# PREVALENCE, ETIOLOGY AND FACTORS ASSOCIATED WITH URINARY TRACT INFECTIONS AMONG ADULT FEMALES AT NYAMAGANA DISTRICT HOSPITAL IN MWANZA CITY, TANZANIA

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# PREVALENCE, ETIOLOGY, AND FACTORS ASSOCIATED WITH URINARY TRACT INFECTIONS AMONG ADULT FEMALES AT NYAMAGANA DISTRICT HOSPITAL IN MWANZA CITY, TANZANIA

**By**

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**A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science (Applied Epidemiology) of**

**Muhimbili University of Health and Allied Sciences**
**October, 2024**

## CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation titled; ‘‘**Prevalence, Etiology and Factors Associated with Urinary Tract Infections among Adult Females at Nyamagana District Hospital in Mwanza City, Tanzania’’,** in (partial) fulfilment of the requirements for the degree of Master of Science in Applied Epidemiology of Muhimbili University of Health and Allied Science**s**.

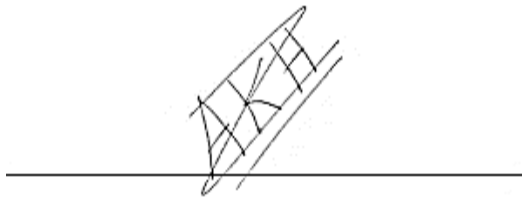
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**Dr. Theresia Ambrose**

(Supervisor)

_____

**Date**



**Dr. Ally K. Hussein**

(Co-Supervisor)

_____

**Date**

## DECLARATION AND COPYRIGHT

I, **Fungo Samson Masalu**, hereby do declare that this **dissertation** is my original work and that it has not been presented and is not intended for presentation to any other University for a similar or any other degree award.



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## ABSTRACT

**Background:** Urinary Tract Infections (UTIs) are public health problems affecting about 150 million people globally each year, mostly among females, representing the top 3 outpatient diagnoses in Nyamagana District in Mwanza region, Tanzania. Bacteria causing UTIs in females are diverse and incorrect treatment of UTIs could lead to antimicrobial resistance and potential complications such as kidney damage and renal failure. Several factors can increase the risk of UTIs including sexual practices, poor hygiene, low water intake, catheterization and history of UTIs.

**Aim:** The aim of the study was to determine the prevalence, etiology, antimicrobial susceptibility patterns, and factors associated with UTIs among adult females at Nyamagana District Hospital in Mwanza City, Tanzania.

**Materials and Methods:** A cross-sectional study was conducted among adult females (≥18 years) attending as outpatients at Nyamagana District Hospital between April and May 2024. A systematic random sampling procedure was used to recruit 392 participants. Data on sociodemographic, clinical, and behavioral factors associated with UTIs were collected using structured interview questionnaire and on etiology and antimicrobial susceptibility for UTIs were obtained through urine culture and sensitivity tests. Descriptive statistics and modified Poisson regression analysis (bivariate and multivariable analysis) were performed using STATA (version 15.1) where the association between UTIs and the independent variables was interpreted using adjusted prevalence ratios with significance level set at p-value< 0.05.

**Results:** Among 392 participants with a Median age of 30 years and Interquartile Range (IQR) of 23 – 42 years, UTIs were found in 32.1% (95% CI: 27.5-36.8, n=126) adult females. The UTI was significantly associated with younger age, unsafe sexual activity, low drinking water intake, history of catheterization and knowledge on UTI prevention. Of the 126 isolated pathogens, gram-negative bacteria included *Escherichia coli (*31.7%, n=40), *Klebsiella spp*. (18.3%, n=23) and *Enterobacter spp.* (8.7%, n=11) and gram-positive bacteria included *Staphylococcus aureus* (21.4%, n=27) and *Staphylococcus saprophyticus* (5.6%, n=7). *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella spp.,*

the predominant causative bacteria isolated had high antimicrobial susceptibility (≥80.0%) against antibiotics like Ciprofloxacin (*E. coli* – 87.5%, *S. aureus* – 85.2%, *K. spp.* – 87.0%), Gentamycin (*E. coli* – 100.0%, *S. aureus* – 88.9%, *K. spp.* – 95.7%), Ceftriaxone (*E. coli* – 85.0%) and Meropenem (*E. coli* – 92.5%, *K. spp.* – 95.7%). Low antimicrobial susceptibility rates ranged from 0.0% to 47.5% against Penicillin G, Trimethoprim-sulfamethoxazole, Erythromycin, Tetracycline, Clindamycin and Imipenem.

**Conclusion and Recommendations:** The prevalence of UTIs is high among adult females at Nyamagana District Hospital with several socio-demographic, clinical and behavioral factors showing significant association with the disease. *Escherichia coli, Staphylococcus aureus* and *Klebsiella spp.* are the predominant causative bacteria, all of which have shown high antimicrobial susceptibility (≥80.0%) against antibiotics like Ciprofloxacin, Gentamycin, Ceftriaxone and Meropenem which are among the UTI treatment options as per Tanzania Mainland's Standard Treatment Guideline (STG). Other treatment options in the guideline like Nitrofurantoin and Amoxicillin + Clavulanic acid showed considerably lower antimicrobial susceptibility (< 80%). Low antimicrobial susceptibility rates have been observed against other antibiotics which are not UTI treatment options (but could happen to be used) like Penicillin G, Erythromycin, Tetracycline, Trimethoprim-sulfamethoxazole, Clindamycin and Imipenem. There is a need to explore the effectiveness of existing UTI prevention and control interventions along with evaluating the utilization of the existing STG as possibility of UTI treatment contrary to recommended UTI treatment options may exist leading to antimicrobial resistance.

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**ABBREVIATIONS**

| | | |
|---|---|---|
| *A. spp.* | - | Acinetobacter *species* |
| CDC | - | Centers for Diseases Control and Prevention |
| CFU | - | Colony-Forming Units |
| CLSI | - | Clinical and Laboratory Standards Institute |
| DM | - | Diabetes Mellitus |
| *E. coli* | - | *Escherichia coli* |
| *E. spp.* | - | *Enterobacter species* |
| HCF | - | Healthcare Facility |
| HFR | - | Health Facility Registry |
| HIV | - | Human Immunodeficiency Virus |
| HMIS | - | Health Management Information System |
| *K. spp.* | - | *Klebsiella* species |
| LGA | - | Local Government Authority |
| MCC | - | Mwanza City Council |
| MH | - | Mueller Hinton |
| MOH | - | Ministry of Health |
| MUHAS | - | Muhimbili University of Health and Allied Sciences |
| NEMLIT | - | National Essential Medicines List |
| OPD | - | Outpatient Department |
| RS | - | Regional Secretariat |
| *S. aureus* | - | *Staphylococcus aureus* |

| | | |
|---|---|---|
| *S. saprophyticus* | - | *Staphylococcus saprophyticus* |
| SRRH | - | Sekou Toure Regional Referral Hospital |
| STG | - | Standard Treatment Guideline |
| SXT | - | Trimethoprim-sulfamethoxazole |
| UTIs | - | Urinary Tract Infections |
| WHO | - | World Health Organization |

## DEFINITION OF KEY TERMS

In this study the following definitions apply;

**Urinary Tract Infections (UTIs)** – determined by the availability of $10^5$ or more colony-forming units (CFU) or more per ml of respective urine samples after performing urine culture

**Adult female** refers to a female aged 18 years and above

**Nyamagana District** is used interchangeably for Mwanza City Council

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Urinary Tract Infections (UTIs) are infections that affect the urinary tract with the commonly affected parts being the bladder, kidney, ureter, and urethra. They are termed public health problems affecting nearly 150 million people globally per year, most of them being females (Swamy *et al*., 2020). In 2019, about 0.26 million people in the world died of UTIs (Zeng *et al*., 2022). About 50-60% of adult females will contract UTIs in their lifetime (Medina & Castillo-Pino, 2019). Females have a higher risk of UTIs than males because their urethras are very short and closer to the rectum, facilitating easier penetration of etiological agents into the urinary tract (CDC, 2024).

Clinically, UTIs can be categorized into uncomplicated UTIs that occur in individuals leading to little, non-structural, abnormalities to the neurological urinary tract and complicated UTIs that result from the factors that may harm the urinary tract or the person's body defence, such as urinary retention problem, urinary obstruction, renal failure, immunosuppression, renal transplantation, etc. (Karishetti & Shaik, 2019).

UTIs in women are mostly caused by bacteria. The commonly documented UTIs causative bacteria are *Escherichia coli* (Huang *et al*., 2022). Other commonly reported bacteria include *Klebsiella* spp. (Rahayu *et al*., 2022), *Streptococcus* spp., *Staphylococcus* spp. and *Pseudomonas* spp. (Islam *et al*., 2022). Diabetes mellitus, pregnancy, low intake of water, urinary obstructive diseases, previous UTIs history, catheterization, sexual activity as well as hygiene habits are among the factors that could increase chances of UTIs in women population (Hailay *et al.*, 2020; CDC, 2024). Untreated UTIs may have serious consequences on women's health with increased healthcare cost. It has been argued to cause kidney damage and renal failure (Minardi *et al*., 2011). In pregnant women, untreated UTIs may lead to preterm labor, preeclampsia, low birth weight fetus, pregnancy hypertension, and preterm birth, among others (Ali *et al.*, 2022).

Patients with UTIs are empirically treated with antibiotics in LMICs, however, this approach can result in incorrect prescription and misuse of antibiotics, leading to antimicrobial resistance and thus UTIs treatment failure (Arienzo *et al.*, 2020). Antimicrobial resistance rates for UTIs in Tanzania are increasingly becoming common causing a challenge to existing treatment options in the country (Mlugu *et al*, 2023). Antimicrobial resistance has significant economic costs, estimated to result in US$1 trillion in extra healthcare costs by 2050 and a loss of US$ 1 trillion to US$ 3.4 trillion of gross domestic product (GDP) per year by 2030 globally (World Bank, 217).

Various interventions when implemented such as promotion of personal hygiene, safe sex practices and standard infection prevention and control practices could prevent UTIs while proper medical management of the disease could fight antimicrobial resistance rates.

### 1.2 Problem Statement

Globally, UTIs affect around 150 million people annually with the female population being the most affected group (Swamy *et al*., 2020). Studies show there is wide range of microorganisms responsible for causing UTIs in women and may vary between countries or regions (Ali *et al.*, 2022; Yang *et al*., 2022). When not properly managed, UTIs in females could result to significant complications such as recurring infections, delivery of low birth/ premature infants, serious kidney damage and renal failure, and sepsis potentially causing death (Minardi *et al*., 2011; Mayo Clinic, 2022).

Routinely collected patient data in the healthcare facilities shows the trend of UTI incidences in Mwanza region remaining high over the years. The disease is among top three outpatient diagnoses, with 356,902 reported cases of UTIs in 2022 alone in the region, mostly represented by Mwanza City Council (Nyamagana District) at 43% of the reported cases (DHIS2, 2022).

Mwanza City Council of Nyamagana District has made efforts to address communicable diseases like UTIs by implementing health promotion and education programs to encourage safe hygiene practices, awareness on the prevention of sexually transmitted diseases, infection prevention and control in the healthcare facilities and ensuring

availability of medicines for treating UTIs in the healthcare facilities (Mwanza City Council, 2022). Despite these efforts, there are high incidences of UTIs in Mwanza City Council that might be associated by various factors worth studying.

This study aimed to determine the prevalence of UTIs, etiology, antimicrobial susceptibility patterns and factors associated with UTIs among Adult females attending Nyamagana District Hospital as very little is known on the topic under investigation, particularly in the general population of adult females who attend outpatient services.

### 1.3 Conceptual Framework

Figure 1.1 portrays a conceptual framework of the study.

