KAIRUKI UNIVERSITY

DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN ATTENDING ANTENATAL CLINIC AT KILEMA HOSPITAL FROM JUNE TO JULY 2025

INVESTIGATOR: DR. MAYOLA THOMAS MASSAWE

REGISTRATION NO: HK/PG/OG/22/0051

SUPERVISOR: DR. MONICA CHIDUO

CO-SUPERVISORS: 1. PROFESSOR RICHARD MWAISWELO

2. DR. GODFREY MARO

2025

Certification

I Dr. Monica Chiduo. The undersigned certify that this dissertation is the candidate's work carried out under my direct supervision. I certify that I have read and recommend for consideration by Kairuki University the title: **"ASYMPTOMATIC AND SYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN ATTENDING KILEMA HOSPITAL.** "In partial fulfillment of the requirements for the Master's degree of partial fulfillment of the requirements for awarding the Master of Medicine in Obstetrics and Gynecology at Kairuki University. 2025

Supervisor signature..... Date: 20/10/2025

Co-Supervisor Signature..... Date: 27/10/2025

Declaration and Copyright

I, **Mayola T. Massawe,** declare that this dissertation is my original work, it has never been presented to any academic institution for a similar degree award, and is not currently under copyright.

.....Mass..... 20/10/2025

Signature **Date**

Acknowledgment

Special thanks to my supervisors, Dr. Monica Chiduo, Professor Richard Mwaiswelo and Dr. Godfrey Maro, for their contributions to the development of this dissertation.

Additionally, I would like to thank the Obstetrics and Gynecology and departments at Kairuki University and department of microbiology Kilema Hospital for their contribution and guidance during the preparation of my dissertation.

I would also thank my General Superior of the congregation of Our Lady of Kilimanjaro Sisters (CDNK), and My Fellow Sisters for their prayers and social support during my dissertation.

Special thanks to the Catholic Diocese of Moshi for their financial support for my dissertation.

Finally, I would like to thank my colleagues in Obstetrics and Gynecology for their input during preparation of my dissertation.

Dedication

This proposal is dedicated to my Superior General, my fellow CDNK. Sisters, my family, for their prayers, Kilema hospital team for their encouragement, and support during my research.

Abstract

Problem statement

Urinary tract infection (UTI) is among the public health concern in pregnancy, which affects both maternal and fetal health. Symptomatic UTIs are detected and treated but **asymptomatic infections usually remained unnoticed**, but still they have significant risks on both maternal and fetal.

There is challenges on management of UTIs in pregnancy because of increased incidence of **antimicrobial resistance (AMR)**. Irrational use of antibiotics has reduced its effectiveness, this situation has raised concern in most low-income countries like Tanzania, where routine urine culture and antimicrobial susceptibility testing are not performed.

The **prevalence of asymptomatic and symptomatic UTIs among pregnant women** and **antibacterial susceptibility patterns data is limited**. Lack of this information hinder the evidence based clinical decision making and proper management of UTI which is results based.

Therefore, there is a great need of investigating the prevalence of asymptomatic and symptomatic urinary tract infection and antibacterial susceptibility in pregnant women attending antenatal care at Kilema Hospital.

The research findings will provide baseline data which will enhance the strengthening of diagnosis, improve treatment guidelines, and improve maternal and neonatal outcomes.

Objective: This study aimed to determine the prevalence of asymptomatic and symptomatic urinary tract infection, to assess the antibacterial susceptibility for pregnant women attending Antenatal care at Kilema Designated Hospital.

Methodology

A cross-sectional Analytical Hospital-based study was conducted for pregnant women attending antenatal clinic at Kilema Hospital at any gestation age, with a sample size of 310, using a non-probability sampling technique. Midstream samples were collected in a well labeled urine container, transported to laboratory and processed using standard microbiology techniques. Bacterial isolates were identified, and antimicrobial susceptibility testing was performed using the Kirby-Bauer disc diffusion method. Demographic and clinical data were collected using structured questionnaires.

Results

In this study, the total number of pregnant women who participated was 310. Asymptomatic UTI 65/310(21%) had positive urine culture results. Symptomatic urinary tract infections 75/310 (24.1%) had positive urine culture results. The overall prevalence of asymptomatic urinary tract infection was 21% and symptomatic UTI was 24.1%. *E. coli* was the most isolated organism with 64% for symptomatic and 55.4% for asymptomatic UTIs, followed by *P. aeruginosa* 27% for asymptomatic and 24% for symptomatic UTIs. *Klebsiella pneumoniae* isolate on asymptomatic UTI was 4.6%, *Klebsiella oxytoca* for symptomatic 9.4%, asymptomatic was 4.6%, *Staphylococcus saprophytica* was only isolated from asymptomatic UTI by 3.2%, *Acinobacter, Proteus mirabilis*, and *Enterobacter* species were the least organisms found.

Conclusion

From this study symptomatic and Asymptomatic urinary tract infections was still high 24.2% and 21% respectively. Other findings from this study was gradual increase in *Pseudomonas aeruginosa* for both Symptomatic and Asymptomatic urinary tract infection 24% and 27%, which was very low or absent from the research done in other places. There was remarkable antibacterial resistance of the most prescribed antibiotics on pregnant women such as nitrofurantoin, Azithromycin and Amoxycillin/Clavulanic Acid.

TABLE OF CONTENTS

List of Tables

List of Figures

Abbreviations

ASB	Asymptomatic Bacteriuria
ARDS	Acute Respiratory Distress Syndrome
IUGR	Intrauterine Growth Restriction
LBW	Low birth weight
UTI	Urinary Tract Infection
K.C.M.C	Kilimanjaro Christian Medical Center
ASB	Asymptomatic bacteriuria
MDR	Multidrug Resistance
CFU	Colon Forming Unit per milliliter
C.D.N. K	Congregatio Dominae Nostre De Kilimanjaro
B.M.C	Bugando Medical Center.

Operational Definitions

A Colon Forming Unit is where a colony of microbes grows on a Petri dish, from one single microbe(1).

CLED Agar: is a differential medium used for the isolation and enumeration of bacteria from urine(2).

E**numeration**: The process of determining the number of bacteria in a given sample(3).

Asymptomatic urinary tract infection: Patients without symptoms of urinary tract infection but positive for urine culture.

Symptomatic urinary tract infections: Patient with signs and symptoms of urinary tract infection. like fever, dysuria, frequency of urination, and abdominal pain.

-Bacterial isolates: Organisms isolated from study

Antibiotic resistance: The presence of antibiotic resistance can affect the effectiveness of treatment for UTIs in pregnant women, influencing clinical outcomes.

Bacterial pathogens: Different bacterial species which causes symptomatic or asymptomatic UTIs.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Urinary tract infection(UTI) is among the most common bacterial infections during pregnancy, accounting for 23.9% of hospital visits worldwide by pregnant women(4). The infections may be asymptomatic or symptomatic bacteriuria, occurs in 5.3–23% and 17.9–55.9% of pregnant women(5,6). The prevalence of UTI in Dar as-Salam, Tanzania, among pregnant women is 31.6% (7,8). Where the Asymptomatic bacteriuria prevalence ranges from 13% to 17%(9).

Urinary tract infection is associated with an increased risk of prematurity and low birth weight for the fetus, and on maternal side, sepsis, Pre-term labor, and pre-premature rupture of membrane. The physiological changes which occur during pregnancy, such as ureteral dilatation due to compression of ureters from the gravid uterus, and hormonal effects of progesterone, cause smooth muscle relaxation leading to urethral dilatation and urine stasis, which can cause them susceptible to urinary tract infections (UTI) related complications(10,11).

About 36% of pregnant women develop ureteral dilatation (hydronephrosis of pregnancy), which persists until delivery (12).Pregnant women with untreated ASB 20-30% of them will develop symptomatic cystitis, and 30-40% will develop

pyelonephritis. Untreated Pyelonephritis in pregnancy is associated with kidney disease which can lead to morbidity and mortality in pregnant mothers. The UTI also associated with preterm delivery (13).

Escherichia coli is the most common microorganism isolated on urine culture which account for 80-90% of the isolates among pregnant women. Remaining isolates are: *Klebsiella, Enterobacter*, *Proteus* species, and gram-positive bacteria. On gram-positive isolates, *Staphylococcus, Saprophyticus,* and *Enterococcus* are the most common species. The susceptibility of these organisms to antibiotics and antibiotic therapy should be prescribed based on established patterns of antimicrobial sensitivities in the specific area. (13,14)

Routine screening of pregnant women for UTI will decrease the UTIs complications. This will enable early diagnosis and treatment of urinary tract infections in pregnant women before the occurrence of complications(14).

Urinary tract infection (UTI) is among the common cause of perinatal complications which affects approximately 8% of pregnancies. These infections represent a spectrum, from ASB to symptomatic acute cystitis, to the most serious, Pyelonephritis(13,15,16).

1.2 Statement of the problem

Urinary tract infection (UTI) is among the public health concern in pregnancy, which affects both maternal and fetal health. Symptomatic UTIs are detected and treated but **asymptomatic infections usually remained unnoticed**, but still they have significant risks on both maternal and fetal.

There is challenges on management of UTIs in pregnancy because of increased incidence of **antimicrobial resistance (AMR)**. Irrational use of antibiotics has reduced its effectiveness, this situation has raised concern in most low-income countries like Tanzania, where routine urine culture and antimicrobial susceptibility testing are not performed.

The **prevalence of asymptomatic and symptomatic UTIs among pregnant women** and **antibacterial susceptibility patterns data is limited**. Lack of this information hinder the evidence based clinical decision making and proper management of UTI which is results based.

Therefore, there is a great need of investigating the prevalence of asymptomatic and symptomatic urinary tract infection and antibacterial susceptibility in pregnant women. The research findings will provide baseline data which will enhance the strengthening of diagnosis, improve treatment guidelines, and improve maternal and neonatal outcomes.

Rationale

There is increased trend of Asymptomatic and symptomatic urinary tract infections globally and management has complicated due to increased rates of antimicrobial resistance of commonly used antibiotics, especially in low-income countries like Tanzania where there is no routine culture and sensitivity for UTIs in pregnant women. There is limited data of **prevalence of asymptomatic and symptomatic UTIs in pregnant women** and **antibacterial susceptibility**. Understanding the burdens of these infections, and local resistance profiles, will provide planning of evidence-based treatment, updating hospital protocols, and prevention of adverse pregnancy outcomes.

This study will provide essential data on the prevalence of UTIs and antimicrobial susceptibility on pregnant women. The findings will support improvement of diagnosis also to have contributions on the global effort against antimicrobial resistance.

