PREVALENCE OF URINARY TRACT INFECTIONS AMONG INDIVIDUALS WITH PRESUMPTIVE UTI ACCESSING HEALTHCARE IN SELECTED HEALTH FACILITIES IN ENUGU STATE, NIGERIA.

[1]Department of Medical Laboratory Science, Enugu State University of Science and Technology, Nigeria
[2]Department of Medical Laboratory Science, University of Nigeria, Enugu Campus. Nigeria.
[3]Department of Medical Microbiology, Enugu State University of Science and Technology, Nigeria
[4]Department of Science Laboratory Technology, Federal Polytechnic, Idah, Kogi State, Nigeria
[5]Department of Obstetrics and Gynaecology, Enugu State University Teaching Hospital, Enugu
[6]Department of Microbiology, University of Nigeria, Nsukka, Nigeria.
[7]Lona Biomedical Laboratory, Obollo, Enugu State, Nigeria.

Correspondence: humphreyafam@yahoo.com Phone number: +234-8036688783

ABSTRACT

Urinary tract infection (UTI) is infection of the bladder, ureters, kidneys and/or Urethra, symptoms of which vary depending on its severity and the characteristics of an infected individual. This study examined the prevalence of UTI among individual with presumptive UTI accessing health care services in two health facilities in Enugu metropolis. Mid-stream urine samples were collected from 384 participants and analysed bacteriologically using standard methods. The prevalence of UTI among the study participants was 34.6%., 133 out of 384 having positive bacteria urine test. *Staphylococcus aureus* (n=19), *Escherichia coli* (n=52), *Klebsiella pneumoniae* (n=45), *Pseudomonas aeruginosa* (n=12), *Enterococcus faecalis* (n=9) and *Proteus mirabilis* (n=8) were isolated as a single or mixed culture. *Escherichia coli* was the most implicated in the study followed by *Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa, Enterococcus faecalis and Proteus mirabilis.* Prevalence of UTI in females was 63.9% and 36.1% in males. The married (56.8%) and the singles (34.1%) recorded higher prevalence of UTI compared with the widow/widower (6.0%) and the divorced (3.1%). UTI was comparatively high (33.1%) among the age group 25 – 34 years and low (27.1%) in those >64 years. Civil servants and participants with tertiary level of education had UTI prevalence of 41.4% and 38.3% respectively. There was a significant difference in UTI based on sex (p=0.001) and age (p=0.02), but no significant difference based on marital status, occupation and educational level (p>0.05). The prevalence of UTI in the study was high with both gram-positive and gram-negative bacteria implicated. Sex and age seem to play a significant role in UTI unlike marital status, educational level and occupation. Antibiotic susceptibility pattern of the UTI bacteria uropathogens should be investigated, while knowledge and perception of individuals about UTI assessed.

Keywords: Prevalence; urinary tract infection; Enugu.

INTRODUCTION

Urinary tract infections have been described since ancient times with the first documented description in the Ebers Papyrus dated 1550 BC (Al-Achi, 2008). Urinary tract is made up of the bladder, ureters, urethra and kidneys (Abraham and Miao, 2015). According CDC (2015), urinary tract infection (UTI) is an infection affecting the bladder (cystitis), ureters (ureteritis), kidneys (pyelonephritis) and/or Urethra (urethritis). For bacteria mediated UTI, it is the presence of $\geq 10^3$ CFU/ml of urinary bacteria pathogen in urine whether or not there are symptoms (Okonko *et. al.*, 2009; Lane and Takhar, 2011). Urinary tract infection may be complicated or uncomplicated. Salvatore *et. al.,* 2011 defined complicated UTI as one involving the upper urinary tract or occurring in diabetes mellitus, pregnancy, and/or immunocompromised individuals, while UTI is considered uncomplicated in a healthy and premenopausal woman.

According to Flores-Mireles (2015) and Oma (2014), the risk factors of urinary tract infection include: sexual intercourse, age, spermicide and diaphragm use, frequent use of antibiotics, reduced mobility (e.g. after surgery or prolonged bed rest), recurrent UTIs, Kidney stones, the nature of female anatomy (the distance between the anus and the urethra is short unlike in males). Other risk factors include; menopause, pregnancy, prostatitis, male uncircumcision, iatrogenesis (use of catheter, intravenous treatments), diabetes, obesity, family history, urinary abnormalities such as (vesicoureteral reflux), constipation, spinal cord injury and other underlying conditions (Eves and Rivera, 2010; Bhat *et. al*., 2011; Lane and Takhar, 2011).

In young sexually active women, sexual activity is the cause of 75–90% of bladder infections, with the risk of infection related to the frequency of sex (Nicolle, 2008). In post-menopausal women, sexual activity does not affect the risk of developing a UTI (Franco, 2005). Spermicide and diaphragm use, independent of sexual frequency, increases the risk of UTIs, while condom use without spermicide or the use of birth control pills does not increase the risk of uncomplicated urinary tract infection (Nicolle, 2008 and Franco, 2005).

Urinary tract infection occurs when bacteria, often from the skin or rectum, travel up the urethra and into the bladder. Advancing reasons for the higher incidence of UTI in females than males, Dielubanza and Schaeffer (2011) implicated human anatomy as a risk factor of UTI, stating that the urethra is much shorter in women allowing easier access for bacteria into the bladder, and that the proximity or closeness of a woman's urethral opening to the anus and vagina, which are sources of bacteria, put women at a greater risk of UTI than men.

Decreased estrogen levels in women during menopause also increases the risk of urinary tract infections due to the loss of protective flora of the vagina (Dielubanza and Schaeffer, 2011). Goldstein *et. al.* (2013) opined that the vaginal atrophy after menopause has been associated with recurrent urinary tract infections.

It is believed that hormonal changes combined with increased weight of a growing uterus blocks urine from passing out of the bladder contributes to a greater incidence of UTIs in pregnancy (Shopova *et. al.*, 2004). This explains while UTIs in pregnant women involve the kidneys more often than the bladder (Shopova *et. al.*, 2004). Study also showed that during pregnancy, high progesterone levels elevate the risk of decreased muscle tone of the ureters and bladder leading to a greater likelihood of reflux, where urine flows back up the ureters and towards the kidneys (Dielubanza and Schaeffer, 2011; NCCLS, 1999; CDC, 2010).