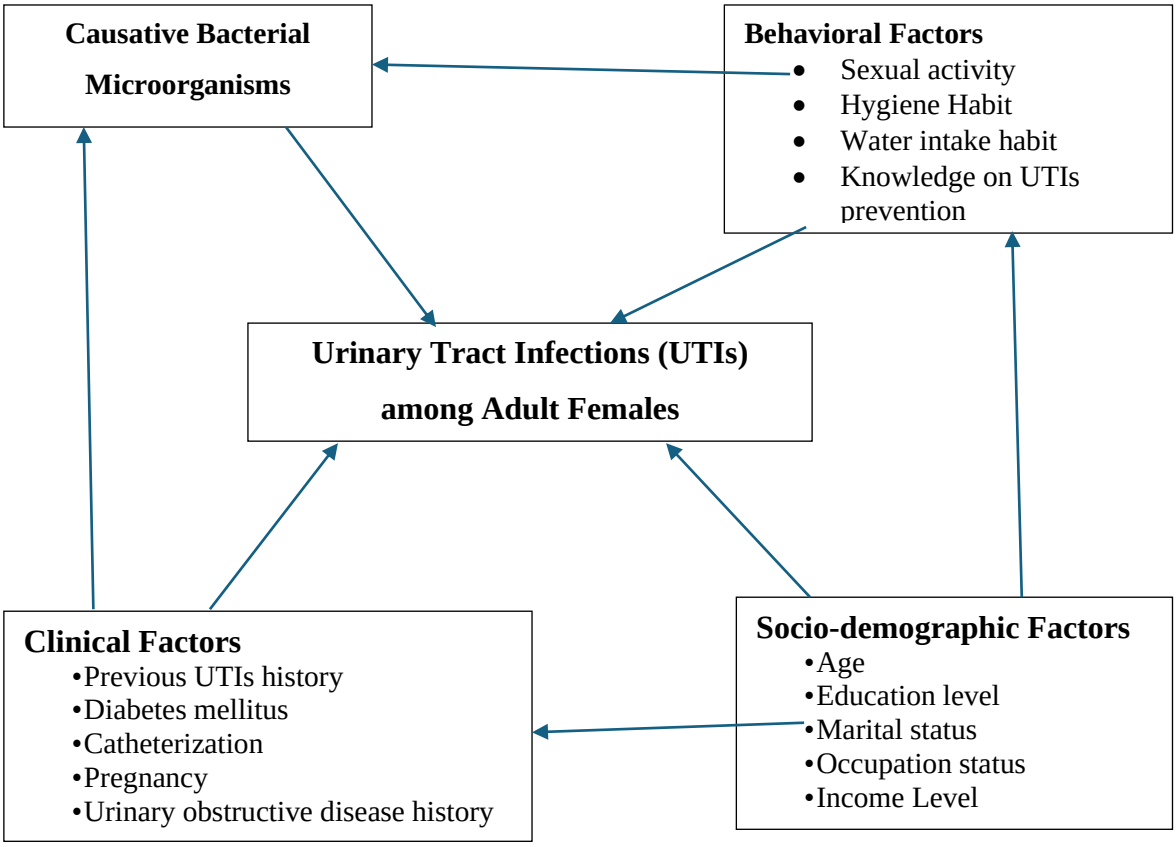



**Figure 1: Conceptual Framework. Adapted from Lentz (2009)**

Figure 1.1 conceptualized that, UTIs in adult females may be caused by different bacterial (Islam *et al*., 2022) pathogens. Factors associated with UTIs include socio-demographic factors such as age (Orrego-Marin *et al.,* 2014), education level and marital status (Almukhtar, 2018) as well as occupation status (Markland *et al.,* 2018). Clinical factors such as catheterization history and diabetes mellitus (Hailay *et al.,* 2020), previous history of UTIs history (Ali *et al.,* 2022) and pregnancy (Almukhtar, 2018) can facilitate UTIs in adult females. Moreover, behavioural factors such as hygiene habit, sexual behaviour and drinking water intake habit may also be associated with UTIs in adult females (CDC, 2024; Hailay *et al.,* 2020).

### 1.4 Rationale

Findings of this study would help to inform the government and other stakeholders and in particular Nyamagana District Hospital on the current prevalence, common causative bacteria, antimicrobial susceptibility patterns and factors associated with UTIs among adult females. Knowledge from this study will significantly be instrumental in the design of appropriate and effective UTI prevention and control interventions and also assist in the proper medical management of UTIs using antibiotics among adult females based on particular causative bacteria thus minimize antimicrobial resistance.

### 1.5 Research Questions

1. What is the prevalence of UTIs among adult females attending Nyamagana District Hospital in 2024?
2. What are the common etiological agents responsible for UTIs among adult females attending Nyamagana District Hospital in 2024?
3. What are the antimicrobial susceptibility patterns for UTIs among adult females attending Nyamagana District Hospital in 2024?
4. What are the factors associated with UTIs among adult females attending Nyamagana District Hospital in 2024?

## 1.6 Research Objectives

### 1.6.1 Broad Objective

To determine the prevalence, etiology, antimicrobial susceptibility patterns and factors associated with Urinary Tract Infections among adult females attending Nyamagana District Hospital.

### 1.6.2 Specific Objectives

1. To determine the prevalence of UTIs among adult females attending Nyamagana District Hospital in 2024
2. To determine the etiology responsible for UTIs among adult females attending Nyamagana District Hospital in 2024
3. To determine the antimicrobial susceptibility patterns for UTIs among adult females attending Nyamagana District Hospital in 2024
4. To assess factors associated with UTIs among adult females attending Nyamagana District Hospital in 2024

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Prevalence of UTIs among Adult females

A study conducted in Makkah, Saudi Arabia reported overall UTIs prevalence of 20% among pregnant women. Specifically, prevalence of symptomatic UTIs and asymptomatic UTIs was recorded as 12% and 8%, respectively (Faidah *et al.,* 2015). Another study in pregnant women at Hargeisa Group Hospital in Somaliland reported UTIs prevalence of 16.4% (Ali *et al.,* 2022). In China, 24.13% of adult females with type 2 diabetes mellitus were diagnosed with UTIs (He *et al.*, 2018). In Tigray region of Ethiopia, the prevalence of UTIs among Adult females was 27.5% (Hailay *et al.*, 2020). In Bushenyi district of Uganda, a study by Odoki *et al.* (2019) reported a prevalence of 37.5% (66/176) in adult females. Another study in Uganda by Kabugo *et al.* (2016) revealed UTIs prevalence of 44% (48/109) in adult females attending Mulago hospital. Studies conducted in Tanzania among females aged 18 years and above found the prevalence of UTIs ranging from 2.1% to 43.9% (Mwambete & Msigwa, 2017; Schmider *et al.,* 2022).

## 2.2 Etiology for UTIs among Adult females

In one cross-sectional study conducted in Dhaka, Bangladesh, *Escherichia coli* was reported as the predominant UTIs causing pathogen among adult females, others being *Streptococcus* spp. *Klebsiella* spp., and *Enterococcu*s spp. (Islam *et al*., 2022). In a study carried out among pregnant women at Johns Hopkins Aramco Healthcare in Saudi Arabia, *Escherichia coli* was again found to be the dominant causative agent for UTIs (Baraka *et al.,* 2021). A study by Rahayu *et al*. (2022) in Indonesia among women at Primaya Hospital Makassar found 60% of bacteria species were *Enterobacter agglomerans*, followed by *E. coli* (30%) and *Klebsiella* spp. (10%).

A study by Ali *et al.* (2022) also identified *Escherichia coli* as the dominant UTIs pathogen (43.5%) among pregnant women in Somaliland followed by *Cougulase negative Staphylococcus* (16%). Frequency of *Staphylococcus aureus*, *Pseudomonas aeruginosa,*

*Proteus mirabilis, Citrobacter* spp., and *Morganella morganii* was 13%, 7.2%, 5.8%, 4.4% and 1.5%, respectively.

A recent study in Minna, Nigeria recorded 55.1% of *Staphylococcus saprophyticus*, 28.6% of *Staphylococcus aureus* and 10.2% of *Staphylococcus epidermidis* isolates from urine samples of adult females with UTIs (Baba *et al.,* 2023).

According to a study by Schmider *et al.* (2022) involving 270 participants with adult females accounting 81.5% of the total participants in Bagamoyo, Tanzania, *Escherichia coli* (23%) was the most detected etiology followed by *Klebsiella* (7%), *Enterobacter* spp. (3%), *Staphylococcus aureus* (2%) and *Staphylococcus saprophyticus* (1%). A study conducted in Mwanza as well as Dar es Salaam regions by Silago *et al.* (2022) in which 77.3% of the total participants were adult females, again *E. coli* was frequently detected in the urine samples with UTIs followed by *Staphylococcus aureus*, and *Staphylococcus haemolyticus.* A proposed study to determine the prevalence, etiological agents, antimicrobial susceptibility patterns, and factors associated with UTIs among the general population of adult females who attend HCFs is very crucial.

### 2.3 Antimicrobial Susceptibility Patterns among Adult females

A study conducted by Onyango et al. (2018) in Nariobi, Kenya among pregnant women found that Gram-negative organisms were resistant to a range of antimicrobials including third-generation cephalosporins, sulfamethoxazole-trimethoprim, cefoxitin, nitrofurantoin and amoxicillin-clavulanic acid where Gram-positive strains showed susceptibility to amoxicillin-clavulanic acid, nitrofurantoin, linezolid and ofloxacin. The study found the prevalence of multi-drug resistance (MDR) in all isolates up to 96%.

Similar studies around the world including Somaliland, Ethiopia and Bangladesh have revealed significant multidrug resistance to UTIs (Ali *et al.*, 2022, Bitew *et al.*, 2022, Islam *et al*., 2022). Studies conducted in parts of Tanzania also found significant antimicrobial resistance for UTIs ranging from 30% to 100% (Mwambete & Msigwa, 2017, Schmider *et al.*, 2022, Silago *et al.,* 2022).

These studies, however, mostly focused on participants with special conditions such as pregnancy, comorbidity with diseases like HIV/AIDS or Malaria, etc. A study to determine the antimicrobial susceptibility patterns in the general population of adult females regardless of special individual health conditions is highly needed.

## 2.4 Factors Associated with UTIs among Adult females

### 2.4.1 Socio-demographic Factors

A study by Orrego-Marin *et al.* (2014) revealed a significant association between women age group with UTIs in Colombia. Some similar findings have been documented from studies in China (He *et al.,* 2018) and Nigeria (Baba *et al.,* 2023). In Somaliland, a study by Ali *et al.* (2022) found that being pregnant with income less than $100 and without formal education were associated with UTIs. Jansåker *et al.* (2021) again observed that low family income and poor education were associated with uncomplicated UTIs among Swedish women. In a study conducted at Mkuranga district and Dar es Salaam region in Tanzania, Mwambete and Msigwa (2017) revealed that being pregnant women from rural area and with younger age were the most risk factors for UTIs.

### 2.4.2 Clinical Factors

UTIs have been associated with a number of clinical factors. In China, a study by He *et al.* (2018) where 24.13% Adult females had type 2 diabetes mellitus attempted to identify factors associated with UTI where it was revealed that factors such as body mass index, duration of diabetes, random blood glucose, glutamic acid decarboxylate antibody, insulin autoantibody, and others such as albumin excretion rate in 24-hour urine, total cholesterol, triglycerides and high-density lipoprotein were significantly associated with UTIs in univariate regression model. However, random blood glucose, only insulin autoantibody, and albumin excretion rate in 24-hour urine were associated with UTIs in multivariate regression model.

A study conducted in Somaliland involving pregnant women reported that being pregnant with previous UTIs history and with previous indwelling catheter was significantly associated with UTIs (Ali *et al.,* 2022). In Ethiopia, Hailay *et al.* (2020) found that diabetes

mellitus, previous history with UTIs history, history of catheterization and having urinary obstructive disease in the past increased significantly the chances of contracting UTIs.

### 2.4.3 Behavioral Factors

Previous studies have also tried to identify behavioural factors which are associated with UTIs in Adult females. A study that was done in Ethiopia reported that insufficient water intake per day and passing of urine in less than five times a day were the risk factors for UTIs (Hailay *et al.*, 2020). Poor hygiene including genital cleaning from back to front and sexual practices have been significantly associated with UTIs (CDC, 2024).

