by different pathogens. This study was designed to determine the prevalence and antimicrobial susceptibility patterns of uropathogens among patients visiting Hasasa Health Center from March to May 2016.A total of 384 patients participated in this study. Culturing and identification of uropathogens were performed by using agar (Mac-Conkey agar and blood agar) and biochemical test. Antimicrobial resistance testing was performed by the Kerby Bauer disk diffusion method. Forty-four (44) uropathogens were isolated from urine samples of the 384-suspected patients with 11.5%overall prevalence of all isolates. The prevalence of Urinary Tract Infectionin female and male was 35(79.5%), 9(20.5% respectively. The highest prevalence of Urinary Tract Infectionis for the age range of 19-28 (17.4%) followed by 29-38(11.8%), 9-18(8.3%), 39-48(7.5%), and more than 49 (5.8%), respectively. Escherichia coli were the most prevalent isolates (56.8%) among the isolates in this study. The other isolates were Proteus mirabilis, Klebisiellapnemoniae, Enterococcus spp, and Enterobactersppwith respective prevalence of 22.7 %, 13.6%, 4.6%, and 2.3%. The highest resistance of isolates was observed toamoxicillin(88.6%)and lowest résistance was to nitrofurantoin (27.3%).All isolates showed high sensitivity to nitrofurantoin (72.7%)and lowest sensitivity to amoxicillin (11.4%). Over the last ten years (2005 to 2014)in the study area, Urinary Tract Infectionprevalence shows a decreasing condition.In conclusion, the present study showed that,lower overall prevalence of Urinary Tract Infectionthan most of the study conducted in other areas. So all stakeholder in the study area can participate in prevention of UTI to keep the status or to reduce the prevalence more.

Keyword: *Hasasa, Prevalence, Susceptibility, Trend, Urinary Tract Infection*

1. INTRODUCTION

Urinary tract infection (UTI) is one of the most common infections in humans that affecteither the upper (ureter, kidney) or the lower (urethra, bladder) part of the urinary tract (Thomson and Armitage, 2010). The gastrointestinal tract is a reservoir from which uropathogens emerge. *Enterobacteriaceae* are the most important cause of UTI in all population groups, accounting for more than 95% of all UTIs (Naber *et al*., 2006). Among these microbes, *E. coli* is by far the most common invader, causing approximately 90% and 50% of UTIs in outpatients and hospitalized patients, respectively.

The second most commonly happened bacterial species is *Proteus mirabilis* (Talkoff-Robin *et al*., 2008).

Urine secreted by normal kidney is sterile and travels to the bladder through the ureter without being contaminated with bacteria. However, normal urine may be contaminated with microbial flora around the external genital area and any voided urine in a normal person may contain thousands of bacteria per milliliter. In order to differentiate this smaller number of microorganisms from the larger number of microorganisms commonly found in infection of the urinary tract, it is essential to count the number of bacteria present in fresh properly collected urine samples by appropriate methods. According to researchers, counts exceeding 10^5/ml in two consecutive clean urine samples or same count in a single mid-stream urine sample can be considered as true bacteriuria (Smaill and Vazquez, 2007).

The pathogens generally follow an ascending pattern of invading the different parts of the urinary tract as the common route of the infection begins from the lower urinary tract from urethra, which invades the bladder and later on ascends to the parts of the upper urinary tract like ureter and kidney. Bacterial ascent is aided by conditions such as pregnancy and urethral obstruction as these conditions inhibit urethral peristalsis. Bacteria that reach the renal pelvis can penetrate the renal parenchyma through the collecting ducts and disrupt the renal parenchyma and the renal tubules (Smellie*et al.*, 1995).

The prevalence of UTI is quite different among genders and age groups. There is high incidence in girls (3%) and lowerin male (1%). However, male infants exceptionally have high incidence (0.7%) when compared to 0.1-0.4% incidence in female infants (Foxman, 2002). Uncircumcised boys have a great tendency to harbor pathogenic organisms in the foreskin due to warm, moist, and mucosal environment; and as a result, bacteria migrate up to the urethra and colonize the bladder (Sawalha, 2009).

In children, UTI is often associated with renal tract abnormalities and it is most common in males in the first three months of life because of congenital abnormalities. In older children, females are more commonly affected than males (Griebling, 2007). About 4-8% of children have had UTI, a common bacterial illness, from a population-based study (Sureshkumar*et al*., 2009).

There are many risk factors for UTIs: Kidney stones, urethral structures, enlarged prostate *glands* or any anatomical abnormalities in the urinary tract increase the risk of infection. In addition to these, people who undergo catheterization, women who use a diaphragm or who have partners that use condoms with spermicidal foam, females who are sexually active have a higher risk of UTI. Older men have a higher risk for UTI because many men develop enlarged prostate glands that may cause slow and incomplete bladder emptying. Pregnant women, patients with chronic disease such as diabetics or those who are immune suppressed (HIV or cancer patients) are also at high risk for UTI (Naber*et al*., 2006).

The introduction of antimicrobial therapy has a significant contribution to the management of UTIs. However, the main problem with current antibiotic therapies is the rapid emergen ceof antimicrobial resistance in hospitals and the community **(**Habte*et al*., 2009). The etiological agents of UTI and their susceptibility patterns vary from one geographical location to the other. Besides, the etiology and drug resistance change through time (Francesco *et al*., 2007).

The prevalence of UTI and the antibiotic resistance of uropathogens have been changing over the past years, both in the community and in hospitals. Knowledge of the local bacterial etiological agents and their susceptibility patterns is required to trace any change that might have occurred in time so that updated recommendation for empirical therapy of UTI is given.Current information on prevalence and antimicrobial susceptibility

patterns is essential for appropriate therapy. So far, no information is available on the prevalence and resistance patterns of bacterial uropathogens in GedabHasasa*woreda*.Thus, the aim of the present study was to determine the prevalence and the antibiotic susceptibility patterns of bacterial isolates from urine samples of patients visiting Hasasa Health Center.

The specific objectives are:

1. To determine the prevalence of uropathogenic bacterial infection among patients who were visiting Health Center of GedabHasasa*Woreda* and suspected to have urinary tract infection.
2. To identify uropathogenic bacterial species causing urinary tract infection among patients attending GedabHasasa Health Center.
3. To test the antibiotic susceptibility patterns of the identified uropathogenic bacterial species isolated from the study participants.
4. To evaluate the trend of urinary tract infection in GedabHasasa*Woreda*over the past ten years from 2005 to 2014.

2. LITERATURE REVIEW

2.1. Urinary Tract Infection

UTIs are one of the most common bacterial infections in humans both in the community and hospital settings (Dalela*et al*., 2012). Worldwide, approximately 150 millions of people are diagnosed with UTIs resulting in USD 6 billion health care expenditures (Weich hart *et al*., 2008). UTIs are the most common bacterial infections encountered by clinicians in developing countries. Gram-negative bacteria like *Escherichia coli*, *Klebsiella* spp., *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Acinetobacter* spp., and *Serratia* spp. and Gram-positive bacteria such as *Enterococcus* spp. and *Staphylococcus* spp. cause most UTI (Kashef*et al*., 2010).

Urinary tract infection is a common contagion among men and women but the incidence is quite high among women due to their physiology. It is a condition in which women will encountered during the span of their lifetime. The prevalence is high during pregnancy. Infection named after the part that is infected and referred as cystitis (bladder infection) and phylonephritis (kidney infection). The symptoms associated with the bladder and kidney infections are contrasting which includes painful and frequent urination in case of cystitis as a result of bladder infection whereas conditions like high fever and flank pain are commonly experienced in case of kidney contagion which is referred to as phylonephritis. Bacteria are the prime perpetrator responsible for conferring the infection among humans but the role of certain fungi and viruses cannot be over looked. Though the infection seems to be harmless in the initial stages, the patient shows a variety of symptoms as the stage progresses and can lead to death in severe circumstances. Research studies have defined urinary tract infection as the most common form of bacterial infection (Demilie*et al*., 2012).

The occurrence of bladder infection is followed by kidney infection and results in blood borne infection and in severe circumstances can lead to dire consequences including death. Therefore, UTI is capable of claiming lives under severe circumstances and proper treatment results in quick recovery from the contagion. The onset of the infection is from 6^{th} to 24^{th} week (Rahimkhani *et al.,* 2008).

2.2. Biology of Urinary Tract

Urinary tract infection affects the parts of the urinary tract that includes the upper and lower urinary tract and the occurrence is high in females due to their reproductive anatomy**.** The urinary system comprising of the parts of the urinary tract is at risk as the infection can affect any part of the urinary tract. Since the urethra is shorter in women (about 1.5 to 2 inches) when compared to men (8 inches), they are more prone to infections associated with the urinary tract. The shorter length of the urethra in women enhances the scope for the pathogen to invade the bladder resulting in bladder infection.

The urinary tract is a distinct mucosal surface of the body and bacterial colonization of the uroepithelium is unique when compared to other mucosal surfaces. Colonizing bacteria must overcome the normal flushing actions of urine flow and the physical barrier of the uroepithelial lining. This lining embodies a tightly interlaced latticework of proteins called uroplakins. Uroplakins are a collection of lipids; sphingolipids, and cholesterol referred to as lipid rafts that cumulatively constitute a surface that is highly impregnable to urine, solutes, and potential pathogens such as UPEC and GBS (Apodaca, 2004).

2.3. The Etiological Agent of UTI

UTIs refer to the presence of microbial pathogens within the urinary tract. Although UTI may be caused by any pathogen that colonizes the urinary tract (e.g., fungi, parasites, and viruses), most causative agents are bacteria of enteric origin. Many bacterial genera cause urinary tract infection. The bacteria that cause urinary tract infections typically enter the bladder via the urethra. However, infection may also occur via the blood or lymph (Vasudevan, 2014*)*. Any source of possible infection occurs through urethra, which initiates the incidence of the infection. Bacteria are usually transmitted to the urethra from the bowel, with females at greater risk due to their anatomy. There are many urinary tract bacterial pathogens responsible for this infection. Among those, the predominant pathogen is *E. coli,* which constitutes up to (80-85%), and is followed by *Staphylococcus saprophyticus,* which account to 5-10 % (Chen *et al*., 2011). In addition to the above mentioned bacterial species *Proteus mirabilis, Proteus vulgari, Enterobacter cloacae*,

*Enterobacteraerogens, Klebsiellapneumoniae, Staphylococcus aureus, Coagulase negative Staphylococcus, Pseudomonas aeroginusa, Streptococcus faecalis, Acinetobactercalcoacticus, and Citrobacterfreundi*are also associated with the infections (Vasudevan,2014*)*.

2.4. Prevalence of UTI Caused by Bacterial Uropathogens

Among the most common infectious disease, urinary tract infections are a commonly encountered disease by clinicians in developing countries with an estimated annual global incidence of at least 250 million (Beyene and Tsegay, 2011). The exact prevalence rate of UTI in Ethiopia is not known but the estimated number according to Statistics by Country for urinary tract infection is more than 2 million (Tessema*et al*., 2007).

The severity of urinary tract infections in the community may range from uncomplicated cystitis to sever pyelonephritis. Currently these infections result in million visits to health care providers each year and may become an unexpected complication of a hospital admission (Foster, 2008). Even though both sexes experience UTIs, the incidence in females far exceeds that of males until the age of 50 (Blanco *et al*., 2003). Sexually active women are commonly experiencing symptomatic UTI (20-35%) of all women experience at least one episode of UTI sometime in their lifetime (Mori *et al*., 2007). The infections are sporadic in about (75%) of the patients and recurrent in 25% (Nicolle, 2001). 80% of the girl and 20% of the boy have the chance of infections including pyleonephritis and cystitis at least once in their childhood (Overturf, 2002). It is more common to see UTIs in very young boys than in very young girls because of higher frequency of urethral malformations in boys. Later in childhood, symptomatic UTI is more common in girls, who also more frequently have asymptomatic UTI (Nicolle, 2001). These infections are due to short urethra but may also be the result of sexual abuse (Rodriguez-Bano*et al*., 2004). In young men, bacterial UTI are rare and often the result of underlying infections of the prostate (Wein, 2007). In the old age, both symptomatic and asymptomatic UTIs are common (Foster, 2008).

