**PREVALENCE OF ASYMPTOMATIC BACTERIURIA, ASSOCIATED RISK FACTORS AND ANTIBIOTIC SENSITIVITY PATTERN AMONG WOMEN ATTENDING ANTE NATAL CLINIC AT KILIMANJARO CHRISTIAN MEDICAL CENTRE IN NOTHERN TANZANIA**

**A Descriptive Cross Sectional Study**

**By**

**Moses Kyania Mwei**

**A dissertation submitted in partial fulfillment for the requirements for Masters in Medicine degree (Obstetrics and Gynaecology) of Tumaini University Makumira**

**Kilimanjaro Christian Medical University College**

**Tumaini University Makumira**

**June, 2017**

# TABLE OF CONTENTS

[TABLE OF CONTENTS i](#_Toc486402733)

[LIST OF TABLES](#_Toc486402734)………………………………………………………………...….v

[CERTIFICATION AND DECLARATION OF COPYRIGHT vi](#_Toc486402735)

[CERTIFICATION vi](#_Toc486402736)

[DECLARATION AND COPYRIGHT vii](#_Toc486402737)

[ACKNOWLEDGEMENT viii](#_Toc486402738)

[ABBREVIATIONS ix](#_Toc486402739)

[OPERATIONAL DEFINITION OF TERMS x](#_Toc486402740)

[ABSTRACT xi](#_Toc486402741)

[**CHAPTER ONE** 1](#_Toc486402742)

[1.0 INTRODUCTION 1](#_Toc486402743)

[1.1 Background information 1](#_Toc486402744)

[1.2 Literature Review 5](#_Toc486402745)

[1.2.1 Prevalence of asymptomatic bacteriuria among pregnant women 5](#_Toc486402746)

[1.2.2 Risk factors 7](#_Toc486402747)

[1.2.3 Antibiotic sensitivity patterns 8](#_Toc486402748)

[1.3 Problem Statement 10](#_Toc486402749)

[1.4 Study Justification 10](#_Toc486402750)

[1.5 Research Question 10](#_Toc486402751)

[**CHAPTER TWO** 11](#_Toc486402752)

[2.0 OBJECTIVES 11](#_Toc486402753)

[2.1 Broad objective 11](#_Toc486402754)

[2.2 Specific objectives 11](#_Toc486402755)

[**CHAPTER THREE** 12](#_Toc486402756)

[3.0 METHODOLOGY 12](#_Toc486402757)

[3.1 Study design 12](#_Toc486402758)

[3.2 Study area 12](#_Toc486402759)

[3.3 Study population 12](#_Toc486402760)

[3.4 Inclusion and Exclusion criteria 12](#_Toc486402761)

[3.4.1 Inclusion criteria 12](#_Toc486402762)

[3.4.2 Exclusion criteria 13](#_Toc486402763)

[3.5 Sample size 13](#_Toc486402764)

[3.6 Sampling technique 13](#_Toc486402765)

[3.7 Study variables 14](#_Toc486402766)

[3.7.1 Dependent variable 14](#_Toc486402767)

[3.7.2 Independent variables 14](#_Toc486402768)

[3.8 Data collection methods and tools 14](#_Toc486402769)

[3.8.1 Data collection methods and procedure 14](#_Toc486402770)

[3.8.2 Laboratory tests 15](#_Toc486402771)

[3.8.3 Data collection tools 15](#_Toc486402772)

[3.9 Data processing and analysis 15](#_Toc486402773)

[3.10 Ethical consideration 15](#_Toc486402774)

[**CHAPTER FOUR** 17](#_Toc486402775)

[4.0 RESULTS 17](#_Toc486402776)

[4.1 Socio demographic and obstetric characteristics of study participants. 17](#_Toc486402777)

[4.2. Factors associated with bacteriuria 19](#_Toc486402778)

[4.3 Bacterial isolates from the Urine sample 20](#_Toc486402779)

[4.4: Antibiotic sensitivity patterns for gram Negative Isolates 21](#_Toc486402780)

[4.5: Antibiotic sensitivity patterns for gram Positive Isolates 22](#_Toc486402781)

[**CHAPTER FIVE** 23](#_Toc486402782)

[5.0 DISCUSSION 23](#_Toc486402783)

[5.1 Strengths and Lmitations 26](#_Toc486402784)

[5.2 Conclusion 26](#_Toc486402785)

[5.3 Recommendations 27](#_Toc486402786)

[**REFERENCES** 28](#_Toc486402787)

[**APPENDICES** 31](#_Toc486402788)

[Appendix 1: Consent Form (English version) 31](#_Toc486402789)

[Appendix 2: Hati ya Kukubali Kushiriki kwenye Utafiti: (Swahili version) 32](#_Toc486402790)

[Appendix 3: Data Collection Forms 34](#_Toc486402791)

[Appendix 4: Ethical clearance certificate 37](#_Toc486402792)

# **LIST OF TABLES**

# **Table 1:** Characteristics of study participants (N=300)……………..…………..….18

**Table 2:** Factors associated with bacteriuria………………………………………..19

**Table 3:** Bacterial Isolates (n=26)…………………………………………………..20

**Table 4:** Rate of sensitivity to antibiotic among Gram negative bacteria……….….21

**Table 5:** Rate of sensitivity to antibiotic among Gram positive bacteria………...…22

# CERTIFICATION AND DECLARATION OF COPYRIGHT

# Certification

The undersigned certifies that this dissertation is the work of the candidate done during his Masters of medicine in obstetrics and gynaecology training and carried out under my direct supervision.

The undersigned certifies that he has read and hereby recommend for consideration by the Kilimanjaro Christian Medical University college of Tumaini University Makumira the dissertation entitled:

**“Prevalence of asymptomatic bacteriuria, associated risk factors and antibiotic sensitivity pattern among women attending antenatal clinic at Kilimanjaro Christian Medical Centre in Northern Tanzania”**

This dissertation is submitted in partial fulfillment of the requirements for the award of Masters of medicine in Obstetrics and Gynaecology of Tumaini University Makumira.

 ………………….………. …………………

**Dr. Eusebious Maro Date**

**Supervisor**

# Declaration and Copyright

I, **Moses Kyania Mwei,** do hereby declare that this is my own work and that it has not been presented and neither will it be presented to any other university for a similar or any other degree.

……………………….. ………………….

**Signature Date**

This dissertation is copyright material protected under the Berne convention, The copyright Act of 1966 and otherinternational and national copyright enactments in that behalf and , or intellectual property right. It may not be produced by any other names, in full or in part, except for the short extracts in fair dealing for research or private study, critical scholarly review or disclosure with acknowledgement, without the written permission of the Director of Postgraduate Studies on behalf of both the author and Tumaini University Makumira.

# ACKNOWLEDGEMENT

I am thankful to the Almighty God for the life that he has given me, His immeasurable love and blessings over my life, and for this far that He has brought me.

I wish to thank my family for the support they have given me during my studies and the course of proposal preparation and subsequent data collection and analysis. I dearly thank them.

To my supervisor Dr. Eusebious Maro I say ‘asante sana’ for your continuous inputs during the entire process of preparing the proposal, data collection, analysis and subsequent write up. I thank you for your considerable energy that you have invested into this work.

To my teachers and friends who have supported me, I thank you for all the work you put into fine tuning the concept note into a research proposal.

I am indebted to Dr. B. Nyombi and the Kilimanjaro Christian Medical Centre microbiology laboratory staff for their cooperation and support during the development of the concept note, proposal, sample collection and subsequent technical support.

I wish to thank my biostatistics and research methodology lecturers, past and present, who have worked tirelessly to impart the knowledge in me that has been put into good use in preparing this project.

To them all who have in one way or another contributed in the development and improvement of this dissertation, I thank you from the bottom of my heart.