# CHAPTER THREE

# METHODOLOGY

## 3.1 Study Area

This study was carried out at Nyamagana District Hospital in the Outpatient Department (OPD). Nyamagana Distirct Hospital is a public healthcare facility found in Butimba ward, Mwanza City Council (MCC) in Nyamagana district of Mwanza region in Tanzania. MCC is one of the 8 councils in Mwanza region with a population size of 594,834, making it the most populated council in the region (NBS, 2022). Nyamagana District Hospital is one of 155 operating HCFs in MCC (Ministry of Health - HFR, 2023). The Hospital offers various services including outpatient services different conditions like UTIs. It is the referral healthcare facility for lower-level facilities in the district. The Hospital also receives patients from different parts of the region facilitated by its strategic location within the City of Mwanza making it a suitable area for this study and serving as representative to many parts of the region.

The Hospital has a laboratory, though it currently doesn't perform microbiology tests such as culture and sensitivity. Urine samples are transported to other facilities like Sekou Toure Regional Referral Hospital for further laboratory investigation.

A total of 356,902 cases of UTIs were attended in Mwanza region in 2022 of which Nyamagana District accounted for most (42.9%) whereas Nyamagana District Hospital represented most (29.4%) of the UTI diagnoses in Nyamagana district (DHIS2, 2022).

## 3.2 Study Design

We conducted a cross-sectional study among adult females aged >18 years attending OPD at Nyamagana Hospital. This study design was considered appropriate as it allows one to collect and analyze data from a population of interest at one point in time as well as it permits researchers to assess the prevalence of diseases and factors associated to the outcome of interest. Additionally, cross-sectional study design is easy and inexpensive to conduct (Wang & Cheng, 2020).

### 3.3 Study Population

The study population comprised of adult females attending outpatient services at Nyamagana District Hospital.

### 3.4 Sample Size

#### 3.4.1 Sample Size Estimation

The required sample size for this study was estimated using a formula by Kish-Leslie (Kabugo *et al*., 2016).

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

Where n= required sample size

Z= Z score at 95% confidence interval which is equal to 1.96

p= prevalence of UTIs among females attending a hospital as outpatients from a previous study conducted in Tanzania which was 63.5% (Chandra *et al.*, 2017)

e = acceptable margin of error, i.e. 5%

$$n=\frac{1.96^2*0.635*(1-0.635)}{0.05^2}=356$$

By considering the 10% non-response rate = 356/0.9 ≈ 396

Therefore, n = 396

#### 3.4.2 Sampling Strategy

A systematic random sampling strategy was conducted in recruiting participants. Given an average of 150 Adult females who attend OPD at Nyamagana District Hospital daily (DHIS, 2022), the study recruited an average of about 30 Adult females per day, by choosing the 1$^{st}$ adult female, and then every 5$^{th}$ adult female who attended OPD in a day. The procedure was serially done until all desired participants were reached.

### 3.5 Inclusion and Exclusion Criteria

#### 3.5.1 Inclusion Criteria

Any adult female ≥18 years attending outpatient services at Nyamagana District Hospital and who consented to participate in the study.

#### 3.5.2 Exclusion Criteria

In this study, patients with terminal illness and those with antibiotic administration history two weeks prior to the study were excluded from the study.

### 3.6 Variables

#### 3.6.1 Dependent Variable

The dependent variable was UTIs in Adult females. This variable was divided into two categories, adult females with UTIs and Adult females without UTIs. Adult females were considered to have a UTI after their collected urine samples were confirmed positive for UTIs determined by $10^5$ or more colony-forming units (CFU) per ml of respective urine samples after performing urine culture.

#### 3.6.2 Independent Variables

The independent variables included UTIs causing bacterial microorganisms and factors associated with UTIs such as socio-demographic factors like marital status, education level, age, income level, and occupation status; clinical factors like previous UTIs history, diabetes mellitus, catheterization, pregnancy, and history of urinary obstructive disease; and behavioral factors like sexual behavior, hygiene habit, drinking water intake habit and knowledge on UTIs prevention.

### 3.7 Data Collection Tools

#### 3.7.1 Structured Questionnaire

A structured questionnaire (Appendix I) was used in the collection of participants' socio-demographic factors (age, occupation status, education level, marital status and income level), clinical factors (pregnancy status, catheterization history, previous UTIs history,

diabetes mellitus status and, history of urinary obstructive disease and behavioural factors (hygiene habit, sexual behaviour, drinking water intake habit and UTIs prevention knowledge). The tool was orally administered to study participants through the assistance of research assistants. A total of 392 participants out of the desired sample size of 396 were involved, a 98.9% response rate. The other four (4) participants withdrew from the study after initially having consented to participate, and hence their data were not collected.

### 3.7.2 Laboratory Methods

**Diagnosis and Etiology for UTIs**

Urine samples were collected from patients as previously described by Tajbakhsh *et al.* (2015). Briefly, 5 ml of midstream urine sample were collected in leak proof sterilized bottles. Urine collection containers were labelled with participants' identification numbers and date. Collected urine samples were placed in ice packs containing cool box and immediately sent to Microbiology Laboratory at Sekou-Toure Regional Referral Hospital not more than 2 hours after collection.

Bacterial UTIs were determined by inoculating 10µl of each urine sample on three agar media plates (i) Sheep blood agar (non-selective, universal agar medium), (ii) MacConkey agar (selective medium for Gram-negative bacteria) and, (iii) UriSelect 4 agar (chromogenic medium for growth of Gram-negative bacteria), then incubated at 35 $^{o}$C for 24 hours aerobically (Schmider *et al.*, 2022). After incubation, cultured plates were examined for bacterial growth where the availability of $10^5$ or more colony-forming units (CFU) per ml of respective collected urine samples were considered bacterial UTIs. All bacteria isolates were preserved in 40% glycerol and kept at -80 oC for further identification (Odoki et al., 2019). The identification of bacteria isolates for species was based on their colony morphology as well as Gram-staining reaction and biochemical tests (i.e., catalase, oxidase, coagulase bile aesculin agar, urease, citrate utilization, triple sugar iron agar and hydrogen sulphide production) (Bitew et al., 2022).

**Antimicrobial Susceptibility Testing**

The testing for antibiotic susceptibility on isolated bacterial species was done according to Ndomba et al. (2022). Briefly, five pure colonies of each isolated bacterium were

suspended in a test tube containing 4 ml of sterile physiological saline using a sterile wire loop. The resulting suspension was homogenized and its turbidity adjusted by addition of more colonies or sterile saline to 0.5 MacFarland. A sterile swab was dipped into the suspension and firmly pressed inside the walls of the tube to remove excess liquid. The remaining bacterial suspension was evenly inoculated on Mueller Hinton (MH) agar plates. Assisted with sterile forceps, Nitrofurantoin (300 µg), Ciprofloxacin (5 µg), Gentamicin (10 µg), Amoxicillin-clavulanic acid (30 µg), Ceftriaxone (30 µg), Ceftazidime (30 µg), Trimethoprim-sulfamethoxazole (25 µg), Meropenem (10 µg), Tetracycline (30 µg), Erythromycin (30 µg), Ciprofloxacin (5 µg) and Nitrofurantoin (300 µg) discs were applied on the MH agar plates within 15 minutes after inoculation and incubated at 35 oC for 24 hours aerobically. After incubation time, zone of inhibition will be measured using a ruler and interpreted according to CLSI recommendation (CLSI, 2020).

### 3.7.3 Investigation tools and validity and reliability

Questionnaire: The questionnaire was structured in a way to capture information that is relevant to the specific study objectives. The structure and feasibility of the questionnaire were tested before the main study. Necessary improvements were made to the questionnaire based on the feedback from the pre-testing of the tools.

Laboratory Methods: To ensure that results from the laboratory tests are valid and reliable, quality control was performed accordingly. Reference strains for culture and antimicrobial susceptibility tests used were for *E. coli* (ATCC 25922) and *S. aureus* (ATCC 25923). Additionally, all related supplies including media and reagents were inspected and verified for date of expiry and storage conditions as well as signs of possible contamination.

## 3.8 Data Analysis

Descriptive statistics were used to summarize data and data was presented in tables and figures for frequency distribution, measures of central tendency and variability (or spread). As UTI is a common condition, with prevalence expected to be higher than 10%, a modified Poisson regression analysis (bivariate and multivariable) was performed to determine the association between UTIs and the independent variables using STATA software (version 15.1). The independent variables with *p*-value of ≤0.20 in the bivariate

analysis were considered for the multivariable model analysis. Washing vagina immediately after sex, as one of important hygiene related factors, was also considered for the multivariable analysis model though had a p-value=0.403 in the bivariate analysis. Adjusted prevalence ratios with 95% confidence intervals at a statistical significance level of $p < 0.05$ were used to interpret the association between UTIs and the independent variables (Mwebesa *et al.*, 2022).

### 3.9 Ethical Considerations

This study was conducted after approval by the ethical review board of Muhimbili University of Health and Allied Sciences (MUHAS). Permission to carry out this study at Nyamagana District Hospital was sought from relevant authorities including the Regional Secretariat of Mwanza and Mwanza City Council including the Nyamagana District Hospital administration. Additionally, consent was obtained from participants prior to the study by signing consent forms confirming their participation. Importantly, participants with positive for UTIs results in this study were advised to seek for further medical care. Privacy of the participants and confidentiality of their information was highly taken into consideration.

# CHAPTER FOUR

## RESULTS

### 4.1 Socio-demographic Characteristics among Adult females at Nyamagana District Hospital

Out of a total of 392 participants in this study majority were in the age groups 18-24 (32.7%, n=128) and 25-35 (31.9%, n=125), followed by age groups 36-49 (18.9%, n=74) and >50 (16.6%, n=65). The median age of the participants was 30 years, with an interquartile range (IQR) of 23 - 42 years. Most had completed either Primary School (57.7%, n=226) or Secondary School (29.9%, n=117), followed by those with no formal education (6.6%, n=26) and least those who completed College or University (5.9%, n=23). Most were married/ cohabiting (65.6%, n=257), followed by those who were single (17.9%, n=70), and least those who were widowed/ separated/ divorced (16.6%, n=65). Most were unemployed (80.9%, n=317), followed by those who were self-employed (12.5%, n=49), and least those who were employed or salaried (6.6%, n=26). Most participants were in the low-income category (62.5%, n=245), followed by the middle-income category (22.2%, n=87), and least those in the high-income category (15.3%, n=60). **Table 1** below summarizes this information.

**Table 1: Socio-Demographic Characteristics among Adult females at Nyamagana District Hospital in 2024 (N=392)**

| Variable | Frequency (n) | Percent (%) |
|---|---|---|
| ***Age Group*** | | |
| 18-24 | 128 | 32.7 |
| 25-35 | 125 | 31.9 |
| 36-49 | 74 | 18.9 |
| >50 | 65 | 16.6 |
| Median Age (IQR) | 30 (23-42) | |
| ***Education Level*** | | |
| College or University | 23 | 5.9 |
| Secondary School | 117 | 29.9 |
| Primary School | 226 | 57.7 |
| No formal education | 26 | 6.6 |
| ***Marital Status*** | | |
| Married/ Cohabiting | 257 | 65.6 |
| Widowed/ Separated/ Divorced | 65 | 16.6 |
| Single | 70 | 17.9 |
| ***Employment Status*** | | |
| Employed/ Salaried | 26 | 6.6 |
| Self-employed | 49 | 12.5 |
| Unemployed | 317 | 80.9 |
| ***Income Level (TZS/ Day) ***** | | |
| High Income (≥10,000) | 60 | 15.3 |
| Middle Income (3,000-9000) | 87 | 22.2 |
| Low Income (<3,000) | 245 | 62.5 |

****** Income categories as per Torre-Castro *et al*., 2022

### 4.2 Prevalence of Urinary Tract Infections among Adult females at Nyamagana District Hospital

Among the 392 adult females attending Nyamagana District Hospital as outpatients, 32.1% (95 CI: 27.5-36.8), n=126, were identified with UTIs.