2.5. Characteristics of Uropathogens

The *Enterobacteriacaea* are among the most important bacteria medically. Most are normal colonists of the human gastrointestinal tract (e.g. *Escherchia, Enterobacter, Klebsiella*), but these bacteria as, well, may occasionally be associated with disease of humans.*Enterobacteriaceae* are facultative anaerobic Gram-negative and none spore forming that live in the intestinal tracts of healthy and diseased animals (Todar, 2011). Most species of the *Enterobacteriaceae* grow well at 37℃ and some are motile. They are oxidase-negative, catalase-positive, distributed worldwide, and found in soil, water, plants, and animals (HPA, 2010).

Staphlococcus species are Gram-positive, non-spore forming, non-motile, occurring in single, in pairs and in irregular clusters. Size may be variable. They form colony, which are opaque in shape, white, or cream in color and occasionally yellow or orange. The optimum growth temperature ranges from 30℃- 37℃. They are facultative anaerobic and have a fermentative metabolism, oxidase-negative, catalase-positive and most of the members reduce nitrates to nitrites. Some species produce extracellular toxins (HPA, 2010).

In general, with its complex mechanism for regulation of metabolism the bacterium can survive the chemicals contents in its environment in advance of synthesizing any enzymes that metabolize these compounds. It does not wasteful produce enzyme for degradation of carbon sources unless they are available, and it does not produce enzymes for synthesis of metabolite if they are available as nutrients in the environment (Todar, 2011).

2.6. Route of Infection

Microorganism can reach the urinary tract by haematogenous or lymphatic spread, but there is abundant clinical and experimental evidence to show that the ascent of microorganism from the urethra is the most common pathway leading to a UTI, especially organism of enteric origin, *E*. coli and other *Enterobactriaceae* (Naber*et al*., 2006).

Bacterial virulence factors play a significant role in determining whether an organism will invade the urinary tract and the level of infection acquired. Uropathogenic *E. coli* (UPEC) is present within bowel flora and pathogenic strains of this micro-organism can infect the urinary tract by expressing specific virulence factors that permit adherence and colonization of the lower urinary tract (Schlager*et al*., 2002). Adherence of the microorganism is dependent on three important environmental characteristics; firstly, the bacteria's own adhesive characteristics, secondly the receptive features of the urothelium and finally the fluid that is present between both surfaces. Bacteria will migrate proximally and precipitate a host derived inflammatory response after adhering to the mucosal surface. Adhesins found on the surface of the bacterial membrane are responsible for initial attachment onto urinary tract tissues (Mulvey, 2002). Bacteria is transmitted to the bladder from the bowel, make attachment to the wall of bladder, form bio-film, which resists the immune response and is the main cause of the infection (Harding *et al*., 2002).

2.7. Clinical Manifestation of UTI

2.7.1. Cystitis

Cystitis is the presence of complaints of dysuria, frequency of urination, urgency of urinations, and abdominal discomfort. Cystitis is inflammation of the bladder that can be a consequence of bacterial infection (Mansor, 2009). Typical symptoms are pain during urination, and passing urine frequently. It may also cause pain in the lower abdomen, blood in the urine and fever. The urine may also become cloudy or smell offensive. Acute uncomplicated cystitis usually occurs in young women but it may also occur in men and children. It has an abrupt onset and produce sever symptoms, which are usually accompanied by pyuira and bacteriuria. Patients usually present with dysuria, frequency and urgency, voiding small amount of urine, incontinence and suprapevlic or pelvic pain (Latif, 2004). Most symptoms of UTIs in pregnant women present as acute cystitis (Naber*et al*., 2006).

2.7.2. Urethritis

Urethritis is the inflammation of the urethra, the tube that carries urine from the bladder to out of the body. It is common in both male and female patients and is often associated with UTI. In men, sexually transmitted diseases cause urethritis and associated with urethral discharge (Naber*et al*., 2006). Primary urethritis is different from secondary urethritis in which it may found in-patient with indwelling catheters and caused by uropathogens. Besides, infective causes of urethritis, chemical, mechanical, and non-infective inflammatory causes have to be considered, such as Reiter's, Behçet's and Wegener's diseases (Ebo, 1998).

2.7.3. Prostatitis

Prostatitis is an inflammation of the prostate gland that occurs in a variety of different forms, some involving infection. Traditionally, the term 'prostatitis' has included both acute and chronic bacterial prostatitis, in which an infective origin is accepted, and the term 'prostatitis syndrome, in which no infective agent can be found and whose origin is multifactorial and in most cases obscure. Prostatitis is diagnosed by symptoms and evidence of inflammation and infection localized to the prostate. A causative pathogen detected by routine methods from only (5-10%) of cases and for whom antimicrobial therapy has a rational basis. Patient treated empirically with numerous medical and physical modalities. However, recent improvement in classification and application of modern methods, including molecular biology, should allow proper systematization of treatment (Schaeffer, 1999).

2.7.4. Epididymitis and Orchitis

Epididymitis is inflammation of the epididymis the tube at the back of the testicle that store and carries sperm, which causes pain, swelling, unilateral, and relatively acute in onset. In some cases, the testis is involved in the inflammatory process called orchitis. Orchitis and epididymitis are classified as acute or chronic processes according to the onset and clinical course. Chronic disease with indurations develops in (15%) of acute epididymitis cases. In the case of testicular involvement, chronic inflammation may result in testicular atrophy and the destruction of spermatogenesis (Naber*et al*., 2006).

2.7.5. Acute and Chronic Pyelonephritis

Acute uncomplicated Pyelonephritis is an inflammation process of the kidney and adjacent structures. Patient presenting with typical lower tract infection symptoms (dysuria, frequency, urgency urination, etc), flank pain, abdominal pain, nausea, rigors, headache, malaise, vomiting, fever, and chills should be suspect of having pyelonephritis (Chenoweth *et al*., 2005). Pyelonephritis severity ranges from mild disease to full blown gram-negative sepsis with few patients developing complications such as intra renal and peripheric abscese. Patients may be hypovoaemic because of poor fluid intake and vomiting and may develop internal or perinephric abcesses. Chronic pyelonephritis is usually associated with urinary tract obstruction, diabetes and immune suppression (Latif, 2004).Enhanced risk of phylonephritis can be a consequence of untreated UTI and can lead to serious outcomes like ephemeral kidney failure, acute respiratory disorders and hematological abnormalities (Ugbogu*et al*., 2012)**.**

2.7.6. Urosepsis

Sepsis is inflammation caused by severe infection. Severe sepsis is a severe situation with a reported mortality rate ranging from 20% to 42%. Sepsis is commoner in men than in women (Rosser *et al*., 1999). In recent years, the incidence of sepsis has increased by (8.7%) per year (Martin *et al*., 2001), but the associated mortality has decreased suggesting improved management of patients (the total in-hospital mortality rate fell from (27.8%) to (17.9%) during the period 1995-2000) (Brun-Buisson *et al*., 2004).

Urosepsis severity is depends mostly upon the host response. Patients who are more likely to develop urosepsis include elderly patients, diabetics, immune suppressed patients (transplant recipients, patients receiving cancer chemotherapy or corticosteroids, and patients with acquired immunodeficiency syndrome). Urosepsis also depends on local factors, such as urinary tract calculi, obstruction at any level in the urinary tract, congenital uropathies, neurogenic bladder disorders, or endoscopic manoeuvres (Bone *et al*., 1992).

2.7.7. Renal Abscesses

UTI is one of the most frequently encountered infections within 3 month of renal transplant, and have an incidence from 10% to 98%. They can range from asymptomatic bactriuria to allograft abscesses and septic shock. Gram-negative organisms are isolated in over 75% of the cases, *E. coli* being the most frequent (Jaik, 2006).

2.8. Classification of UTI

Infection targets the different parts of the urinary tract and contagion the lower and the upper urinary tracts. Infection of urethra and ureter are urethritis and ureteritis respectively whereas cystitis and phylonephritis correspond to bladder and kidney infections respectively.

2.8.1. Complicated and Uncomplicated UTI

A complicated UTI is an infection associated with a condition, such as structural or functional abnormalities of the genitourinary tract or the presence of an underlying disease, which increases the risks of acquiring an infection or failing of therapy (Kumazawa and Matsumoto, 1997).

Complicated UTI can arise in a heterogeneous group of patients. However, neither patient age nor gender is part of the definition of a complicated UTI. With regard to prognosis and clinical studies, it is advisable to stratify complicated UTIs due to urological disorders (Naber, 1999).

2.8.2. Recurrent UTI

Recurrent UTI is a common phenomenon observed among women who have experienced uncomplicated UTIs and classified as re-infection and relapse. Major cases of recurrent UTI is a condition encountered by the patient after several weeks of antibiotic treatment. The less frequent type of recurrent UTI is relapse an outcome of treatment failure and the patient encounters the condition within two weeks of the previous infection. Relapse UTIs are usually associated with phylonephritis which

results in renal failures, kidney impediments through kidney stones and anatomical abnormalities in men and women (Fihn, 2003).

2.8.3. Asymptomatic and Symptomatic UTI

Depending on the presence or absence of the symptoms, UTI grouped as symptomatic and asymptomatic UTI. As the name indicates, symptomatic is the condition where the symptoms seen in the patient and asymptomatic UTI is a condition in which the symptoms not observed. Studies have substantiated an enumeration of 10^3 CFU/ ml of sample to be appropriate for the diagnosis of group B streptococcus (GBS) in urinary tract infection (Tan *et al*., 2012)**.** The diagnosis of UTI among asymptomatic patients is carried out by positive cultures for uropathogens to confirm the presence of the infection (Emilie and Edward, 2011)**.** Attempts demonstrate the occurrence of asymptomatic and symptomatic UTI because of bacteriuria that is the presence of bacteria in urine (Ipe*et al*., 2013)**.**

Evidence shows that asymptomatic bacteriuria is causing symptomatic bacteriuria and research studies have confirmed that the occurrence of symptomatic bacteriuria is due to untreated asymptomatic bacteriuria(Sibiani, 2010)**.** Hence, asymptomatic bacteriuria accounts up to (70%) of cases of symptomatic UTI among unscreened pregnant women. Asymptomatic bacteriuria is a true bacteriuria in absence of specific symptoms during acute UTI. The occurrence of asymptomatic bacteriuria during pregnancy ranges between 2 to 10% (Jones *et al*., 2009)**.**

2.9. Risk Factors to UTI

2.9.1. Catheters

Long-term urinary catheters are a leading cause of morbidity in acute care settings, accounting for up to 40% of hospital-associated infections (Smith *et al*., 2000). Within the hospital environment, the intensive care unit has the highest prevalence of nosocomial infections with estimated rates of 8–21% for nosocomial UTI of which 95% are catheter-associated (Wilde, 2003). The daily incidence of bacteriuria in catheterized patients is approximately 3–10%. Among patients with bacteriuria, up to 25% will

develop symptoms of local UTI, and about 3% will develop bacteremia (Saint *et al*., 2005). Catheter-associated UTI is the second most common cause of nosocomial bloodstream infection. Patients who develop nosocomial UTI have their hospital stay extended by approximately three days and are nearly three times more likely to die during hospitalization than patients without such an infection are. The case-fatality rate from UTI-associated bacteremia is approximately 13%within severely ill patients at highest risk (Trautner*et al*., 2005).

2.9.2. Long-Term Hospitalized Patients

Long term hospitalized patients with indwelling urinary catheters and patients undergoing urological treatment are prone to nosocomial infections. The pathogens accountable for the infection initiate from the individual's endogenous flora and the moist environment of the hospital aggravates the condition (Naber*et al*., 2006).

Urinary tract infection (UTI) is common in hospitalized patients. It has been reported that in U.S. hospitals, among adults and children outside of the intensive care units (ICUs), the urinary tract is the most common site of HAI, accounting for (36%) of infections, followed by surgical site infections (20%), bloodstream infections and pneumonia (11%, each) and other infection types all (22%)(Klevens*et al*., 2007).