May our good Lord bless you and increase you abundantly.

# ABBREVIATIONS

ANC Antenatal Clinic

ASB Asymptomatic Bacteriuria

CFU Colony Forming Units

CLED Cystein Lactose Electrolyte Deficient

KCMC Kilimanjaro Christian Medical Centre

KCMUco Kilimanjaro Christian Medical University college

LBW Low Birth Weight

ML Milli litre

SPSS Statistical Package for Social Sciences

SSA Sub Saharan Africa

UTI Urinary Tract Infection

PPROM Preterm Premature Rupture Of Membranes

WBCs White Blood Cells

WHO World Health Organisation

# OPERATIONAL DEFINITION OF TERMS

**Asymptomatic bacteriuria-** presence of more than 100,000 bacteria of a single colony forming unit bacterial in a midstream urine sample collected from women without symptoms of urinary tract infection, that is, frequent urination, painful or burning sensation on passing urine, supra pubic pain not from other causes, fever or these symptoms in combination.

**Urinary tract infection -** invasion of the kidney, ureter, bladder or urethra by organisms that results in symptoms of either increased frequency of urination, lower abdominal pain, fever or pain during urination.

**Early pregnancy –** will for the purpose of this study e considered as any gestation at or below the gestation of 20 weeks by dates.

**Low birth weight -** birth weight less than 2500 grams.

**Pyuria –** Presence of degenerated White blood cells in urine.

#

# ABSTRACT

**Background:** Asymptomatic bacteriuria (ASB) has been demonstrated to have adverse maternal and pregnancy outcomes precisely pyelonephritis, low birth weight, preterm premature rupture of membranes and preterm labour. Local data supporting formulation of clinical protocols for its screening and treatment are scarce.

**Objective:** The aim of this study was to determine the prevalence of asymptomatic bacteriuria, associated risk factors and antibiotic sensitivity pattern among women attending antenatal clinic at Kilimanjaro Christian Medical Centre (KCMC) in Nothern Tanzania.

**Methodology:** This was a descriptive cross sectional study involving 300 women attending antenatal clinic at Kilimanjaro Christian Medical Centre which was carried out between October and December 2016. Consent was obtained and interviews conducted using a questionnaire. Urine samples were collected for laboratory diagnosis and culture. Data were entered, cleaned and analyzed using SPSS version 20. Ethical approval was obtained from Kilimanjaro Christian Medical University college ethical committee certificate number 696.

**Results:** The prevalence of ASB among pregnant women in this study was 8.9%. While no risk factors were significantly associated with this prevalence, the commonest isolate was *Escherichia coli* (50%).

The rate of antibiotic sensitivity among gram negative bacteria ranged from 100% among *E. coli* and *Proteus mirabilis* to ceftriaxone while ampicillin was shown to have 0% sensitivity to *Klebsiella pneumoniae* and *Proteus mirabilis*. Among the gram positive bacteria erythromycin had 100% sensitivity to group A streptococcus but no sensitivity to group B streptococcus.

**Conclusion:** The relatively high prevalence of ASB among pregnant women and the low sensitivity to common antibiotics warrant protocol guided screening and treatment of ASB in this population.

#  CHAPTER ONE

# 1.0 INTRODUCTION

# 1.1 Background information

Asymptomatic bacteriuria (ASB) is the significant presence of bacteria in the urine of an individual without symptoms (Imade et al, 2010). Significant numbers of more than 100,000 colony forming units of the same bacteria per milliliter (cfu/ml) of urine is noted as being significant. These symptoms are lower abdominal pain, frequent urination or pain during urination (Ajayi et al, 2012).

Asymptomatic bacteriuria must be distinguished from symptomatic urinary tract infection (UTI) by the absence of symptoms compatible with UTI or by a clinical determination that the said symptoms are of a non urinary origin because neither the type of bacteria species nor the presence of pyuria can be used to determine whether the patient has ASB or UTI (Trautner and Grigoryan, 2014).

About 10% of pregnant women with asymptomatic bactriuria worldwide will progress to develop symptoms during pregnancy and thereby prompt the woman to seek medical care because of the symptoms (Ahmad et al, 2011).

Despite this knowledge on the association of ASB and adverse maternal and neonatal outcomes, screening for this condition in the developing countries is not included as part of the antenatal care offered to pregnant women (Tadesse et al, 2014).

Studies have shown that 30- 40% of untreated pregnant women with ASB will develop acute pyelonephritis in late pregnancy which is associated with significant morbidity for the mother and fetus and thus exact screening and treatment of bacteriuria regardless of symptoms is a must in order to avoid complications related to bacteriuria in pregnancy (Ahmad et al, 2011).

Worldwide surveys show that between 2% and 10 % of pregnant women will be diagnosed with asymptomatic bacteriuria at one point of their pregnancy (McIsaac et al, 2005), with frequency of ASB increasing among lower socioeconomic status, increasing age and parity groups. Some studies indicate a higher prevalence range of between 7% and as high as 86.6% ( Lee et al, 2015).

Studies show that 13% to 27% will develop pyelonephritis which in turn is associated with premature labour, premature rupture of membranes, low birth weight and increased perinatal mortality (McIsaac et al, 2005).

Several immunological, anatomical as well as behavioral factors factors have been linked to increased susceptibility of the female urinary tract to pathogens and which are compounded exponentially by physiological changes of pregnancy (Dielubanza and Schaeffer, 2011).

During pregnancy, there is a marked increase in urine stasis in the urinary tract mainly in the ureters and bladder due to the relaxing effect of progesterone and thus creating a micro environment favoring the multiplication of pathogens in the urinary tract (Glaser and Schaeffer, 2015).

The increasing uterine size can also compress on the ureters resulting in mechanical obstruction of urine flow down to the bladder and thus contribute to urine stasis, this and the resulting glycosuria of pregnancy can consequently lead to significant bacterial growth ( Ade-Ojo et al, 2013).

Some commonly practiced hygiene practices among different populations such as postcoital voiding, front to back wiping, increased fluid intake and voiding frequency, douching or avoidance of douching as well as proper sanitary ware use did not show any significant reduction of the prevalence of ASB in those populations compared to the populations where such practices were not in use (Dielubanza and Schaeffer, 2011 ).

Bacterial isolates identified through urine culture among asymptomatic pregnant women have been described to have a reductive evolution in their genome due to several factors such as modulation of host immune response, variation of adhesion and biofilm formation ( Lavigne et al, 2011).

Due to these changes seen in pregnancy predisposing the women to ASB, it is important to screen and treat for this condition during pregnancy to avoid developing pyelonephritis or symptomatic urinary tract infection (UTI) later in the pregnancy (Kehinde et al, 2011) or more serious morbidities such as premature labour, pre eclampsia and low birth weight (Ajayi et al, 2011).

Apart from the anatomical and immunological risk factors in pregnancy, previous studies have identified other risk factors such as a history of UTI, low socioeconomic status, conditions such as diabetes mellitus and sickle cell anemia as being risk factors for the development of ASB during pregnancy (Dielubanza and Schaeffer, 2011).

Different types of studies have been conducted to analyze the effect of treatment of ASB visa vie its non treatment, and have concluded that its treatment decreases the incidence of both maternal and neonatal morbidity and adverse pregnancy outcomes. This knowledge has advised the Canadian Task Force on Preventive Health Care and the United States Preventive Task Force (USPTF), to recommend for routine screening of ASB in pregnant women by use of either urinalysis, dipslide testing or urine culture (McIsaac et al, 2005).

The American Congress of Obstetricians and Gynecologists recommends that screening should be done by use of a urine culture as gold standard for diagnosis although it does not explicitly say whether this culture should be repeated to confirm the diagnosis or not ( Glaser and Schaeffer, 2015).