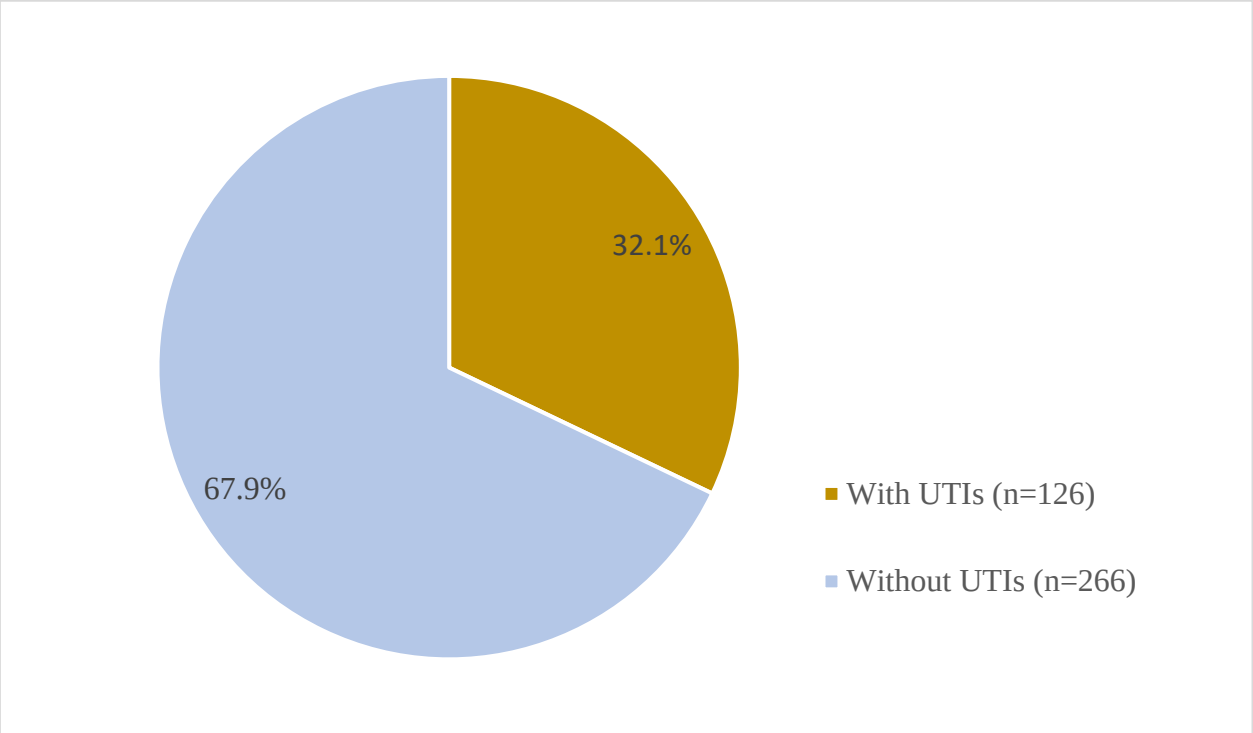



**Figure 2: Proportions of adult females with and without UTIs at Nyamagana District Hospital in 2024**

#### 4.2.1 Prevalence of UTIs among Adult females by Socio-demographic Factors at Nyamagana District Hospital

There were significant differences in prevalence of UTIs by: age, where the prevalence was higher among the age group 18-24 years 40.6% (n=52, p-value=0.022); marital status, where the prevalence was higher among those who are widowed/ separated/ divorced 46.1% (n=30, p-value<0.001); occupation, where the prevalence was higher among those who are unemployed 36.0% (n=114, p-value=0.003); and income, where the prevalence was higher among those who had low income 38.8% (n=95, p-value=0.001). There was no statistically significant difference of the prevalences by education level (p=0.376). **Table 2** below summarizes this information.

**Table 2: Prevalence of UTIs among Adult females by Socio-demographic Factors at Nyamagana District Hospital, 2024**

| | | UTI Status - n (%) | | |
|---|---|---|---|---|
| **Variable** | **Number** | **Yes** | **No** | **p-value** |
| | **n (%)** | **126 (32.1)** | **266 (67.9)** | |
| ***Age Group*** | | | | |
| 18-24 | 128 (32.7) | 52 (40.6) | 76 (59.4) | |
| 25-35 | 125 (31.9) | 30 (24.0) | 95 (76.0) | |
| 36-49 | 74 (18.9) | 20 (27.0) | 54 (73.0) | |
| >50 | 65 (16.6) | 24 (37.0) | 41 (63.0) | **0.022** |
| ***Education Level*** | | | | |
| College or University | 23 (5.9) | 49 (17.4) | 19 (82.6) | |
| Secondary School | 117 (29.8) | 36 (30.8) | 81 (69.2) | |
| Primary School | 226 (57.7) | 76 (33.6) | 150 (66.4) | |
| No formal education | 26 (6.6) | 10 (38.5) | 16 (61.5) | 0.376 |
| ***Marital Status*** | | | | |
| Married/ Cohabiting | 257 (65.6) | 80 (31.1) | 177 (68.9) | |
| Widowed/Separated/Divorced | 65 (16.6) | 30 (46.1) | 35 (53.9) | |
| Single | 70 (17.9) | 16 (22.9) | 54 (77.1) | **<0.001** |
| ***Occupation*** | | | | |
| Employed/ Salaried | 26 (6.6) | 3 (11.5) | 23 (88.5) | |
| Self-employed | 49 (12.5) | 9 (18.4) | 40 (81.6) | |
| Unemployed | 317 (80.9) | 114 (36.0) | 203 (64.0) | **0.003** |
| ***Income Level (TZS/ Day)*** | | | | |
| High Income (≥10,000) | 60 (15.3) | 11 (18.3) | 49 (81.7) | |
| Middle Income (3,000-9000) | 87 (22.2) | 20 (23.0) | 67 (77.0) | |
| Low Income (<3,000) | 245 (62.5) | 95 (38.8) | 150 (61.2) | **0.001** |

### 4.2.2 Prevalence of UTIs among Adult females by Clinical Factors at Nyamagana District Hospital

There were significant differences in prevalence of UTIs by: history of previous UTIs, where the prevalence higher in those with previous history of UTIs 53.5% (n=68, p-value<0.001); history of urine obstructive disease; where the prevalence was higher among those with history of obstructive disease 72.0% (n=18, p-value<0.001); and history of use of catheter, where the prevalence was higher among those with history of catheterization 83.6% (n=51, p-value<0.001). The differences in prevalence of UTIs by pregnancy status and diabetes mellitus diagnosis were statistically not significant at p-value=0.075 and p-value=0.068 respectively. **Table 3** below summarizes this information.

**Table 3: Prevalence of UTIs among Adult females by Clinical Factors at Nyamagana District Hospital, 2024**

| Variable | Number n (%) | UTI Status - n (%) Yes 126 (32.1) | No 266 (67.9) | p-value |
|---|---|---|---|---|
| ***Pregnancy Status*** | | | | |
| No | 313 (79.8) | 94 (30.0) | 219 (70.0) | |
| Yes | 79 (20.2) | 32 (40.5) | 47 (59.5) | 0.075 |
| ***History of UTIs*** | | | | |
| No | 265 (67.6) | 58 (21.9) | 207 (78.1) | |
| Yes | 127 (32.4) | 68 (53.5) | 59 (46.5) | **<0.001** |
| ***History of/ Current Urine Obstructive Disease*** | | | | |
| No | 367 (93.6) | 108 (29.4) | 259 (70.6) | |
| Yes | 25 (6.4) | 18 (72.0) | 7 (28.0) | **<0.001** |
| ***History of/ Current Use of Catheter*** | | | | |
| No | 331 (84.4) | 75 (22.7) | 256 (77.3) | |
| Yes | 61 (15.6) | 51 (83.6) | 10 (16.4) | **<0.001** |
| ***Frequent Leakage of Small Amounts of Urine*** | | | | |
| No | 332 (84.7) | 96 (28.9) | 236 (71.1) | |
| Yes | 60 (15.3) | 30 (50.0) | 30 (50.0) | **0.001** |
| ***Diabetes Mellitus Status*** | | | | |
| No | 386 (98.5) | 122 (31.6) | 264 (68.4) | |
| Yes | 6 (1.5) | 4 (66.7) | 2 (33.3) | 0.068 |

### 4.2.3 Prevalence of UTIs among Adult females by Behavioural Factors at Nyamagana District Hospital

There were significant differences in the prevalence of UTIs by: number of sexual partners, where the prevalence was higher in those with multiple sexual partners at 95.6% (n=61, p-value<0.001); frequency of sexual intercourse, where the prevalence was higher among those who frequently (≥3 times weekly) practiced sex at 45.7% (n=79, p-value<0.001); protected sex, where the prevalence was higher among those who practiced unprotected sex on previous day at 81.0% (n=81, p-value<0.001); urinating immediately after sex, where the prevalence was higher among those who did not urinate immediately after sexual activity at 52.2% (n=117, p-value<0.001; drinking water intake, where the prevalence was higher among those who drank water inadequately (less than 1L) in a day at 91.3% (n=66, p-value<0.001); and knowledge of UTI prevention, where the prevalence was higher among those who had low knowledge on UTI prevention at 76.8% (n=43, p-value<0.001). The differences in prevalence of UTIs by sexual practice and washing vagina immediately after sex were not statistically significant at p-value=0.306 and p-value=0.403 respectively. **Table 4** below summarizes this information.

**Table 4: Prevalence of UTIs among Adult females by Behavioural Factors at Nyamagana District Hospital, 2024**

| Variable | Number n (%) | UTI Status - n (%) | | p-value |
|---|---|---|---|---|
| | | Yes 126 (32.1) | No 266 (67.9) | |
| ***Ever Practiced Sex*** | | | | |
| No | 26 (6.6) | 6 (23.1) | 20 (76.9) | |
| Yes | 366 (93.4) | 120 (32.8) | 246 (67.2) | **0.306** |
| ***Multiple Sexual Partners*** | | | | |
| No | 328 (83.7) | 65 (19.8) | 263 (80.2) | |
| Yes | 64 (16.3) | 61 (95.3) | 3 (4.7) | **<0.001** |
| ***Frequency of Sexual Practices (Weekly)*** | | | | |
| ≥3 times | 173 (44.1) | 79 (45.7) | 94 (54.3) | |
| 1-2 times | 159 (40.6) | 32 (20.1) | 127 (79.9) | |
| None | 60 (15.3) | 15 (25.0) | 45 (75.0) | **<0.001** |
| ***Unprotected Sex on Previous Day*** | | | | |
| No | 292 (74.5) | 45 (15.4) | 247 (84.6) | |
| Yes | 100 (25.5) | 81 (81.0) | 19 (19.0) | **<0.001** |
| ***Urinating Immediately after Sexual Activity*** | | | | |
| No | 224 (57.1) | 117 (52.2) | 100 (47.8) | |
| Yes | 168 (42.9) | 9 (5.4) | 159 (94.6) | **<0.001** |
| ***Washing Vagina immediately after Sex*** | | | | |
| No | 208 (53.1) | 63 (30.29) | 145 (69.71) | |
| Yes | 184 (46.9) | 63 (34.24) | 121 (65.76) | **0.403** |
| ***Use Genital Hygiene Products*** | | | | |
| No | 366 (93.4) | 124 (33.9) | 242 (66.1) | |
| Yes | 26 (6.6) | 2 (7.7) | 24 (92.3) | **0.006** |
| ***Drinking water intake*** | | | | |
| >2L | 194 (49.5) | 12 (9.5) | 114 (90.5) | |
| 1-2L | 72 (18.4) | 48 (24.7) | 146 (75.3) | |
| <1L | 126 (32.1) | 66 (91.3) | 6 (8.3) | **<0.001** |
| ***Knowledge of UTIs prevention*** | | | | |
| High Knowledge | 132 (33.7) | 39 (29.5) | 93 (70.5) | |
| Moderate Knowledge | 204 (52.1) | 44 (21.6) | 160 (78.4) | |
| Low Knowledge | 56 (14.3) | 43 (76.8) | 13 (23.2) | **<0.001** |