UTI is the most common hospital acquired infection constituting up to 35% of nosocomial infection and a vital factor for the outbreak of bacteremia among hospitalized patients. Despite the fact, that *E. coli* is the prime perpetrator, studies have validated the significance of *S. aureus* in conferring the infection (Ugbogu*et al*., 2010)**.**

2.9.3. Pregnancy

The incidence of UTI among pregnant women across the world varies widely. The prevalence of symptomatic, asymptomatic bacteriuria among women during pregnancy is common, and the previous history of the infection is a major risk factor. The effect of asymptomatic UTI can be subsided by employing suitable treatment, which in turn prevents the adverse consequences of its progress. Urinary tract infection is a consequence of poor diagnosis during pregnancy. This in turn enhances the scope of infection and pregnant women under such circumstances are susceptible to serious

complication. Women within the age group of 15-32 were prone to infection and pregnancy has in turn enhanced the susceptibility rate among women. During the course of pregnancy, factors like parity and gravidity play a vital role in conferring the infection. Gravidity is the number of pregnancies and parity is the number of healthy deliveries. Scientific studies have cited multiple pregnancies as a problematic indication but this remains arguable (Creinin and Simhan, 2009).

Pregnancy is one of the factors, which increase the risk of UTI.This due to the pressure of gravid uterus on the ureters causing stasis of urine flow and is attributed to the humeral and immunological changes during normal pregnancy (Ramzan*et al.*, 2004).

During pregnancy, UTI carries risk of fetal loss, pre-term labor, intrauterine growth attitude and practice regarding UTI was categorized as retardation, maternal anemia, and the chance of recurrent infections (Kladenský and Gynekol, 2012).

2.9.4. Diabetes

Diabetes is a metabolic disease associated with blood sugar levels and high sugar level than required, results in dire consequences. Demonstrative research studies have substantiated the significance of diabetes in relation to UTI and sufficient evidence in the form of data is implying the role of diabetes in UTI. Women with diabetes are more vulnerable to UTI than without diabetes. Infection begins as asymptomatic bacteriuria, which develops in to symptomatic bacteriuria as the infection progresses. Studies have highlighted the consequences of asymptomatic bacteriuria and its role in causing renal defect under untreated condition. Occurrence of type I and type II diabetes enhances the factors associated with UTI (Wild *et al.*, 2004).

The occurrence of asymptomatic bacteriuria among healthy women range from (2%) to (5%) and the incidence is three to four folds higher among women with diabetes **(**Balasoiu*et al.*, 1997).Higher content of glucose in urine and compromised immune system aspects incline towards the infection. High blood sugar levels negatively influence the functioning of the neutrophils resulting in their malfunction in turn amplifies the intracellular calcium levels and phagocytosis. Patients with diabetes are

also susceptible to conditions like cystopathy, nephropathy, and renal papillary necrosis, complications that incline them towards UTI. Diabetic cystopathy causes vesicourethral reflux. Vesicourethral reflux causes the backward flow of the urine from the bladder to ureter, kidney, and this result in periodic infections. Around (30%) of women diagnosed with diabetes are prone to medical conditions like cystocele, cystourethrocele, or rectocele that may in turn cause persistent UTIs among diabetic females (Geerlings*et al*., 2000)**.**

2.9.5. Other Factors

UTI is common with varying prevalence by age, sexual activity and the presence of genitourinary abnormalities. In addition, factors like employment of immunosuppressant, financial condition of the individual as well as geographical location also have a prominent in conferring the infection. Immune suppressants are the substances that given to a patient after a transplantation surgery in order to avoid the rejection of the transplanted organ. Immune suppressants suppress the immune system of an individual and a compromised immune system is susceptible to the attack of pathogenic microbes. Financial situation not a prime factor but a prevalence of (17%) of UTI recorded among women during pregnancy in nations like Tanzania (Olsen *et al*., 2000: Masinde*et al*., 2009).

Medical condition like renal and perirenal abscess, emphysematous pyelonephritis, and emphysematous cystitis encountered among diabetic women with complicated UTI. In addition, fungal infections, xanthogranulomatous pyelonephritis, and papillary necrosis are persistent among diabetic females. Obstruction of the urinary tract of diabetes can cause emphysematous UTIs which leads to necrosis and hemorrhagic infarction **(**Wan, 1996**).**

2.10. Emergence of Resistance among UTI Pathogens

Nowadays, drug resistance is a huge growing problem in treating infectious diseases like malaria, tuberculosis (TB), diarrheal diseases, urinary tract infection (UTI) etc. As suggested by Goldman and Huskins (1997) the improper and uncontrolled use of many

antibiotics resulted in the occurrence of antimicrobial resistance, which became a major health problem worldwide. Many kinds of resistant strains were discovered in the past decade. For example, methicillin resistant *Staphylococcusaureus* (MRSA) (Wagenlehner and Naber, 2004), multidrug resistant *Pseudomonasaeruginosa* (Linuma, 2007) and *Serratia*marcescens (Kim *et al*., 2006), vancomycin resistant *Enterococci* (VRE) (Gold, 2001) and extended spectrum beta lactamase (ESBL) resistant *Enterococci* (Bhattacharya, 2006).

Drug resistance of pathogens is a serious medical problem, because of very fast arise, and spread of mutant strains that are insusceptible to medical treatment. Microorganisms use varied mechanisms to acquire drug resistance viz. horizontal gene transfer (plasmids, transposons and bacteriophages), recombination of foreign DNA in bacterial chromosome and mutations in different chromosomal locus (Klemm*et al*., 2006).
In the last three decades, there are reports in the scientific literature inappropriate use of antimicrobial agents and the spread of bacteria resistance among microorganisms causing urinary tract infections (Kurutepe*et al*., 2005).

2.11. Diagnosis

The diagnosis of bacterial UTI has usually made by bacteriologic method of isolation and identification in voided urine sample either via clean mid-stream urine directly voided by patient or collection of urine by sterile bag attached around the urethra.

2.11.1. Urine Analysis

The two common component of urine analysis that is useful for rapid screening of UTI are dipstick screening test and microscopy (Dulczak and Kirk, 2005). Urine dipstick consists of chemically treated paper, which displays different colors indicating the presence of leukocyte esterase, nitrite, blood, and protein when dipped into urine sample. The presence of nitrites on urinalysis may be indicative of UTI. Leukocyte esterase is an enzyme made by the breakdown of neutrophils white blood cells. The presence of more than three white blood cells per high power field suggests pyuria, which is the result of an inflammatory response of urogentials mucosa to colonize bacteria (Mond*et al*., 2005).

Microscopic examination of the urine for the presence of white blood cells usually performed after centrifugations (Tanagho and Mccaninch, 2004).

2.11.2. Urine Culture

The best and acceptable method in the diagnosis of UTI to identify the causative organisms and to make an accurate decision about the best treatment is urine culture (NICE, 2007).

Urine culture done through plating a loop full of urine on a culture media and incubating them at 37℃ for 24 hr in an incubator. Identifying the uropathogens and counting the number of bacterial colonies that grow on the culture plate by colony forming unit (CFU) of bacteria per ml in a clean catch or mid-stream urine specimen considered diagnostic of a UTI. According to researchers, count exceeding 10^5 CFU/ml in two consecutive clean urine samples or same count in a single mid-stream urine sample can be considered as true bacteriuria (Smaill and Vazquez, 2007).

2.12. Treatment of UTI

The initial treatment efforts involve the employment of a variety of antimicrobial agents and this could in turn make the pathogen resistant to commonly employed drugs. Such kind of treatment is empirical treatment. Therefore, a sporadic assessment of the causative pathogens against the antimicrobial agents is necessary (Santos *et al*., 2008).
The empirical treatment with ampicilline and gentamycin may be provided once the UTIs were diagnosed. Empirical treatment may also switch to appropriate antibiotics when the definitive results of urine culture and sensitivities are available. For upper urinary tract infection, oral antibiotics are not inferior to the parenteral antibiotics, low resisted antibiotics such as cephalosporin is recommended with course for 7-10 days. Parenteral antibiotics can be used in cases of oral antibiotics cannot be used, ceftriaxone or cefataxime for 4-7 days, depends upon the responding of infection. For lower urinary tract infection, amxocillin, cephalosporin, trimethoprim or nitrofurantoin may be used for 3-7 days. Prophylasis of antibiotics is not recommended for prevention of recurrent UTIs, which may increase the risk of drug resistance (Hsu *et al*., 2010; Nicolau, 2011).

2.13. Prevention

Prevention of UTI is by developing the habits of drinking plenty of water daily, using mild body soap only, and using extra lubricating during intercourse if needed. Decreasing the frequency and duration of sexual intercourse, practicing safe sex (using condoms and other barrier method), urinating before and after sex, wiping from front to back after going to toilet, avoiding thong under wear and tight clothes are some of the methods in preventing UTI caused by bacteria(Shankel, 2010).

One of the biggest and most widely health benefits of eating cranberries, in whatever form, either as whole fruit or juice or cocktail, is that it helps prevent urinary tract infection (UTI). While this was what our elders passed on to us as traditional oral medicinal knowledge, it is now recognized as official medical fact (Avorn*et al*., 1994).

3. MATERIAL AND METHODS

3.1. Description of the Study Area

The present study was undertaken in GedabHasasa*Woreda*, West Arsi Zone of Oromiya Regional State, Ethiopia. The study area is 285 km far from Addis-Ababa, the capital city of Ethiopia. The *woreda* is located along the main road from Addis-Ababa to Bale, and 110 km far from Asella town. Geographically, it is located at $7^0$01'20" - $7^0$22'52" North and $38^0$57'59" - $39^0$25'20" East. There are 28 rural and urban *kebeles* in the *woreda*. It has an elevation of 2300-3100 m above sea level. According to the *wereda* agricultural office, the population of the *woreda* was estimated to be 228,045. The annual maximum rainfall of the area is 2700 mm and the minimum is 1500 mm. The maximum and minimum annual temperatures are 30℃ and 10℃, respectively.

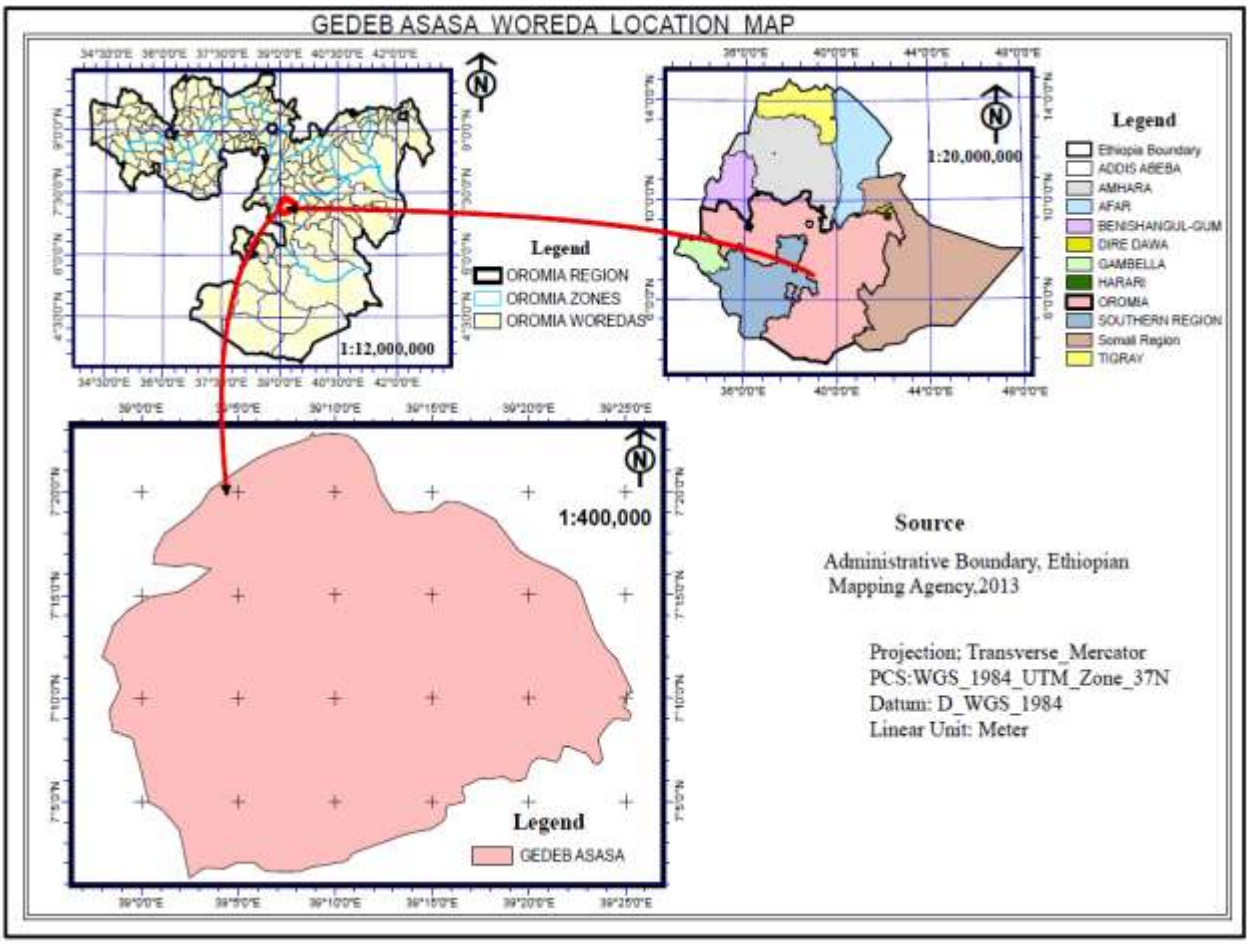


Figure 1.Map of GedabHasasa*Woreda*

3.2. Design of the Study

A laboratory based cross-sectional survey study was conducted between March and May 2016 on all patients who visited Hasasa Health Centerand suspected to have urinary tract infection. The sample size was determined using the formula employed by Naing*et al*, (2007) following the 95% level of confidence, 5% margin of error and the assumption that 50% was the expected prevalence of UTI in the study area.