According to Holt *et. al* (2016) chronic prostatitis which increases with age is associated with recurrent urinary tract infections in males. Studies had revealed that bacteria commonly present in the urine of older males does not appear to affect the risk of urinary tract infections (NCCLS, 1999; CDC, 2010).

The role of routine circumcision in preventing UTIs in male has not been well studied (Jagannath *et. al.*, 2012). However, Bhat *et. al.* (2011) reported that among children, urinary tract infection is the most common in uncircumcised males less than three months of age, followed by females less than one year. Blood-borne infection may result in kidney and bladder infections (Gould *et. al.*, 2010). If bacteriuria is present in pregnancy, there is a 25–40% risk of a kidney infection (Dielubanza and Schaeffer, 2011). Chronic use of catheter and voiding dysfunction in spinal cord injury as well as iatrogenesis (as in the case of urinary catheter) increases the risk for urinary tract infections and account for an upward increase in the risk of bacteriuria from 3% to 6% per day (Dielubanza and Schaeffer, 2011). Nicolle (2001); Phipps *et. al* (2006) and Gould *et. al* (2010) reported that the risk of catheter associated infection can be decreased by catheterizing only when necessary, using aseptic technique for insertion, and maintaining unobstructed closed drainage of the catheter. In young children, there can sometimes be a structural problem in the urinary tract that can lead to more frequent UTIs (CDC, 2010).

Urinary tract infections are the most frequent bacterial infection in women occurring most frequently between the ages of 16 and 35 years, with 10% of women being infected annually

and more than 40–60% having an infection at some point in their lives (Colgan and Williams, 2011; Nicolle, 2008; Salvatore *et. al.*, 2011). Recurrences are common, with nearly half of people getting a second infection within a year. Urinary tract infections occur four times more frequently in females than males (Salvatore *et. al.*, 2011). Pyelonephritis occurs between 20–30 times less frequently (Nicolle, 2008). They are the most common cause of hospital acquired infections accounting for approximately 40% of the infection. Rates of asymptomatic bacteria in the urine increase with age from two to seven percent in women of child bearing age to as high as 50% in elderly women in care homes (Dielubanza and Schaeffer, 2011). Rates of asymptomatic bacteria in the urine among men over 75 are between 7-10% (Woodford and George, 2011). Asymptomatic bacteria in the urine occur in 2% to 10% of pregnancies (Smaill and Vazquez, 2007).

Urinary tract infections are more common in women than in men and up to 20% of women will experience at least one UTI in their lifetime (Nicolle, 2008). Up to 10% of women have a urinary tract infection in a given year and half of women having at least one infection at some point in their lives (Nicolle, 2008 and Salvatore *et. al.*, 2011). About 20% percent of women will have a second UTI, and up to 30 percent of those women will have a third. Of those women who have a third UTI, about 80% of them will have recurrent UTIs. The infection occurs most frequently between the ages of 16 and 35 years (Salvatore *et. al.*, 2011).

Urinary tract infections may affect 10% of people during childhood (Salvatore *et. al.*, 2011). Among children, urinary tract infection is the most common in uncircumcised males less than three months of age, followed by females less than one year (Bhat *et. al.*, 2011). Estimates of frequency among children, however, vary widely. In a group of children with a fever, ranging in age between birth and two years, 2 to 20% were diagnosed with a UTI (Bhat *et. al.*, 2011).

Bacteria are the most common cause of urinary tract infection. According to Flores-Mireles *et al* (2015), *Escherichia coli* from the gut and *Staphylococcus saprophyticus* account for about 80–85% and 5 – 10% of community-acquired urinary tract infections respectively, while *E. coli* (27%), *Klebsiella* (11%), *Pseudomonas* (11%), and *Enterococcus* (7%) among others are associated with hospital acquired UTI. In a study to track the causes of urinary tract infection in pregnant women in University Hospital of Obstetrics and Gynaecology "Maichin dom" Shopova *et. al (*2004) isolated *E. coli, Proteus, Klebsiella* (gram negative) and *S. aureus* and *Enterococcus* (gram positive) bacteria.

Lane and Takhar (2011) opined that *Chlamydia trachomatis* and *Mycoplasma genitalium* can infect the urethra but not the bladder, stating that urinary tract infections due to *Staphylococcus aureus* typically occur secondary to blood-borne infections.

Concerning other groups of microorganisms, *Candida albicans* and *Trichomonas vaginalis* are the commonest fungi and parasite implicated in UTI especially in women (Amdekar, 2011). Viruses are rarely implicated in UTIs, however herpes virus has been found to play role in urethritis (Amdekar, 2011).

According to Nicolle (2008), the most common symptoms of lower urinary tract infection are burning sensation on urination, frequent urination and/or an urge to urinate even with an empty bladder in the absence of vaginal discharge and significant pain. There may be pain above the pubic bone or in the lower back (Colgan and Williams, 2011; Drieux *et. al.,* 2006). These symptoms may vary from mild to severe lasting for an average of six days in women depending on the stage of the infection and history of an infected individual (Lane and Takhar, 2011; Colgan and Williams, 2011).

People experiencing an upper urinary tract infection, or pyelonephritis, may experience flank pain, pain or burning while urinating, frequent urination, feeling the need to urinate despite having an empty bladder, low fever (less than 101 °F), mental status changes, chills, or night sweats, cloudy or bloody urine, pressure or cramping in the groin or lower abdomen or nausea and vomiting in addition to the classic symptoms of a lower urinary tract infection (Lane and Takhar, 2011). The urine rarely appears bloody or contains visible pus (Salvatore *et. al.,* 2011; Arellano, 2016).

In young children, fever may be the only symptom of a urinary tract infection. Because of the lack of more obvious symptoms, when females under the age of two or uncircumcised males less than a year exhibit a fever, a culture of the urine is recommended. Infants may feed poorly, or exhibit fussiness or changes in appetite, vomit, sleep more, or show signs of jaundice, change in urine smell or color (Bhat *et al.,* 2011). In older children, urinary incontinence i.e. loss of bladder control may occur (Bhat *et al.,* 2011).