### 4.3 Factors Associated with Urinary Tract Infections among Adult females at Nyamagana District Hospital

By performing a multivariable analysis using modified Poisson regression we found several factors significantly associated with UTIs. The factors found to have an increased risk of UTIs among adult females include age; higher risk in younger age group 18-24 (aPR 1.5, 95% CI: 1.1-2.1) compared to the older (>50 years), marital status; higher risk in widowed/ separated/ divorced (aPR 1.5, 95% CI: 1.1-2.0) compared to the married, income level; higher risk in those with middle income (aPR 3.4, 95% CI: 2.1-5.5) and low income (aPR 2.9, 95%CI: 1.8-4.4) compared to those with high income, history of catheterization; higher risk in those who ever used a catheter (aPR 1.3, 95% CI: 1.0-1.6) than their counterpart, incontinence (frequent passage of small amounts of urine); higher risk in those with incontinence (aPR 1.5, 95% CI: 1.1-2.0) than their counterpart, protected sex; higher in those who did unprotected sex on previous day (aPR 2.1, 95% CI: 1.5-2.9) than those who didn't, drinking water intake; higher risk in those who drank less water (<1 litre) (aPR 2.7, 95% CI: 1.6-4.6) and 1 – 2 litres (aPR 1.9, 95% CI: 1.14-3.09) compared to those who drank more than 2 L in a day and knowledge on UTI prevention; higher risk in those with low knowledge on UTI prevention (aPR 1.5, 95% CI: 1.1-2.2) compared to those with high knowledge. Additionally, urinating immediately after sexual activity (aPR 0.2, 95% CI: 0.1-0.3) and using genital hygiene products (aPR 0.4, 95% CI: 0.1-0.9) were not associated with UTIs. Diabetes Mellitus was also not associated with UTIs (aPR 0.5, 95% CI: 0.3-0.9). **Table 5** below summarizes this information

**Table 5**: **Modified Poisson Regression of Factors Associated with UTIs among Adult females at Nyamagana District Hospital, 2024**

| Variable | Number n (%) | UTIs n (%) | cPR (95 CI) | aPR (95 CI) | p-value |
|---|---|---|---|---|---|
| ***Age Group*** | | | | | |
| 18-24 | 128 (32.7) | 52 (40.6) | 1.1 (0.7-1.6) | 1.5 (1.1-2.1) | **0.018** |
| 25-35 | 125 (31.9) | 30 (24.0) | 0.7 (0.4-1.0) | 1.1 (0.8-1.6) | 0.511 |
| 36-49 | 74 (18.9) | 20 (27.0) | 0.7 (0.4-1.2) | 0.92 (0.6-1.4) | 0.692 |
| >50 | 65 (16.6) | 24 (36.9) | **Ref** | | |
| ***Educational Level*** | | | | | |
| College or University | 23 (5.9) | 49 (17.4) | **Ref** | | |
| Secondary School | 117 (29.8) | 36 (30.7) | 1.8 (0.7-4.5) | 1.3 (0.7-2.4) | 0.431 |
| Primary School | 226 (57.7) | 76 (33.6) | 1.9 (0.8-4.8) | 1.5 (0.8-2.8) | 0.182 |
| No formal education | 26 (6.6) | 10 (38.5) | 2.2 (0.8-6.1) | 1.6 (0.7-3.5) | 0.273 |
| ***Marital Status*** | | | | | |
| Married/ Cohabiting | 257 (65.6) | 80 (31.1) | **Ref** | | |
| Widowed/ Separated/ Divorced | 65 (16.6) | 30 (46.1) | 1.5 (1.1-2.0) | 1.5 (1.1-2.0) | **0.006** |
| Single | 70 (17.9) | 16 (22.9) | 0.7 (0.4-1.2) | 0.9 (0.6-1.2) | 0.403 |
| ***Income Level (TZS/ Day)*** | | | | | |
| High Income (≥10,000) | 60 (15.3) | 11 (18.3) | **Ref** | | |
| Middle Income (3,000-9000) | 87 (22.2) | 20 (23.0) | 1.2 (0.6-2.4) | 3.4 (2.1-5.5) | **<0.001** |
| Low Income (<3,000) | 245 (62.5) | 95 (38.8) | 2.1 (1.2-3.7) | 2.9 (1.8-4.4) | **<0.001** |
| ***Pregnancy Status*** | | | | | |
| No | 313 (79.8) | 94 (30.0) | **Ref** | | |
| Yes | 79 (20.2) | 32 (40.5) | 1.35 (0.98-1.85) | 0.9 (0.7-1.1) | 0.272 |
| ***History of UTIs*** | | | | | |
| No | 265 (67.6) | 58 (21.9) | **Ref** | | |
| Yes | 127 (32.4) | 68 (53.5) | 2.4 (1.8-3.2) | 1.1 (0.8-1.4) | 0.568 |
| ***History of/ Current Urine Obstructive Disease*** | | | | | |
| No | 367 (93.6) | 108 (29.4) | **Ref** | | |
| Yes | 25 (6.4) | 18 (72.0) | 2.4 (1.8-3.3) | 1.1 (0.8-1.4) | 0.526 |
| ***History of/ Current Use of Catheter*** | | | | | |
| No | 331 (84.4) | 75 (22.7) | **Ref** | | |
| Yes | 61 (15.6) | 51 (83.6) | 3.7 (2.9-4.6) | 1.3 (1.0-1.6) | **0.044** |

| | | | | | |
|---|---|---|---|---|---|
| ***Frequent Leakage of Small Amounts of Urine*** | | | | | |
| No | 332 (84.7) | 96 (28.9) | **Ref** | | |
| Yes | 60 (15.3) | 30 (50.0) | 1.7 (1.3-2.3) | 1.5 (1.1-2.0) | **0.005** |
| ***Multiple Sexual Partners*** | | | | | |
| No | 328 (83.7) | 65 (19.8) | **Ref** | | |
| Yes | 64 (16.3) | 61 (95.3) | 4.8 (3.8-6.0) | 1.1 (0.8-1.4) | 0.621 |
| ***Frequency of Sexual Practices (Weekly)*** | | | | | |
| None | 60 (15.3) | 15 (25.0) | **Ref** | | |
| ≥3 times | 173 (44.1) | 79 (45.7) | 1.8 (1.1-2.9) | 0.7 (0.5-1.1) | 0.182 |
| 1-2 times | 159 (40.6) | 32 (20.1) | 0.9 (0.6-1.7) | 0.6 (0.4-0.9) | **0.034** |
| ***Unprotected Sex on Previous Day*** | | | | | |
| No | 292 (74.5) | 45 (15.4) | **Ref** | | |
| Yes | 100 (25.5) | 81 (81.0) | 5.3 (3.9-6.9) | 2.1 (1.5-2.9) | **<0.001** |
| ***Urinating Immediately after Sexual Activity*** | | | | | |
| No | 224 (57.1) | 117 (52.2) | **Ref** | | |
| Yes | 168 (42.9) | 9 (5.4) | 0.10 (0.1-0.2) | 0.2 (0.1-0.3) | **<0.001** |
| ***Use Genital Hygiene Products*** | | | | | |
| No | 366 (93.4) | 124 (33.9) | **Ref** | | |
| Yes | 26 (6.6) | 2 (7.7) | 0.2 (0.1-0.9) | 0.4 (0.1-0.9) | **0.049** |
| ***Drinking water intake*** | | | | | |
| >2L | 194 (49.5) | 12 (9.5) | **Ref** | | |
| 1-2L | 72 (18.4) | 48 (24.7) | 2.6 (1.4-4.7) | 1.9 (1.14-3.09) | **0.011** |
| <1L | 126 (32.1) | 66 (91.7) | 9.6 (5.6-16.6) | 2.7 (1.6-4.6) | **<0.001** |
| ***Knowledge of UTIs prevention*** | | | | | |
| High Knowledge | 132 (33.7) | 39 (29.5) | **Ref** | | |
| Moderate Knowledge | 204 (52.0) | 44 (21.6) | 0.7 (0.5-1.1) | 0.8 (0.6-1.0) | 0.125 |
| Low Knowledge | 56 (14.3) | 43 (76.8) | 2.6 (1.9-3.5) | 1.5 (1.1-2.2) | **0.012** |
| ***Diabetes Mellitus Status*** | | | | | |
| No | 386 (98.5) | 122 (31.6) | **Ref** | | |
| Yes | 6 (1.5) | 4 (66.7) | 2.1 (1.2-3.8) | 0.5 (0.3-0.9) | **0.026** |

### 4.3 Etiology for Urinary Tract Infections among Adult females at Nyamagana District Hospital

Among the 126 adult females found to have UTIs (defined as significant growth of $\geq 10^5$ CFU/ ml), most (71.4%) of the bacterial isolates were gram-negative (n=90). The isolated gram-negative bacteria included *Escherichia coli* (31.7%, n=40), *Klebsiella spp*. (18.3%, n=23) and *Enterobacter spp.* (8.7%, n=11) and gram-positive bacteria isolates included *Staphylococcus aureus* (21.4%, n=27) and *Staphylococcus saprophyticus* (5.6%, n=7). Other isolated bacteria include *Proteus spp.* (7.9%, n=10), *Acinetobacter spp.* (2.4%, n-3), *Streptococcus pneumoniae* (0.8%, n=1), *Serratia marcescens* (0.8%, n=1), *Morganella morganii* (0.8%, n=1), *Enterococcus faecalis* - 0.8% (n=1) and *Citrobacter freundii* (0.8%, n=1). **Figure 3** below summarizes this information.

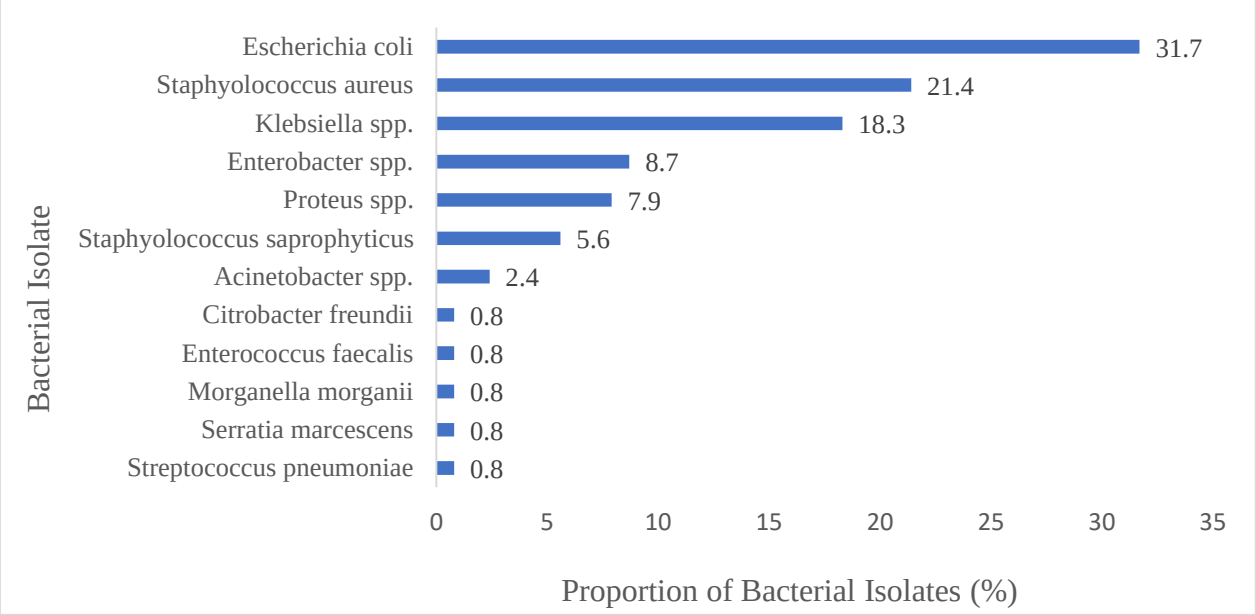



**Figure 3*:* Proportion of isolated UTI causative bacteria among adult females at Nyamagana District Hospital**

### 4.4 Antimicrobial Susceptibility Patterns for UTIs among Adult females at Nyamagana District Hospital

Among the predominant gram-negative bacteria, a high antimicrobial susceptibility was observed against Gentamycin (*E. coli* - 100%, *K. spp.* - 88.9%, *E. spp.* - 100.0%) Amikacin

(*E. coli* - 97.5%, *K. spp*. - 100.0%, *E. spp.* - 100%), Meropenem (*E. coli* - 92.5%, *K. spp.* - 95.7%, *E. spp*. – 90.9%), Ciprofloxacin (E. coli - 87.5%, *K. spp*. – 87%, *E. spp*. – 100.0%), Ceftazidime (*E. coli* – 90.0%, *E. spp*. – 90.9%), Ceftriaxone (E. coli - 85.0%, *E. spp.* 90.9%) and Cefotaxime (*E. coli* - 82.5%, *K. spp*. - 82.6%, *E. spp*. – 100.0%) and least antimicrobial susceptibility against Trimethoprim-sulfamethoxazole (*E. coli* – 27.5%, *K. spp*. – 26.1%) and Imipenem (*E. coli* – 47.5%, *K. spp.* – 43.5%). For the predominant gram-positive bacteria, a high antimicrobial susceptibility with *Staphylococcus aureus* was observed against Gentamycin (88.9%) and Ciprofloxacin *(*85.2%) and least antimicrobial susceptibility against Penicillin G (*S. aureus* – 0.0%, *S. saprophyticus* – 28.6%), Trimethoprim-sulfamethoxazole (*S. aureus* – 14.8%, *S. saprophyticus* – 14.3%), Erythromycin (*S. aureus* – 11.1%, *S. saprophyticus* – 42.9%), Tetracycline (*S. aureus* – 22.2%, *S. saprophyticus* – 14.3%) and Clindamycin (*S. aureus* – 25.9%). **Tables 6** and **7** below summarize this information.