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where, n = required sample size

$$n = \frac{1.96^2 X 0.5(1-0.5)}{0.05^2}$$

z = 95% confidence interval (1.96)

d -= margin of error (5%)

p = prevalence of UTI (50%)

$$n = \frac{0.9604}{0.0025} = 384$$

Hence, the total sample size in this study was 384.

3.3. Sampling Techniques

Purposive sampling technique was done until the sample size requiredreached.
Those patients suspected for urinary tract problems by the physician were included in this study.

3.4. Inclusion and Exclusion Criteria

In this study, all outpatients complaining about UTI and those who were willing to give their consent were included in the study, whereas patients who were not willing to give their consent and children below one year old were excluded.

3.5. Urine Sample Collection, Handling and Transport

Ten to fifteen milliliter of early morning mid-stream urine (MSU) samples were collected from 384 serially selected patients who visited HHC from March to May 2016 using sterile containers (vials) labeled with patient codes. The patients were properly informed

by laboratory technicians, on how to collect the specimens in the sterile bottle. The collected urine was taken to the laboratory by data collector within 30 minutes of collection and refrigerated immediately to retard the growth of bacteria until urine culture was performed.

3.6. Culture and Identification

The urine sample was inoculated onto Mac Conkey agar (MCA) or blood agar (BA) with calibrated loop of 0.001 ml by using streak dilution technique (Graham and Galloway, 2001).The inoculated agar plates were incubated aerobically at 37℃ for 24 hr.After 24 hr incubation, the bacterial growth on the respective media was observed, and total colony count was done and checked for significant bacteriuria (Cheesbourgh, 2006). A significant bacteriuria was considered if urine culture yields ≥105 CFU/mL mid-stream urine. All positive urine cultures showing significant bacteriuria was sub-cultured and further identified by their characteristics appearance on their respective media(colony morphology) and confirmed by the pattern of biochemical reactions using the standard procedures (Vandepitte*et al*., 2003; Cheesbourgh, 2006). The *Enterobacteriaceae*were identified bylactose fermentation,indole production, citrate utilization, motility test, urease test,catalase tests and oxidase test as shown Table 3.1. (Cheesbrough, 2008)

Table 3.2. Biochemical tests for bacterial isolates.

Bacteria Isolates	**Oxidase**	**Lactose**	**Indole**	**Urease**	**Citrate**	**Catalase**	**Motility**
E. coli	-	+	+	-	-	NA	+
Klebsiellapneumoniae	-	+	-/+	+	+	NA	-
Proteus mirabilis	-	-	+/-	+	+/-	NA	+
Enterococcus spp.	NA	+	-	+	-	+	-
Enterobacter spp.	-	+	-	-	+	NA	+

Key:- = negative, + = positive NA= non applicable

3.7. Retrospective Analysis of Clinical Records

Previously recorded cases of UTI from 2005 to 2014 were collected from Hasasa Health Center and this collected data were analyzed to show the trend of UTI over the last ten years in the selected study area.

3.8. Antimicrobial Susceptibility Testing

Antimicrobial susceptibility tests were carried out on Mueller-Hinton agar using the Kirby-Bauer disk diffusion method. Bacterial inoculums were prepared by suspending the freshly grown bacteria in 25 ml sterile nutrient broth usingthree to five well isolated colonies from Mac Conkey agar (MCA) or blood agar (BA) plates. The solution within the test tubes was emulsified after shaking. The turbidity of the resulting emulsified suspension was matched with a turbidity standard (0.5 Mc Farland) and adjusted by adding more colonies or normal solution to the emulsified suspension until the equivalent suspension was obtained. These emulsified solutions of bacterial uropathogens were used directly for swabbing onto Mueller Hinton agar platesby using sterile cotton swab.

Eight (8) disks were dispensed onto each Mueller Hinton agar plate. These include tetracycline (30 µg), nitrofurantoin (300 µg), erythromycin (15 µg), chloramphenicol (30 µg), gentamicin (10 µg), ciprofloxacin (5 µg), ceftriaxone (30 µg), and amoxycillin (10 µg).Antibiotics used were selected among the currently available and commonly used chemotherapeutic agents for treatment of UTI infection.

The predetermined sets of antibiotic-impregnated disks were dispensed onto the surface of the inoculated Mueller Hinton agar plates using sterile forceps. Each disk was pressed down individually to ensure complete contact with the agar surface. The plates were incubated for 24 hours at 37℃.After 24 hours of incubation, each plate was examined for zone of inhibition. The diameters of the zone of complete inhibition (judged by the unaided eye), including the diameters of the disk zones, were measured in millimeters to the nearest whole millimeter, using a ruler. The sensitivity of the isolates to the antibiotics were recorded as susceptible, intermediate and resistant by referring to standard diameter of the zone of inhibition (CLSI, 2014).

Table 3. 3. Zone Reading Interpretive Chart of Susceptibility

No	Antibiotic	Resistant	Intermediate	Sensitive
1	Amoxicillin (10µg)	≥17	14-16	13
2	Ceftriaxone(30µg)	≥35		
3	Chloramphenicol(30µg)	≥18	13-17	≤12
4	Ciprofloxacin(5 µg)	≥21	16-20	≤15
5	Erythromycin(15 µg)	≥23	14-22	≤13
6	Gentamicin(10µg)	≥15	13-14	≤12
7	Nitrofurantoin(300µg)	≥17	15-16	14
8	Tetracycline(30µg)	≥15	12-14	≤11

Reference; Performance Standards for Antimicrobial Disk Susceptibility Test **Clinical and Laboratory Standards Institute** 34 (1); Jan. 2014

3.9. Data Analysis

The whole data obtained from the study participants at HHC (Hasasa Health Center) as well as from the laboratory experiment were carefully recorded. These data were entered into the computer and analyzed using ANOVA with SPSS version 20 statistical package. P-values of less than 0.05 were considered as statistically significant.

4. RESULTS AND DISCUSSION

4.1. Overall Prevalence of UTI

During the study period, urine samples from 384 complainants of urinary tract infection were examined. Of these, 44 urine samples were positive for uropathogens giving an overall prevalence of 11.5% (Table 1). This result was lower than other results reported 30.2%, 22.7%, and 17.8%, from Ethiopia by Fantahun and Bayeh (2009), Mulugeta and Bayeh (2010), and Gizachew (2012), respectively. Similarly, they were also lower than the results reported from Iran (13.2%)and Brazil (14.82%)byFarajnia*et al*., (2009)and Barros *et al*., (2008), respectively. However, the prevalence of UTI (11.5%) was higher than those of the other studies done in Ethiopia (9.2%), andIran (8.7%)(Getnet andWondwosen, 2011; Mansour*et al*., 2009).The differences in results among different studies may be due to differences in methodologies, study population, andsample size used in the studies.

Table 4.1. The Overall Prevalence of UTI among the Study Participants.

	Number (%) of cases of UTI	
Urine samples	Frequency	Percentage (%)
Positive	44	11.5
Negative	340	88.5
Total	384	100

4.2. Prevalence of UTI by Sex among Study Participants

Urinary tract infection distribution among patients demonstrated that females presented the highest prevalence of the infection than males. Both genders male and female were susceptible to infection, but because of their anatomy and reproductive physiology, women are more vulnerable to the infection than men (Samia, 2012) are. In this study, the number of female patients complaining about urinary tract infections was 291(75.8%). Of

the suspected females, 256(88%) were negative and 35(12%) were positive. The total number of male patients with complaints of UTI in this study was 93(24.2%). Out of this, about 84(90.3%) were negative and the rest 9(9.7%) were positive. Of the positive samples, males and females constitute about 9(20.4%) and 35(79.5%), respectively. The number of positive females exceeds the number of positive males by 26(59.1%) (P=0.048; x^2 =3.895). There is a statistically significant difference in prevalence of UTI between the two sexes; $p < 0.05$(Table 2).

Table 4.2.Prevalence of UTI by Sex among the Study Participants.

Sex	Positive No (%)	Negative No (%)	Total No (%)	P-value	Chi-Square
Male	9(9.7)	84(90.3)	93(24.2)		
				0.048	3.895
Female	35(12.0)	256(88)	291(75.8)		
Total	44(11.5)	340(88.5)	384(100)		

Resultof this study showed a more or less similar prevalence of UTI between sexes with other reported studies conducted in Ethiopia where the prevalence of UTI in male and female was shown to be 33% and 67%, respectively (Fantahun and Bayeh, 2009). Barros *et al*. (2008) also showed a statistically significant predominance of females over males in prevalence of UTI by reporting 79.4% and 20.6% for females and males, respectively.

The anatomical relationship of the female's urethra and vagina makes it liable to trauma during sexual intercourse as well as bacteria being massaged up the urethra into the bladder during pregnancy and childbirth. Several reports have also indicated that females were more prone to having UTI than males (Kolawale*et al*., 2009).Physiological and anatomical differences are believed to account for the differences in distribution of UTI in males and females. This is because of the fact that compared to females; the drier environment in the male urethra prevents the optimal growth of bacteria. The antimicrobial activity of prostate secretions and longer distance between the

anus and urethra meatus are among the factors responsible for the differences in prevalen ce between the two genders (Hooton, 2000).

4.3. Prevalence of UTI by Age in the Study Population

This study showed that age may be one of the factors affecting the prevalence of UTI. The ages of the study, population ranged between 9 and 61 years with a mean age of 31.2 yrs. Age categorization with in class interval was calculated using the formula given by Sturges formula.This formula gives k = 1 + 3.322($\log_{10} n$), where k stands for the number of class intervals and n is the number of values in the data. Width of the class intervals is determined by dividing the range by k, the number of class intervals(Sturges, 1926).

In this study, five (5) age class intervals is determined and the highest prevalence of UTI was seen in the age group 19-28 and followed by 29-38 which account for 4.95% and 3.65% respectively. The other age categories also showed more or less close values in prevalence of UTI. As can be seen from Table 3, the age groups 39-48, more than 49 and 9- 18 account for the prevalence of 1.6%, 0.8%, and 0.5%, respectively, with p = 0.138; x^2= 6.969 (Table 3). These values do not show statistically significant difference between age categories.

Table 4.3.Prevalence of UTI by Age Group among the Study Participants.

	No of study subjects		No of Positive samples (%)		P-value	Chi-Square
Age group	Male (%)	Female (%)	Male (%)	Female (%)		
9-18	8(2.1)	16(4.2)	1(0.3)	1(0.3)		
19-28	21(5.5)	88(22.9)	2(0.5)	17(4.4)	0.138	6.969
29-38	27(7.03)	92(24)	3(0.8)	11(2.9)		
39-48	32(8.4)	48(12.5)	1(0.3)	5(1.3)		
≥49	37(9.6)	15(3.9)	2(0.5)	1(0.5)		

Total	84(21.9)	256(66.67)	9(2.3)	35(9.1)

The distribution of UTI in the current study showed the highest prevalence in the age range 19-28 (17.4%) which was lower than the prevalence reported by a study conducted in other parts of Ethiopia in which it was shown to be 27.16% for the age range 21-30 (Getachew*et al*., 2013).