In the elderly, urinary tract symptoms may be vague with incontinence, a change in mental status (dementia), fatigue and/or sepsis as the only symptoms with fever, chills and leucocytosis as the systemic signs of the infection (Lane and Takhar, 2011 and Salvatore, 2011).

Kidney infections are less common but more serious (Teklu *et al.,* 2019). Warning signs for a kidney infection include flank or lower back pain, high fever (101 °F or above), nausea or vomiting, mental status changes, chills, or night sweats (Teklu *et al.,* 2019).

The bacteria that cause urinary tract infections typically enter the bladder or kidney via the urethra, blood or lymph. It is believed that the bacteria are usually transmitted to the urethra from the bowel, with females at greater risk due to the proximity of the anus to the vagina. After gaining entry to the bladder, most of the urinary tract pathogens such as *E. coli*, *Klebsiella* and *Proteus* spp are able to attach to the bladder wall and form a biofilm which resists the body's immune response (Salvatore *et. al.,* 2011).

Diagnosis of urinary tract infection can be based on symptoms alone (Nicolle, 2008). Personal experience shows that laboratory diagnosis is necessary using a number of techniques (urine analysis, microscopy, culture and molecular analysis) for empirical evidence of UTI.

Urine analysis reveals the presence of nitrite, leukocyte or leukocyte esterase in UTI (CDC, 2010). The presence of red blood cell, white blood cells, or bacteria could be observed in UTI during urine microscopy, while urine culture is considered positive for urinary tract infection if it shows a bacterial colony count of greater than or equal to 10^3 colony-forming units per mL of a typical urinary tract organism (CDC, 2010).

In those with vague symptoms, diagnosis can be difficult because bacteria may be present without there being an infection. In complicated cases or if treatment fails, a urine culture may be useful (Colgan *et. al.,* 2011). However, women with negative cultures may still improve with antibiotic treatment (Nicolle, 2008). Since symptoms of urinary tract infection could be vague, diagnosis can be difficult in the elderly without reliable tests for urinary tract infections mentioned albinitio (Woodford and George, 2011). In children, a positive urinary culture is required to make diagnosis of a urinary tract infection (Bhat *et al.,* 2011).

Antibiotic sensitivity can also be tested with these cultures, making them useful in the typing of the isolated bacteria (NCCLS, 1999). Antibiotics sensitivity is also useful in the selection of antibiotic for evidence-based treatment (CDC, 2010). The presence of an ESBL-producing organism in a clinical infection can result in treatment failure if ceftazidime, cefotaxime, and ceftriaxone or aztreonam is used (Teklu *et al.,* 2019). ESBLs can be difficult to detect because they have different levels of activity against various cephalosporins (NCCLS, 1999, CDC,

2010). Thus, the choice of which antimicrobial agents to test is critical. For example, one enzyme may actively hydrolyze ceftazidime, resulting in ceftazidime minimum inhibitory concentrations (MICs) of 256 µg/ml, but have poor activity on cefotaxime, producing MICs of only 4 µg/ml (Drieux *et. al.*, 2006). If an ESBL is detected, all penicillins, cephalosporins, and aztreonam should be reported as resistant, even if in vitro test results indicate susceptibility (NCCLS, 1999; CDC, 2010).

The mainstay of UTI treatment is antibiotics. In uncomplicated UTIs, treatment with a short course of antibiotics such as nitrofurantoin or trimethoprim/sulfamethoxazole has been found effective (Salvatore, 2011).

Commonly used medications for treating UTIs include: trimethoprim and sulfamethoxazole (Bactrim, Septra, Cotrim), nitrofurantoin (Macrodantin, Furadantin), fosfomycin (Monurol), ciprofloxacin (Cipro), levofloxacin (Levaquin), cephalexin (Keflex), trimethoprim (Trimpex), amoxicillin (Amoxil, Trimox, Wymox), ampicillin (Omnipen, Polycillin, Principen, Totacillin). In some cases, medications to numb the bladder such as phenazopyridine (Pyridium) may be prescribed if the UTI is especially painful. When ESBL is involved, the commonly used medications are: carbapenems (imipenem, meropenem, and doripenem), cephamycins (cefoxitin and cefotetan), fosfomycin, nitrofurantoin, beta-lactamase inhibitors (clavulanic acid, tazobactam, or sulbactam), non-beta-lactamases and colistin, if all other medications have failed.

Suggested measures aimed at preventing UTI include; infection prevention and control practice among catheterized patients, urinating when need to, wiping from front to back after using the bathroom to prevent spreading bacteria from the anus or vagina into the urethra, not using douches or feminine hygiene sprays, which can irritate the urethra, taking showers rather than sitting in baths, wearing cotton underwear and avoiding tight-fitting garments, drinking more water, emptying the bladder after sexual activity, as well as use of tampons instead of pads during menstrual periods and prompt treatment to prevent a kidney infection which can cause high blood pressure, early labor, premature delivery, and low birth weight in pregnancy (Lam *et. al.*, 2014).

Although a number of researches conducted among wide range of subjects in Nigeria have revealed the prevalence of UTI, there was no documented evidence on the size of the problem among individuals with presumptive UTI especially in Enugu metropolis in the recent times.

Hence, understanding the prevalence of the infection among these group of individuals is important in improving management of the infection.

Therefore, the aim of the study is to ascertain the prevalence of UTI among individuals with presumptive UTI attending clinic at ESUT Teaching Hospital and Omniscient Medical Diagnostic Centre, Enugu.

METHODOLOGY

3.1 Study Area

Enugu is a large city in Nigeria, regarded as the oldest urban area in the Igbo speaking area of Southeast Nigeria, and the capital of the same name state. It is located on latitude and longitude 6° 27' 35.8704" N and 7° 32' 56.2164" E. The population is about 725,000 people according to 2006 Nigerian census, and it is a Center for coal mining, business, and education. There are many health facilities, a few bottling companies and palm seed oil producing businesses (www.LatLong.net 2012-2021). The name *Enugu* is derived from the two Igbo words *Énú Ụ́gwụ́* meaning "hill top" denoting the city's hilly geography. It shares boundaries with Anambra on the West, Abia State on the South, Kogi on the North while Benue and Ebonyi on the East. Enugu and Nsukka are its major towns. Enugu was the headquarters of the former East Central State and Eastern Nigeria.