While the recommendations on the timing of the urine culture differ between different professional bodies, the Infectious Diseases Society of America (IDSA) and the American academy of paediatrics (AAP) recommend early screening of ASB in pregnancy using a urine culture, whereas the American Association of Family Physicians (AAFP) and the USPTF recommend screening between 12-16 weeks of gestation. Recommendations on whether to repeat cultures or not for confirmation of the diagnosis also varies between professional bodies. The IDSA does not make any recommendation for a repeat urine culture if the initial test was negative because there is limited data pertaining the timing of screening and its effect on maternal morbidity or pregnancy out comes. Despite this, evidence has shown that only a small percentage of the women with a negative urine culture in early pregnancy will develop pyelonephritis later in the pregnancy (Glaser and Schaeffer, 2015).

Despite the consensus among different professional bodies acknowledging the gold standard of diagnosing ASB as being based on the results of a urine culture of a clean catch urine sample in the absence of symptoms of UTI (Nicolle et al, 2005) there is still no consensus in literature on screening frequency for ASB among pregnant women ( Trautner and Grigoryan, 2014).

While the urine dipstick has limited use in screening due to its low sensitivity compared to the culture method (Masinde et al, 2009), dipsticks that test for the presence of nitrites and leukocyte esterase have low sensitivity and therefore have very limited role in screening for asymptomatic bacteriuria among pregnant women (Mignini et al, 2009).

Despite the fact that dipsticks are widely available and of much lower cost than doing cultures in most clinical settings in the developing world, a major disadvantage for their use in screening would be that clinicians would have to come up with a protocol to combat their poor negative predictive values ( Little et al, 2010).

The screening for and treatment of ASB in pregnancy has become a standard of obstetric care in most developed countries with most antenatal guidelines having incorporated routine screening for ASB. Non the less, there is still no consensus on the antibiotic or duration of therapy for ASB. Treatment is currently based on individual patient or the local culture and sensitivity patterns. Nonetheless, treatment of ASB during pregnancy has been shown to significantly reduce maternal morbidity (Schnarr and Smaill, 2008).

Cost evaluation studies conducted have shown that when there is a prevalence of ASB of more than 2% in a given population, only then do the cost effectiveness advantages outweigh the cost implication of managing the consequences of un managed ASB (Perera et al, 2012).

While several research on ASB in pregnancy have been carried out in Africa, the bulk of these studies has been carried out in West Africa with varying results and very few have been done in East Africa and in particular Tanzania.

# 1.2 Literature Review

Literature review search was conducted by use of search engines such as google, google scholar, and HINARI. Key words and phrases used included asymptomatic bacteriuria in pregnancy, prevalence of asymptomatic bacteriuria, risk factors for asymptomatic bacteriuria, sensitivity patterns of bacteria of the urinary tract, physiological changes of pregnancy among others.

### 1.2.1 Prevalence of asymptomatic bacteriuria among pregnant women

The average prevalence of ASB among pregnant women globally ranges between 2% - 10% ( McIsaac et al, 2005).

The prevalence of ASB none the less differs widely depending on different populations studied and the strategies of screening used.

In a prospective cohort study with an embedded randomized controlled trial conducted in Netherlands, screening for ASB in women with singleton pregnancies between 16 and 22 weeks gestation, screening was done with a single dip slide and two culture media. The prevalence of ASB in that study which was conducted in multiple ultrasound screening centers 0.05 ( Kazemier et al, 2015).

In a Canadian study to compare different screening strategies for ASB in pregnancy, there were 49 cases of ASB among 1050 women (4.7%). Leucocyte- esterase- nitrite testing at each prenatal visit identified 7 cases ( 14.3%), compared with 20 cases ( 40.8%) with one urine culture, 31 ( 63.3%) with two urine cultures and 43 ( 87.8%) with three urine cultures ( McIsaac et al, 2005).

In an American study to determine the accuracy of diagnostic tests to detect ASB during pregnancy, the prevalence was noted to be 15%. In that study, the accuracy of dip slide culture and dip stick for nitrites and leukocyte esterase was tested (Mignini et al, 2009).

 In a study conducted in Kashmir to determine the prevalence of ASB among pregnant women and published in the Sri Lanka journal of obstetrics and gynaecology, a prevalence of 6.1% was obtained among 392 women who were enrolled in that study in the first ANC visit less than 18 weeks gestation, with two subsequent midstream urine samples being cultured before coming up with the diagnosis (Ahmad et al, 2011).

A prevalence of 5.5% was obtained from a referral hospital based cross sectional study in Ghana where most pregnant women come in at advanced gestational ages (Labi et al, 2015).

Some studies show high prevalence rates such as the study done in Benin city, Nigeria involving asymptomatic women attending the antenatal clinic in a primary health facility where the prevalence was 45.3% (Imade et al, 2010), or for a similar study done in Yobe state, Nigeria where the prevalence was 43.3% (Musbau and Muhammad, 2013).

 Prevalence of ASB has also been demonstrated to differ depending on the setup under which the subjects in the study are recruited. This is notable in a study involving asymptomatic pregnant women receiving antenatal care in a traditional birth home in Benin city, Nigeria, where the prevalence was 55% (Oladeinde et al, 2015).

In a university teaching hospital in Nigeria, asymptomatic women with bacterial counts more than 100,000 colony forming units per milliliter of the same organism was found to account for 14.6% (Olamijulo et al, 2016) this is much lower than other similar studies conducted in the same country.

The prevalence of ASB can also be affected by the gestational age in which the participants are recruited from. This is notable from a cross sectional study conducted at a teaching and referral hospital in Ethiopia with the majority (45.1%) of the asymptomatic pregnant women recruited in the study being in the third trimester and 41% being in the second trimester with the mean age of the participants being 26.13 years, 18.8% were positive for significant bacteriuria (Tadesse et al, 2014).

A history of recent antibiotic use can also affect the prevalence rates, such as in the study done in Uganda to determine the prevalence and identify the aetiological agents associated with asymptomatic bacteriuria in 218 consecutive antenatal mothers at Mulago hospital, where women with a history of antibiotic use for any other reason other than a urinary tract infection were not excluded from the study, twenty nine (13.3%) of the samples had significant bacterial growth (Andabati and Byamugisha, 2010).

This is markedly higher prevalence of ASB when compared to a hospital based study conducted in Mwanza, Tanzania, where the prevalence was 13% among 169 asymptomatic pregnant women attending a referral hospital in the Lake zone, with 90.9% of these being observed in the third trimester of pregnancy (Masinde et al, 2009).

### 1.2.2 Risk factors

The risk factors for ASB that were statistically associated with ASB were varying from one population to the other.

In a study conducted in Canada to compare four screening strategies for detecting asymptomatic bacteriuria in pregnancy, the frequency of asymptomatic bacteruria increased with lower socio economic status, increasing age and parity of the participants (McIsaac et al, 2005).

Low socio economic status was positively noted as influencing the prevalence of ASB, while no statistically significant association was found between ASB and either age, parity, level of education or parity in the group that was recruited in Iran study (Jalali et al, 2013).

A study on the diagnosis of ASB and associated risk factors among pregnant women that was conducted in Mangalore, Karnataka, India, an important risk factor that played a role in that study was previous history of a urinary tract infection and accounted for 64.2% of the cases studied (Rajaratnam et al, 2014 ).

While several studies have been conducted in Sub Saharan Africa with varying prevalence rates, a study in Ghana which had a prevalence of ASB among pregnant women of 5.5% found a statistically significant association between ASB and gestational age. The prevalence was found to be higher among women in their second trimester than those in either the first or third trimesters of pregnancy, however, no significant associations with educational status, parity, gestational age, marital status and the number of fetuses carried ( Labi et al, 2015).