1.4 Research questions

1. What is the prevalence of **asymptomatic and symptomatic UTI bacterial infections** in pregnant women at Kilema Hospital?
2. What are the most common bacterial pathogens responsible for infections in asymptomatic and symptomatic UTIs in pregnant women?
3. What is the **antibacterial susceptibility pattern** of the common bacterial pathogens identified in asymptomatic UTIs in pregnant women?

1.5 Objectives

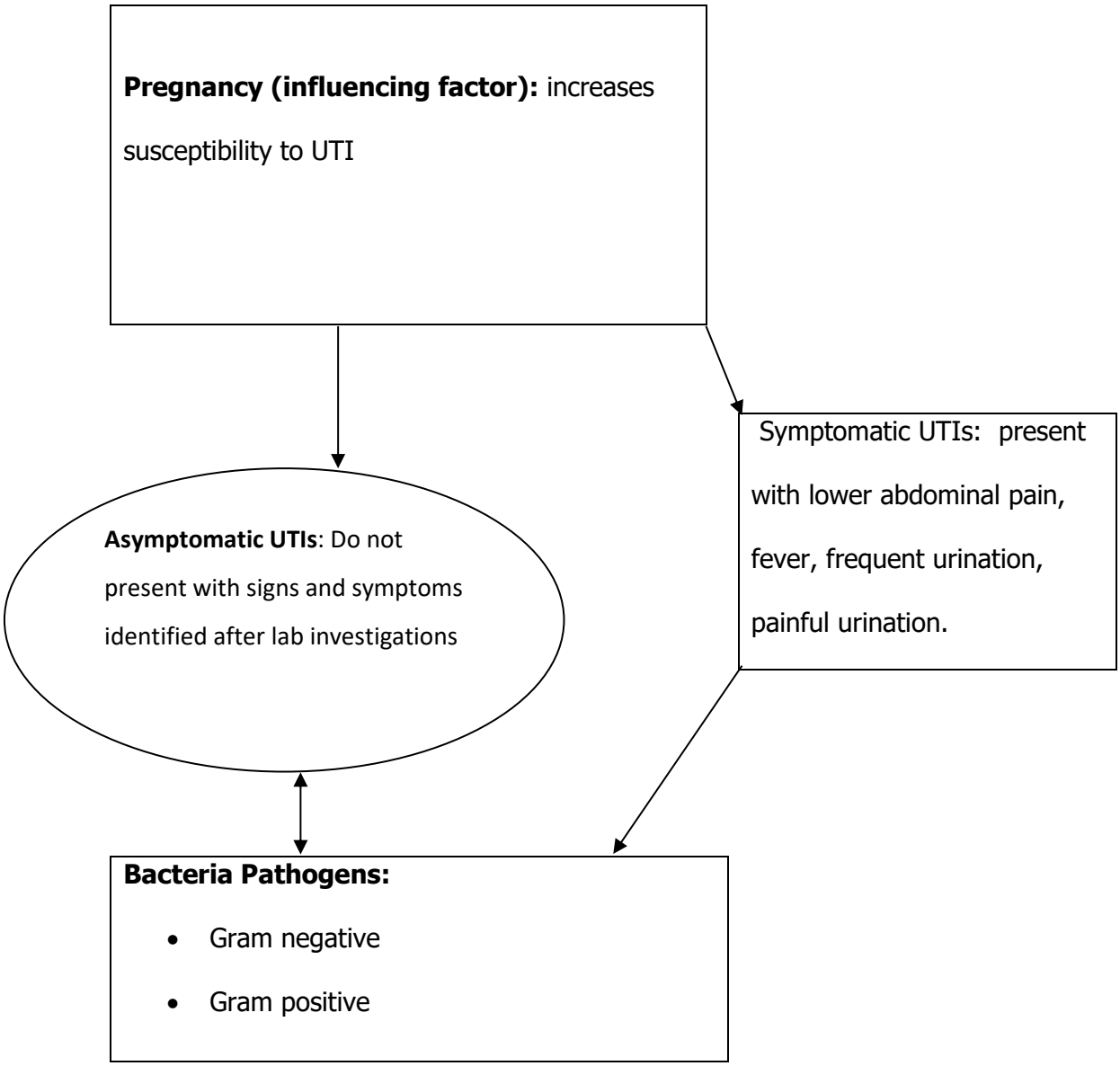
Broad objective

To assess the prevalence of **asymptomatic and symptomatic urinary tract bacterial infections** among pregnant women at Kilema Hospital and to evaluate their **antibacterial susceptibility** patterns.

Specific objectives

1. To determine the prevalence of asymptomatic and symptomatic urinary tract infections in pregnant women attending Kilema Hospital.
2. To investigate the types of bacteria responsible for asymptomatic and symptomatic urinary tract infections in pregnant women.
3. To determine the antibacterial susceptibility patterns of bacterial isolates in pregnant women with asymptomatic and symptomatic urinary tract infections.

1.6 Theoretical Framework/Conceptual Framework



Description of conceptual frame work

Conceptual frame work of this study aimed to demonstrate the prevalence of symptomatic and asymptomatic urinary tract infections on pregnant women and antibacterial susceptibility for pregnant women attending antenatal clinic at Kilema hospital Kilimanjaro Tanzania.

The dependent variables will be described by pregnant women with symptoms of urinary tract infections such as lower abdominal pain, painful urination frequency urination and fever and those do not present with symptoms urinary tract infections.

Antimicrobial resistant contributed with irrational use of antibiotics, failure to adhere on standard guideline and inadequate culture and sensitivity in lower facility level.

CHAPTER TWO

2.0 LITERATURE REVIEW

Urinary tract infection (UTI) and antimicrobial susceptibility among pregnant women due to their potential complications. The prevalence of ASB and symptomatic among pregnant women globally is 5.3-23.9% and 17.9-55.9, respectively. The hospital study on symptomatic and asymptomatic done in Tanzania by Masinde et al in 2009, reported that asymptomatic and symptomatic bacteriuria in pregnant women range from 13% and 17% respectively. In another study done by Mayomba *et al*. 2022 at Bugando Medical Center, the incidence of ASB was 16.9%. Study done by Joseph *et al* 2023 at Sinza District hospital asymptomatic UTI was 9/21(6.6%), *E.coli* isolated was 9/21(42.8%),followed by *Staphylococci spp*.(19.0%). *E.coli* was high resistant to amoxicillin(89%,) amoxicillin-clavulanic acid (89%), trimethoprimim/ sulphamethaxazole (78%) (9,17,18). In Turkey, the asymptomatic rate ranges from 10%-20%, and the symptomatic UTI (32%). *E. coli* contributed 67% and other isolates 33.3%. On antibacterial susceptibility, Fosfomycin was highly sensitive by 100%, followed by meropenem at 99.45%, and nitrofurantoin at 97.8%. Cephalosporin third generation shows some resistance (19,20).

A hospital-based study from Kenyatta National Hospital presented with lower abdominal pain among antenatal women and their etiological microorganism and defined the sensitivity pattern to commonly used antibiotics. The predominant

bacterial pathogens were *Escherichia coli* by 40%, *Staphylococcus species* 25%, *Klebsiella spp.* 10%, other isolates were *Enterococcus, Enterobacter*, and *Citrobacter species*. The isolated gram-negative bacteria were 100% sensitive to meropenem, imipenem, Augmentin, ceftazidime, and levofloxacin. Cefuroxime was about 81%. The bacteria showed significant resistance to gentamycin and ampicillin of up to 80%. The isolated gram-positive bacteria were 100% sensitive to Augmentin, cefuroxime, ceftriaxone, ceftazidime, meropenem, and imipenem but showed significant resistance to levofloxacin, gentamycin, nitrofurantoin, and ampicillin of between 20% and 80% (21). There was difference in the percentage of *E. Coli* growth between Africa and Asia. But in Tanzania, studies are scarce.

A cross-sectional study done in India by *Rafat et.al* on the uropathogen of asymptomatic UTI, with 320 pregnant women, asymptomatic were 21(6.6%). *E.coli* isolated were 9/21(42.8%), followed by *Staphylococci* spp 4/21 (19.0%). *E.coli* demonstrated a high resistance rate to amoxicillin (89%), amoxicillin-clavulanic acid (89.0%), and trimethoprim/ sulphamethaxazole (78.0%) but was susceptible (100.0%) to amikacin, gentamycin, nitrofurantoin, and meropenem. All *enterococci spp* were resistant to trimethoprim/sulphamethaxazole and 66.6% to nitrofurantoin, while *Staphylococci* spp showed 50% resistance (22). A similar study from Ghana found *E. Coli* to be 27%, Klebsiella 23%, and Proteus species 18%. Bacterial susceptibility to gentamycin was sensitive for *E. coli*, and cotrimoxazole was

the most resistant antibiotic (23). From Kenya study done by Onyango *et al.* 2018, the microorganisms that cause UTI in Pregnancy are *E. Coli, Klebsiella-Pneumoniae*, *Staphylococcus, Enterococcus, S. aureus*. This study recruited 210 pregnant women. Of the 99 UTI isolates identified, 78 (78.8%) were gram-negative while 21 (21.2%) were gram-positive bacteria. *E. coli* was the most predominant UTI isolate at 44.5% followed by *Klebsiela pneumoniae* (21.2%) and S. aureus (15.1%). Other organisms were *Pseudomonas aeruginosa, Acinetobacter spp.*, and *Enterococcus spp*., each accounting for 6.1%(24).

A study from Indonesia on antibacterial susceptibility research done by Laily *et al* 2018 on associated risk factors for urinary tract infection among pregnant women. The incidence of UTI was 38.9%. *Escherichia coli* (35.7%) was the most common bacterial isolate, followed by *Staphylococcus aureus* (28.6%), *Staphylococcus epidermidis* (28.6%), and *Klebsiella pneumonia* (7.1%)(25). A cross-sectional study from Saudi Arabia by Labib El-Kashif *et al*.2019 reported that out of 303 pregnant women, 162 were positive for urinary tract pathogens. *Escherichia coli* was the most frequent organism isolated from a positive pregnant woman's urine culture, followed by *Klebsiella pneumonia*, while the lowest was *Staphylococcus saprophytic*. Amoxicillin and cefoxitin are the most used antibiotics by infected pregnant women for the treatment of UTI, while the least used is fusidic acid. (26). From East Africa, especially in Uganda, Bahati Johnson et al. 2021 revealed that the proportion of

culture-positive UTI was 140/400 (35%). Gram-negative bacteria were more prevalent (73%): *Klebsiella pneumoniae* 52(37.41%), *Escherichia coli* 40(28.78%), *Pseudomonas aeruginosa* and *Proteus mirabilis* 7(5.04% each), Citrobacter freundii 1(1%). *Staphylococcus aureus* 33(23.57%) was the only gram-positive isolate. All the isolates were resistant to ampicillin, amoxicillin, amoxicillin/clavulanic acid, and ceftazidime/clavulanic acid (95.7, 95.0, 72.9, and 50.7% respectively). The prevalence of extended-spectrum beta-lactamase-producing Enterobacteriaceae was 29.0% while that of *methicillin-resistant Staphylococcus aureus* was 33.3%. All cultures demonstrated resistance to more than one drug. The majority of the bacterial isolates were sensitive to ciprofloxacin, ceftriaxone, nitrofurantoin, cefotaxime, and gentamycin at 82.9, 81.4, 79.3, 78.6, 66.4, and 65.7% respectively(27). In Ethiopia, a systematic review and meta-analysis done in 2021 on the prevalence of Urinary Tract Infection and its associated factors among pregnant women, the overall pooled prevalence of UTI among pregnant women in Ethiopia was 15.37%(28).