The people of Enugu are typically Ibos. Enugu State has a total of seventeen (17) local government areas. These are Enugu South, Igbo-Eze South, Enugu North, Nkanu, Udi Agwu, Oji-River, Ezeagu, Igbo Eze North, Isi-Uzo, Nsukka, Igbo-Ekiti, Uzo-Uwani, Enugu East, Aninri, Nkanu East and Udenu.

The state is predominantly agricultural with yam tubers, palm produce and rice being their main produce. There is in place an agricultural policy aimed at maximizing its agricultural potentials. Besides coal, new mineral deposits have recently been discovered in Enugu State. These include limestone, iron ore, crude oil, natural gas and bauxite.

3.2 Study Design

This is a cross-sectional and facility-based study in which participants with self-reporting urinary tract infection attending clinic in Enugu State University Teaching Hospital and Omniscient Medical Diagnostic Centre were examined for urinary tract infection.

3.3 Study Population

Individuals with presumptive urinary tract infection accessing medical care at Enugu State University Teaching Hospital and Omniscient Medical Diagnostic Centre Enugu between April and August 2019 were studied.

3.4 Sample size

A total of 385 patients were studied. The sample size was determined using Cochran's sample size formula by Bartlett *et al.* (2001).

$$n_o = (Z^2pq)/e^2$$

Where:

e = the desired level of precision (i.e. the margin of error) (0.05)

p = the (estimated) proportion of the population which has UTI (0.5)

q = 1 – p.

z = constant depending on confidence level (A 95 % confidence level gives Z values of 1.96)

e = 0.05, p= 0.5, z = 1.96

Substituting the above figures in the formula: $n_o = (Z^2pq)/e^2$

$n_o = ((1.96)^2 (0.5) (0.5)) / (0.05)^2 = 385.$

3.5 Sampling Strategy

Convenient sampling strategy was used to select participants in the study. Urine specimen collection was scheduled for Mondays and Wednesdays in the month of April – August 2019 until the sample size of 385 was reached. The two days were selected conveniently to make for enough time for urine specimen analysis and for space management in the incubator.

3.6.2 Urine sample collection

The participants were advised on how to collect a 'Clean catch' mid-stream urine. The specimens were coded to ensure anonymity and confidentiality with demographic details of the patients regarding age and gender properly recorded before transported to Omniscient Medical Diagnostic Centre, Enugu, Enugu State for further processing.

3.6.2.1 Urine culture

The urine specimens were cultured on Blood agar, MacConkey agar and Cysteine, Lactose, and Electrolyte Deficient (CLED) agar using streaking method (Ochei and Kolhatkar, 2000). The culture was incubated at 37^{o}C for 24 hours and the plate read. UTI isolates were subjected to gram staining and biochemical tests for identification.

3.6.2.2 Identification of Isolates

Gram staining and a combination of conventional biochemical testing techniques including Catalase and coagulase tests for *S. aureus*, indole test for suspected *E. coli*, citrate and malonate

utilization tests for suspected *K. pneumoniae*, and oxidase test for suspected *P. aeruginosa*, Bile Resistance test for *E. faecalis*, and motility test for *P. mirabilis* were carried out.

3.7 Inclusion and Exclusion Criteria

All adult individuals with suspected UTI whose willingness and consent were obtained were included, while those who refused to participate by not giving consent as well as female patients menstruating were excluded.

3.8 Ethical Considerations

Ethical permission for the research was obtained from Enugu State University Teaching Hospital Ethical Committee. The three ethical principles namely; safety, privacy and confidentiality of participant's information were maintained. The guidelines on the conduct of biomedical research by the Council of International Organization of Medical Sciences (CIOMS) and that of the International Conference on Harmonization – Good Clinical Practice (ICH-GCP) were followed on the course of the research.

3.9 Statistical Analysis

The data were analysed by SPSS 23 software. To compare qualitative variables, chi-square test was applied. Level of significance was $P < 0.05$.

RESULTS

4.1 UTI among participants

A total of 384 participants were involved in the study. One hundred and thirty-three participants showed positive bacteria urine test, accounting for UTI prevalence rate of 34.6%, with six different bacteria uropathogens being implicated.

Isolated bacteria

Six (6) different species of bacteria uropathogens were isolated from 133 participants, some occurring either singly or as a mixed growth. Bacteria species isolated include; *Staphylococcus aureus* (18), *Escherichia coli* (42), *Klebsiella pneumonia* (33), *Pseudomonas aeruginosa* (11), *Enterococcus faecalis* (9) and *Proteus mirabilis* (8) which occurred as single isolates, as well as *Klebsiella pneumoniae* + *Escherichia coli* (10), *Staphylococcus aureus* + *Escherichia coli* (1) and *Pseudomonas aeruginosa* + *Klebsiella pneumoniae* (1) that occurred as mixed growths.

Therefore, a total of 145 bacterial pathogens belonging to the 6 genera listed above were isolated from 133 participants with UTI. One hundred and twenty-one (121) isolates were from

121 (91.0%) participants who had UTI due to a single bacteria species and 24 isolates from 12 (9.0%) participants with UTI due to mixed infection caused by two different bacteria species. Table 1 shows the isolates disaggregated into single and mixed bacteria isolates.

Sex distribution of UTI among the participants

Out of 190 males and 194 females that participated in the study, 48 (36.1%) males and 85 (63.9%) females had a positive bacteria urine test respectively. Figure 1 shows the percentage sex distribution of UTI

Age distribution of UTI among the participants

The age group 25-34 years recorded the highest (44) no of positive bacteria urine test unlike the age group 45-54 years with the least (7). Figure 2 shows the age distribution of UTI in the study.

Distribution of UTI among the participants based on Marital Status

UTI was high among the married (56.8%), followed by the single (34.1%). Table 2 presents the distribution of the infection in the study according to the marital status of participants.