**Table 6: Antimicrobial susceptibility patterns of gram-negative bacteria among adult females at Nyamagana District Hospital**

| Antibiotics | % of Susceptible Bacteria | | | | | |
|---|---|---|---|---|---|---|
| | ***E. coli*** | ***K. spp.*** | ***E. spp.*** | ***P. spp.*** | ***A. spp.*** | **Others** |
| | ***n=40*** | ***n=23*** | ***n=11*** | ***n=10*** | ***n=3*** | ***n=3*** |
| Nitrofurantoin | 28 (70.0) | 16 (69.6) | 6 (54.5) | 9 (90.0) | 2 (66.7) | 2 (66.7) |
| Ciprofloxacin | 35 (87.5) | 20 (87.0) | 11 (100.0) | 9 (90.0) | 2 (66.7) | 3 (100.0) |
| SXT | 11 (27.5) | 6 (26.1) | 7 (63.6) | 2 (20.0) | 2 (66.7) | 1 (33.3) |
| Gentamycin | 40 (100.0) | 22 (95.7) | 11 (100.0) | 10 (100.0) | 2 (66.7) | 3 (100.0) |
| AMC | 25 (62.5) | 18 (78.3) | 9 (81.8) | 10 (100.0) | 2 (66.7) | 3 (100.0) |
| Cefotaxime | 33 (82.5) | 19 (82.6) | 11 (100.0) | 8 (80.0) | 2 (66.7) | 3 (100.0) |
| Ceftriaxone | 34 (85.0) | 18 (78.3) | 10 (90.9) | 7 (70.0) | 2 (66.7) | 3 (100.0) |
| Ceftazidime | 36 (90.0) | 14 (60.9) | 10 (90.9) | 7 (70.0) | 3 (100.0) | 3 (100.0) |
| Meropenem | 37 (92.5) | 22 (95.7) | 10 (90.9) | 9 (90.0) | 3 (100.0) | 3 (100.0) |
| Imipenem | 19 (47.5) | 10 (43.5) | 7 (63.6) | 4 (40.0) | 1 (33.3) | 2 (66.7) |
| Cefepime | 28 (70.0) | 15 (65.2) | 7 (63.6) | 6 (60.0) | 2 (66.7) | 1 (33.3) |
| Amikacin | 39 (97.5) | 23 (100.0) | 11 (100.0) | 10 (100.0) | 3 (100.0) | 3 (100.0) |

*K. spp. = Klebsiella species*, *E. spp. = Enterobacter species*, A. spp. = *Acinetobacter species*, SXT = Trimethoprim-sulfamethoxazole; AMC = Amoxicillin + Clavulanic Acid, other bacteria = (*Citrobacter freundii*, *Morganella morganii* and *Serratia marcescens)*

**Table 7: Antimicrobial susceptibility patterns of gram-positive bacteria among adult females at Nyamagana District Hospital**

| Antibiotics | % of Susceptible Bacteria | | | |
|---|---|---|---|---|
| | ***S. aureus*** | ***S. saprophyticus*** | ***S. pneumoniae*** | ***E. faecalis*** |
| | ***n=27*** | ***n=7*** | ***n=1*** | ***n=1*** |
| Nitrofurantoin | 18 (66.7) | 4 (57.1) | 1 (100.0) | 1 (100) |
| Ciprofloxacin | 23 (85.2) | 5 (71.4) | 1 (100) | 1 (100) |
| SXT | 4 (14.8) | 1 (14.3) | 1 (100) | 0 (0.0) |
| Gentamycin | 24 (88.9) | 4 (57.1) | 1 (100) | 1 (100) |
| Clindamycin | 7 (25.9) | 4 (57.1) | 1 (100) | 0 (0.0) |
| Penicillin G | 0 (0.0) | 2 (28.6) | 1 (100) | 0 (0.0) |
| Erythromycin | 3 (11.1) | 3 (42.9) | 1 (100) | 0 (0.0) |
| Tetracycline | 6 (22.2) | 1 (14.3) | 1 (100) | 0 (0.0) |

*S. aureus=Staphylococcus aureus, S. saprophyticus= Staphylococcus saprophyticus, SXT* = Trimethoprim-sulfamethoxazole

# CHAPTER FIVE

## DISCUSSION

### Prevalence of Urinary Tract Infections among Adult females at Nyamagana District Hospital

The observed prevalence rate of UTIs among Adult females in this study is consistent with other similar studies that have shown a prevalence of UTIs above 30.0% including in Uganda – 32.2% (Odoki *et al*, 2019), Ghana – 34% (Karikari *et al,* 2022) and Tanzania – 41% (Mlugu *et al,* 2023). Some studies have shown lower prevalence rates, however, such as in Kenya (Onyango *et al*, 2018) and Tanzania (Mwambete & Msigwa, 2017) with prevalences of 11.4% and 12.5% respectively. The prevalence of UTIs in our study varied by different sociodemographic, clinical and behavioral factors, a similar observation across many other studies that have shown variations in UTI prevalences among different factors (CDC, 2024; Mancuso *et al*, 2023; Mlugu *et al*, 2023; Ali *et al.*, 2022; Ahmed et al, 2019; Odoki et al, 2019).

### Etiology of Urinary Tract Infections among Adult females at Nyamagana District Hospital

This study observed similar categories of predominant UTI causative bacterial isolates including *Escherichia. coli, Staphylococcus aureus* and *Klebsiella spp.,* with slight variations in the frequency of isolated pathogens as in other studies (Ernest *et al*, 2024; Mancuso *et al*, 2023; Mlugu *et al*, 2023; Mwang'onde and Mchami, 2022). Other bacterial isolates in this study such as *Enterobacter spp.*, *Staphylococcus saprophyticus, Proteus spp., Streptococcus pneumoniae*, *Serratia marcescens*, *Morganella morganii*, *Enterococcus faecalis* and *Citrobacter freundii* are also documented in previous similar studies (Mlugu *et al*, 2023; Ali *et al*, 2022; Karikari et al, 2022; Badran *et al,* 2019).

### Antimicrobial Susceptibility Patterns among Adult females at Nyamagana District Hospital

High antimicrobial susceptibility rates (≥80.0%) with much of similarity or little variations to other studies (Ernest *et al*, 2024; Ahmed *et al,* 2019; Gidabayda *et al* 2017) was observed against antibiotics likeAmikacin, Meropenem, Ciprofloxacin, Ceftazidime,

Gentamycin, Ceftriaxone and Cefotaxime for the isolated predominant UTI causative bacteria *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella spp.* Among the antibiotics, Meropenem, Ciprofloxacin, Gentamycin and Ceftriaxone are UTI treatment options in the current Tanzania Mainland's STG (STG, 2021). Some studies, have shown low antimicrobial susceptibility against ceftriaxone and ciprofloxacin (Masinde et al, 2009; Moremi et al, 2015). The predominant bacteria showed considerably lower lower antimicrobial susceptibility rates (≤ 80%) against other treatment options stipulated in the guideline like Nitrofurantoin and Amoxicillin + Clavulanic acid. High antimicrobial resistance rates against other antibiotics which are not part of the UTI treatment options (but may happen to be used) like Penicillin G, Erythromycin, Tetracycline, Trimethoprim-sulfamethoxazole and Clindamycin are similarly observed in other studies (Ernest *et al*, 2024; Ali *et al.,* 2022; Ahmed et al, 2019). The observed antimicrobial resistance rates could be explained by several reasons including; overuse and misuse of antibiotics, suboptimal infection prevention and control practices, poor awareness and education on proper use of antibiotics and bacterial genetic factors.

**Factors Associated with Urinary Tract Infections among Adult females at Nyamagana District Hospital**

The prevalence of UTIs in this study has been significantly associated with several factors as similarly observed in other studies. Younger adult age group (18-24 years) is observed to have higher risk of UTIs compared to older (>50 years), concurring with other similar studies (Chandra *et al.*, 2017) and contrasting other similar studies (Karikari *et al,* 2022; Swamy *et al*., 2020). The younger adult females maybe affected more as they are expected to be at their early and more active period of sexual practices, a factor associated with UTIs and may lack adequate knowledge and experience with UTI prevention and control compared to older females. Unprotected sex is significantly associated with UTIs, similarly as from other studies (Hailay *et al.*, 2020; Foxman *et al*, 1995) as well as history of catheterization (Ali *et al.,* 2022; Bitew *et al.*, 2022; Hailay *et al.*, 2020), urine incontinence (involuntary/ frequent passing of small amounts of urine) (Demir *et al,* 2020; Chandra *et al.*, 2017), low drinking water intake (Hailay *et al.*, 2020; Hailay *et al.*, 2020; Scott *et al*, 2020; Chandra *et al.*, 2017), low knowledge of UTI prevention (Almaghlouth et al, 2023;

Hailay *et al.*, 2020; Onyango *et al*, 2018). This study also found other factors with association to UTIs though not significantly including history of previous UTIs, history of urine obstructive disease, frequency of sexual intercourse per week, and having multiple sexual partners, all of which have been significantly associated with UTIs in other studies (Bitew *et al.*, 2022; Hailay *et al.*, 2020; Badran *et al*, 2015).

Diabetes Mellitus (DM), commonly a factor significantly associated with UTIs in many studies (Swamy *et al.*, 2020; Hailay *et al.*, 2020; Odoki et al, 2019), was insignificantly associated with UTIs in our study. However, a very small number (6/392) of DM participants were identified to have UTIs and the fact that this was self-reported through questionnaire could affect the true association, though 66.7% of the DM participants had UTIs. Patients with DM are also likely to drink more water, a factor found to be protective of UTIs in this study, as well as they tend to attend clinics frequently where they might benefit more with health education on disease prevention and control. Pregnancy, a condition significantly associated with UTIs in many studies (Onyango *et al*, 2018; Faidah *et al.*, 2015), was also found to be less associated with the disease in our study. Our findings are consistent with other studies that also found pregnancy to be less associated with UTIs (Mlugu *et al*, 2023; Odoki et al, 2019). Additionally, urinating immediately after sex and using genital hygiene products were found to be protective of UTIs, similarly documented in other articles (CDC, 2024; Foxman *et al*, 1995), of which when practiced could help to reduce the transmission of UTIs.

The study had few limitations including non-response for some selected participants and risk of urine sample contamination, however, these were minimized by considering a 10% non-response rate in sample estimation and ensuring safe procedures for sample management and transportation respectively.