Study done in Nigeria by Ezwugu *et.al* found that the most frequently isolated bacteria were species of E. *coli* (40.6%) followed by *S. aureus* (28.3%), *K. pneumoniae* (16.4%), and *P. aeruginosa* (8.2%). Others Were *Enterococcus* sp. *Enterobacter* sp. and *Proteus* sp. (29). The antibiotic susceptibility test showed that the pathogens were highly sensitive to most of the antibiotics except streptomycin, ciprofloxacin, and gentamycin, which recorded high resistance. This contradicts the report of

Muhammed, who recorded high sensitivity of pathogens to ciprofloxacin. In A study done in the Northern region of Ghana targeted pregnant women receiving antenatal care at a primary health care facility. The antimicrobial resistance pattern of isolates showed that 2 Gram-negatives were resistant to ampicillin in 144(98.6%) of participants, cotrimoxazole (131, 89.7%), ceftriaxone (123, 84.2%), tetracycline (114, 78.1%), erythromycin (107, 73.3%), nitrofurantoin (98, 67.1%), norfloxacin (61, 41.8%), chloramphenicol (58,39.7%), and the least to amoxicillin-clavulanic acid (52, 35.6%), respectively. Low resistance was observed to ciprofloxacin (32, 21.9%), meropenem (29, 19.9%), and gentamicin (29, 19.9%). Gram positives were resistant to ampicillin in 54(70.1%) of the participants, followed by erythromycin (45, 58.4%), cotrimoxazole (37, 48.1%), vancomycin (37, 48.1%), chloramphenicol (35, 45.5%), and ceftriaxone (31, 40.3%). There was low resistance against gentamicin in 9(11.7%) of the participants, amoxicillin-clavulanic acid in 10(13.0%), ciprofloxacin in 19(24.7%), and nitrofurantoin in 22(28.6%) of the participants, respectively(30).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

The hospital-based cross-sectional analytical study. The study involved both clinical and laboratory analyses of urine samples to assess the types of bacteria present, their resistance patterns, and the clinical symptoms associated with UTIs. The average number of antenatal clinic visits is 150 to 200 per month. Among the routine ANC investigations are: HIV test, HB level, Blood group, RH status, urinalysis, and VDRL.

3.2 Study setting

The study was conducted at Kilema Designated Hospital (CDH) located in Moshi Rural District, Kilimanjaro region in the Northern Part of Tanzania. The Hospital Started as a dispensary in 1920, and in 1976 it was upgraded to the level of a hospital, and in 1984 to a District Designated Hospital (CDH). Kilema Hospital is owned by the Catholic Diocese of Moshi. It is operated jointly with the Government of Tanzania through a private-public partnership as the designated hospital of the Moshi District Council (CDH). Kilema Hospital refers patients to Mawenzi Regional Hospital and Kilimanjaro Christian Medical Center zonal hospital (K.C.M.C). It serves a population of 290,000.Antenatal clinic at Kilema hospital is conducted from Monday to Friday 0800 to 0200 hours.

3.3 Study Population

The study focused on **pregnant women** attending Kilema Hospital for prenatal care from the first visit at any gestation age.

3.4. Sample size

The sample size was calculated by using Leslie and Kish's formula in a cross-sectional study.

$N=Z^2 P (1-P)/E^2$

Whereby:

N =the minimum sample size

Z=standard normal deviation

E= marginal error set at 5%

P= Prevalence of urinary tract infection from previous related studies done globally is 23.9%(20)

Given that:

Z=1.96

E=0.05

P=0.239

$N=1.96^2 x 0.239\ (1-0.239)/0.05^2$

Sample size= 279+27.90=307

Sample size =307

3.5 Sampling procedure, inclusion, and exclusion criteria

Pregnant women attending the Antenatal Clinic at Kilema Hospital from the first visit, regardless of gestation age, included those who presented with symptoms suggestive of UTIs (symptomatic) and those with no symptoms (asymptomatic)

Inclusive criteria

- Pregnant women from first ANC visits.

Symptomatic: fever, painful urination, frequent urination, lower abdominal pain.

Asymptomatic: no symptoms

- Pregnant women who accepted to participate by signing a consent form.

Exclusive criteria

Pregnant women who had used antibiotics within 48 hours.

Participants who refused to sign consent form for participation.

3.6 Sampling technique

A **convenience sampling** technique was employed. All Pregnant women attending the hospital for routine prenatal check-ups who met the inclusion criteria were recruited into the study. First case was obtained from day one of data collection where the first participant enrolled was counted as a first case. A minimum sample size of 310 participants who were aimed for, which provided sufficient statistical power for the analysis.

3.7 Study variables

Dependent variable

Urinary Tract Infection in Pregnancy

Independent variable

- ✓ Asymptomatic pregnant women with UTI
- ✓ Symptomatic pregnant women with UTI
- ✓ Bacteria pathogens

3.8 Data Collection-Instruments, Validity and Reliability

Data collection instrument: A structured questionnaires were used to collect demographic information. Components of questionnaires included (age, gestation age, parity, occupation, education level.)

Clinical symptoms for symptomatic: History of lower abdominal pain, fever, painful urination, and frequent urination.

For asymptomatic, no above symptoms.

Well-labeled urine container with: Name, Sample collection date, time, and sample type.

Laboratory results from urine samples

Urine culture: Bacteria growth/No bacterial growth.

Gram stain: Gram-negative/Gram-positive.

Bacteria isolated, type of bacteria, colony count (CFU/mill), number of colonies,

A biochemical test was done to identify specific organisms

Sensitivity testing was done for: nitrofurantoin, azithromycin, amoxicillin+ clavulanic acid, Ceftriaxone, gentamycin, ampicillin, Amikacin, cefotaxime, piperacillin, Imipenem, erythromycin, penicillin, cefotaxime, trimethoprim, Ciprofloxacilin, meropenem.

Antibiotic susceptibility: Susceptible(S), Intermediate (I), Resistant ®.

Lab results were recorded using the number given in correlation with the lab results

3.9 Data collection procedures

- A Qualified Nurse was at the Antenatal clinic for orientation and enrollment of participants.

Potential Participants were informed about the study and its procedures. Questionnaires were filled in by the researcher's assistant to make easy for those who were illiterate to participate. Participants were obtained from antenatal clinic visits daily by using acceptable criteria until the sample size was reached maximum number of recruitments per day was 8 participants. Data collection took almost 39 days.

Principal investigator had the responsibility of assembling research team, training and coordinating team, ensuring rights, safety and wellbeing of participants were observed, to ensure law of institution were observed.

Qualifications of research assistants were as follows:

- Laboratory scientists who deal with giving instructions to participants on sample collection, processing, and investigations.
- Specialist Doctor (Gynecologist) who attended participants, counseling, and treated those whose culture results were positive for bacterial growth on culture and sensitivity.
- -Assistant researcher, technical personnel with computer knowledge who deal with recording and data entry.

The laboratory expert instructed participants on how to take a midstream urine sample. (To allow the First urine to pass, then to collect urine at mid before finishing urination) Participants were given well-labeled urine containers.

Midstream urine was collected using a sterile urine sample container, a screw-capped, leak-proof container. Collected urine samples were transported to laboratory using the same container.

The sample was processed within two hours after collection; in case of unavoidable delay in the processing of the sample, it was refrigerated to prevent the rate of the specimen's bacterial overgrowth.

The urine sample was kept on culture media

The urine sample was taken for Gram stain microscopically to distinguish gram-negative and gram-positive bacteria and for culture and sensitivity.

Gram stain Steps:

1. Primary stain was applied (Cristal violet)
2. A mordant (Gram's iodine) added
3. Rapid decolorization with ethanol, acetone, or a mixture of both.
4. Counterstaining with safranin

The procedure for culture and sensitivity steps:

1. Gently rotation of the urine and to inoculate on a quarter plate of blood Agar(BA) and CLED (Cystine Lactose Electrolyte Deficient). (The inoculation was done with 1ul disposable wire loop).
2. It was Incubated at 35 degrees centigrade for 18-24 hours aerobically
3. The culture was read, and an estimate of the approximate number of colonies
4. The number of colonies on the plate was counted (This is the number of colonies per 1ul of urine)
5. The conservation factor was converted from 1ul into 1ml

Calculation of CFU

For inoculation produces 10 colonies, the number of organisms presented in 0.001ml urine is 10,000 CFU in mil urine.

Interpretation

Less than 10,000 organisms/mL, not significant

10,000-100,000/mL, doubtful significance, suggests repeat specimen indicates bacterial infection, 100,000 mL significant bacteriuria

A bacterial count of 100,000/mil urine could mean an infection or contamination. A repeat specimen was indicated

A count of less than 10,000/ml urine was nearly always due to contamination unless the urine was cultured after antimicrobial treatment had been started.

Appearance of pathogens on CLED agar

E. coli: Yellow opaque colonies often with a slightly deeper colored center

Klebsiella spp: Large mucoid yellow or yellow-white colonies

Proteus: translucent blue-grey colonies

Pseudomonas aeruginosa: green colonies with rough periphery (characteristic color)

Staphylococcal aureus: Deep yellow colonies of uniform color.

Staphylococcus Saprophyticus and other coagulase-negative *staphylococci*: yellow to white colonies.

Biochemical test for Gram-negative

A biochemical test was done for the identification of specific organisms

After Gram stain: for gram-negative, Lactose fermentation (LF) was done, which included:

Oxidase: Positive for *Pseudomonas aeruginosa*.

Citrate test: Negative for *E.coli*

Urease test: negative for *E.coli, P. aeruginosa*, and *Enterobacteriaceae*

Indole test: positive for *E.coli* and *Klebsiella oxytoca*

Motility: Positive for *E.coli*, *Pseudomonas aeruginosa*, and *Enterobacteriaceae*

Triple Sugar Iron: Gas positive for all gram-negative but negative for *pseudomonas Aeruginosa*

Gram-positive Cocci biochemical test

Catalase test: To differentiate *Staphylococcus* species from *Streptococcus* species.