Distribution of UTI among the participants based on Occupation

On the basis of occupation of the participants, UTI was found to be higher among the civil servants (40.6%), followed by the business people (27.1%), Farmers (12.8%), Students (12.8%) and the unemployed (6.8%) as shown in figure 3.

Distribution of UTI on the basis of Educational level

Participants with tertiary education had 38.3% prevalence of UTI against 9.8% among those with no formal education. Figure 4 presents UTI prevalence on the basis of Educational level of participants.

4.4 Distribution of bacteria isolates based on sex and age

The prevalence of UTI was more in females (63.9%) than males (36.1%) with *E. faecalis* and *K. pneumoniae* + *E. coli* being the most implicated single and mixed isolate in females and males respectively. The participants in the age group 25 – 34 years recorded the highest UTI prevalence of 34.6% followed by those >64 years with 27.1%. *E. faecalis* occurring singly

occurred more among participants in 25 – 34 years age group. Table 3 shows the age and sex distribution of bacteria uropathogens in the study.

5.1 Discussion

Urinary tract infections (UTIs) are one of the most common microbial diseases encountered in medical practice which affect people of all ages (Kunin, 1994). The prevalence of UTI in this study was 34.6%. One hundred and thirty-three (133) out of 384 participants had positive urine culture implying UTI. This prevalence is nearly similar to 39.69% and 32.2% prevalence reported in Nigeria and Uganda respectively (Oladeinde *et. al*., 2011 and Odoki *et. al*., 2019) and varies from 11% and 5.8% reported among febrile children less than five years of age, the elderly and HIV patients in separate studies in Nigeria (Ibeneme *et. al*. 2014; Omeregie *et. al*., 2010; Sheyin *et. al*., 2018). The reason for the lower prevalence of 11% and 5.8% could be attributed to such factors as age, sexual intercourse, cerebral palsy, use of antibiotics in management of opportunistic infections in HIV/AIDS among others which are determinants of urinary tract infection (Anigilaje and Bitto, 2013; Omeregie *et. al*., 2010; Sheyin *et. al*., 2018). A higher prevalence of 56% was obtained in another study among pregnant women (Nwachukwu *et. al*., 2018). Hormonal changes in pregnancy were attributed to the observed high prevalence in addition to other determinants of UTI such as sexual intercourse and douching among others (Nwachukwu *et. al*., 2018; Brusch, 2020).

Six different species of bacteria (gram negatives and gram positives) were isolated. They include: *S. aureus, E. coli,* K. *pneumoniae*, *P. aeruginosa*, *E. faecalis* and *P. mirabilis*. This was consistent with the report of other studies but with little difference in species diversity. S. *aureus, E. coli, K. pneumoniae, P. aeruginosa, E. faecalis* and *S. saprophyticus* were isolated among patients with UTI (Mitu *et. al*., 2019).

There were differences in the frequency at which the organisms were isolated. For instance, 52(35.9%) of *E. coli*, 45(31.0%) of *K. pneumoniae*, 19(13%) of S. *aureus*, 12(8.3%) of *P. aeruginosa*, 9(6.2%) of *E.* f*aecalis* and 8(5.5%) of *P. mirabilis* were isolated. *E. coli* was the leading cause of UTI in the study followed by *Klebsiella* spp and *Staphylococcus* spp and others. This correlates with the findings of other studies which implicated *E. coli* as the major cause of UTI (Rizyi *et. al*., 2011; Omeregie *et. al*., 2010; Anigilaje and Bitto, 2013; Mitu, *et. al*., 2019, Odoki *et. al*., 2019). Contrary to the findings of this study, *Klebsiella* sp was the highest occurring urinary tract bacteria pathogen followed by *E. coli* (Agbagwa and Ifeanacho, 2015). Two recent studies in Benin City Nigeria among urban settlers showed that

Staphylococcus aureus was the most predominant isolate (Omeregie *et. al*., 2010). It is possible that the preponderance of the agents of UTI may differ from one location to another and that the characteristics of individuals studied may be important in determining which uropathogen would be implicated in UTI. Hence, further investigations should be carried out to verify the role of location and characteristics of individual in the preponderance of uropathogens in UTI. There was a statistically significant difference (p = 0.4) in sex distribution of UTI. Females recorded a higher prevalence of 63.9% than the males (36.1%). This was in agreement with higher UTI prevalences in females (83.5%, 55.1%, 77.4%, 6.6%) than males (16.5%, 34.6%, 22.6%, 4.8%) documented in other studies (Mitu, *et. al*., 2019; Omeregie *et. al*., 2010; Ibeneme *et. al*. 2014; Agbagwa and Ifeanacho, 2015, Sheyin *et. al*., 2018). Finding of this study on sex distribution of UTI agreed with a study that demonstrated that female gender had statistically significant relationships with UTI (Nicolle, 2008; Odoki *et. al*., 2019). The frequency of all the bacteria uropathogens in this study were more in females than the males with *Escherichia coli* (29.0%) taking the lead and females accounting for 71.4% of infection due to this singular bacterium. This was consistent with the high prevalence of *E. coli*, but at variance with the high prevalence of *Staphylococcus aureus* in males reported in another study (Oladeinde *et. al*., 2011). UTIs appear to be more common in females than males due to the nature of the anatomical structure and proximity of the female external urethral orifice to the anus, smaller urethra, incontinence, sexual intercourse and bad toilet (Mitu *et. al*., 2019; Brusch, 2020; Oladeinde *et. al*., 2011). Studies around the world showed that approximately 1 in 5 adult women experience a UTI at some point (Brusch, 2020).