The results reported in this study were also in line with those reported from other areas in which the prevalence of UTI for the age ranges 19-39 and 40-49, were shown to be 53.5% and 25.9%, respectively (Janet, 2010).In healthy women, the prevalence of bacteriuria increases with age from about one percent in female (5-14 years of age) to more than 20 percent in women of the age of 80 years old (Colgan*et al*., 2006).

The majority 35(9.1%) were from females, and 17(4.4%) from patientsof 19-28 years old. This supports the idea women are more prone to UTIs. Likewise, UTIs were morecommon among women of reproductive age groups which agrees with earlier studies in this countryand abroad.

4.4. The Prevalence of Uropathogenic Bacteria Isolated in the study

In this study, five different isolates were identified with the highest prevalence shown by *E.coli*, 25(56.8%), followed by *Proteus mirabilis*, 10(22.7%), and *Klebsiella pneumoniae* ,6(13.6%); while the lowest prevalence was shown by*Enterococus*spp., 2(4.6%), and *Enterobacter*spp. 1(2.3%) (Table 4).

Different studies were conducted in different parts of Ethiopia, which showed similar results with the present study. A study conducted at Dessie Health Research Laboratory to assess the prevalence and antibiogram of bacterial isolates from urinary tract infections indicated that *E.coli*(63.6%) was the dominant isolate followed by *Klebsiella*spp(8.5%) and *Proteus* spp 8.2% (Kibret and Abera, 2014). Another study done at Jimma University Teaching Hospital indicated that *Klebsiella spp.*(33.3%) and *E.coli*(27.7%) were the most common bacterial pathogens isolated, followed by *Enterobacter spp.* 6% (Teshager*et al.*,

2008). This result is different from the results obtained in the current study because*Klebsiella*spp. is not the predominant isolate in the present study.

A study conducted in Ethiopia also showed that the prevalence of *E. coli*and*Klebsiellapneumoniae* were the first and second most prevalent isolates showing a 55.1% and 16.4% prevalence, respectively (Theodros, 2010). This is in agreement with the results of the present study. In addition, the same result was reported from other bacteriological studies conducted at Gondar University Hospital with *E. coli*(31.7%) being the most prevalent and the commonest bacterial pathogen (Yismaw*et al*., 2012).

Mohamed (2010) isolated eight different uropathogens and obtained the highest incidence for *E. coli* 123(49.2%) followed by *Proteus mirabilis* 55(22%) and *Klebsiella pneumonia* e 40(16 %), which is in agreement also with this study. The same author also obtained the lowest incidence for *Staphylococcus aureus*and *Enterobacter spp.* with an incidence of 4(1.6%) and 1(0.4%) respectively. However, another study conducted in Nigeria showed that *E. coli* had low prevalence that is 30%**(**Turay*et al*., 2014).

Table 4.4.Bacteria SpeciesTypeand Frequency Isolated from the Study.

Bacteria isolated	**Frequency**	**Percentage**
Escherichia coli	25	56.8
Proteus mirabilis	10	22.7
Klebsiellapneumoniae	6	13.6
Enterococcus spp.	2	4.6
*Enterobacter*spp.	1	2.3
Total	44	100

Escherichia coli (56.8%) *was* themost dominant isolate in the current study, which is similar to other studies (Theodros, 2010; Yismaw*et al*., 2012; Kibret and Abera, 2014). This confirms that *Escherichia coli* are one of the most prevalent gram-

negative aerobic bacterial pathogen causing urinary tract infections. Hence, it is considere d as the most prevalent uropathogenic isolate due to its virulence factors for colonization and invasion of the urinary epithelium (Anderson *et al*., 2004).

4.5. Antibiotic Susceptibility Tests for the Isolated Uropathogens

In this study, the antibiotic susceptibility profiles of the bacterial isolateswere determined and the results are shown in Table 5. Among 44(11.5%) isolates subjected to 8 antibiotics, 88.6%, and 81.8% of the isolates were resistant to amoxicillin and tetracycline, respectively, whereas, 27.3% and 36.4% were resistant to nitrofurantoin and chloramphenicol, respectively. Similarly, 50%, 52.3%, 70.5%, and 77.3% of the isolates were resistant to gentamicin, ciprofloxacin, ceftriaxone, and erythromycin, respectively. As the results of the study show, intermediate resistance was observed by 6.8%, 4.6%, and 2.3% of the isolates to chloramphenicol, erythromycin, and gentamicin, respectively.On the other hand, 72.7%, 56.8%, 47.7%, 29.5%, 18.2%, and 11.4% of the isolates were sensitive tonitrofurantoin, chloramphenicol, ceftriaxone, ciprofloxacin, & gentamicin, tetracycline & erythromycin and amoxicillin, respectively.

Table 4.5.Antibiotic Susceptibility of Bacterial Isolates Identified in the Study (n=44).

Antibiotics	Susceptibility patterns		
	Resistant	Intermediate	Sensitive
Amoxicillin (10µg)	39(88.6%)	0	5(11.4%)
Ceftriaxone (30µg)	31(70.5%)	0	13(29.5%)
Chloramphenicol (30µg)	16(36.4%)	3(6.8%)	25(56.8%)
Ciprofloxacin (5 µg)	23(52.3%)	0	21(47.7%)
Erythromycin (15µg)	34(77.3%)	2(4.5%)	8(18.2%)
Gentamicin (10µg)	22(50%)	1(2.3%)	21(47.7%)
Nitrofurantoin (300µg)	12(27.3 %)	0	32(72.7%)
Tetracycline (30µg)	36(81.8%)	0	8(18.2%)

The proportion of resistant isolates to amoxicillin and tetracycline were high in the current study as compared to earlier studies conducted in Addis Ababa in which 78.5% and 77.7% of the isolates found to be resistant to amoxicillin and tetracycline, respectively (Getachew*et al*., 2011). The percentage of amoxicillin and tetracycline resistance in the present study was comparable to those reported from Dessie in which 83.9% and 76.7%, of the isolates, respectively, were found to be resistant. A comparably result in nitrofurantoin susceptibility was reported from Dessie, in which 95.5% of the isolates were found to be sensitive to this drug (Mulugeta and Bayeh, 2010).The finding that,88.6% and81.8% isolates were resistant to Amoxicillin and Tetracyclinehave great importance and implies that these antibiotics cannot be used as empirical therapy for urinary tract infection particularly in the study area.

According to this study, the choice of antibiotics for empirical treatment of UTI caused by bacterial pathogens was nitrofurantoin and chloramphenicol. The lowest level of resistance against nitrofurantoin might be due to its narrow range of clinical indication, which might have resulted from its less frequent usage (Hooton, 2000). The high-level resistance of beta-lactam ring containing antibiotics (amoxicillin, ampicillin etc) could happen because of the presence of extended spectrum beta-lactamase in the strains (Ben-Ami *et al*., 2009).

The higher resistance of *E. coli* to amoxicillin (96%)in this study was in agreement with the findings in Dessie where 87.3% resistance was observed to amoxicillin (Mulugeta and Bayeh, 2010). In another study conducted at Jimma Specialized Hospital, nearly similar resistance was observed for *E. coli* and *Klebsiellapneumoniae*(100%) to amoxicillin.Again, a comparable resistance has been reported from a study conducted in Iraq in which *E. coli* showed 100% resistance to tetracycline and low resistance to Chloramphenicol 24.4 % (Mohamed, 2010). Other studies showed that *E. coli* hadhigh percentage of resistance to amoxicillin87% (Mezue, 2005).

Table 4.6.AntibioticsResistance of Each Bacterial Isolates against Eight Antibiotics.

Antibiotics	*E. coli* (25)	*Proteus mirabilis* (10)	*Klebsiella pnemoniae* (6)	*Enterococcus* spp. (2)	*Enterobacter* spp. (1)
	N (%)	N (%)	N (%)	N (%)	N (%)
Amoxicillin (10µg)	24(96%)	8(80%)	4(66.7%)	2(100%)	1(100%)
Ceftriaxone (30µg)	15(60%)	9(90%)	4(66.7%)	2(100%)	1(100%)
Chloramphenicol(30µg)	5(20%)	8(80%)	2(33.3%)	1(50%)	0
Ciprofloxacin (5µg)	13(52%)	5(50%)	3(50%)	1(50%)	1(100%)
Erythromycin (15µg)	18(72%)	9(90%)	4(66.7%)	2(100%)	1(100%)
Gentamicin (10µg)	13(52%)	5(50%)	2(33.3%)	1(50%)	1(100%)
Nitrofurantoin(300µg)	2(8%)	8(80%)	1(16.7%)	1(50%)	0
Tetracycline (30µg)	20(80%)	7(70%)	5(83.3%)	2(100%)	1(100%)

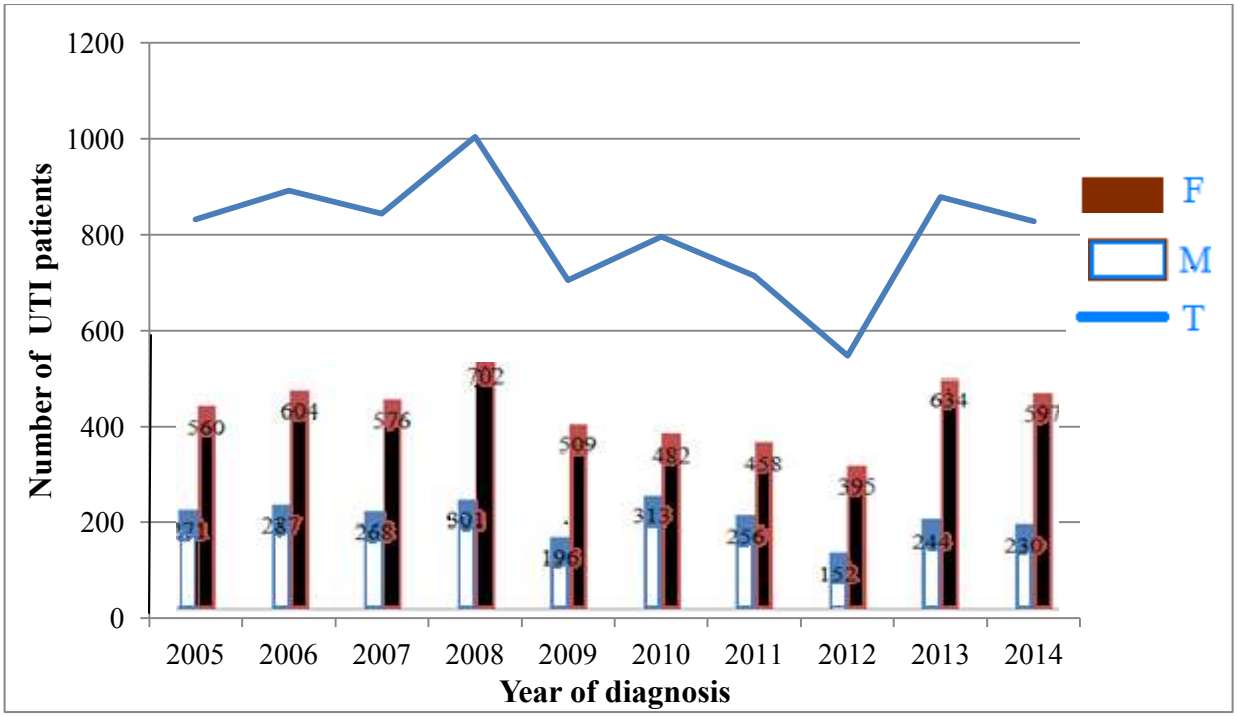
N= Number of isolates resistant to antimicrobial agents, %= Percentage of isolates resistant to the antimicrobials.