The risk factors of developing ASB also seemed to be influenced by characteristics such as age of the participants, for example, in the primary facility study in Nigeria which found there was a significant difference in the prevalence of ASB with reference to age (P < 0.001) however there was no significant difference with respect to trimester ( P= 0.2006) (Imade et al, 2010).

Age of the participants did not however significantly influence risk factors in some studies such as the study done in Ethiopia, where the rate of isolation was higher in the age group of 35years or more (41.67%), although the difference was not statistically significant (P= 0.07) (Tadesse et al, 2014).

The prevalence of ASB in a particular population did not seem to influence significant association with risk factors such as a study that was conducted in Uganda in a population with a prevalence of ASB of 13.3%, none of the selected socio-demographic characteristics (age, education level, marital status, gravidity, mean gestation and antibiotic use in the previous two weeks), was significantly associated with asymptomatic bacteriuria (Andabati and Byamugisha, 2010).

In the Tanzania Lake zone study with a prevalence of 13%, there was no statistically significant association between maternal age, parity, gestational age, occupation, marital status or education with bacteriuria (Masinde et al, 2009).

### 1.2.3 Antibiotic sensitivity patterns

Antibiotic sensitivity patterns vary widely, mostly influenced by the geographical location where the studies were conducted and seem mostly being attributed to local prescribing guidelines as well as the individual organism isolated.

In a study done on 250 asymptomatic pregnant women in Sri Lanka, coliforms were the most common organisms isolated (67%) with all strains isolated in that study showing sensitivity to nitrofurantoin, while a significant number of isolates showed resistance to ampicillin and oral cephalosporins ( Perera et al, 2012). Similar results were seen in the Iran study where the predominant organisms were *Escherichia coli* (58.96%) and showed resistance to ampicillin (Enayat et al, 2008). In both instances, the microbial isolates were resistant to the most common prescribed antibiotics.

The different types of micro organisms isolated also displayed differences in the antibiotics they were sensitive to.

Unlike most studies which isolated *Escherichia coli* as the most common isolated organism, the Ghana study isolated *Enterococcus* and *Proteus mirabilis* as the most common organisms isolated, and both displayed high susceptibility to nitrofurantoin which could be explained by the fact that the drug was not used routinely in the treatment of urinary tract infections in that country (Imade et al, 2015).

This trend is also seen in a Nigerian study where the prevalence of uropathogens showed *Escherichia coli* (27.1%) as the most predominant organism followed by *Staphylococcus aureus* ( 24.4%) with the overall antimicrobial susceptibility being to ciprofloxacin, ceftriaxone and augmentin which are least used antibiotics in that set up ( Labi et al, 2010).

In a different study, but also conducted in Nigerian, *Klebsiella pneumoniae* was the commonest organism isolated and the organism was noted to be resistant to amoxicillin and cloxacillin which are the commonly prescribed antibiotics but sensitive to ofloxacin, ceftazidime and gentamicin which are again least used in that setting (Olamijulo et al, 2016).

These trends were also similar in a cross sectional study in Cameroon on 102 pregnant women between the age of 15 and 45 years, *Escherichia coli* were the most common pathogens isolated and were 100% sensitive to cephalosporins while the least sensitive were cotrimoxazole and nitrofurantoin which were again the common antibiotics used in that setting ( Mukobe et al, 2013).

This sensitivity pattern in relation to the most commonly used drugs showing higher resistance is again demonstrated in an Ethiopian study where the predominant bacterial species were coagulase negative *Staphylococcus* (32.6%), *Escherichia coli* (26.1%), and *Staphylococcus aureus* (13%), with the organisms isolated being most sensitive to norfloxacin (64.7%) and least sensitive to ampicillin (17.3%) (Tadesse et al, 2014).

In Uganda, *Escherichia coli* was the commonest bacterial isolate accounting for 51.2% of all positive cultures followed by *Staphylococcus epidermidis* (20.2%) and *Klebsiella* (18%), with most of the bacterial isolates (62%) being resistant to the common antibiotic amoxicillin. The sensitivity of *Escherichia coli*, the most prevalent isolate, was highest (100%) to ceftriaxone and augmentin which are (68%), which are both not first line antibiotics in that country (Andabati and Byamugisha, 2010).

Locally, *Escherichia coli* (47.2%) and *Enterococcus* species (22.2%) were the most commonly recovered pathogens in Tanzania with the rate of resistance of *Escherichia coli* being high to a commonly available drug for most bacterial infections, ampicillin (53%) and low to imipenem (0%) which, apart from not being a first line antibiotic, is also not widely available in the pharmaceutical market (Masinde et al, 2009).

# 1.3 Problem Statement

Asymptomatic bacteriuria has been associated with both adverse fetal outcomes and maternal morbidity such as low birth weight, preterm labour and progression into pyelonephritis if no proper interventions in its management are made. It is for this reason that screening and treatment protocols have been formulated in the developed world to curb the problem and reduce its burden on pregnant women.

In Tanzania particularly, there exists no regional antibiotic resistance pattern monitoring and thus no sensitivity guided protocols for management of ASB among pregnant women. The problem of not monitoring these sensitivity patterns would be inadequate treatment of the condition and therefore more adverse maternal and neonatal outcomes due to ASB.

# 1.4 Study Justification

This research aimed at pinpointing the exact burden of ASB locally in terms of its prevalence, associated factors as well as the common organisms and antibiotic sensitivity pattern and thus help in development of screening protocols tailored to our population.

 The development results of this study can be used by regional and national health departments to draft treatment protocols which take into consideration the local antibiotic sensitivity patterns which will lead to the alleviation of the burden associated with inadequate management of ASB among pregnant women.

# 1.5 Research Question

What is the prevalence of asymptomatic bacteriuria, associated risk factors and antibiotic sensitivity pattern among women attending antenatal clinic at Kilimanjaro Christian Medical Centre in Northern Tanzania?

# CHAPTER TWO

# 2.0 OBJECTIVES

# 2.1 Broad objective

To determine the prevalence of asymptomatic bacteriuria, associated risk factors and antibiotic sensitivity pattern among women antenatal clinic at Kilimanjaro Christian Medical Centre (KCMC) in Northern Tanzania from October 2016 to December 2016.

# 2.2 Specific objectives

1. To determine the prevalence of asymptomatic bacteriuria among women attending antenatal clinic at KCMC.

2. To determine the association between ASB and participant characteristics among women attending antenatal clinic at KCMC.

3. To determine the antibiotic sensitivity pattern in asymptomatic bacteriuria among women attending antenatal clinic at KCMC.

# CHAPTER THREE

# 3.0 METHODOLOGY

# 3.1 Study design

This was a descriptive cross sectional study involving pregnant women attending antenatal clinic (ANC) at KCMC from October 2016 to December 2016.

# 3.2 Study area

The study was conducted at the obstetrics and gynaecology outpatient clinic of KCMC between October 2016 and December 2016.

 Kilimanjaro Christian Medical Centre is a zonal referral hospital located in Moshi Urban District, Kilimanjaro Region in the Nothern zone of Tanzania. It also is a teaching hospital for the Kilimanjaro Christian Medical University College.

The out patient clinic runs three days a week, which is Monday, Wednesday and Friday and attends to both Obstetrical and Gynecological cases with an average attendance of 300 patients per week attended by consultants, residents and medical officer interns.

Kilimanjaro Christian Medical Centre operates a standard laboratory accredited by both the International Organisation for Standardization (ISO 15189) and The Southern African Development Community Accreditation Service (SADCAS) accreditation bodies where the laboratory work was carried out.

# 3.3 Study population

A total of 304 women who were attending routine antenatal visit at a gestation age less than 37 weeks and who met the inclusion criteria were recruited into the study after signing a consent form.

# 3.4 Inclusion and Exclusion criteria

### 3.4.1 Inclusion criteria

Pregnant women with a gestational age less than 37 weeks who routine ANC at KCMC and gave their informed consent.