The prevalence rate of UTI was 8.3%, 33.1%, 17.3%, 5.3%, 9.0% and 27.1% among participants in 15 – 24 years, 25 – 34years, 35 – 44 years, 45 – 54 years, 55 – 64 years and >64years age group respectively. The study showed that there was UTI in all age groups as opposed to UTI not reported in age group ≥46yrs (Sheyin *et. al*., 2018). Although UTI transmission was sinusoidal based on age, it did not follow a regular pattern. The prevalence of UTI increased with increase in age from 8.3% among those in 15 – 24 years age group reaching the peak of 33.1% at 25 -34 years, decreasing to 17.3% and 5.3% among participants in 45 – 54 years and 55 – 64 years and rising sharply to 27.1% in those above >64years in agreement with findings of Salvatore *et. al.*, 2011. Contrary to this finding, age ≤19 years were demonstrated as having statistically significant relationships with UTI (Odoki *et. al*., 2019). An inverse relationship between age and prevalence of UTI was reported in another study in Nigeria with significant decline in the prevalence of UTI with increase in age as opposed to

increased prevalence with increase in age (Odoki *et. al*., 2019; Omeregie *et. al*., 2010, Ibeneme *et. al.* 2014). Hence, age may be playing role together with other determinants in UTI.

The age range of 21 – 30 years had the highest prevalence of UTI (44.67%). This is in agreement with the findings of Ibeneme *et. al*. 2014. However, the prevalence of UTI did not differ significantly among the different age groups in this study ($p>0.05$).

Married participants reported a high prevalence rate of 71.4% against 1.5% among the divorced. This consistent with the finding of Subramaniam *et. al.,* 2016 in which there was a high prevalence of UTI among married women compared with those of individuals with other marital status. Sexual intercourse among the married may have contributed to the observed high prevalence among the group compared with the Widow/widower and the Divorced. Civil servants had 40.6% prevalence of UTI, with the unemployed recording the least prevalence of 6.8%. Participants with tertiary education had 38.3% prevalence of UTI against 9.8% among those with no formal education. Occupation and level of education were not significant factors in UTI ($p>0.05$). Meanwhile, there was no report on the prevalence of UTI based on occupation and level of education among the literature reviewed for comparative analysis of this results with that of other studies. Findings of this study could therefore serve as a reference for further studies.

Conclusion

This study revealed that the burden of UTI among the studied participants was high with 133 out of 384 being infected. *S. aureus, E. coli,* K. *pneumoniae, P. aeruginosa, E. faecalis* and *P. mirabilis* were isolated among the participants with UTI. *E. coli* and *K. pneumoniae* occurred more frequently than the other isolates implicated in the infection. Females were more likely to have UTI than the males, while the married, the civil servants and those with tertiary level of education showed higher risk of the infection when compared with their counterparts.

5.3 Recommendations

Prompt diagnosis and effective treatment should be instituted for individuals with presumptive UTI. Investigations should be carried out to ascertain the antibiotic susceptibility pattern of the isolates, while further studies should be conducted to access knowledge and perception of individuals about UTI.

Tables

Table 1: Bacteria uropathogen isolated from the participants disaggregated into single and mixed bacteria isolates.

Bacterial isolates	**No of participants**
Single Bacterial Isolates	
S. aureus	18
E. coli	42
K. pneumoniae	33
P. aeruginosa	11

E. faecalis	9
P. mirabilis	8
Mixed Bacterial Isolates	
K. pneumoniae + E. coli	10
S. aureus + E. coli	1
P. aeruginosa + K. pneumoniae	1
Total	**133**

Table 2: Distribution of UTI among the participants based on Marital Status

Marital status	**Number of participants with positive bacteria urine test (%)**
Single	131(34.1)
Married	218(56.8)
Divorced	12(3.1)
Widow/widower	23(6.0)

Table 3: Sex and Age distribution of bacteria uropathogens in the study

Bacterial isolates (n)	**Sex**		**Age group in Years (%)**					
	M	**F**	**15 – 24**	**25 – 34**	**35 – 44**	**45 – 54**	**55 – 64**	**>64**
Single Bacterial Isolates								
S. aureus (18)	7(38.9)	11(61.1)	3(16.7)	7(38.9)	5(27.8)	1(5.6)	0	2(11.1)

E. coli (42)	12(28.6)	30(71.4)	4(9.5)	13(31.0)	5(11.9)	2(4.8)	6(14.3)	12(28.6)
K. pneumoniae (33)	15(45.5)	18(54.5)	1(3.0)	10(30.3)	6(18.2)	2(6.1)	3(9.1)	11(33.3)
P. aeruginosa (11)	4(36.4)	7(63.6)	1(9.1)	5(45.5)	2(18.2)	0	1(9.1)	2(18.2)
E. faecalis (9)	2(22.2)	7(77.8)	0	6(66.7)	1(11.1)	0	0	2(22.2)
P. mirabilis (8)	2(25)	6(75)	0	2(25.0)	4(50.0)	0	0	2(25.0)
Mixed Bacterial Isolates								
K. pneumoniae + *E. coli* (10)	6(60.0)	5(40.0)	1(10.0)	3(30.0)	0	1(10.0)	1(10.0)	4(40.0)
S. aureus + *E. coli* (1)	0	1(100)	0	0	0	0	0	1(100.0)
P. aeruginosa + *K. pneumoniae* (1)	0	1(100)	0	0	0	1(100.0)	0	0
Total	**48(36.1)**	**85(63.9)**	**10(7.5)**	**46(34.6)**	**23(17.3)**	**7(5.3)**	**11(8.3)**	**36(27.1)**