Positive for *Staphylococcus*, negative for *Streptococcus.*

Coagulase test: Differentiates *Staphylococcus aureus* from *Staphylococcus epidermidis* and *Staphylococcus saprophyticus*.

Positive for *Staphylococcus aureus* but Negative for *Staphylococcus epidermidis* and *Staphylococcus saprophyticus*

Novobiocin sensitivity test: Differentiates *Staphylococcus epidermidis* from *Staphylococcus saprophyticus*

Positive for *Staphylococcus epidermidis* and negative for *Staphylococcus saprophyticus*.

3.10 Data analysis

- **Quantitative Data:**
  - Descriptive statistics (e.g., frequency, percentage, mean, standard deviation) were used to summarize demographic and clinical characteristics of the participants.
  - The prevalence of symptomatic and asymptomatic UTIs was calculated and compared.
  - The susceptibility patterns of bacterial isolates were assessed using appropriate statistical methods, such as chi-square tests to determine the resistance rates across different bacteria and to different antibiotics.
- **Qualitative Data:**
  - The qualitative data from questionnaires (e.g., symptoms and medical history) were analyzed for trends and patterns in UTI presentation in pregnant women.

The data collected was reviewed by the principal researcher daily to ensure completeness and consistency before analysis. A pre-test questionnaire was used to collect demographic and clinical data to minimize errors and biases. A computer database was created to enter the coded data daily before analysis.

Quantitative data were double-entered using Statistical Package for the Social Sciences Version 25.

3.11 Ethical consideration

Ethical approval to conduct the study was obtained from the Kairuki University Ethical Review Committee. Permission to carry out the study was obtained from the Health Facility In charge of Kilema Hospital. Written and verbal informed consent was obtained from the study participants. The obtained information was kept confidential, and participant codes were used instead of names. Participants with positive results for UTI were given their results and treated accordingly.

3.12 Plan for Dissemination of Results

Research findings was disseminated to the Department of Obstetrics and Gynecology, Kairuki University, Dean Students' School of Medicine, Kairuki University, Director of Post Graduate Kairuki University, and Medical Officer in Charge, Kilema Hospital.

CHAPTER FOUR

4.0 RESULTS

4.1 Characteristics of the study participants

From Table 1. bellow, the study included a total of 310 study participants. The mean (SD) age of the study participants was 26.8 (5.9) SD years. Age distribution, the younger age group between 18-29% was 211 (68.1%), which was the dominant group. 174 (56.1%) had secondary education, 225 (72.6%) were residing in rural, 245 (79.1%) were married, 106 (34.2%) were peasants, 219 (70.7%) were not employed, 6 (1.9%) were insured, 194 (62.6%) were multi-gravida.

Table 1: Characteristics of the study participants (n=310)

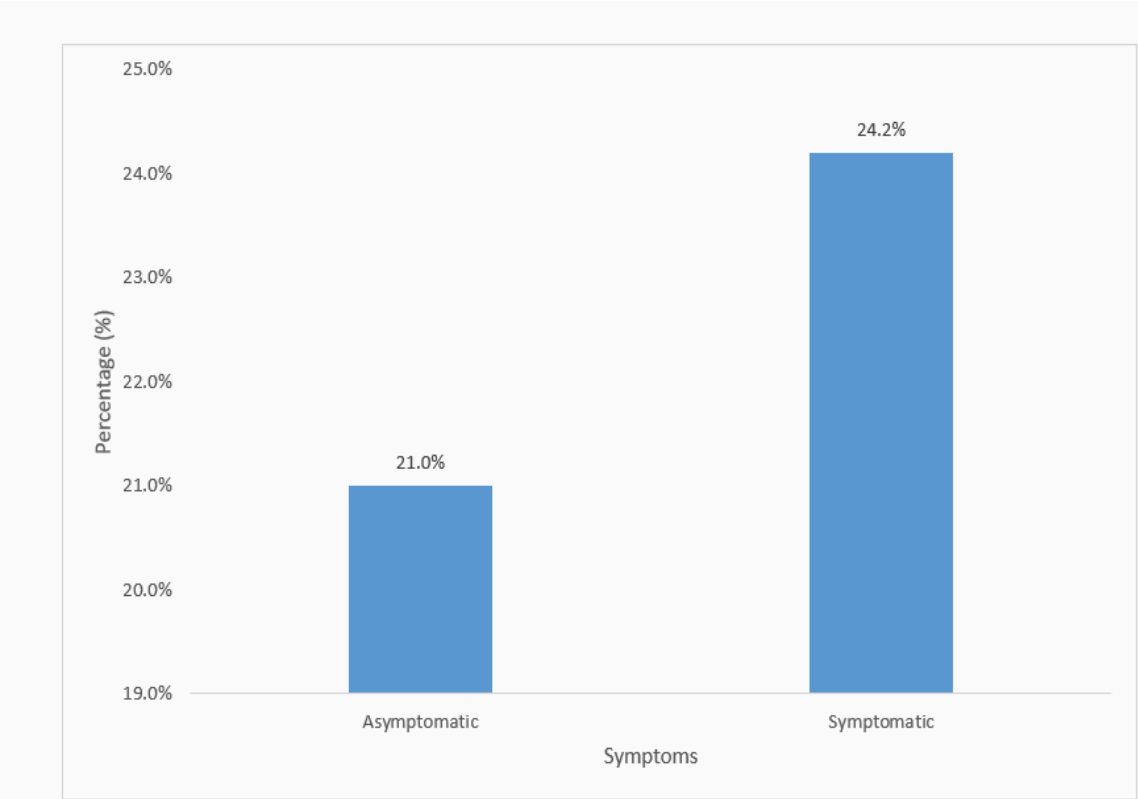
Characteristics	n (%)
Age (mean (SD) (years)	26.8 (5.9)
Age (years)	
< 18	3 (0.9)
18 – 29	211 (68.1)
30 – 39	92 (29.7)
> 39	4 (1.3)

Education	
Primary	107 (34.5)
Secondary	174 (56.1)
Tertiary	29 (9.4)
Residence	
Rural	225 (72.6)
Urban	85 (27.4)
Marital status	
Single	65 (20.9)
Married	245 (79.1)
Occupation	
House wife	76 (24.5)
Peasants	106 (34.2)
Business	94 (30.3)
Entrepreneur	24 (7.7)
Professional jobs	10 (3.2)
Employment	
Employed	19 (6.1)
Not employed	219 (70.7)
Self employed	72 (23.2)

Insurance	
No	304 (98.1)
Yes	6 (1.9)
Gravidity	
Prime	116 (37.4)
Multi	194 (62.6)

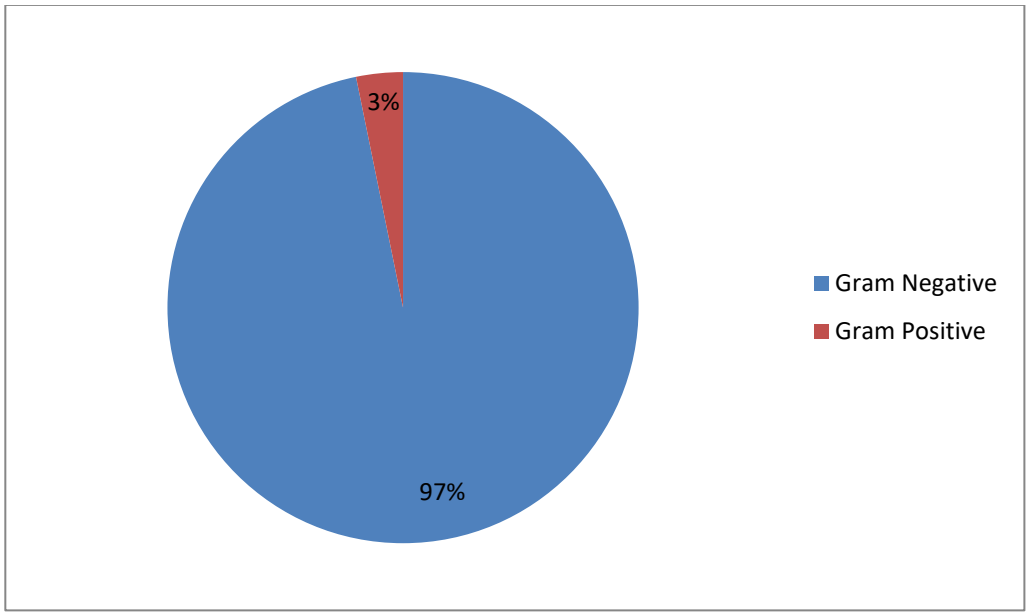
4.2 The prevalence of asymptomatic and symptomatic urinary tract bacterial infections in pregnant women.

Figure 1: Prevalence of Symptomatic and Asymptomatic urinary tract infection with sample size of 310 participants



Asymptomatic gram positive isolated bacteria was 2(3.2%) and gram negative isolated bacteria was 96.8%.

FIGURE 2: PIE CHART FOR GRAM STAIN BACTERIA FOR ASYMPTOMATIC URINARY TRACT INFECTIONS



4.3 The types of bacteria responsible for asymptomatic and symptomatic urinary tract infections in pregnant women (n=140)

Of 65 asymptomatic urinary tract infection with positive urine culture results, *E.coli* was 36(55.4%) *pseudomonas aeruginosa* 18(27.7%), *proteus mirabilis* 3(4.6%), *Acinobacter* 1(1.5%), *Klebsiella pneumoniae* 3(4.6%), *Klebsiella oxytoca* 3(4.6%), *staphylococcus saprophytica* 2(3.2%), *Enterobacter species* 1(1.5%)

Of 75 symptomatic urine culture positive E.coli was 48(64%), *Pseudomonas aeruginosa 18(24.0%)*, *Klebsiella oxytoca 7(9.4),* proteus mirabilis 1(1.3), Acinobacter 1(1.5).This shown on figure 2 bellow