### 3.4.2 Exclusion criteria

Pregnant women who reported a history of antibiotic use within the last week prior to their interview were excluded.

Human immunodeficiency virus infected clients, as well as clients known to have diabetes mellitus were excluded as these conditions are known to be important risks for ASB in pregnancy.

# 3.5 Sample size

A formula of Kish & Lisle (1965) was used to calculate the sample size as shown below.

 N = Z2 P (1- P)

 E2

Where:-

N= Minimal sample size

Z= Standard normal deviation of 1.96, corresponding to 95% confidence interval

P= 13% prevalence of ASB (Masinde et al, 2009).

E= Precision= 5%

N = (1.96)2 x 0.13 (1- 0.13)

 0.052

Therefore, a minimum estimated sample size was 173.

# 3.6 Sampling technique

A simple random sampling technique was used to select the required sample size from a cohort.

# 3.7 Study variables

### 3.7.1 Dependent variable

 Asymptomatic bacteriuria

### 3.7.2 Independent variables

* Maternal age
* Marital status
* Residence
* Level of education
* Occupation
* Parity
* Gestational age
* Number of antenatal visits

#

# 3.8 Data collection methods and tools

### 3.8.1 Data collection methods and procedure

Women who consented after being given detailed information about the study underwent a face to face interview to collect socio demographic and obstetric information by use of a questionnaire.

After the interview, a wide mouth sterile container was given to the pregnant women to collect urine sample for diagnosis of ASB. The sample was stored temporarily for an average of four hours after collection at the clinic in an ice packed cool box at temperatures of between 2 and 8 degrees Celsius before being transferred to the laboratory. Participants who were diagnosed to be ASB positive were offered treatment free of charge.

### 3.8.2 Laboratory tests

Once the samples were received in the lab, each was examined macroscopically and recording done. 20 micro litres was placed onto blood agar and Mac Conkey culture mediums and cultured for 24 hours for gram negative and gram positive bacteria respectively.

For the samples that showed a single colony growth of 100,000 units, sensitivity to the common antibiotics used during pregnancy, that is, Ampicillin, Amoxivlav, Gentamicin, Ceftriaxone and Erythromycin was done on Muller Hinton media using a standard wire loop procedure with the filling of a laboratory data extraction sheet for each sample.The two sets of data were then be cleaned and compounded to come up with a tallying data sheet.

# 3.9 Data processing and analysis

Data obtained was entered, processed and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Before analysis, data was cleaned by using frequency analysis. Descriptive analysis was used to summarize data. Categorical data were summarized in percentages. Continuous variables were summarized by use of mean with their respective measures of dispersion. P value of < 0.05 was taken as cut off level of statistical significance

# 3.10 Ethical consideration

Ethical approval was obtained from the Kilimanjaro Christian Medical University college Research Ethics committee prior to starting data collection and a research ethical clearance certificate number 969 issued by the Kilimanjaro Christian Medical University College and permission sought from the head of Obstetrics and Gynecology to conduct the study at the departments out patient clinic.

Participants were informed about the purpose of the study and asked to sign the consent form prior to their enrollment and were informed about their right to refuse to participate or to withdraw from the study. Equal standard of care during attendance to the clinic and subsequent care during delivery at our facility was assured to the participants and non participants of the study.

 No names were entered into either the data collection sheet or the laboratory data extraction sheet and all information gathered was only privy to the research team. No costs pertaining to this study were borne by the participants.

Telephone numbers were entered into the socio demographic and obstetric questionnaire so that information on the results of the test and information on how to get her treatment free of charge.

# CHAPTER FOUR

# 4.0 RESULTS

# 4.1 Socio demographic and obstetric characteristics of study participants.

The socio-demographic characteristics of the study participants are characterized in Table1. A total of 304 pregnant women were involved in this study however, only 300 participants were analyzed after 4 forms were withdrawn due to irretrievable information. The mean age of the women was 26.9 ±5.6 and majority 235(78) aged between 21-35 years. More than half 189 (63) of these women were residing in urban Moshi, 156 (52) had college or university education and majority were married.

Regarding the number of deliveries, a woman had ever had, 168 (56) had 1-2 deliveries, of this 73(24) had history of abortion. More than half 172 (57) of the women were in their second trimester. Majority 151 (90%) of the participants had never had history of delivering babies with low birth weight, also less than half (28%) of the participants attended 4 or more ANC visit with 66% having had between one and three prior antenatal clinic visits and only 14 (5%) had never attended ANC visit.

Almost half (49%) reported being unemployed. A bigger proportion of the participants were married (92%), with 76% of the participants reporting no history of an abortion while 90% reported no history of having a low birth weight delivery.

In this study, the prevalence of asymptomatic bacteriuria among pregnant women was 8.6%.

|  |
| --- |
| **Table 1: Characteristics of study participants (N=300)** |
| **Variable** | **N** | **%** |
| **Age mean(SD)** | 29.6(5.6) |  |
| **Age group** |  |  |
| 15-20 | 9 | 3 |
| 21-35 | 235 | 78 |
| 35 and above | 56 | 19 |
| **Place of residence** |  |  |
| Moshi Urban | 189 | 63 |
| Moshi Rural | 70 | 23 |
| Others | 41 | 14 |
| **Education level** |  |  |
| Primary level | 74 | 25 |
| Secondary level | 70 | 23 |
| College/University | 156 | 52 |
| **Occupation** |  |  |
| Unemployed | 146 | 49 |
| Informal employed | 17 | 5 |
| Formal employed | 137 | 46 |
| **Marital status** |  |  |
| Single | 25 | 8 |
| Married | 275 | 92 |
| **Number of term deliveries** |  |  |
| None | 105 | 35 |
| 1-2 | 168 | 56 |
| 3 and above | 27 | 9 |
| **History of abortion** |  |  |
| No | 227 | 76 |
| Yes | 73 | 24 |
| **History of low birth weight** |  |  |
| No | 151 | 90 |
| Yes | 17 | 10 |
| **ANC visit(s)** |  |  |
| None | 14 | 5 |
| 1-3 | 197 | 66 |
| 4 or more | 85 | 28 |
| Missing=4 |  |  |
| **History of urinary tract infections** |  |  |
| No | 136 | 89 |
| YesMissing= 148 | 16 | 11 |
| **Gestation age(weeks)** |  |  |
| 1st Trimester | 53 | 18 |
| 2nd Trimester | 172 | 57 |
| 3rd Trimester | 71 | 24 |
| Missing=4 |  |  |

# 4.2. Association between ASB and participant characteristics

Table 2 highlights the association between ASB and socio demographic and obstetric characteristics of the pregnant women attending ANC visit at KCMC who were enrolled into this study. As shown all factors were not significantly associated with ASB this includes; gestation age, occupation, level of education age, history of abortion, prior ANC visit and number of deliveries a woman had ever had. Other factors that were also not statistically associated with the outcome are shown below.