Figures

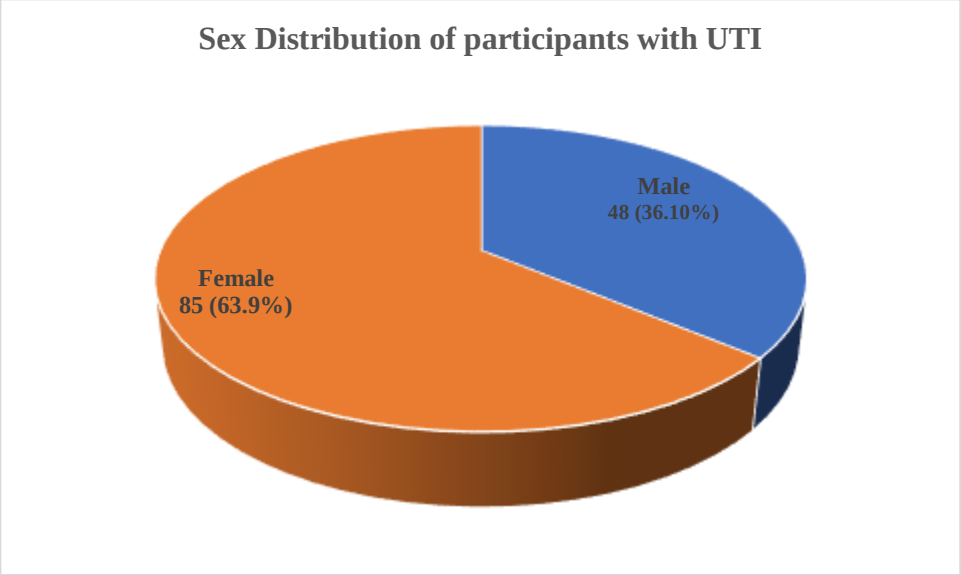

Figure 1: Sex distribution of UTI among the participants

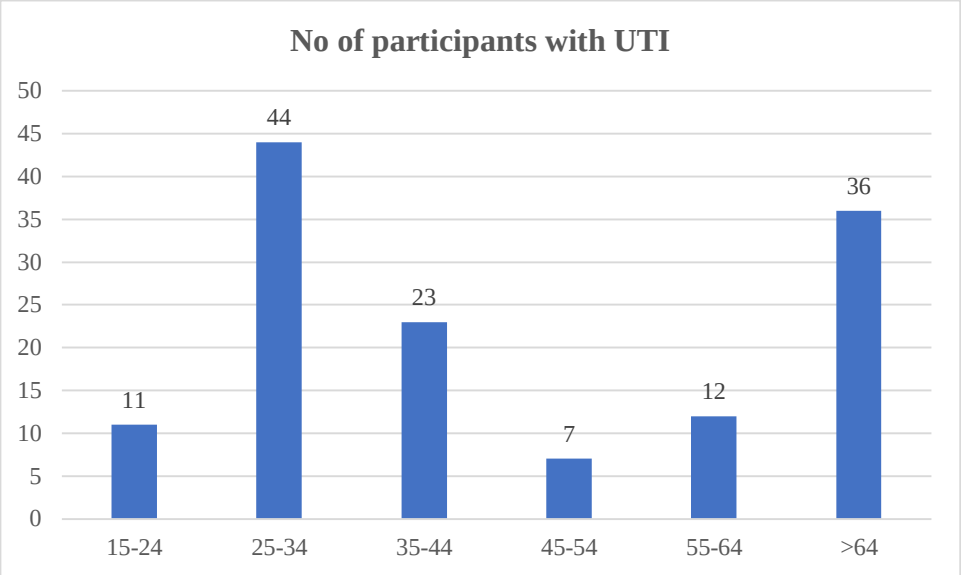

Figure 2: Age distribution of UTI among the participants

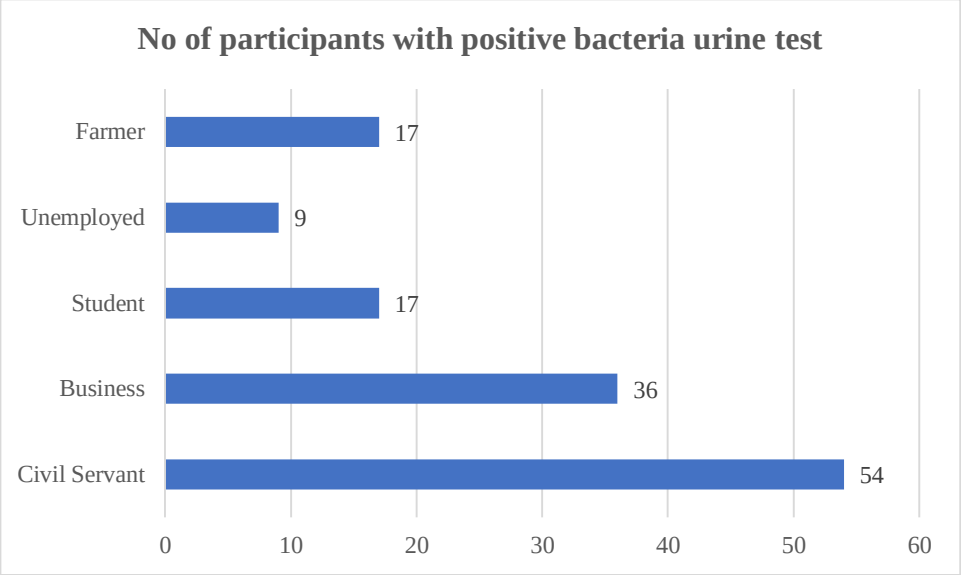

Figure 3: Distribution of UTI among participants based on Occupation.