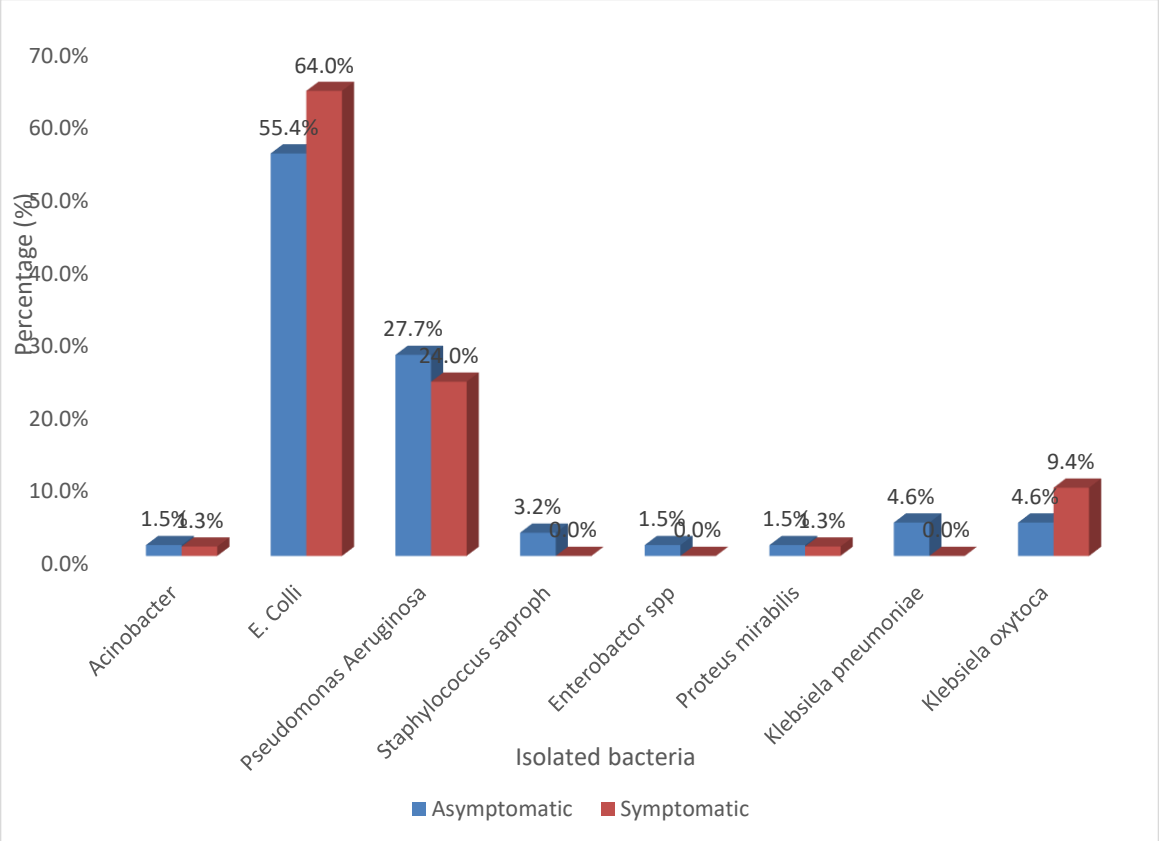


Figure 3 above: Isolated bacteria for asymptomatic and symptomatic urinary tract infections for pregnant women.

4.4 The antibacterial susceptibility patterns of bacteria isolates in pregnant women with asymptomatic and symptomatic urinary tract infections.

4.4.1 asymptomatic urinary tract infection

The antibacterial susceptibility was done against the isolated bacteria. The isolated bacteria were sensitive (S), Intermediate(I),Resistant (R) to the antibiotics as shown on table 3 and 4

The antibacterial susceptibility was tested for isolated bacteria.

E. coli **was sensitive to** ceftriaxone by 20/46(76.9%), gentamycin 19/48(57.%) Amikacin 20/53(60.6%) Cefepime 18/48(64.3), resistance to ampicillin by 21/27(77.8%), Azithromycin 9/28(42.9%), nitrofurantoin 30/65(51.7%), amoxicillin - clavulanic acid 28/44(73.7%).

Table 2: The antibacterial susceptibility patterns of bacterial isolates in pregnant women with asymptomatic urinary tract infections (n=65)

	Isolated bacteria							
	AB n (%)	EC n (%)	PA n (%)	SS n (%)	ES n (%)	PM n (%)	KP n (%)	KO n (%)
					1	1		
Antimicrobial	1 (1.5)	36 (55.4)	18 (27.7)	2 (3.1)	(1.5)	(1.5)	3 (4.6)	3 (4.6)
Amikacin (n=53)								
S (n=33)	0 (0.0)	20 (60.6)	6 (18.2)	1 (3.0)	1(3.0)	0(0.0)	3 (9.1)	2 (6.1)
I (n=9)	0 (0.0)	6 (66.7)	2 (22.2)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	1(11.1)
R (n=11)	1 (9.1)	5 (45.5)	5 (45.5)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
Genta (n=48)								
S (n=33)	0 (0.0)	19 (57.6)	8 (24.2)	1 (3.0)	1(3.0)	1(3.0)	2 (6.1)	1 (3.0)
I (n=2)	0 (0.0)	1 (50.0)	1 (50.0)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
R (n=13)	1 (7.7)	8 (61.5)	2 (15.4)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	2(15.4)
Ceftriaxone (n=46)								
S (n=26)	0 (0.0)	20 (76.9)	4 (15.4)	0 (0.0)	0(0.0)	0(0.0)	1 (3.8)	1 (3.8)
I (n=2)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
R (n=18)	1 (5.6)	10 (55.6)	2 (11.1)	0 (0.0)	1(5.6)	0(0.0)	2(11.1)	2(11.1)

Nitrofurantoin (n=65)								
S (n=2)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
I (n=5)	0 (0.0)	4 (80.0)	0 (0.0)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	1(20.0)
R (n=58)	1 (1.7)	30 (51.7)	18 (31.0)	2 (3.5)	1(1.7)	1(1.7)	3 (5.2)	2 (4.6)
Amoxyclav n=44								
S (n=6)	0 (0.0)	5 (83.3)	0 (0.0)	0 (0.0)	0(0.0)	0(0.0)	1(16.7)	0 (0.0)
I (n=0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
R (n=38)	1 (2.6)	28 (73.7)	3 (7.9)	0 (0.0)	1(2.6)	0(0.0)	2 (5.3)	3 (7.9)
Azithromycin (n=28)								
S (n=6)	0 (0.0)	1 (16.7)	5 (83.3)	0 (0.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
I (n=1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0(0.0)	0(0.0)	0 (0.0)	0 (0.0)
R (n=21)	0 (0.0)	9 (42.9)	10 (47.6)	1 (4.8)	0(0.0)	1(4.8)	0 (0.0)	0 (0.0)
Cefepime (n=48)								
S (n=28)	0(0.0)	18 (64.3)	9 (32.1)	0 (0.0)	0 (0.0)	1 (3.6)	0(0.0)	0 (0.0)
I (n=4)	0(0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
R (n=16)	0(0.0)	8 (50.0)	5 (31.3)	0 (0.0)	1 (6.3)	0 (0.0)	1(6.3)	1 (6.3)
Ampicillin (n=27)								
S (n=0)	0(0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
I (n=0)	0(0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
R (n=27)	0(0.0)	21 (77.8)	4 (14.8)	0 (0.0)	0 (0.0)	0 (0.0)	1(3.7)	1 (3.7)
Piperacillin (n=13)								

S (n=3)	0(0.0)	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
I (n=1)	0(0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
R (n=9)	0(0.0)	1 (11.1)	8 (88.9)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
Imipenem (n=31)								
S (n=24)	1(4.2)	10 (40.7)	8 (33.3)	1 (4.2)	0 (0.0)	0 (0.0)	2(8.3)	2 (8.3)
I (n=5)	0(0.0)	2 (40.0)	2 (40.0)	0 (0.0)	0 (0.0)	1 (20.0)	0(0.0)	0 (0.0)
R (n=2)	0(0.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
Trimethoprim (n=12)								
S (n=0)	0(0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
I (n=1)	0(0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
R (n=11)	0(0.0)	1 (9.1)	8 (72.7)	1 (9.1)	0 (0.0)	1 (9.1)	0(0.0)	0 (0.0)
Penicillin (n=3)								
S (n=1)	0(0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	(0.0)	0 (0.0)
I (n=1)	0(0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)
R (n=1)	0(0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)

From the table bellow for symptomatic urinary tract infections (UTI):

E.coli was sensitive to Ceftriaxone 25/26(96.2%), Gentamycin 31/39(79.5%), Amikacin 36/42(85.7), Ciprofloxacilin 24/34(70.6%) and Meropenem 39/55(70.9%), resistant to Ampicillin was 8/11(72.7%), Amoxicillin/Clavulanic acid 33/38(86.8%), and Nitrofurantoin 31/55(56.4%).

Table 3: The antibacterial susceptibility patterns of bacterial isolates in pregnant women with symptomatic urinary tract infections (n=75)

	Isolated bacteria				
	AB	EC	PA	PM	KO
	n (%)	n (%)	n (%)	n (%)	n (%)
Antimicrobial drugs	1 (1.3)	48 (64.0)	18 (24.0)	1 (1.3)	7 (9.3)
Amikacin (n=67)					
S (n=42)	0 (0.0)	36 (85.7)	6 (14.3)	0 (0.0)	0 (0.0)
I (n=12)	0 (0.0)	7 (58.3)	2 (16.7)	0 (0.0)	3 (25.0)
R (n=13)	1 (7.7)	3 (23.1)	7 (53.8)	0 (0.0)	2 (15.4)
Gentamycin (n=66)					
S (n=39)	0 (0.0)	31 (79.5)	5 (12.8)	0 (0.0)	3 (7.7)
I (n=3)	0 (0.0)	1 (33.3)	0 (0.0)	1 (33.3)	1 (33.3)
R (n=24)	1 (4.2)	12 (50.0)	8 (33.3)	0 (0.0)	3 (12.5)
Ceftriaxone (n=57)					
S (n=26)	0 (0.0)	25 (96.2)	1 (3.8)	0 (0.0)	0 (0.0)
I (n=8)	0 (0.0)	5 (62.5)	1 (12.5)	0 (0.0)	2 (25.0)
R (n=23)	1 (4.4)	16 (69.6)	3 (13.0)	0 (0.0)	3 (13.0)

Nitrofurant (n=75)					
S (n=17)	0 (0.0)	14 (82.3)	3 (17.6)	0 (0.0)	0 (0.0)
I (n=3)	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
R (n=55)	1 (1.8)	31 (56.4)	15 (27.3)	1 (1.8)	7 (12.7)
Meropenem (n=75)					
S (n=55)	0 (0.0)	39 (70.9)	11 (20.0)	1 (1.8)	4 (7.3)
I (n=5)	0 (0.0)	2 (40.0)	1 (20.0)	0 (0.0)	2 (40.0)
R (n=15)	1 (6.7)	7 (46.7)	6 (40.0)	0 (0.0)	1 (6.7)
Cefotaxime (n=46)					
S (n=20)	0 (0.0)	18 (90.0)	1 (5.0)	0 (0.0)	1 (5.0)
I (n=5)	0 (0.0)	2 (40.0)	1 (20.0)	0 (0.0)	2 (40.0)
R (n=21)	0 (0.0)	15 (71.4)	2 (9.5)	1 (4.7)	3 (14.3)
Cipro (n=73)					
S(n=34)	0(0.0)	24(70.6)	8(23.5)	1(2.9)	1(2.9)
I(N=6)	0(0.0)	3(50.0)	1(16.7)	0(0.0)	2(33.3)
R(n=33)	1(3.0)	20(60.6)	8(24.2)	0(0.0)	4(12.1)