**Table 2: Association between ASB and participant characteristics**

|  |  |  |
| --- | --- | --- |
| **Variable** | Bacteriuria | χ2 Pvalue |
|  | Yes n (%) | No n (%) | P value |
|  |  |  |  |
| **Age group** |  |  | 0.477\* |
| 15-20 | 1 ( 11) | 8 (89) |  |
| 21-35 | 22 ( 9) | 213 ( 91) |  |
| 35 and above | 3 (5) | 53 (95) |  |
| **Place of residence** |  |  | 0.871\* |
| Moshi Urban | 18 (10) | 171 (90) |  |
| Moshi Rural | 5 (7) | 65 (93) |  |
| Others | 3 (7) | 38 (93) |  |
| **Education level** |  |  | 0.536  |
| Primary level | 7 (9) | 67 (91) |  |
| Secondary level | 8 (11) | 62 (89) |  |
| College/University | 11 (7) | 145 (93) |  |
| **Occupation** |  |  | 0.756\* |
| Unemployed | 11 (8) | 135 (92) |  |
| Informal employed | 2 (12) | 15 (88) |  |
| Formal employed | 13 (9) | 124 (91) |  |
| **Marital status** |  |  | 0.386\* |
| Single | 1 (4) | 24 (96) |  |
| Married | 25 (9) | 250 (91) |  |
| **Number of term deliveries** |  |  | 1.000\* |
| None | 9 (9) | 96 (91) |  |
| 1-2 | 15 (9) | 153 (91) |  |
| 3 and above | 2 ( 7) | 25 (93) |  |
| **History of abortion** |  |  | 0.876 |
| No | 20 (9) | 207 (91) |  |
| Yes | 6 (8) | 67 (92) |  |
| **History of low birth weight** |  |  | 1.000\* |
| No |  14 ( 9) | 137 (91) |  |
| Yes | 1 (6) | 16 (94) |  |
| **Anc visits** |  |  | 0.197\* |
| None | 3 (21) | 11 (79) |  |
| 1-3 | 15 (8) | 182 (92) |  |
| 4 or more | 7 (8) | 78 (92) |  |
| **History of urinary tract infections** |  |  | 1.000\* |
| No | 16 (12) | 120 ( 88) |  |
| Yes | 1 (6) | 15 (94) |  |
| **Gestation age(weeks)** |  |  | 0.351\* |
| 1st Trimester | 7 (13) | 46 (87) |  |
| 2nd Trimester | 15 (9) | 157 (91) |  |
| 3rd Trimester | 4 (7) | 67 (94) |  |

**\*exact P value**

# 4.3 Bacterial isolates from the Urine sample

The organism isolated from the urine sample according to the frequency of occurrence was *Escherichia coli* (50%), *Streptococcus pyogenes* (19%), *Klebsiella pneumoniae* (15%), Group B *Streptococcus* (8%), Group A *Streptococcus* and *Proteus mirabilis* (4%) respectively as summarized in table 3.

|  |
| --- |
| **Table 3. Bacterial Isolates (n=26)** |
| **Bacterial Isolates** | **n(%)** |
| *Escherichia coli* | 13(50) |
| *Streptococcus pyogenes* | 5(19) |
| *Klebsiella pneumoniae* | 4(15) |
| Group B *Streptococcus*  | 2(8) |
| Group A *Streptococcus* | 1(4) |
| *Proteus mirabilis* | 1(4) |

# 4.4: Antibiotic sensitivity patterns for gram Negative Isolates

Antibiotic susceptibility testing was performed for all isolates. Antibiotic sensitivity was highest for ceftriaxone and least for ampicillin.

*Escherichia coli* was highly sensitive to ceftriaxone that is 100%, followed by gentamycin 75% and it was less sensitive to Ampicillin which was 15%. *Klebsella pneumoniae* was not sensitive to Ampicillin however this organism had a sensitivity of 75% for ceftriaxone, gentamycin and Nitrofurantoin. *Proteus mirabilis* was less sensitive to ampicillin as well as for nitrofurantoin however highly sensitive to ceftriaxone and gentamycin. See table 4.

|  |
| --- |
| **Table 4: Rate of sensitivity to antibiotic among Gram negative bacteria** |
| **Organisms**  | **Drugs** |
|  | Ceftriaxone | Nitrofurantoin | Amoxiclav | Gentamycin | Ampicillin |
| ***Escherichia coli*** **(n=13)** | 100 | 62 | 69  | 77 | 15 |
| ***Klebsiella pneumoniae* (n=4)** | 75 | 75 | 75  | 100 | 0 |
| ***Proteus mirabilis*** **(n=1)** | 100 | 0 | 100 | 100 | 0 |

# 4.5: Antibiotic sensitivity patterns for gram Positive Isolates

Among the gram positive bacteria, *Streptococcus* group A was highly sensitivity to erythromycin, and ampicillin. *Streptococcus* group B was highly (100%) sensitive to Penicillin but less sensitive to Erythromycin as shown on table 5. *Streptococcu*s group A showed sensitivity to erythromycin, amoxiclav and ampicillin. *Streptococcus* group B displayed sensitivity to amoxiclav and ampicillin but was resistant to erythromycin.

Of 5 samples that grew *Streptococcus pyogenes*, one colony displayed sensitivity to erythromycin while four colonies of the same organism were sensitive to amoxiclav and ampicillin.

 Less than half (40%) of the *Streptococcus pyogenes* isolates were sensitive to Penicillin. On the other hand, *Streptococcus pyogenes* showed a sensitivity of 20% to erythromycin.

This is summarized in table 5.

|  |
| --- |
| **Table 5: Rate of sensitivity to antibiotic among Gram positive bacteria** |
|  | Erythromycin |  | Penicillins |
| **streptococcus group A****(n=1)** | 100 |  | 100 |
| **streptococcus group B****(n=2)** | 0 |  | 100 |
| **streptococcus pyogenes****(n=5)** | 20 |  | 40 |

# CHAPTER FIVE

# 5.0 DISCUSSION

The results of this study show a prevalence of 8.6% of asymptomatic bacteriuria among pregnant women attending ANC at KCMC hospital. The most common bacterial isolates were *Escherichia coli* comprising 50% of the isolates,followed by *Streptococcus pyogenes* and *Klebsiella pneumoniae*, each accounting for 19% of the isolates while least in terms of frequency was *Proteus mirabilis* with 4% of the total isolates. In this study, all gram negative bacteria isolates were sensitive to ceftriaxone and gentamicin while the gram positives were sensitive to erythromycin and penicillins. No socio demographic and obstetric characteristics were significantly associated with asymptomatic bacteriuria in pregnancy in this study.

The prevalence of ASB in this study is comparable to that reported in Mwanza, Tanzania, which reported a prevalence of 13%. This similarity can be due to the reason that both studies were conducted in referral setting and the clients had most likely been exposed to antibiotics in their primary health care facilities. Similarly, both studies recruited their participants from antenatal clinics where trained personnel were available (Masinde et al, 2009).

However, the prevalence is higher compared to that reported in Ghana of 5.5% (Labi et al, 2015). The observed difference may also be attributed to the characteristics of the participants in that most of the participants in this study were in their third trimester (63.1%). This phenomenon comes out again in a similar study in Ghana in which the percentage incidence of asymptomatic urinary tract infection over the three trimesters of a normal full term pregnancy was highest in the second trimester (50.4%) (Boye et al, 2012).

In a cross-sectional study done in Nigeria involving 220 asymptomatic pregnant women attending a traditional birth home for ante natal care, the prevalence of ASB was 55%, and was significantly affected by parity and gestational age (P< 0.05) (Oladeinde et al, 2015). This prevalence was significantly higher than what we got in our study.

While the prevalence in the Oladeinde study was markedly higher, this may be attributed to the setting in which the study was conducted in, which was a traditional birth clinic where untrained attendands were at hand (Oladeinde et al, 2015).

Our study also looked into the association between the prevalence of ASB and the socio demographic and obstetric characteristics of the participants. There was however no statistically significant association between the outcome and the exposure variables. This lack of significant statistical association could be linked to the low prevalence obtained in this study (8.6%) and thus the inability to draw a statistically significant inference on the population based on that prevalence.

This finding was similar to a study done in Tanzania that enrolled 169 asymptomatic women and had a prevalence of 13%. Subsequently on analysis, no statistically significant association between the outcome and the exposure variables (Masinde et al, 2009).

The non association could be attributed to the low prevalence in both studies and thus lack of a statistical association between the socio demographic and obstetric characteristics and ASB.

In contrast, studies that have had high prevalence rates have been able to draw statistically significant exposure- outcome associations.