As seen from this study, most of the isolates showed resistance to most antibiotics.One reason for this resistance can be the presence of many private pharmacies and clinicsin the study area, which might have contributed to overuse of antibiotics, and self-medication resulting in drug resistance.As drug resistance among pathogens is an evolving process, routine surveillance and monitoring studies should be conducted to proved physicians with knowledge about the most effective empirical treatment of UTIs.

4. 6. Trend of UTI in the Study Area from 2005 to 2014

Trendof UTI in the study area for the last ten years were studied using a retrospective analysis of Clinical Health records kept between the years 2005 and 2014 from Hasasa Health Center. The data collected from the study area show the previous UTI

prevalencehistory in the study area and used tocomparewith thepresent study result in that the prevalence of infectionshows more or less in decreasing situation.



F-female M-male T-total

Figure 2.Trend of UTI prevalence over the last ten years in the study area (2005- 2014)

As can be seen from Figure 2, in the last ten years, the highest prevalence was observed in the year 2008. The next highest prevalence of infection was seen in the year 2013. During the first three years, i.e. 2005, 2006, and 2007, UTI showed relatively more or less similar prevalence but there was a general decreasing trend from 2007 to 2009. However, the trend showed slight increment in year 2010 and then the trend again showed a more pronounced decrease in the year 2012. Between 2013 and 2014, again there had been a sharp increase in prevalence. From the figure it can be seen that the highest and lowest prevalence in ten years were 1003 and 547 cases, respectively, per 8035 people. These values corresponded to the years 2008 and 2012, respectively. Although the data are too small and premature to generalize, the trend seems to show a cyclic pattern of increase and decrease every three to four years.

5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Summary

A cross sectional study was conducted in Hasasa Health Center from March to may 2016 to determine the overall prevalence of uropathogens from patients complaining about UTI. The study involves urine culture on all 384 urine samples, which was collected from suspected patients. After sample collection, culturing and identification of isolated urophatogens were performed according to National Committee for Clinical Laboratory Standards procedures. Culturing was done by using Mac Conkey agar and blood agar. Uropathogens identification was performed by using biochemical test (lactose fermentati on test, indole test, citrate test, ureas test, and motility).

Antibiotic sensitivity testing was carried out with Modified Kirby Baur disc diffusion technique on Mueller Hinton agar against tetracycline, nitrofurantoin, erythromycin, chloramphenicol, gentamicin, ciprofloxacin, ceftriaxone, and amoxicillin. Evaluation of trend and patterns of UTI over the past ten years from 2005 to 2014 was performed by using data record of patient in health center.

5.2. Conclusion

In conclusion, the present study showed that 44(11.5%) overall prevalence of UTI that is lower than most of study conducted in other area. The incidence of urinary tract infection was higher in female population as compared with males due to physiology. In this present study, high prevalence of UTI was observed in the age group of 19-28(4.95%). Five different uropathogens were identified among them *E. coli* was considered as dominant pathogen. The organisms showed resistance to older urinary antimicrobial agents such as amoxicillin and tetracycline. This indicates that increased consumption of a particular antibiotic can be a pathway to its resistance. Nitrofurantoin and chloramphenicolwere effective in the treatment of UTI. In the current study, the prevalence of UTI is lower than previous years in the study area when compared with retrospective trend analysis for the last ten years. This indicate that the prevalence of UTI decreasing in the area so health professionals in the area continue educating population in all round and giving empirical treatment if they encounter a case.

5.3. Recommendation

Based on the results, the following recommendations are made:

- Further studies should be done to identify other uropathogens causing UTI and drug sensitivity since this study done for three month only, it cannot assess all uropathogens.
- Healthcare providers must educate residents and families of the study area on UTI transmission and protection
- Drugs for which the isolates have developed resistance (amoxicillin and tetracycline) should not be used as a drug of choice for the treatment of UTI without making sensitivity test.
- Drug sensitivity test must be done at least once or twice a year to examine development of drug resistance in the area.
- Control the distribution of antimicrobials to prevent people from purchasing drugs without prescription.
- Evaluate the trend of urinary tract infection over the past year to take appropriate control measures on the prevalence of uropathogens.

6. REFERENCES

Apodaca G. 2004. The Uroepithelium: Not Just a Passive Barrier. *Traffic*, 5; 117-128.

Avorn J, Monane M, Gurwitz J. H. 1994. Reduction of Bacteriuria and Pyuria after Ingestion of Cranberry Juice. *Journal of the American Medical Association*, 271: 751-754.

Balasoiu D, Van Kessel KC, Van Kats-Renaud HJ, Collet TJ, Hoepelman AI. 1999. Granulocyte functions in women with diabetes and asymptomatic bacteriuria. *Diabetes Care,* 20(3): 392-395.

Barros ICAR, Ribeiro A U, Costa ACV, Nunes D C, Neres K S, Carneiro D S. 2008.Microorganisms Prevalent in Urinary Tract Infections and Antimicrobial Sensitivity Profile Analysis of Patients who Attended at the Military Police Hospital of the State of Goiás. *Journal of Health Sciences Institute,* 29(4): 243-247.

Ben-Ami R, Rodríguez-Baño J, Arslan H, Pitout J D, Quentin C, Calbo E S. 2009. Multinational Survey of Risk Factor for Infection with Extended-Spectrum B-Lactamase Producing *Enterobacteriaceae*In Non-Hospitalized Patient. *Journal of Clinical Infectious Disease*, 49: 682–90.

Bhattacharya S. 2006. Extended Spectrum Beta-Lactamase from Petri-Dish to the Patient. *Indian Journal of Medical Microbiology*, 24: 20-24.

Blanco, J., M. Blanco, J. E. Blanco, A. Mora, E. A. Gonzalez, M. I. Bernardez, M. P. Alonso, A. Coira, A. Rodriguez, J. Rey, J. M. Alnso, and M. A. Usera. 2003. Verotoxin – Producing *E. coli* in Spain; Prevalence, Serotypes, and Virulence Gene of O157: H7 and non-O157 VTEC in Ruminants, Raw Beef Products, and Humans. *Experimental Biology Medicine*, 228; 345-351.

Brun-Buisson C, Meshaka P., Pinton P, Valle B. 2004. Reappraisal of the Epidemiology and Outcome of Severe Sepsis in French Intensive Care Unit. *International Care Medicine*, 30: 580-588.

Carol E. Chenoweth, Karen R. Fonde, R. Van Harrison, and Lauren B. Zoschnick. 2005. Urinary Tract Infection Guideline (University of Michigan Guidelines for Healthy System), pp 1-9.

Cheesbrugh, M., 2005. Microbiological test. In district laboratory practice in tropical country.

Cheesbourgh M. (2006) Medical Laboratory Manual for Tropical Countries.2nded. England Butter Worth-Heineman Ltd.

Chen Y H, Po-Ren Hsueh , Robert E. Badal , Stephen P. Hawser ,Daryl J. Hoban , Samuel K. BouchillonYuxing N, David L. 2011. Antimicrobial susceptibility profiles of aerobic and facultative Gram-negative bacilli isolated from patients with intra-abdominal infections in the Asia-Pacific region, according to currently established susceptibility interpretive criteria. *Journal of Infection*, 62: 280-291.

Clinical and Laboratory Standards Institute(CLSI).2014. Performance Standards for Antimicrobial Disk Susceptibility Test, 34 (1).

Colgan R., Nicolle A. Mcglone. 2006. Asymptomatic Bacteriuria in Adult. *American Family Physician,* 74: 985-990.

Creinin M D, Simhan H N. 2009. Can we communicate gravidity and parity better? *Obstetric Gynecology*, 113(3): 709-711.

Dalela G, Gupta S, Jain D K, Mehta P. 2012. Antibiotic Resistance Pattern in Uropathogens at a Tertiary Care Hospital, at Jhalawar with Special Reference to Esbl, Ampc β-Lactamase and MRSA Production. *Journal of Clinical Diagnosis Research,* 6: 645-651.

Demilie T, Beyene G, Melaku S, Tsegaye W. 2012. Urinary bacterial profile and antibiotic susceptibility pattern among pregnant women in North West Ethiopia. *Ethiopian Journal of Health Sciences*, 22(2): 121-128.

Dobrindt U. 2010. Virulence factors of uropathogens. *Urology Agent*, 4(9): 598-605.

Dulczak S., Kirk. 2005. Overview of the Evaluation, Diagnosis, and Management of Urinary Tract Infection in Infant and Children. *Journal of Urology*, 15(4**)**.

Ebo D G, Mertens A V, De Clerck L S, Gentens P, Daelemans R. 1998. Relapse of Wegener's Granulomatosis Presenting as a Destructive Urethritis and Penile Ulceration. *Clinical Rheumatology,* 17: 239-241.

Emilie KJ, Edward DK. 2011. UTIs in Pregnancy. *International Journal of Antimicrobial Agents,* 85-90.

FantahunBiadglegne and BayehAbera. 2009.Antimicrobial Resistance of Bacterial Isolates From Urinary Tract Infections at FelgeHiwot Referral Hospital Ethiopia, *Ethiopian Journal of Health Development,* 23(3): 236-238.

Farajnia S, Alikhani M Y, Ghotaslou R, Naghili B, Nakhlband A. 2009. Causative Agents and Infection in the North west of Iran. *International Journal of InfectiousDisease*, 13: 140-144.

Fihn S D. 2003. Acute Uncomplicated Urinary Tract Infection In Women. *The NewEngland Journal of Medicine*, 349(3); 259-266.

Foster R T Sr. 2008. Uncomplicated Urinary Tract Infection In Women. *ObsetGynecol Clinical of North America,* 35(2); 235-248.

Foxman B. 2002. Epidemiology of Urinary Tract Infections Incidence, Morbidity, and Economic Costs. *American Journal of Medicine,* 113(1 A); 5-13.

Francesco M A, Giuseppe R, Laura P, Riccardo N, Nino M. 2007. Urinary Tract Infections in Brescia Italy: Etiology of Uropathogens and Antimicrobial Resistance Of Common Uropathogens. *Medical Science Monitoring,* 13: 136-144.

Graham JC, Galloway A.(2001) The laboratory diagnosis of urinary tract infection. *Journal of ClinicalPathoogy,* **54**:911–919.

Geerlings S E, Stolk R P, Camps M J, Netten P M, Hoekstra J B. 2000. Asymptomatic Bacteriuria May be Considered as Complication in Women with Diabetes. *Diabetes Care,* 23(6): 744-749.

GetachewKabew, TamiratAbebe, AdaneMiheret. 2013. A Retrospective Study on Prevalence and Antimicrobial Susceptibility Patterns of Bacterial Isolates From Urinary Tract Infections in TikurAnbessa Specialized Teaching Hospital Addis Ababa, Ethiopia.*Ethiopian Journal of Health Development,* 27(2):111-117.

GetenetBeyene and WondewosenTsegaye. 2011. Bacterial Uropathogens in Urinary Tract Infection and Antibiotic Susceptibility Pattern in Jimma University Specialized Hospital, Southwest Ethiopia. *Ethiopian Journal of Health Science*, 21(2); 141-146.

GizachewYismaw, Daniel Asrat, YimtubezinashWoldeamanuel, Chandrashekhar G. Unakal. 2012. Urinary Tract Infection: Bacterial Etiologies, Drug Resistance Profile and Associated Risk Factors in Diabetic Patients Attending Gondar University Hospital, Gondar, Ethiopia. *European Journal of Experimental Biology,* 2(4); 889-898.

Goldman, D. A. and W. CHuskins, 1997. Control of nosocomial antimicrobial-resistant bacterial; a strategy priority for hospital worldwide. *Clinical Infectious Disease*, 24(139-145).

Gregory GAnderson, Karen WDodson, Thomas MHooton, and Scott J. Hultgren. 2004. Intracellular Bacterial Communities of *Uropathogenic Escherichia Coli* In Urinary Tract Pathogenesis. *Trends in Microbiology*, 12(9); 424-430.

H. A. Sturges. 1926. The Choice of Class Intervals. *Journal of the American Statistical Association*, 21; 65-66.

Habte T M, Dube S, Ismail N, Hoosen A. 2009. Hospital and Community Isolate of Uropathogens at a Tertiary Hospital in South Africa. *South Africa Medical Journal*, 99(58); 4–7.