Amoxclav (n=52)					
S (n=8)	0 (0.0)	7 (87.5)	1 (12.5)	0 (0.0)	0 (0.0)
I (n=6)	0 (0.0)	4 (66.7)	0 (0.0)	0 (0.0)	2 (33.3)
R (n=38)	1 (2.6)	33 (86.8)	1 (2.6)	0 (0.0)	3 (7.9)
Azithromycin (n=29)					
S (n=10)	0 (0.0)	4 (40.0)	5 (50.0)	1 (10.0)	0 (0.0)
I (n=0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
R (n=19)	1 (5.3)	6 (31.6)	9 (47.4)	0 (0.0)	3 (15.8)
Cefepime (n=45)					
S (n=19)	0 (0.0)	12 (63.2)	6 (31.6)	1 (5.3)	0 (0.0)
I (n=5)	0 (0.0)	4 (80.0)	0 (0.0)	0 (0.0)	1 (20.0)
R (n=21)	1 (4.8)	11 (52.4)	8 (38.1)	0 (0.0)	1 (4.8)
Ampicillin (n=11)					
S (n=0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
I (n=0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
R (n=11)	1 (9.1)	8 (72.7)	2 (18.2)	0 (0.0)	0 (0.0)
Piperacillin (n=15)					
S (n=1)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)
I (n=3)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)
R (n=11)	0 (0.0)	1 (9.1)	9 (81.8)	0 (0.0)	1 (9.1)

Imipenem (n=50)					
S (n=40)	0 (0.0)	23 (57.5)	11 (27.5)	1 (2.5)	5 (12.5)
I (n=3)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)	0 (0.0)
R (n=7)	0 (0.0)	5 (71.4)	1 (14.3)	0 (0.0)	1 (14.3)
Trimethoprim (n=8)					
S (n=1)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)
I (n=0)	0 (0.0)	1 (14.3)	5 (71.4)	1 (14.3)	0 (0.0)
R (n=7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Key words

AB - *Acinobacter*

EC- *Escherichia Coli*

PA - *Pseudomonas Aeruginosa*

SS - Staphylococcus Saprophyticus

ES - *Enterobacter species*

PM - *Proteus mirabilis*

KP - *Klebsiella pneumoniae*

KO - *Klebsiella oxytoca*

CHAPTER FIVE

5.0 DISCUSSION

From this study the prevalence of Symptomatic urinary tract infection attending antenatal clinic at Kilema hospital was 75(24.1%), *E.coli* was the mostly isolated bacterial by 48(64%), followed by *Pseudomonas aeruginosa 18(24.0%)*, *Klebsiella oxytoca 7(9.4),* proteus mirabilis 1(1.3). Asymptomatic UTI was 65(21.0%), isolated bacteria *E.coli* was 36(55.4%), *pseudomonas aeruginosa* 18(27.7%), *proteus mirabilis* 3(4.6%), *Acinobacter* 1(1.5%), *Klebsiella pneumoniae* 3(4.6%), *Klebsiella oxytoca* 3(4.6%), *staphylococcus saprophytica* 2(3.2%),*Enterobacter species* 1(1.5%). There was high resistance of antibacterial to isolated bacteria on both symptomatic and asymptomatic urinary tract infections especially on nitrofurantoin, ampicillin, amoxicillin-clavulanic acid, and azithromycin. High sensitivity to Ceftriaxone, Gentamycin, Cefotaxime, Meropenem, Ciprofloxacilin, Amikacin.

prevalence of Symptomatic urinary tract infection from this study 75(24.1%), correlate with the average results of symptomatic urinary tract infection on pregnant women globally of 23.9%, contradict with study conducted at Turkey by Hela M.Shareen *et.al* (2016) which results was 32% and study done at Bugando Medical center 2009 by Masinde *et al* results was 17%. This difference may be due to the time intervals of documented studies, which are more than 9 years back. Asymptomatic Urinary tract infection was 65(21.1%). Had the same results as the global study, which reported the

prevalence of Asymptomatic urinary tract infections of 23% and closely related to a study done in Turkey with results of 20% for asymptomatic urinary tract infections for pregnant women. Slightly differ from the study done at Bugando Medical Center by Myomba *et al.* 2022 with results of 16,9%. But this result contradicts the results of studies from K.C.M.C Moses K. Mwei *et al.,* 2016 with results of 8.9% and at Sinza district hospital Dar es salaam by Joseph *et.al*, 2023 which was 6.6%.

The bacteria isolated for asymptomatic urinary tract infections in pregnant women *E. coli* were 36(55.4%), *pseudomonas aeruginosa* 18(27.7%), *proteus mirabilis* 3(4.6%), *Acinobacter* 2(3%), *Klebsiella pneumoniae* 3(4.6%), *Klebsiella oxytoca* 3(4.6%), *staphylococcus saprophytica* 2(3.2%), *Enterobacter species* 1(1.5%). This was consistent with other studies done at Bugando Medical Center by (Mayomba *et a*l. 2022), the results for *E.coli* were 50.8%, from KCMC by (Moses K.Mwei et al. 2016), it was 50%, Uganda by (Julius Nteziyaremye et al. 2019) 46.4% for *E. Coli*. Symptomatic urinary tract infection *E.coli* was 48(64%),*Pseudomonas aeruginosa 18(24.0%)*, *Klebsiella oxytoca 7(9.4%), proteus mirabilis* 1(1.5%), *Acinobacter 2(3%)*. For *E. coli* was is much higher compared to other studies done at Bugando Medical Center by Masinde *at, el*.2009, where *E.coli* was 47.2%, study done at Mbarara Regional Referral Hospital by Bahati Johnson *et al*. 2021 *E.coli* was 40%, in Kenya by Onyango *at el* 2018 it was 44%, In Asia study done by Laily *et al* 2018, results was 35.7%. For *pseudomonas aeruginosa* asymptomatic Urinary tract infection *was*

18(27.7%), on symptomatic 18(24.0%). This contradicts other studies, done in Kenya by Onyango *et.al* 2018 which was (6.1%), in Uganda by Bahati Johnson. *et. al*, 2018 (5.04%). Other organisms for asymptomatic were *Klebsiella pneumoniae* 3(4.6%), *Klebsiella oxytoca* was 3(4.6%) and 7(9.4%). This contradict to other studies done in Kenya by (Onyango et al. 2018) which found *Klebsiella pneumoniae* be 21.2%, in Uganda by (Bahati Johnson et al. 2018) which was 37.4%. Close to the study done in Asia by Laily et al, which was 7.1%. *Staphylococcus Saprophyticus* was 2(3.2%) for asymptomatic and 1(1.5%) for *Enterobacter species*. *Proteus mirabilis* was 1(1.5%) for both asymptomatic and symptomatic urinary tract infections.

The overall Antibacterial susceptibility of for asymptomatic was 77.4% for Imipenem, Meropenem 61%, Amikacin 62.3%, Gentamycin 68.8%, Cefepime 58.3%, Ceftriaxone 58.1%, Cefotaxime 58.1%, Erythromycin 50%. Resistance was higher on ampicillin 100%, Trimethoprim 91.2%, amoxicillin–clavulanic Acid 86.4%, Nitrofurantoin 89.2%, and Azithromycin 75%. Symptomatic Imipenem was 80%, Meropenem 73.3%, Amikacin 62%, Gentamycin 59.1%, Ceftriaxone 45.5%, Cefotaxime 43.5%, Cefepime 42.2%, Azithromycin 34.5%, Doxycycline 30%, Nitrofurantoin 22.7%, Amoxiclav 15.4%, Trimethoprim 12.5%. Piperacillin 6.67%, Ampicillin 0%.

Asymptomatic UTI *E.coli* was sensitive for ceftriaxone by 76.9%, Gentamycin by 19(57.9) Meropenem 61%, Cefotaxime 66.7%,Ciprofloxacillin 70.6% But it was resistant to Amoxicillin +clavulanic acid by 73.7%, Azithromycin by 42.9%,

Nitrofurantoin 56.4% and Ampicillin by 77.8%. Symptomatic UTI it was sensitive to Ceftriaxone by 25(96.2%), Gentamycin 31(79.5%), Cefotaxime (90%), Meropenem (70.9%), Ciprofloxacilin (70.6%), Amikacin (85.7%) It was resistant to Ampicillin by (72.7%), Nitrofurantoin (56.4%), Amoxycillin-clavulanic Acid (73.9) and Trimethoprim 100%. *Pseudomonas aeruginosa*, was more sensitive to Piperacillin by 100%, Clindamycin by 100%, Azithromycin by 83.3%, and Trimethoprim by 100%. But it was resistant to Imipenem 100%, Amikacin 45.5%, Meropenem 35.3%.

CHAPTER SIX

6.0 Conclusion

From this study the prevalence of symptomatic and asymptomatic urinary tract infections was still higher than previous studies findings in Tanzania. *E. coli* was the most isolated organism causing asymptomatic and symptomatic UTI, followed by *pseudomonas aeruginosa.* There was increased resistance to most of the prescribed antibiotics for pregnant women especially for oral antibiotics such as nitrofurantoin, Azithromycin and Amoxycillin/Clavulanic Acid. We recommend other studies to be conducted so as to establish cause of this increase of pseudomonas aeruginosa.

6.1 Limitations

Limited time for study only two months.

Study was conducted on single hospital

6.2. Recommendations.

1. To conduct other studies which will cover large population and geographical location.
2. To update standard guideline which will base on current antibacterial susceptibility results on urinary tract infections on pregnant women.
3. To include urine culture in antenatal routine screening at least once during antenatal clinics.