In a Nigerian study, a prevalence of 28.8% drew up an association between ASB and relatively high socio economic class consisting of skilled professionals and those with tertiary education. This was linked to the possibility that this set of people could afford the antibiotics available from chemist shops even without a doctor’s prescription and that may have predisposed them to sub clinical infections (Kahinde et al, 2011).

In a study done on 220 asymptomatic women attending ante natal clinic at a traditional birth home in Nigeria and in which the investigators obtained a very high prevalence of 55%, a statistically significant association between outcome variable and both parity and gestational age was identified in that study (P<0.05) (Oladeinde et al, 2015).

The implication of this study, consistently reaffirmed by previous studies, is that a decision to screen for ASB in asymptomatic pregnant women should be influenced more by the prevalence rather than the population characteristics where the prevalence is low.

In this study, *Escherichia coli, Klebsiella pneumoniae and* Group B *streptococcus* were the most common organisms isolated, accounting for 50%, 19% and 15% respectively of the total isolates.

*Proteus mirabilis* had the least number of isolates accounting for 4% of the total isolates.

The finding is similar to the study done in Tanzania where *Escherichia coli* was the most common cultured pathogen (47.2%) (Masinde et al, 2009).

Overall, the gram negative bacteria accounted for a larger percentage (69%), compared to the gram positive bacteria (31%) in our study.

The rate of sensitivity of *Escherichia coli* to ceftriaxone was highest (100%), while the rate of ampicillin was low at 15%. *Klebsiella pneumoniae* showed high sensitivity to gentamicin but no sensitivity to ampicillin. *Proteus mirabilis* displayed no sensitivity to the common antibiotics, nitrofurantoin and ampicillin, in our study.

Similar pattern of sensitivity was also displayed in the Tanzania study where gram negative bacteria showed low rate of resistance to gentamicin, imipenem and ciprofloxacin, while the gram positive bacteria displayed high rate of resistance to the widely available nitrofurantoin, ciprofloxacin and ampicillin (Masinde et al, 2009).

This is also similar to West African studies where both the gram negative and the gram positive bacteria displayed low susceptibility to ampicillin and erythromycin (Boye et al, 2012).

*Escherichia coli* is a normal flora of the bowel and therefore contamination of the specimen as well as contamination of the urethral area by fecal matter may contribute to its high prevalence among the asymptomatic women while low sensitivity to the common antibiotics has been noted with concern.

The implication of these findings would be to lobby for regulations on tighter control on non prescription use of antibiotics. This would check the growing exposure of antibiotics to these micro organisms and thus control the rising antibiotic resistance.

# Despite this study meeting similar challenge as in other studies conducted in Sub Saharan Africa in that it was conducted in a referral centre and thus the sample may not be representative of the entire population, it has a strength that samples were collected in wide mouth sterile containers and thus minimized significantly the risk of contamination and subsequent false positives.

# 5.1 Conclusion

The ASB prevalence of 8.9%, coupled with the low sensitivity of micro organisms isolated in this study to first line antibiotics warrant placement of national guidelines to screen and treat ASB in this population.

# 5.2 Recommendations

A checklist can be created to ensure that only the women with risks are identified to be screened to minimize the chances of unnecessary costs to the client and burden to the service providers and health care system.

Mechanisms for monitoring changing patterns of antibiotic sensitivity should be set up in future to help in proper management of infections in the urinary tract.

# REFERENCES

Ade-Ojo IP, Oluyege AO, Adegun PT, Akintayo AA, Aduloju OP, Olufinbiyi BA (2013). Prevalence and antimicrobial susceptibility of asymptomatic significant bacteriuria among new antenatal enrollees in Southwest Nigeria. International research journal of microbiology, 4(8): 197-203.

Ahmad S, Shakooh S, Salati SA, Muneim A (2011). Prevalence of asymptomatic bacteriuria among pregnant women in Kashmir. Sri Lanka journal of obstetrics and gynaecology, 33: 158-162.

Ajayi AB, Nwabuisi C, Aboyeji AP, Ajayi NS, Fowotade A, Fakeye OO (2012). Asymptomatic bacteriuria in antenatal patients in Ilorin, Nigeria. Oman medical journal, 27(1): 31-35.

Andabati G, Byamugisha J (2010). Microbial aetiology and sensitivity of asymptomatic bacteriuria among antenatal mothers in Mulago hospital, Uganda. African health sciences, 10(4): 349-352.

Boye A, Siakwa PM, Boangpong JN, Koffuor GA, Ephraim RK, Amoateng P et al (2012). Asymptomatic urinary tract infections in pregnant women attending antenatal clinic in cape coast, Ghana. Journal of medical research, 1(16): 74-82.

Dielubanza EJ, Schaeffer AJ (2011). Urinary tract infections in women. Medical Clinics of North America 95: 27-41.

Enayat K, Fariba F, Bahram N (2008). Asymptomatic bacteriuria among pregnant women referred to outpatient clinics in Sanandaj, Iran. International braz journal of urology, 34(6): 699-707.

Glaser AP, Schaeffer AJ (2015). Urinary tract infection and bacteriuria in pregnancy. Urologic clinics of North America, 42: 547-560

Imade PE, Izekor PE, Eghafona NO, Enabulele OI, Ophori E (2010). Asymptomatic bacteriuria among pregnant women. North American journal of medical sciences, 2(6): 263-265.

Jalali M, Shamsi M, Roozbehani N, Kabir K (2014). Prevalence of urinary tract infection and some factors affected in pregnant women in Iran Karaj city. Middle East journal of scientific research, 20(7):781-785.

Kazemier BM, Koningstein FN, Schneeberger C, Ott A, Bossuyt PM, DeMiranda E et al (2015). Maternal and neonatal consequences of treated and untreated asymptomatic bacteriuria in pregnancy. Lancet infectious diseases, 15: 1324- 1333.

Kehinde AO, Adedapo KS, Aimaikhu CO, Odukogbe AA, Olayemi O, Salako B (2011). Significant bacteriuria among asymptomatic antenatal clinic attendees in Ibadan, Nigeria. Tropical medicine and health 39(3): 73-76.

Labi AK, Yawson AE, Ganyaglo GY, Newman MJ (2015). Prevalence and associated risk factors of asymptomatic bacteriuria in ante-natal clients in a large teaching hospital in Ghana. Ghana medical journal, 49(3): 154-158.

Lavigne J, Boutet-Dubois A, Laouini D, Combescure C, Bouziges N, Mares P et al (2011). Virulence potential of *Eschericia coli* strains causing asymptomatic bacteriuria during pregnancy. Journal of clinical microbiology, 49(11): 3950- 3953.

Lee AC, Quaiyum MA, Mullany LC, Mitra DK, Labrique A, Ahmed P et al (2015). Screening and treatment of maternal genitourinary tract infections in early pregnancy to prevent preterm birth in rural Sylhet, Bangladesh: a cluster randomized trial. BMC Pregnancy and Childbirth, 13: 326.

Little P, Moore MV, Turner S, Rumsby K, Warner G, Lowes JA et al (2010). Effectiveness of five different approaches in management of urinary tract infection: Randomised controlled trial. British medical journal, 340: 199.

Masinde A, Gumodoka B, Kilonzo A, Mshana SE (2009). Prevalence of urinary tract infection among pregnant women at Bugando medical centre, Mwanza, Tanzania. Tanzania journal of health research, 11(3):154- 161.

McIsaac W, Carrol JC, Biringer A, Bernstein P, Lyons E, Low DE et al (2005). Screening for asymptomatic bacteriuria in pregnancy. Journal of obstetrics and gynaecology of Canada, 27(1): 20-24.