Hanno PM. Painful bladder syndrome interstitial cystitis and related disorders. Wein AJ

Harding G K, Zhanel G G, Nicolle L E, Cheang M, Manitoba. 2002. Antimicrobial Treatment in Diabetic Women With Asymptomatic Bacteriuria. *The New England Journal of Medicine,* 347(20); 1576-1583.

Healthy Protection Agency (HPA). 2007. Identification of *Staphylococcus* Species, *Micrococcus* Species, and *Rothia* Species. *Issue,* 2(1).

Herbert A Sturges 1926. The Choice of Class Intervals. *Journal of The American Statistical Association*21(65-66).

Hooton T M. 2000. Pathogenesis of Urinary Tract Infections. *Journal of Antimicrobial Chemotherapy*, 46(1); 1-17.

Hsu LY, Tan T Y, Tam V H, Kwa A, Fisher D A, Koh T H. 2010. Surveillance and Correlation of Antibiotic Prescription and Resistance of Gram-Negative Bacteria In Singaporean Hospitals. *Antimicrobial Agents & Chemotherapy,* 54(3); 1173-1178.

Ipe D S., Sundac L, Benjamin W H Jr, Moore K H, Ulett G C. 2013. Asymptomatic bacteriuria: prevalence rates of causal microorganisms, etiology of infection in different patient populations, and recent advances in molecular detection. *Federation of European Microbiological Societies Microbiology Letters,* 346(1); 1-10.

Jaik N P., K. Sajuitha, U. Sekar, S. Kuruvilla, G. Abraham, S. Shroff. 2006. Renal Abscess. *Journal Associations of Physicians India, 54*; 241-243.

Janet A. 2010. Detection of Some Bacterial Infection in Urinary Tract and their Antibiotic Sensitivity. *International Journal for Sciences and Technology*, 5(3); 21-29.

Jone L A., Woodman P J., Ruiz H E. 2009. Urinary Tract Infection During Pregnancy. *EmergenceMedicine,* 9.

Kashef N, Djavid G E, Shahbazi S, 2010. Antimicrobial susceptibility patterns of community-acquired uropathogens in Tehran. *Iran Journal of Infectious Developing Countries,* 4; 202-206.

Kibret M. and Abera B. 2014. Prevalence and Antibiogram of Bacterial Isolates From Urinary Tract Infections at Dessie Health Research Laboratory, Ethiopia. *Asian Pacific Journal of Tropical Biomedicine*, 4(2): 164-168.

Kim B. N., S. I. Choi, and N. H. Ryoo. 2006. Three Year Follow-Up of An Outbreak of SerratiaMarcescensBacteriuria In A Neurosurgical Intensive Care Unit. *Journal of Korean Medical Sciences, (*21); 973-978.

Kladenský, J. 2012. Urinary Tract Infections in Pregnancy When To Treat, How To Treat, and What To Treat. *Ceska Gynecology,* 77(2); 167-71.

Klemm, P., V. Roos, G. C. Ulett, C., Svanborg and M. A. Schembri. 2006. Molecular Characterization of the *Escherichia coli* Asymptomatic Bacteriuria Strain 83972. *Infectious Immunology*, 74; 781-785.

Klevens, R. M., Edward J. R. 2007. Estimating Health Care Associated Infections and Deaths In U.S. Hospitals. *Public Health Reports,* 122; 160-166.

Kolawale A. S., Kolawale O. M., Kandaki-Olukemi Y. T., Babatunde S. K., Durowade K. A., Kplawale C. F. 2009. Prevalence of Urinary Tract Infection Among Patient Attending

DalhatuAraf Specialist Hospital LafiaNasarawa State, Nigeria. *International Journal of Medical Science,* 1(5); 163-167.

Kumazawa J, Matsumoto T. 1997. Complicated UTIs. *Infectioulogy*, 1; 19-26.

Kurutepe S., S., Surucuoglu, C. Sezgin, H. Gazi, M. Gulay and B. Ozbakkaloglu. 2005. Increasing Antimicrobial Resistance in *Escherichia coli* Isolates From Community-Acquired Urinary Tract Infections During 1998-2003 in Turkey. *Japan Journal of Infectious Disease*, 58: 159-161.

Latif, Ahmed S. 2004. Urogenial Infections in Tropics. http;\\www.tropmed.org\primer\chapter8.

Linuma, Y. 2007. Infection Control Strategies for Antimicrobial Resistance. *Nippon Rinsho*, 65: 175-184.

Mansour A., Manijeh M., ZohrehPourdangchi. 2009. Study of Bacteria Isolated From Urinary Tract Infections and Determination of Their Susceptibility to Antibiotics.*Jundishapur Journal of Microbiology* 2(3): 118-123.

Martin G S, Mannino D M, Eaton S, Moss M. 2001. The Epidemiology of Sepsis in the United States From 1979 Through 2001. *The New England Journal of Medicine,* 348: 1546-1554.

Masinde A, Gumodoka B, Kilonzo A, Mshana S E. 2009. Prevalence of Urinary Tract Infection Among Pregnant Women at Bugando Medical Centre. *Tanzania Journal of Health Research,* 11(3): 154-161.

Mezue K.2005. Antibiotic sensitivity patterns in UTI at a Tertiary Hospital. Medicine on CD-Rom Oxford University, 1; 522-528.

Mohamed R. Ali. 2010. Detection of Uropathogens in Urinary Tract Infection and their Sensitivity to many Antimicrobial Agents. *Ibn Al-Haitham Journal for Pure & Applied Science,* 26(3); 15-24.

Mond M C, Gruneberg R N, Smellie, 2005. A study of childhood urinary tract infection in general practice. *Brazil Medical Journal,* 1; 602-605.

Mori R, Lakhhanpaul M, Verrier-Jones K. 2007. Diagnosis and Management of Urinary Tract Infection in Children. Summary of NICE Guideline, 335(7616); 395039.

MulugetaKibret and BayehAbera. 2010. Prevalence and Antibiogram of Bacterial Isolates From Urinary Tract Infection at Dessie Health Research Laboratory, Ethiopia. *Asian Pacific Journal of Tropical Biomedicine*, 4(2); 164-168.

Mulvey, M. A. 2002. Adhesion and Entry of Uropathogenic *Escherichia coli.Microbiology*, 4(5); 257-271

Naber K.G. 1999. Experience with the New Guidelines on Evaluation of New Anti-Infective Drug for the Treatment of Urinary Tract Infection. *International Journal of Antimicrobial Agents,* 11: 189-196.

Naber, K .G., M .C .Bishop, T. E. Bjerklund-Johansen, H. Botto, M. Grabe, B. Lobel, J. Palou and P. Tenke. 2006. Guidelines on the Management of Urinary and Male Genital Tract Infections. *European Association of Urology,*

Naing L. T., T. Winn, and B. N. Rusil. 2007. Practical Issue in Calculating Sample Size for Prevalence Studies. *Archives of Orofacial Sciences*, 1; 9-14.

National Committee for Clinical Laboratory Standards (NCCLS), 2014.Performance Standards for Antimicrobial Susceptibility Testing; Twenty-Fourth Informational Supplement. CLSI document M100-S24. Wayne, PA

National Committee for Clinical Laboratory Standards. 2007. Performance standards for antimicrobial disk susceptibility tests. Approved standard M2-A6. Wayne, Pa

National Institute for Health and Clinical Excellence(NICE). 2007. Urinary Tract Infection in Children Diagnosis, Treatment, and Long-Term Management. National Collaborating Center for Women's and Children's Health, London. NICE(Clinical Guidance 6).

Nicolau D P. 2011. Current Challenge in the Management of the Infected Patient. *Current Opinion of Infectious Diseases*, 24(1); 1-10.

Nicolle L E. 2001. Epidemiology of Urinary Tract Infection. *Journal of Infectious Medicine*, 18; 153-162.

Olsen B E, Hinderaker S G, Lie R T, Gasheka P, Baerheim A. 2000. The Diagnosis of Urinary Tract Infection among Pregnant Women In Rural Tanzania. *Acta Obstetric Gynecology Scandinavian,*79(9): 729-736.

Overturf G. D. 2002. Urinary tract infection, In; Jenson H B, Baltimore R S. ED. *Pediatric infection disease, 2nd ed*. Saunders Company, United States of America, pp. 983-984.

PremalaSurshkumar, Mike Jones, Robert G Cumming, and Jonathan C Craig. 2009. Risk Factors for Urinary Tract Infection in Children; A Population Based Study of 2856 Children. *Journal of Paediatrics and Child Health* 45(87-97).

Rahimkhani M., Khaveri-Daneshvar H, Sharifian R. 2008. Asymptomatic Bacteriuria, and Pyuria in Pregnancy. *World Journal of Urology,* 17(6); 415-420.

Ramzan M., S Bakhsh and A. Salam. 2004. Risk Factors in Urinary Tract Infection. *Gomal Journal of Medicine Sciences*, 2(5); 50-53.

Rodriguez-Bano J, Navarro M, D Romero. 2004. Epidemiology and Clinical Features of Infections Caused by Extended Beta Lactam-Producing *E. coli* In Non-Hospitalized Patients. *Journal of Clinical Microbiology*, 42; 1089-1094.

Rosser C J, Bare R L, Meredith J W. 2004. Urinary Tract Infections in the Critically Ill Patient with A Urinary Catheter. *American Journal of Surgery*, 177: 287-290.

Rosser C,Bare R, Meredith J. 1999 . UTIs in critically patient with urinary catherter. *American journal of surgery*, 177(287-290).

Rubin R H., Shapiro E D, Andriole V T, Davis R J, Stamm. 1992. General Guideline for the Evaluation of New Anti-Infective Drug for the Treatment of UTI. *The European Society of Clinical Microbiology and Infectious Diseases*, pp. 240-310.

Saint S., Kaufman S R., Thompson M., Rogers M A., Chenowith C E. 2005. A Reminder Reduces Urinary Catheterization in Hospitalized Patients. *Journal on Quality and Patient Safety*,31(8): 455-462.

Samia S. Khamees. 2012. Urinary Tract Infection Causative Agents, The Relation BetweenBacteriuria and Pyuria .*World Applied Sciences Journal,* 20(5**)**: 683-686.

Santos F.,Oraichi D, Berard A. 2008. Prevalence and Predictors of Anti-Infective Use During Pregnancy. *Pharmacoepidemiol Drug Safety,* 19(4): 418-427.

Sawalha R. M.H. 2009. Prevalence of Urinary tract Infection among Children Primary school in Nablus. An-Najah National University, Nabulus Palestine, Pp 31-33.

Schaeffer A. J., Jones J. M. and Dunn J. K. 1999. Association of *vitro Escherichia coli* Adherence to Vaginal and Buccal Epithelial Cells with Susceptibility of Women to Recurrent Urinary Tract Infections. *The New England Journal of Medicine*, 304(18); 1062-1066.

Schlager, T. A., Hendley, J. O., Bell, A. L. and Whittam, T. S. (2002) 'Clonal diversity of *Escherichia coli* colonizing stools and urinary tracts of young girls', *Infect Immun,*

Shankel S. 2010. Bacterial Urinary Tract Infection. Merck Sharp and Dohm Crop., a subsidiary of Merck and Co., Inc., Whitehouse Station, N. J. USA

Sibiani S A A. 2010. Asymptomatic Bacteriuria in Pregnant Women in Jeddah Western, Region of Saudi Arabia. *Journal of King Abdul-Aziz University Medical Sciences,* 17(1); 29-42.

Smail and Vanquez. 2007.Antibiotics for asymptomatic bacteruria in pregnancy. *Cochrane Database of Systematic Review, issue* 2;CD00490.

Smellie, J., Edwards, D., Hunter, N., Normand, I. C. and Prescod, N. 1995. Vesico-Ureteric Reflux and Renal Scarring. *Kidney International Supply*, 4; 65-72.

Smith P W, Seip C W, Schaefer S C, Bell-Dixon C. 2000. Microbiologic Survey of Long Terms Care Facilities. *America Journal of Infectious Control,* 28: 8-13.

Stamm W. E., Norrby S. R. 2001. Urinary Tract Infectious Disease Panorama and Challenge. *Journal* of *Infectious Disease,* 183(1); 1-4.

Talkoff- Rubin N E. Cotran R S, Rubin R H. 2008. Urinary tract infection, pyelonephritis, and reflux nephropathy. Brenner and Rector is The Kidney. Saunders Elsevier, Philadelphia, 1203-1238.