REFERENCES

1. Lopera JEP, Cabezas DCM, Serna YZ, Garces-Gomez YA. Semi-automatic model to colony forming units counting. Int J Electr Comput Eng. 2023;13(3):2761–8.
2. Maldonado-Barrueco A, Grandioso-Vas D, Rico-Nieto A, García-Rodríguez J, García-Bujalance S. The Brief Case: Proteus mirabilis Causing Coraliform Lithiasis and Bacteremia in an Elderly Catheterized Patient. J Clin Microbiol. 2022;60(10).
3. Zhang L. Machine learning for enumeration of cell colony forming units. Vis Comput Ind Biomed Art. 2022;5(1).
4. Salari N, Khoshbakht Y, Hemmati M, Khodayari Y, Khaleghi AA, Jafari F, et al. Global prevalence of urinary tract infection in pregnant mothers: a systematic review and meta-analysis. Public Health. 2023 Nov;224:58–65.
5. Dube R, Al-zuheiri STS, Syed M, Harilal L, Allah D, Zuhaira L. Resistance of Symptomatic Urinary Tract Infections in Pregnant Women. Mdpi. 2023;12(33).
6. Nteziyaremye J, Iramiot SJ, Nekaka R, Musaba MW, Wandabwa J, Kisegerwa E, et al. Asymptomatic bacteriuria among pregnant women attending antenatal care at Mbale Hospital, Eastern Uganda. PLoS One [Internet]. 2020;15(3):1–12. Available from: http://dx.doi.org/10.1371/journal.pone.0230523

7. Kaduma J, Seni J, Chuma C, Kirita R, Mujuni F, Mushi MF, et al. Urinary tract infections and preeclampsia among pregnant women attending two hospitals in Mwanza City, Tanzania: A 1:2 Matched case-control study. Biomed Res Int. 2019;2019.

8. Chandra Bala Sekharan, Devarajan Dinesh Kumar, Koneru Ratna Kumari, Cecilia Alphonce Joachim. Determination of Prevalence of Urinary Tract Infection Among the Pregnant Women with Lower Abdominal Pain. Pharm Biosci J. 2017 Apr 30;50–5.

9. Mayomba C, Matovelo D, Kiritta R, Kashinje Z, Seni J. Asymptomatic bacteriuria and its associated fetomaternal outcomes among pregnant women delivering at Bugando Medical Centre in Mwanza, Tanzania. PLoS One [Internet]. 2024;19(10):e0303772. Available from: http://dx.doi.org/10.1371/journal.pone.0303772

10. Shaheen S, Fatima S, Wazir S, Naz LS, Hamid BS, Tabasum S. Association of Preterm Delivery with Urinary Tract Infection and Preventive Role of Ceftriaxone. Pakistan J Heal Sci. 2024;155–60.

11. Kerure RD, Biradar A V., Lakshetty S, Biradar S. A study of urinary tract infection in pregnancy and its effect on maternal and perinatal outcome. Int J Reprod Contraception, Obstet Gynecol. 2024;13(2):284–9.

12. Oriji PC, Kiridi EK, Abasi IJ. Maternal hydronephrosis in normal pregnancy in Bayelsa state, South-South Nigeria. Int J Reprod Contraception, Obstet Gynecol. 2022;11(3):664.

13. Kalinderi K, Delkos D, Kalinderis M, Athanasiadis A, Kalogiannidis I. Urinary tract infection during pregnancy: current concepts on a common multifaceted problem. J Obstet Gynaecol (Lahore). 2018 May 19;38(4):448–53.

14. Krishna D, Guerra H, Spatola L, Almeida DO, Chon CW. CHAPTER 55 Risks and consequences of urinary infections during pregnancy : A longitudinal study.

15. Degtyareva EI, Romanova DG. Urinary tract infections in pregnant women. Meditsinskiy Sov = Med Counc. 2024 May 1;(4):65–72.

16. Al-Sarray HAK. Prevalence of Bacterial Urinary Tract Infection among Pregnant Women in Wasit Province in Iraq. South East Eur J Public Heal. 2024;24(s2):513–9.

17. Joseph N, Turwa W, Joachim A. Asymptomatic Bacteriuria among Pregnant Women Attending Antenatal Care at Sinza District Hospital, Dar es Salaam, Tanzania . Tanzania Med J. 2023 Nov 29;34(2):83–97.

18. Masinde A, Gumodoka B, Kilonzo A, Mshana SE. Prevalence of urinary tract infection among pregnant women at Bugando Medical Centre, Mwanza, Tanzania. Tanzan J Health Res. 2009;11(3):154–9.

19. Kasinathan A, Thirumal P. Prevalence of asymptomatic bacteriuria in antenatal women attending a tertiary care hospital. Int J Reprod Contraception, Obstet Gynecol. 2014;16(4):437–41.

20. Tuna A, Akkuş İ, Gül S, Kaçmaz B. Pyuria, bacteriuria and empirical antibiotic selection in pregnant women. J Heal Sci Med. 2024;7(4):361–5.

21. Willy Fred N, Gichuhi JW, Mugo NW. Prevalence of Urinary Tract Infection, Microbial Aetiology, and Antibiotic Sensitivity Pattern among Antenatal Women Presenting with Lower Abdominal Pains at Kenyatta National Hospital, Nairobi, Kenya. Open Access J Sci Technol. 2015;3.

22. Rafat D, Agrawal A, Khalid S, Khan AU, Nawab T, Sultan A. Bacterial abundance and antimicrobial resistance patterns of uropathogens among pregnant women with asymptomatic bacteriuria: Association with glycemic status. Eur J Obstet Gynecol Reprod Biol X. 2024 Mar;21:100263.

23. Kwashie SDY, Mensah BT, Attipoe I, Akorly E, Degenu VA, Kupeh EK, et al. Prevalence, resistant pattern and associated risk factors of asymptomatic bacteriuria among antenatal clients in a municipal hospital in Ghana. Int J Community Med Public Heal. 2024;11(7):2614–23.

24. Onyango HA, Ngugi C, Maina J, Kiiru J. Urinary Tract Infection among Pregnant Women at Pumwani Maternity Hospital, Nairobi, Kenya: Bacterial Etiologic Agents, Antimicrobial Susceptibility Profiles and Associated Risk Factors. Adv

Microbiol. 2018;08(03):175–87.

25. Laily F, Lutan D, Amelia S, Tala MRZ, Nasution TA. Associated risk factors for urinary tract infection among pregnant women at Puskesmas Kenangan, Deli Serdang district. IOP Conf Ser Earth Environ Sci. 2018;125(1).

26. Labib Al-Kashif MM. Urinary Tract Infection among Pregnant Women and its Associated Risk Factors: A Cross-Sectional Study. Biomed Pharmacol J. 2019 Dec 31;12(04):2003–10.

27. Johnson B, Stephen BM, Joseph N, Asiphas O, Musa K, Taseera K. Prevalence and bacteriology of culture-positive urinary tract infection among pregnant women with suspected urinary tract infection at Mbarara regional referral hospital, South-Western Uganda. BMC Pregnancy Childbirth. 2021;21(1):1–9.

28. Getaneh T, Negesse A, Dessie G, Desta M, Tigabu A. Prevalence of Urinary Tract Infection and Its Associated Factors among Pregnant Women in Ethiopia: A Systematic Review and Meta-Analysis. Biomed Res Int. 2021;2021.

29. Ezugwu IA, Afunwa RA, Onyia FC, Chukwunwejim CR, Offe IM, Onyia CO, et al. Prevalence of Urinary Tract Infections and Associated Risk Factors among Pregnant Women in Enugu Metropolis, Nigeria. J Biosci Med. 2021;09(10):156–71.

30. Vicar EK, Acquah SEK, Wallana W, Kuugbee ED, Osbutey EK, Aidoo A, et al. Urinary Tract Infection and Associated Factors among Pregnant Women Receiving Antenatal Care at a Primary Health Care Facility in the Northern Region of Ghana. Int J Microbiol. 2023;2023.

APPENDICES

APPENDIX 1: Consent form: English version

Participant ID No--------

My name is Dr.Mayola Thomas Massawe, a student of Master in Obstetrics and Gynecology at Kairuki University; I'm doing my research on SYMTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIMICROBIAL SUCSEPTIBILITY FOR PREGNANT WOMEN ATTENDING AT KILEMA HOSPITAL.

The research is conducted in partial fulfillment of the Masters of Medicine in Obstetrics and Gynecology at Kairuki University.

Requirement for participation

You will be required to sign the consent form and provide the information required from questioners. Participation is voluntary; No one will be forced to sign the consent form, only those participants who will sign the consent form will be allowed to participate in the study. Your report is confidential it will not be released to anyone without your permission.

For those who don't know how to read and write will be assisted with research assistant under witness of close relative or husband.

You will be given your investigation results. Those who will be found with the infection will receive proper treatment.

The participation is once. After submission of urine sample no more of your time will be consumed unless for positive results who will require treatment.

You have been selected to participate on study because you met the criteria that's is pregnant woman. You will only required to submit urine for investigation at once

I, ----------I have read/ been told the contents of this form and about the study, my questions have been answered. I'm ready to participate in this study.

Signature of participant---------- Date of signing----------

Rights to withdraw from study

You are allowed to withdraw from study at any time without any force because participation is voluntary. There is no penalty or negative effects for participants who withdraw from the study.

Are you ready to participate in the study?

Yes

No

APPENDIX 2: Consent form: Swahili version

Fomu ya ridhaa ya kushiriki katika utafiti

Lengo la utafiti

Mimi naitwa Dr.Mayola Massawe, Mwanafunzi wa shahada ya pili katika chuo kikuu cha Kairuki.Ninafanya utafiti juu ya **Maambukizi ya nia ya mkojo yenye dalili na yasiyo na dalili kwa wanawake wajawazito na usugu wa bacteria kwa dawa za kuwa vijidudu kwa wanawake wajawazito wanaofika kupata huduma katika Hospitali Teule Kilema**, ili kuweza kukamilisha masomo yangu ya kupata shahada hiyo.

Wajibu wa mshiriki

Ninakualika kusoma dodoso litakaloambatanishwa hapo chini kwa makini nakulielewa kabla ya kusaini dodoso hili ilikuonyesha ukubali wako katika kushiriki zoezi hili.

Taarifa za washiriki katika utafiti huu zitakuwa ni siri hazitatolewa kwa mtu yeyote bila ridhaa ya mhusika.

Washiriki wasiojuwa kusoma na kuandika watasaidiwa kusomewa na kuandika dodoso hili na msaidizi wa tafiti mbele ya ndugu au mume ambae ni shahidi.

Ushiriki katika utafiti huu ni wa mara moja tu. Baada ya kutoa mkojo kwa kipimo hutalazimika kufika tena kwa utafiti isipokuwa tu kwa wale watakaogundulika kuwa na tatizo na watakaohitaji matibabu.

Hakuna malipo yoyote yatakayotolewa kwa kushiriki utafiti huu.

Wale watakaogundulika kuwa na maambukizi kwenye kibofu cha mkojo watapatiwa matibabu sahihi.

Haki ya kutoshiriki au kujiondoa kwenye utafiti

Wahusika watakaosaini dodoso hili ndio tu watakaoshiriki katika utafiti huu, wale ambao hawatasaini hawatalazimishwa kushiriki katika utafiti huu.

Mshiriki anaruhusiwa kujiondoa kwenye utafiti wakati wowote bila masharti au pingamizi.

Wahusika watapatiwa majibu yao ili wale watakaogundulika kuwa na tatizo waweze kupatiwa matibabu stahiki.