# CHAPTER SIX

# CONCLUSION AND RECOMMENDATIONS

## 6.1 Conclusion

The prevalence of UTIs among adult females attending as outpatients at Nyamagana District Hospital in this study is high. Predominant causative bacteria for UTIs were identified as *Escherichia coli, Staphylococcus aureus* and *Klebsiella spp*., among others. Antimicrobial susceptibility patterns for UTIs were varying where resistance is seen to be as high as above 80.0% against antibiotics like trimethoprim-sulfamethoxazole, Imipenem, Penicillin G, Erythromycin, Tetracycline and Clindamycin. In spite of the findings from this study showing the predominant bacteria have high antimicrobial susceptibility against most of the UTI treatment options such as Ciprofloxacin, Gentamycin, Ceftriaxone and Meropenem, other stipulated treatment options like nitrofurantoin and amoxicillin + clavulanic acid have shown considerably lower susceptibility rates, as such there is a need to evaluate utilization of the existing Tanzania Mainland's STG as possibility of UTI treatment that is contrary to the recommended options may exist where patients may be treated based on easy availability and accessibility including price of antibiotics rather than consideration for drug sensitivity rates. This could lead to the already existing antimicrobial resistance for some antibiotics.

Several factors have been significantly associated with an increased risk of UTIs including younger age, history of catheterization, unprotected sex, poor hygiene such as not urinating immediately after sexual activity, low drinking water intake and low knowledge of UTI prevention. UTIs is a preventable and treatable communicable disease. Currently, there is no specific department or section primarily responsible with addressing UTIs in Tanzania Mainland. This could be one of the reasons for continued high prevalence of the disease as routine and adequate prevention and control interventions specific to UTIs might be not provided, with this study observing a high proportion of participants having low to moderate knowledge on UTIs.

### 6.2 Recommendations

Based on the findings of this study we recommend the following: The government, in particular MOH and PORALG (RS, LGAs, and Healthcare Facilities) to emphasize the promotion and implementation of public awareness interventions on the prevention and control of UTIs by encouraging adequate water intake, proper hygiene particularly immediately after sex and cleaning of genital parts, appropriate and safe use of catheter and protected sex practices; Healthcare Facilities to ensure UTI patients have access to and are treated with effective antibiotics like Ciprofloxacin, Gentamycin, Ceftriaxone and Meropenem that have been to be most responsive to most predominant UTI causative bacteria; Healthcare Facilities to ensure correct UTI diagnosis before drug prescription and hence regularly perform urine culture tests for samples found to be positive for UTIs through normal (dipstick/ rapid) tests; the Councils and Healthcare Facilities to prioritize prevention and control interventions for UTIs in their Comprehensive Health Plans considering UTIs are among the top 10 outpatient diagnoses; and further study should be conducted to assess the behavioral factors in the communities and households to explore other important factors associated with UTIs such as status of Water, Sanitation, and Hygiene (WASH) practices that could not be assessed in this study as this was a hospital based study.

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# APPENDICES

## Appendix I: Questionnaire

Participant's ID: .....

Date: .....

**<u>SECTION A</u>: Socio-demographic information (*Select or check the correct choice*)**

1. What is your age? ……

2. Residence? Region ……. District Council …… Ward ……. Village/ Mtaa …….

| | | |
|---|---|---|
| 3. | Highest level of education | ( ) No formal education<br>( ) Primary school<br>( ) Secondary school<br>( ) College or University |
| 4. | Marital status | ( ) Married/ Co-habiting<br>( ) Widowed/ Separated<br>( ) Single |
| 5. | Occupation status | ( ) Housewife/unemployed<br>( ) Government or private employee<br>( ) Self-employed |
| 6. | Income Level (TZS/ Day) | ( ) > 10,000<br>( ) 3,000 – 9,000<br>( ) < 3,000 |

**<u>SECTION B</u>**: **Clinical Information (*Select or check the correct choice*)**

7. Are you pregnant?

( ) No

( ) Yes

---

8. Have you ever experienced urinary tract infections previously?

( ) No

( ) Yes

---

9. Have you experienced urinary obstructive disease in the past?

( ) No

( ) Yes

---

10. Are you currently using or have previously used catheter?

( ) No

( ) Yes

---

11. Do you experience small amount of urine leakage frequently?

( ) No

( ) Yes

12. Have you ever tested for diabetes mellitus before?

( ) No

( ) Yes

13. Have you ever been diagnosed with diabetes mellitus?

( ) No

( ) Yes

**SECTION C**: **Behavioural related Factors (*Select or check the correct choice)***

14. Have you ever practiced sex?

( ) No

( ) Yes

---

15. Do you have more than one sexual partner?

( ) No

( ) Yes

---

16. 15. How many times do you practice sexual intercourse per week?

( ) None

( ) 1- 2 times

( ) ≥ 3 times

---

17. Did you practice unprotected sex more than a day ago?

( ) No

( ) Yes

---

18. Do you immediately urinate after sexual intercourse?

( ) No

( ) Yes

---

19. Do you immediately wash your vagina after sexual intercourse?

( ) No

( ) Yes

---

20. Do you use genital hygiene products to wash your vagina?

( ) No

( ) Yes

---

21. How many liters of water do you drink per day?

( ) < 1 L

( ) 1 – 2 L

( ) > 2 L

---

22. Level of knowledge about UTIs prevention
    a. Have you ever heard about UTI?
    ( ) No ( ) Yes
    b. Do you know how UTI can be transmitted?
    ( ) No ( ) Yes
    c. Do you know that less water consumption (less than 2L a day) could be a risk factor for UTIs?
    ( ) No ( ) Yes
    d. Do you know that not using condom during sexual intercourse could be a risk factor for UTs?
    ( ) No ( ) Yes

**Appendix II: Consent Form**

**Introduction:**

Greetings,

I am Mr. Fungo Samson Masalu, a student at Muhimbili University of Health and Allied Sciences (MUHAS). I'm currently carrying out research titled *"Prevalence, Etiology and Risk Factors for Urinary Tract Infections among Adult females at Nyamagana District Hospital in Mwanza City, Tanzania*" as a part of degree award requirements. I hereby ask you to take part in this study and you will be asked few questions relevant to the study by either me or my research assistants. Additionally, you will be screened for Urinary Tract Infections.

**Aim of the study**

This study aims to determine the prevalence, etiology, antimicrobial susceptibility patterns and factors associated with urinary tract infections among adult females attending Nyamagana district hospital.

**Benefit**

Your participation will help me to inform the government and hospital in general on prevalence of urinary tract infections, most common etiology, antimicrobial susceptibility patterns and factors associated with urinary tract infections among adult females attending Nyamagana District Hospital. Moreover, you will benefit by being screened for Urinary Tract Infections and once found positive you will be advised on the proper management of your condition.

**Risk**

Some questions that you will be asked could make you uncomfortable. However, you will not be forced to answer any questions that will make you feel so.

**Confidentiality**

Information collected from you will be confidentially treated. Your name will not be recorded anywhere instead only assigned code will be used.

**Consent**

Your participation in this study is completely voluntary and your agreement to participate will be indicated by signing the consent form. You are free to withdraw yourself at any time without any penalty.

**Participant's Statement**

I have read/ been told the content of this form and I agree to be part of this study.

Participant's Code: …….

Participant's Signature: …….

Date: …….

If you need any information or have questions, please use the following contact:

1. **Principal Investigator**
   Mr. Fungo Samson Masalu,
   Phone number: 0759986796
   Email address: fungomas@gmail.com
2. **Supervisor**
   Dr. Theresia Ambrose
   Phone number: 0712252322
   Email address: tambroce@yahoo.com
3. **Supervisor**
   Dr. Ally Hussein
   Phone number: 0713633136
   Email address: allykhussein@gmail.com

**Appendix III: Dodoso**

Namba ya Mshiriki: .....

Tarehe: .....

**<u>Sehemu A</u>**: **Taarifa za Kijamii na Kijiographia (*Chagua/ jaza jibu sahihi*)**

1. Umri ……

2. Unapotokea/ Makazi? Mkoa ……. Halmashauri …… Kata ……. Kijiji/ Mtaa ……

| | | |
|---|---|---|
| 3. | Kiwango cha Juu cha Elimu | ( ) Sijasoma<br>( ) Shule ya Msingi<br>( ) Shule ya Sekondari<br>( ) Chuo |
| 4. | Hali ya Ndoa | ( ) Ameolewa/ Anaishi na Mwanamme<br>( ) Mjane/ Ameachika<br>( ) Hajaolewa |
| 5. | Hali ya Kazi | ( ) Mama wa Nyumbani/ Hana Kazi<br>( ) Serikalini au Kazi Binafsi<br>( ) Self-employed |
| 6. | Hali ya Kipato (Shilingi/ Siku) | ( ) Zaidi ya 10,000<br>( ) 3,000 – 9,000<br>( ) Chini ya 3,000 |

**<u>Sehemu B</u>**: **Taarifa za Kitabibu (*Chagua/ jaza jibu sahihi*)**

7. Una ujauzito?

   ( ) Hapana

   ( ) Ndiyo

---

8. Umeshapatwa na Maambukizi ya Mfumo wa Mkojo (UTI) kipindi cha nyuma?

   ( ) Hapana

   ( ) Ndiyo

---

9. Je, umewahi kupatwa na ugonjwa wa kizuizi cha mkojo kutoka?

   ( ) Hapana

   ( ) Ndiyo

---

10. Unatumia au umewahi kutumia kifaa cha kuwezesha kukojoa kipindi cha nyuma?

    ( ) Hapana

    ( ) Ndiyo

---

11. Je, huwa unatokwa na matone ya mkojo mara kwa mara?

    ( ) Hapana

    ( ) Ndiyo

12. Je, umewahi kupima ugonjwa wa Kisukari hapo kabla?

    ( ) Hapana

    ( ) Ndiyo

13. Je, umewahi kugundulika na ugonjwa wa Kisukari?

    ( ) Hapana

    ( ) Ndiyo

**<u>Sehemu C</u>**: **Vichocheo vya Kitabia (*Chagua/ jaza jibu sahihi*)**

14. Je, umewahi kufanya tendo la ndoa?

    ( ) Hapana

    ( ) Ndiyo

---

15. Je, una mpenzi zaidi ya mmoja?

    ( ) Hapana

    ( ) Ndiyo

---

16. Je, mara ngapi unafanya tendo la ngono kwa wiki?

    ( ) Hakuna

    ( ) Mara Moja hadi Mbili

    ( ) Mara Tatu au Zaidi

---

17. Je, umefanya ngono isiyo salama siku moja iliyopita?

    ( ) Ndiyo

    ( ) Hapana

---

18. Je, una tabia ya kukojoa mara tu baada ya tendo la ngono?

    ( ) Ndiyo

    ( ) Hapana

---

19. Je, unasafisha sehemu ya siri mara tu baada ya tendo la ngono?

    ( ) Ndiyo

    ( ) Hapana

---

20. Je, unatumia bidhaa maalumu kwa usafi wa sehemu za siri kusafisha sehemu za siri?

    ( ) Ndiyo

    ( ) Hapana

---

21. Kiasi gani cha lita za maji unakunywa kwa siku?

    (  ) < 1 L

    (  ) 1 – 2 L

    (  ) > 2 L

---

22. Kiwango cha uelewa dhidi ya kujikinga na UTI

    a. Je, umewahi kusikia kuhusu UTI?

       (  ) Hapana  (  ) Ndiyo

    b. Je, unafahamu jinsi UTI inavyoambukizwa?

       (  ) Hapana  (  ) Ndiyo

    c. Je, unafahamu kuwa unywaji wa maji kiasi cha chini ya Lita 2 kwa siku unahusishwa na kuchangia kupata maambukizi ya UTI?

       (  ) Hapana  (  ) Ndiyo

    d. Je, unafahamu kuwa kutotumia kondomu wakati wa tendo la ngono kunaweza kuchangia katika maambukizi ya ugonjwa wa UTI?