Tan C K, Ulett K B, Steele M, Benjamin W H Jr, Ulett G C. 2012. Prognostic Value of Semi-Quantitative Bacteriuria Counts in the Diagnosis of Group B Streptococcus Urinary

Tract Infection: A 4-Year Retrospective Study In Adult Patients. *Biomedical center forInfectious Diseases,* 12: 273.

Tanagho, E. A and J. W. Mcaninch. 2004. Bacterial Infection of the Genitourinary Tract. McGraw-Hill companies Inc.United States of America. pp 203-227.

Teshager L, Asrat D, Gebre-selassie S, Tamiru S. 2008. Catheterized and non-catheterized Urinary tract infections among patients attended at Jimma university teaching hospital. *Ethiopian Medical Journal*, 46(1); 55-62.

Tessema, B., A. Kassu., A. Mulu., G. Yismaw. 2007. Predominant Isolates Of Urinary Tract Pathogens And Their Antimicrobial Susceptibility Patterns in Gondar, University Teaching Hospital, North West Ethiopia. *Ethiopian Medical Journal*, 1; 61-67.

Theodros, G. 2010. Bacterial Pathogens Implicated In Causing Urinary Tract Infection (UTI) and Their Antimicrobial Susceptibility Pattern in Ethiopia. *RevistaCENIC.CienciasBiologicas*, 41: 1-6.

Thomson C, Armitage A. 2010. *Urinary tract infection.* Oxford Textbook of Medicine, Oxford University Press, Oxford, pp 4103-4122.

Todar K. 2011. Pathogenic *E.coli*. Retrieved from http; \\textbookofbacteriology.net\e.coli.html. Retrieved on 7\2\2015

Trautner B W, Hull R A, Darouiche R O. 2005.Prevention of Catheter-Associated Urinary Tract Infection. *Current Opinion on Infectious Disease,* 18(1); 37-41.

Turay, A. A., Eke, S. O., Oleghe, P. O, and Ozekhome, M. C. 2014. The Prevalence Of Urinary Tract Infections Among Pregnant Women Attending Antenatal Clinic At Ujoelen Primary Health Care Centre, Ekpoma, Edo State, Nigeria.*International Journal of Basic, Applied, and Innovative Research*, 3(1); 86 – 94.

Ugbogu O, Ogbonnaya R, Nworie O. 2010. Asymptomatic Bacteriuria among Pregnant Women in Abuja, Nigeria. *Journal of Microbiology,* 24; 2024 -2027.

Vasudevan R. 2014. Urinary Tract Infection An Overview of the Infection and the Associated Risk Factors. *Journal of Microbiology Experiment*, 1(2); 88-108.

Wagenlehner, F. M., and K. G. Naber. 2004. New Drug for Gram-Positive Uropathogen. *International Journal of Antimicrobial Agents*, 24; 39-43.

Wan Y L, Lee T Y, Bullard M J, Tsai C C. 1996. Acute Gas-Producing Bacterial Renal Infection Correlation Between Imaging Finding and Clinical Outcome. *Radiology,* 198(2); 433-438.

Weichhart T, Haidinger M, Hörl, W H, Säemann M D. 2008. Current Concept of Molecular Defense Mechanism Operative During Urinary Tract Infection. *European Journal of Clinical Investment*, 38: 29-38.

Wein, A. J, 2007.Campbell-Walsh urology.9thed China; Saunders Elsevier Volume number **4**p 23-37.

Wild S, Roglic G, Green A, Sicree R, King H. 2004. Global Prevalence of Diabetes Estimates for the Year 2000 and Projection for the Year 2030. *Diabetes Care,* 27(5): 1047-1053.

Wilde, M H. 2003. Urinary Tract Infection in People With Long Term Urinary Catheter. *Journal of Wound Ostomy and Contingence Nursing*, 30: 314-323.

Yismaw G, Asrat D, Woldeamanuel Y, Chandrashekhar G. 2012. Urinary Tract Infection: Bacteria Etiologies, Drug Resistance Profile and Associated Risk Factors in Diabetic Patients Attending Gondar University Hospital. *European Journal of Experimental Biology*, 2(4): 889-898.

7. APPENDICES

Consent Form for Study Participants

Name: _____

Identification Code: _____

(To be translated to Patient language during Interview)

I read the information sheet (or it has been read to me). I have understood that this study is about "**Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection Visiting Hasasa Health Center, GedabHasasa*Woreda*, and West Arsi Zone, Ethiopia**". The investigator has briefed me that there is minimal risk associated with sample collection. I have asked some questions and clarification has been given to me. For this study, I have been requested to give urine sample. I have also been informed that I will respond to some questions related to demographic characteristics. I have been informed that the study might directly benefit me based on the laboratory results. The investigator also informed me that all the laboratory results and all private information about me will be kept confidential. Moreover, I have also been well informed of my right to withdraw from participating in this research and that my actions will have no impact on the overall health services. I have been given enough time to think over before I signed this informed consent. It is therefore, with full understanding that I gave my informed consent and approved my agreement with my signature.

Participant's signature: _____Date:_____

Information Sheet for Study Participants

(To be translated to Patient language during Interview)

Title of Research: **Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection Visiting Hasasa Health Center, GedabHasasa*Woreda*, West Arsi Zone, Ethiopia**.

Name of the Principal Investigator: AdugnaFeyissa.

Purpose: The purpose of this research is to determine the prevalence and the antibiotic susceptibility patterns of bacterial isolates of urinary tract infection. The prevalence of UTI and the antibiotic resistance of uropathogens have been changing over the past years, both in the community and in hospitals. Knowledge of the local bacterial etiological agents and their susceptibility patterns is required to trace any change that might have occurred in time so that updated recommendation for empirical therapy of UTI is given. Current information on prevalence and antimicrobial susceptibility patterns is essential for appropriate therapy. This research was developed with this aim and would like to ask your voluntary participation in the conduct of the study.

Benefits:Your participation in this research might have direct benefit to you depending on the laboratory result that your treating physician can use for management of your condition. In addition, your participation is likely to help us in understanding the bacterial isolates causing UTI, drug resistant pattern and urinary tract associated risk factor of urinary tract pathogen patient which may benefit in the future to design preventive measures for others.

Incentives:There is no any incentive for your participation in this research project.

Confidentiality: Any information collected about the participant from this research will be kept confidential. It will be stored in a file, which will not have your name on it, but a code number assigned to it. Which number belongs to which name will be kept under lock and key, and it will not be revealed to anyone except the principal investigator and health professional attending you.

Participant Right:You have full right to refuse from participating in this research if you do not wish to participate. You have also had full right to withdraw from this research at any time you wish to, without losing any of your rights as a patient in your health institution.

Data Collection Form

I. Patient Identification

1. Serial No. _____
2. Patient name _____
3. Age of the Patient : _____
4. Gender: Male ☐ Female ☐
5. Date of clinic admission/visit: _____
6. Time of sample collection _____
7. Clinical diagnosis: UTI ☐
8. Clinical specimen examined; Urine ☐
9. Organism isolated: _____
10. Antibiotic Sensitivity Pattern:

Antibiotic	**Disk Content**	**Zone Reading(mm)**	**Result (S or I or R)**
Tetracycline	30µg		
Erythromycin	15µg		
Chloramphenicol	30µg		
Ceftriaxone	30µg		
Nitrofurantoin	300 µg		
Ciprofloxacin	5 µg		
Gentamicin	10µg		
Amoxicillin	10µg		

Zone Reading Interpretive Chart of Susceptibility

No	Antibiotic	Disk Content	Resistant	Intermediate	Sensitive
1	Tetracycline	30µg	≥15	12-14	≤11
	Erythromycin	15µg	≥23	14-22	≤13
	Chloramphenicol	30µg	≥18	13-17	≤12
4	Ceftriaxone	30µg	≥35		
5	Nitrofurantoin	300 µg	≥17	15-16	14
6	Ciprofloxacin	5 µg	≥21	16-20	≤15
7	Gentamicin	10µg	≥15	13-14	≤12
8	Amoxicillin	10µg	≥17	14-16	13

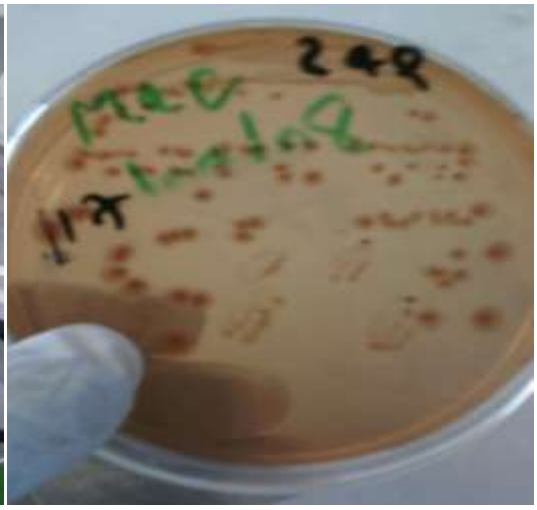
Reference; Performance Standards for Antimicrobial Disk Susceptibility Test **Clinical and Laboratory Standards Institute** 34 (1); Jan. 2014

8. **ANNEX**

Instrument in Sterilization

Prepared Media in Water Bath

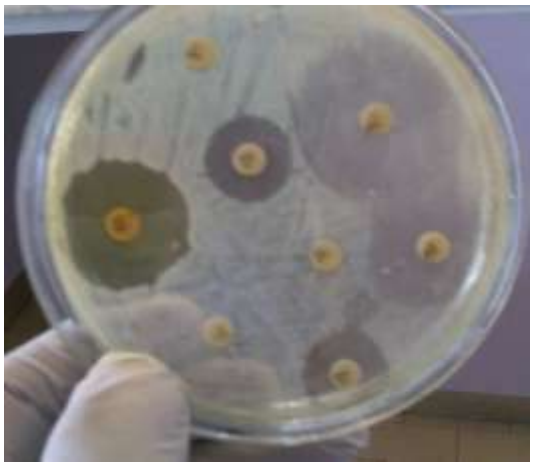
Prepared Media in Refrigerator



Colony on Mac Conkey Agar

Blood Agar Preparation

Colony Counting



Drug Susceptibility

Biochemical Test

Ref. WKEAC/3017/05

Date 14/02/05

To Hasasa Health Center

Hasasa

Subject; Providing Ethical Clearance to Adugna Feyissa

We are writing this in reference to Adugna Feyissa who is a graduate student in the department of Biology in Haramaya University.

The candidate request ethical clearance from Hasasa town Health office to conduct research in the center. The candidate thesis research proposed with a title Prevalence and Antibiotic Susceptibility of Bacterial Uropathogens among Patients of Urinary Tract Infection (UTI) Visiting Hasasa Health Center, Gadeb Hasasa *Woreda*, West Arsi Zone, Ethiopia.

This is there fore to kindly request Hasasa Health Center to allow him to conduct his research work and thesis writes up in the center.

With Best Regards

Abdurahaan Huseen Waac

Cc

Mr. Adugna Feyissa

አርሲ ዩኒቨርሲቲ
የጤና ሳይንስ ኮሌጅ

ARSI UNIVERSITY
COLLEGE OF HEALTH SCIENCES

Ref No A10/11/15/CP
Date 20/02/8

To Assela Teaching & referral Hospital Laboratory Department

Assela

Subject : **Request for support**

Mr. Adugna Feyisa is a student at Haramaya University is going to undertake a research project entitled as '**Prevalence and antibiotic susceptibility of bacterial uropathogens among patients of Urinary Tract infection visiting Hassasa Health center, Gedeb Assasa Woreda Arsi Zone, Ethiopia**'

This is therefore: to request your good office to give him the whole round support during the sample processing and execution of the research project. The University appreciates you usual cooperation in advance!

With regards!

ሀይሉ ፍቃዱ ደምሴ
Hailu Fekadu
Demssie (MPH)

ም/ዲን ምርምርና ማህበረሰብ አገልግሎት ተ/ዲን
Vice Dean For Research and
Community Service

CC//

V/D for research and community service

አርሲ ዩኒቨርሲቲ
የጤና ሳይንስ ኮሌጅ
Arsi University
College of Health Sciences