Mignini L, Carroli G, Abalos E, Widmer M, Amigot S, Nardin JM et al (2009). Accuracy of diagnostic tests to detect asymptomatic bacteriuria during pregnancy. Journal of obstetrics and gynaecology, 113(2): 346-352.

Mokube MN, Atashili J, Halle-Ekane GE, Ikomey GM, Ndumbe PM (2013). Bacteriuria amongst pregnant women in Buea health district, Cameroon: Prevalence, predictors and antibiotic sensitivity patterns and diagnosis. Plos one, 8(8): 71-86.

Musbau S, Muhammad Y (2013). Prevalence of asymptomatic bacteriuria among pregnant women attending antenatal clinic at federal medical centre Nguru Yobe state. Scholars journal of applied medical sciences, 1(5): 658-660.

Nicolle L, Bradley S, Colgan R, Rice J, Schaeffer A, Hooton TM (2005). Infectious diseases society of America guidelines for the diagnosis and treatment of asymptomatic bacteria in adults. Clinical infectious diseases, 40: 643-54.

Oladeinde BH, Omoregie R, Oladeinde OB (2015). Asymptomatic urinary tract infection among pregnant women receiving antenatal care in a traditional birth home in Benin city, Nigeria. Ethiopia journal of health sciences, 25(1): 3-8.

Rajaratnam A, Baby NM, Kuruvilla TS, Machado S (2014). Diagnosis of asymptomatic bacteriuria and associated risk factors among pregnant women in Mangalore, Karnataka, India. Journal of clinical and diagnostic research, 8(9): 23-25.

Schaeffer AJ (2001). What do we know about urinary tract infection- prone individual? The journal of infectious diseases, 183(supplementary 1): 66-69.

Schnarr J, Smaill F (2008). Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. European journal of clinical investigation, 38: 50- 55.

Tadesse E, Teshome M, Merid Y, Kibret B, Shimelis T (2014). Asymptomatic urinary tract infection among pregnant women attending the antenatal clinic of Hawassa referral hospital, southern Ethiopia. Biomed central research notes, 7:155.

Trautner BW, Grigoryan L (2014). Approach to a positive urine culture in a patient without urinary symptoms. Infectious disease clinic of North America, 28(1): 15-31.

**APPENDICES**

# Appendix 1: Consent Form (English version)

I (full name) …………………….. ………………. …………………………….

do here by freely agree to be involved in the study and that I am willing to undergo a urine test and treatment if necessary as explained to me by the doctor. I have been explained to in length about the study and I have been made aware that I have a right to consent or to refuse and that the latter will not affect the quality of care I and my baby receive at this hospital.

I hereby also agree to give out my telephone number and to be contacted for free treatment if my test will be positive.

Signature (Patient /Guardian) …………………………….

Date …………………………………

# Appendix 2: Hati ya Kukubali Kushiriki kwenye Utafiti: (Swahili version)

Mimi (Majina kamili) ………………………….. ………………….. ……………………

nakubali kwa hiari yangu kuhusishwa kwenye utafiti huu na kwamba niko tayari kufanyiwa kipimo cha mkojo na kupewa tiba kama itakua inahitajika kama nilivyo elezwa na dakitari. Nimeelezwa kwa kina kuhusu utafiti huu na nimeeleweshwa kwamba nina haki ya kukubali au kukataa na endapo nitakataa maamuzi yangu hayata adhiri kiwango cha matibabu tutakayoyapata mimi au mwanangu katika hospitali hii.

Nakubali pia kwa hiari yangu kutoa namba yangu ya simu na kupigiwa simu kwa ajili ya matibabu bila gharama endapo kipimo change kitaonekana kuwa na shida.

Saini (Mgonjwa/Mlezi) ……………………………….

Tarehe ……………………………………..

# Appendix 3: DATA COLLECTION FORMS

**SOCIO-DEMOGRAPHIC AND OBSTETRIC QUESTIONNAIRE**

1. Serial Number ……………

2. HOSPITAL REGISTRATION NUMBER…………………………………..

3. TELEPHONE NUMBER …………………………………..

4. AGE………………

5. AREA OF RESIDENCE

 a). Moshi Urban

 b). Moshi Rural

 c). Other ( Specify) …………………………………………..

6. MARITAL STATUS

 a). Married

 b). Single

 c). Cohabiting

7. LEVEL OF EDUCATION

 a). Informal

 b). Primary level

 c). Secondary level

 d). College/ University

8. OCCUPATION.

 a). Unemployed

 b). Housewife

 c). Informal employment

 d). Formal employment

9. NUMBER OF TERM DELIVERIES………………………………………...

10. NUMBER OF PRETERM DELIVERIES (INCLUDING SPONTANEOUS ABORTIONS)….

11. LOWEST WEIGHT OF BABY DELIVERED (GRAMS)…………………..

12. HIGHEST WEIGHT OF BABY DELIVERED ( GRAMS)…………………

13. GESTATION AGE ( BY DATES/ EARLY ULTRASOUND) ………………

14. NUMBER OF PRIOR ANC VISITS…………………………….

15. URINE ANALYSIS DONE DURING PRIOR VISITS

 a). Yes

 b). No

 c). Not applicable

16. IF YES,

 a). Negative for bacteria/ nitrites/ wbc

 b). Positive for bacteria/ nitrites/ wbc

17. IF POSITIVE FOR BACTERIA, ANY TREATMENT OFFERED?

 a). Yes

 b). No

**SOCIO-DEMOGRAPHIC AND OBSTETRIC QUESTIONNAIRE- Swahili version**

1. Namba ya serial ………………
2. Namba ya kujiandikisha hospitali …………………………
3. Namba yako ya simu………………………………………..
4. UMRI WAKO……………….
5. SEHEMU UNAPOISHI
6. Moshi mjini
7. Moshi vijijini
8. Kwingineko (Taja)
9. UMEOLEWA?
10. Ndio
11. Hapana
12. Kinyumba
13. ELIMU YAKO
14. Sijasoma
15. Primary
16. Sekondari
17. Chuo
18. KAZI YAKO
19. Sina ajira
20. Mama wa nyumbani
21. Nimejiajiri
22. Nimeajiriwa
23. NIMEJIFUNGUA MARA NGAPI MIMBA ZILIZOTIMIA……..
24. WATOTO ULIOJIFUNGUA BILA KUTIMIA (PAMOJA NA MIMBA ZILIZO HARIBIKA)……..
25. UZITO WA CHINI KABISA WA MTOTO ULIYEWAHI KUJIFUNGUA (GRAMU)…………….
26. UZITO WA JUU KABISA WA MTOTO ULIYEWAHI KUJIFUNGUA (GRAMU)…………….
27. UMRI WA MIMBA (KWA TAREHE/ ULTRASOUND YA AWALI)…….
28. JE ULISHAWAHI KUPIMWA MKOJO WAKATI WA MAHUDHURIO YALIYOPITA?
29. Ndio
30. Hapana
31. Si husika
32. KAMA NDIO,
33. Hasi kwa bacteria/ nitrites/ wbc
34. Chanya kwa bacteria/ nitrites/ wbc
35. KAMA JIBU LILIKUA NI CHANYA KWA BACTERIA, ULIPEWA TIBA YEYOTE?
36. Ndio
37. hapana

**LABORATORY DATA EXTRACTION SHEET**

1. SERIAL NUMBER …………………………………..

2. HOSPITAL REGISTRATION NUMBER ……………………………

3. VOLUME OF SPECIMEN (mls) ……………………

4. COLOUR ……………………………………

5. APPEARANCE

 a). Clear

 b). Cloudy/ Particulate

6. ORGANISMS ISOLATED

……………………………………

………………………………………

7. SENSITIVE TO

………………………………

………………………………..

……………………………….

8. RESISTANT TO

……………………………………

……………………………………

……………………………………

# Appendix 4: Ethical clearance certificate