       (  ) Hapana  (  ) Ndiyo

**Appendix IV: Fomu ya Ridhaa ya Kushiriki**

**Utangulizi:**

Salaam,

Naitwa Fungo Samson Masalu, Mwanafunzi wa Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Ninafanya utafiti unaohusu *"Kiwango cha Maambukizi, Vijidudu Sababishi vya Maambukizi, na Vichocheo vya Maambukizi ya Ugonjwa wa Mfumo wa Mkojo (UTI) miongoni wa Wanawake Watu Wazima wanaohudhuria Hospitali ya Wilaya ya Nyamagana, Jijini Mwanza*" ikiwa ni sehemu ya Kukamilisha Masomo ya Shahada ya Uzamili ya Sayansi za Ufuatiliaji na Udhibiti wa Magonjwa. Hivyo, naomba ushiriki wako katika utafiti huu muhimu ambapo mimi au watafiti wenzangu tutakuuliza maswali mahsusi kuhusiana yanayolenga utafiti huu.

Pia, kupitia utafiti huu utafanyiwa vipimo kutambua uwepo wa Maambukizi ya Ugonjwa wa UTI.

**Lengo la Utafiti**

Utafiti huu unalenga kutambua kiwango cha Maambukizi ya UTI, Vijijidu Sababishi vya UTI na Vichocheo vya Maambukizi ya UTI miongoni mwa Wanawake Watu Wazima wanaohudhuria katika Hospitali ya Wilaya ya Nyamagana.

**Manufaa**

Ushiriki wako utachangia katika kuifahamisha Serikali na Hospitali ya Nyamagana kwa ujumula juu ya Kiwango cha Maambukizi ya UTI, Vijidudu maarufu kwa Maambukizi ya UTI, na Vichocheo vya Maambukizi ya UTI miongoni mwa Wanawake Watu Wazima ili kusaidia katika afua za kuzuia na kupambana na Ugonjwa huo pamoja na kuwezesha matibabu sahihi kulingana na wadudu husika. Aidha, utafaidika na kupimwa UTI kwa gharama za Utafiti huu na kama utagundulika kuwa na magonjwa hayo utapewa ushauri juu ya matibabu yake.

**Athari**

Baadhi ya maswali utakayoulizwa unaweza usiyafurahie sana. Hata hivyo, hautalazimishwa kuyajibu endapo utaona ni maswali yasiyokufurahisha.

**Usiri**

Taarifa binafsi zinazokusanywa kupitia utafiti huu ni siri. Pia, jina lako halitahitajika katika utafiti huu bali namba tu zitatumika kusaidia katika uchambuzi wa taarifa zinazopatikana.

**Ridhaa ya Kushiriki**

Ushiriki wako katika utafiti huu ni wa hiari na utashiriki baada ya kukubali kwa kusaini fomu hii ya ridhaa ya kushiriki katika utafiti. Aidha, uko huru kujiondoa katika utafiti huu muda wowote bila adhabu yoyote.

**Tamko la Mshiriki**

Nimesoma/ nimesomewa maelezo ya fomu hii ya kuridhia kushiriki katika utafiti na ninakubali kushiriki.

Namba ya Mshiriki: …….

Saini ya Mshiriki: ……

Tarehe: …….

Endapo utakuwa na maswali zaidi au utahitaji taarifa yoyote kuhusiana na utafiti huu, tafadhali wasiliana na yoyote kati ya hawa walioorodheshwa hapa chini: -

1. **Mtafiti Mkuu,**
   Bw. Fungo Samson Masalu,
   Simu: 0759986796
   Barua Pepe: fungomas@gmail.com
2. **Msimamizi**
   Dr. Theresia Ambrose
   Simu: 0712252322
   Barua Pepe: tambroce@yahoo.com
3. **Msimamizi**
   Dr. Ally Hussein
   Simu: 0713633136
   Barua Pepe: allykhussein@gmail.com

**Appendix V: Approval ethical clearance**

**UNITED REPUBLIC OF TANZANIA**

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

**OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION**

Ref. No.DA.282/298/01.C/2036 Date: 14/02/2024

MUHAS-REC-02-2024-2036
FUNGO SAMSON MASALU
MUHAS

**RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: PREVALENCE, ETIOLOGY, AND FACTORS ASSOCIATED WITH URINARY TRACT INFECTIONS AMONG ADULT FEMALES AT NYAMAGANA DISTRICT HOSPITAL IN MWANZA CITY, TANZANIA**

Reference is made to the above heading,

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 14/02/2024
EXPIRATION DATE OF APPROVAL: 14/02/2025

**STUDY DESCRIPTION:**
**Purpose:**

The purpose of this observational cross-sectional study is to determine the prevalence, etiology, and factors associated with Urinary Tract Infections among adult females attending Nyamagana District Hospital

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014554.pdf and in the MUHAS archives.

**The PI is required to:**

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Dr. Nahya Salim Masoud,
**Chairperson, MUHAS Research and Ethics Committee**

Muhimbili University of Health and Allied Sciences
DIRECTOR
Research & Publications
Box 65001

## Appendix VI: Introduction Letter - MUHAS to RS

**UNITED REPUBLIC OF TANZANIA**
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
**OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES**

In reply quote;
Ref. No. HD/MUH/T.841/2022

14th March, 2024

REGIONAL ADMINISTRATIVE SECRETARY,
OFFICE OF THE REGIONAL COMMISSIONER,
P.O.BOX 119,
**MWANZA.**

**RE: INTRODUCTION LETTER OF FUNGO SAMSON MASALU**

We would like to inform you that the carrier of this letter is Fungo Samson Masalu with registration number HD/MUH/T.841/2022 a student in the School of Public Health and Social Sciences at Muhimbili University of Health and Allied Science (MUHAS), pursuing MSc. Applied Epidemiology.

As part of his studies, he will be doing an elective research titled **"THE PREVALENCE,ETIOLOGY, AND FACTORS ASSOCIATED WITH URINARY TRACT INFECTIONS AMONG ADULT FEMALES AT NYAMAGANA DISTRICT HOSPITAL IN MWANZA CITY,TANZANIA".**

The Ethical Clearance for doing the said research has been given by the University.

Kindly request your assistance and cooperation to our student.

Yours Sincerely,

*Ms. Victoria Mwanilwa*
**For: DIRECTOR, POSTGRADUATE STUDIES**

cc: Fungo Samson Masalu

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

**Appendix VII: Introduction Letter - RS to LGA**

**UNITED REPUBLIC OF TANZANIA**
**PRESIDENT'S OFFICE**
**REGIONAL ADMINISTRATIVE AND LOCAL GOVERNMENT AUTHORITIES**

MWANZA REGION:

"REGCOM"
Phone: 028-2501037/2500686
Fax: 028 – 2541242/2501057
Email: ras@mwanza.go.tz

REGIONAL COMMISSIONER'S OFFICE
Regional Drive road,
P.O.BOX 119
**33180 NYAMAGANA, MWANZA**

Please reply to:

Ref. No. GB 47/333/01 19th March, 2024

The City Director,
P.O.BOX 1333,
**MWANZA.**

Re: **INTRODUCTION OF FUNGO SAMSON MASALU**

Please refer to the above subject.

2. Fungo Samson Masalu is a student at Muhimbili University of Health and Allied Sciences (MUHAS), pursing Master of Science Applied Epidemiology. One of requirements of his studies is to undertake an elective research.

3. The student is expecting to carry out the elective research titled **"The prevalence, etiology and factors associated with urinary tract infections among adult females at Nyamagana District hospital in Mwanza City, Tanzania".**

4. You are requested to give him necessary support to ensure this study is successfully done.

Thank you for your cooperation.

Dr. Thomas Rutachunzibwa
**For: REGIONAL ADMINISTRATIVE SECRETARY**
**MWANZA**

**Copy to:** Fungo Samson Masalu,
MUHAS,
P. O. Box 65001,
**DAR ES SALAAM**

1/1

**Appendix VIII: Digital Receipt**

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## Digital Receipt

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

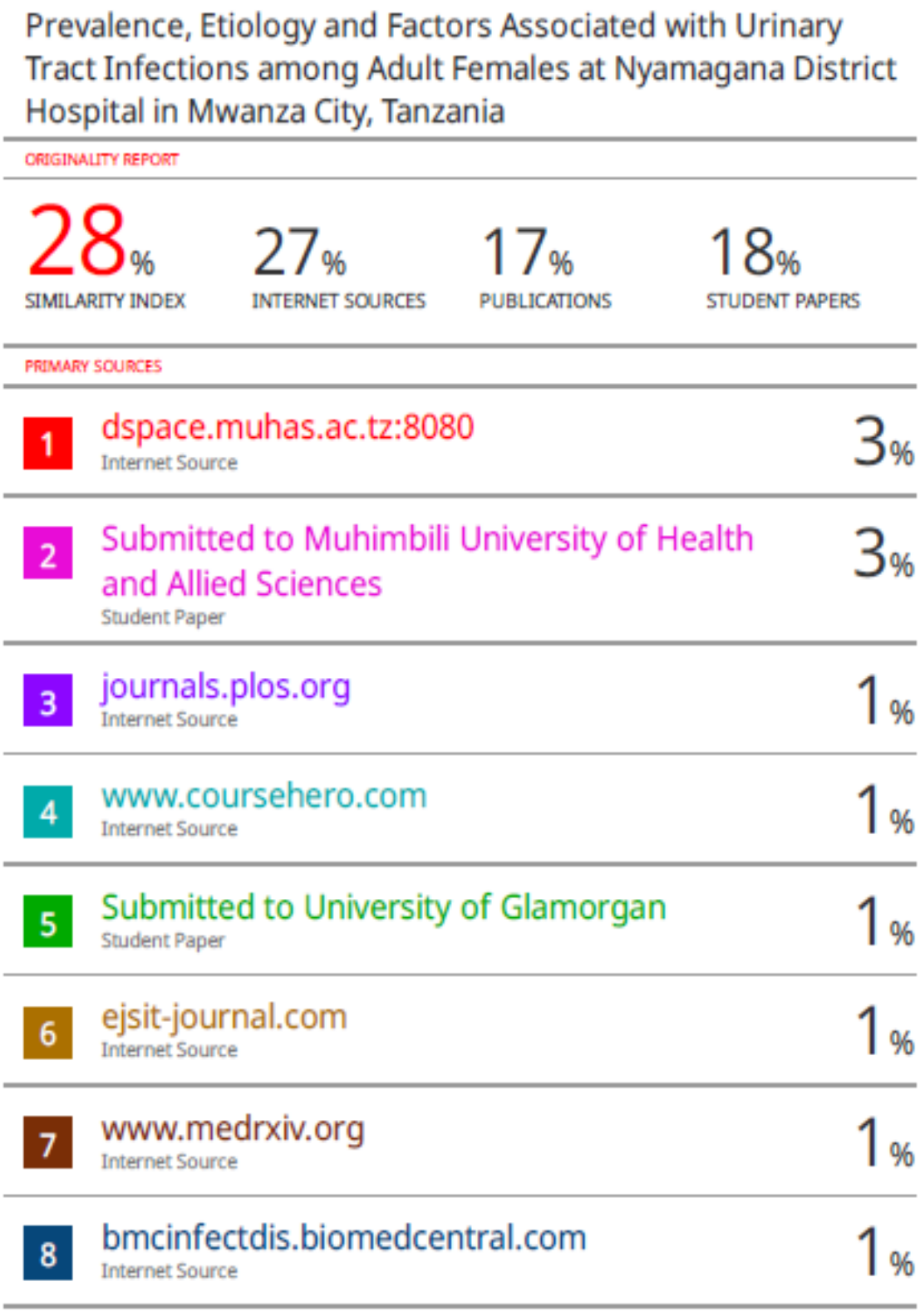
The first page of your submissions is displayed below.

| | |
|---|---|
| Submission author: | Fungo Masalu |
| Assignment title: | DISSERTATION FOR COHORT 15 |
| Submission title: | Prevalence, Etiology and Factors Associated with Urinary Tra... |
| File name: | DISSERTATION_REPORT_UTI_FSM_01_JUL_2024.doc |
| File size: | 15.73M |
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| Submission date: | 01-Jul-2024 01:38PM (UTC+0300) |
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**Appendix IX: Plagiarism report**



Prevalence, Etiology and Factors Associated with Urinary Tract Infections among Adult Females at Nyamagana District Hospital in Mwanza City, Tanzania

ORIGINALITY REPORT

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