Taarifa za washiriki zitakuwa siri na zitahifadhiwa katika mfumo data kwa kutumia namba badala ya majina yao.

Appendix 3: Questionnaire English Version

- AGE:
- SEX:

1. EDUCATION LEVEL:

- Primary:
- Secondary:
- Collage:

-University:

RESIDENCE:

MARITAL STATUS

1. Married
2. Divorced
3. Single

GRAVIDITY

PRIMIGRAVIDA

MULTIPARA

Status of employment

1. Employed,
2. Not employed
3. Self-employment

4. Peasant

5. Housewife

Have you suffered from Urinary tract Infection?

Yes

No

If Yes:

When did you suffer from it?

Were you treated?

1. Yes

2. No

For how many days

Did you finish the dosage?

Yes

No

Have you checked again after treatment?

1. Yes

2. No

Are there more symptoms of Urinary Tract Infections?

APPENDIX 4: Questionnaire: Swahili vision

Dodoso

Namba ya usajili----------

UMRI:

NUMBER YA UJAUZITO:

1.Ujauzito wa kwanza-

2.Zaidi ya ujauzito mmoja-

JE UMEOLEWA:?

- Ndio
- Hapana
- Nimeachika
- Mjane

KIWANGO CHA ELIMU

- Darasa la saba
- Secondary
- Chuo cha kati
- Chuo kikuu
- Sijasoma

KAZI:

- Nimeajiriwa
- Mjasiriamali
- Mama wa nyumbani

Je umeshawahi kuugua ugonjwa wa mfumo wa mkojo?

Ndiyo

Hapana

Kama ndiyo uliugua lini?

Je ulipatiwa matibabu?

Je ulimaliza dawa?

Bado una dalili zozote za ugonjwa?

CATHOLIC DIOCESE OF MOSHI
KILEMA COUNCIL DESIGNATED HOSPITAL
P.O BOX 1080
MOSHI – KILIMANJARO
TANZANIA
TEL: +255-27-2756430
FAX: +255-O27-2756430
Email: kilemahospital@ymail.com

12nd,June, 2025

Kumb.Na.KH/KU/VOL.I.1

KAIRUKI UNIVERSITY (KU)
P.O BOX 65300,
DAR ES SALAAM,
TANZANIA

RE; PERMISSION TO DR.MAYOLA MASSAWE TO COLLECT DATA FOR RESEARCH TITTLE SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN AT KILEMA HOSPITAL KILIMANJARO.

Kindly refer to the above heading.

This is to inform you that permission to collect data for your research tittle SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN AT KILEMA HOSPITAL KILIMANJARO.

HAS BEEN GRANTED.

Thank you for understanding and cooperation.

Sincerely

.....

Dr. Godfrey Maro
Act.Medical Officer Incharge.
Kilema Hospital

MEDICAL OFFICER I/C KILEMA HOSPITAL P.O Box 1080 MOSHI

KAIRUKI UNIVERSITY (KU)

70 Chwaku Street,
Mikocheni,
P.O BOX 65300,
Dar es Salaam,
Tanzania.

Tel: +255-22-2700021/4
Fax: +255-22-2775591
Email: irec@ku.ac.tz
Website: www.ku.ac.tz

Ref. No. KU/IREC/27.10/577 **12 June, 2025**

Dr. Mayola Thomas Massawe,
Kairuki University,
70 Chwaku Street,
Mikocheni,
P. O. Box 65300.
Dar es Salaam, Tanzania.

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING HEALTH RESEARCH

I am pleased to inform you that the research titled: **Symptomatic and Asymptomatic Urinary Tract Infection and Antibacterial Susceptibility for Pregnant Women Attending Kilema Hospital from June to July 2025 (Massawe, M. T., 2025)** has been granted ethical approval.

This approval is in effect for one year from the above date.

- Any changes in the procedures should be reported to the Institutional Research Ethics Committee.
- Significant changes will require the submission of a revised request for ethical approval.
- You will be required to submit **a study progress report** every six months.

Permission to publish your findings should be sought from the National Institute for Medical Research (NIMR) before submission to a publisher and not concurrently.

CHAIR PERSON

Name: Prof. Frederick Kaijage

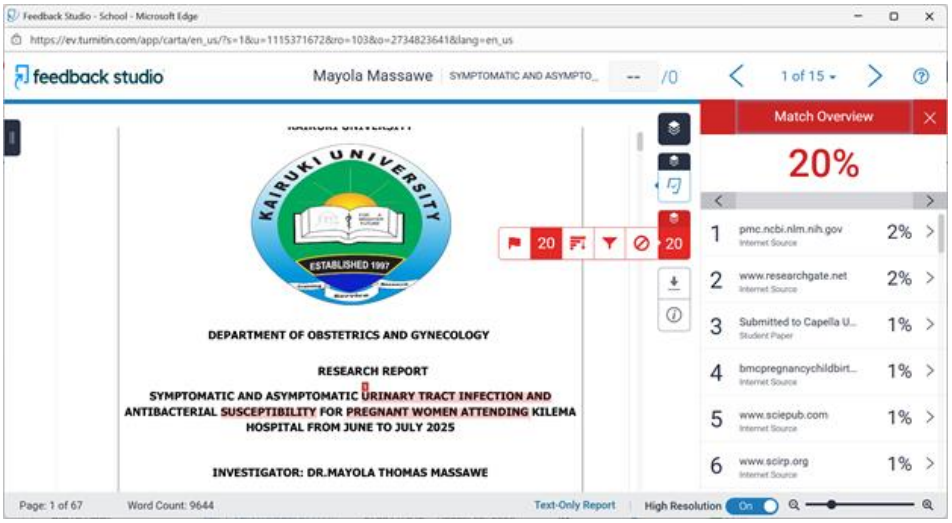
Signature:

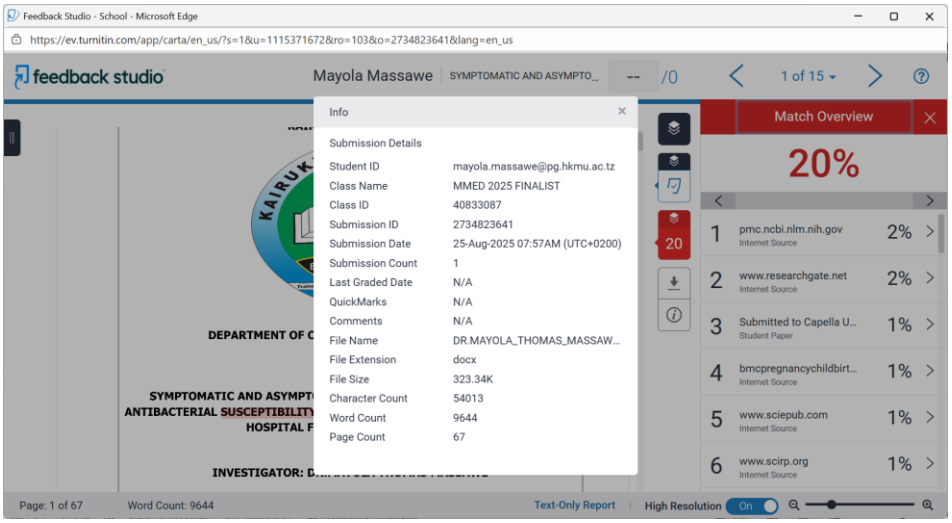
SECRETARY

Name: Prof. Columba Mbekenga

Signature:

DIRECTOR POSTGRADUATE STUDIES AND RESEARCH INSTITUTE
KAIRUKI UNIVERSITY
P. O. Box 65300, Dar es Salaam


Feedback Studio - School - Microsoft Edge
https://ev.turnitin.com/app/carta/en_us/?s=1&u=1115371672&ro=103&o=2734823641&lang=en_us
feedback studio
Mayola Massawe
SYMPTOMATIC AND ASYMPTO...
1 of 15
Match Overview
20%
1 pmc.ncbi.nlm.nih.gov 2%
2 www.researchgate.net 2%
3 Submitted to Capella U... 1%
4 bmcpregnancychildbirt... 1%
5 www.sciepub.com 1%
6 www.scirp.org 1%
DEPARTMENT OF OBSTETRICS AND GYNECOLOGY
RESEARCH REPORT
SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN ATTENDING KILEMA HOSPITAL FROM JUNE TO JULY 2025
INVESTIGATOR: DR.MAYOLA THOMAS MASSAWE
Page: 1 of 67
Word Count: 9644
Text-Only Report
High Resolution


Feedback Studio - School - Microsoft Edge
https://ev.turnitin.com/app/carta/en_us/?s=1&u=1115371672&ro=103&o=2734823641&lang=en_us
feedback studio
Mayola Massawe
Info
Submission Details
Student ID mayola.massawe@pg.hkmu.ac.tz
Class Name MMED 2025 FINALIST
Class ID 40833087
Submission ID 2734823641
Submission Date 25-Aug-2025 07:57AM (UTC+0200)
Submission Count 1
Last Graded Date N/A
QuickMarks N/A
Comments N/A
File Name DR.MAYOLA_THOMAS_MASSAW...
File Extension docx
File Size 323.34K
Character Count 54013
Word Count 9644
Page Count 67
Match Overview
20%
Page: 1 of 67
Word Count: 9644
Text-Only Report
High Resolution

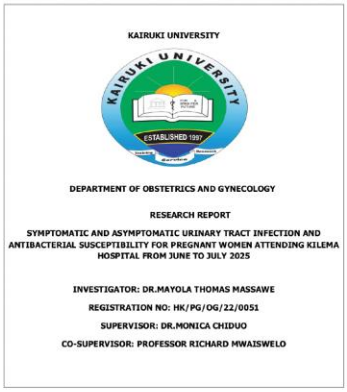
turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Mayola Massawe
Assignment title:	Research Proposal
Submission title:	SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTI...
File name:	DR.MAYOLA_THOMAS_MASSAWE-_DISERTATION.docx
File size:	323.34K
Page count:	67
Word count:	9,644
Character count:	54,013
Submission date:	25-Aug-2025 07:57AM (UTC+0200)
Submission ID:	2734823641



KAIRUKI UNIVERSITY

DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

RESEARCH REPORT

SYMPTOMATIC AND ASYMPTOMATIC URINARY TRACT INFECTION AND ANTIBACTERIAL SUSCEPTIBILITY FOR PREGNANT WOMEN ATTENDING KILEMA HOSPITAL FROM JUNE TO JULY 2025

INVESTIGATOR: DR.MAYOLA THOMAS MASSAWE

REGISTRATION NO: HK/PG/OG/22/0051

SUPERVISOR: DR.MONICA CHIDUO

CO-SUPERVISOR: PROFESSOR RICHARD MWAISWELO