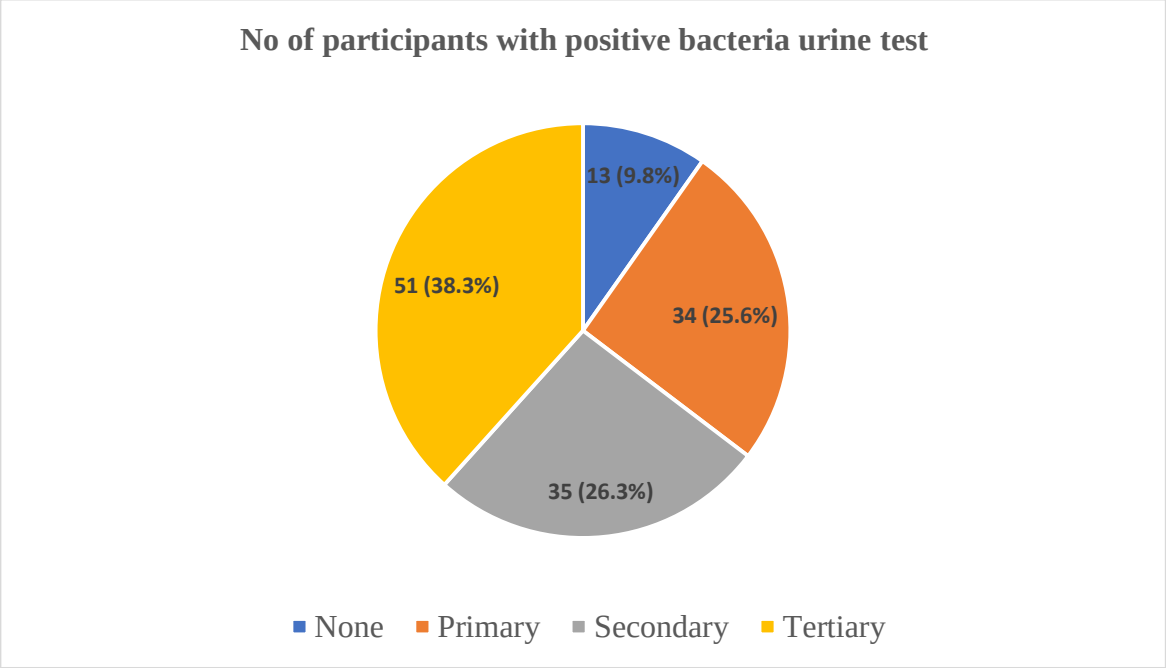

Figure 4: Distribution of UTI among participants based on Educational level.

REFERENCES

Abraham SN, Miao Y. (2015). "The nature of immune responses to urinary tract infections". Nature Reviews. Immunology. 15 (10): 655–663.

Agbagwa OE and Ifeanacho EJU. (2015). The Prevalence of UTI Pathogens in Urine Specimen Obtained from a Hospital in Rivers State Nigeria. Journal of Microbiology Research. 5(5): 143-148

Al-Achi A. (2008). An Introduction to Botanical Medicines: History, Science, Uses, and Dangers. Westport, Conn. Praeger Publishers. p. 126.

Amdekar S, Singh V, Singh DD. (2011). "Probiotic therapy: immunomodulating approach toward urinary tract infection". Current microbiology. 63 (5): 484–90

Anigilaje EA, Bitto TT. (2013). Prevalence and Predictors of Urinary Tract Infections among Children with Cerebral Palsy in Makurdi, Nigeria. Int J Nephrol. 937268.

Arellano RS. (2016). Non-vascular interventional radiology of the abdomen. New York: Springer. p. 67.

Bartlett JE, Kotrlik JW, Higgins CC. (2001) Organizational Research: Determining Appropriate Sample Size in Survey Research. Information Technology, Learning, and Performance Journal, 19, 43-50.

Bhat RG, Katy TA, Place FC. (2011). "Pediatric urinary tract infections". Emergency medicine clinics of North America. 29 (3): 637–53.

Brusch JL. (2020). What is the global prevalence of urinary tract infection (UTI)? Medscape.

Centers for Disease Control and Prevention (CDC). (2010). Laboratory Detection of Extended-Spectrum β-Lactamases (ESBLs). https://www.cdc.gov/hai/settings/lab/lab_esbl.html

Cheesbrough M. (2006). District laboratory practice in tropical countries. Part 2, 2nd Edn. Cambridge University Press. London. Pp. 27 - 80

Colgan R, Williams M. (2011). "Diagnosis and treatment of acute uncomplicated cystitis". American Family Physician. 84 (7): 771–6

Dielubanza EJ, Schaeffer AJ. (2011). "Urinary tract infections in women". The Medical clinics of North America. 95 (1): 27–41.

Drieux L, Brossier F, Sougakoff W, Jarlier V. (2006). Phenotypic detection of Extended-Spectrum B-Lactamase production in Enterobacteriaceae: Review and Bench guide. European Society of Clinical Microbiology and Infectious Diseases, CMI, 14 (1), 90–103.

Eves FJ, Rivera N. (2010). "Prevention of urinary tract infections in persons with spinal cord injury in home health care". Home healthcare nurse. 28 (4): 230–41.

Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. (2015). "Urinary tract infections: epidemiology, mechanisms of infection and treatment options". Nature Reviews. Microbiology. 13 (5): 269–84.

Franco AV. (2005). "Recurrent urinary tract infections". Best practice & research. Clinical obstetrics & gynaecology. 19 (6): 861–73.

Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. (2010). "Guideline for prevention of catheter-associated urinary tract infections 2009". Infect Control Hosp Epidemiol. 31 (4): 319–26.

Goldstein I, Dicks B, Kim NN, Hartzell R. (2013). "Multidisciplinary overview of vaginal atrophy and associated genitourinary symptoms in postmenopausal women". Sexual Medicine. 1 (2): 44–53.

Holt JD, Garrett WA, McCurry TK, Teichman JM. (2016). "Common Questions About Chronic Prostatitis". American Family Physician. 93 (4): 290–6.

Ibeneme CA, Oguonu T, Okafor HU, Ikefuna AN, Ozumba UC. (2014). Urinary Tract Infection in febrile under five children in Enugu, South Eastern Nigeria. Nigeria Journal of Clinical Practice. 17(5): 624-628.

Jagannath VA, Fedorowicz Z, Sud V, Verma AK, Hajebrahimi S. (2012). "Routine neonatal circumcision for the prevention of urinary tract infections in infancy". Cochrane Database of Systematic Reviews. 11: CD009129. Study Guide for Pathophysiology .2013. Elsevier Health Sciences. (5 ed.). p. 272

Kunin CM. (1994). Urinary Tract Infections in Females. Clinical Infectious Diseases, 18, 1-12.
http://dx.doi.org/10.1093/clinids/18.1.1

Lam TB, Omar MI, Fisher E, Gillies K, MacLennan S. (2014). "Types of indwelling urethral catheters for short-term catheterisation in hospitalised adults". The Cochrane Database of Systematic Reviews. 9:

Lane DR, Takhar SS. (2011). "Diagnosis and management of urinary tract infection and pyelonephritis". Emergency medicine clinics of North America. 29 (3): 539–52.

Mitu FS, Al Marfu MA, Mahanty A, Huda AKMN, Khan SA, Rahman MM. (2019). Prevalence of extended spectrum beta-lactamase (ESBL) and AmpC beta-lactamase producing bacteria in urinary tract infection patients in Bangladesh. Malayasian Journal of Microbiology. 15(3): 204 – 212.

National Committee for Clinical Laboratory Standards (NCCLS). (1999). Performance standards for antimicrobial susceptibility testing. NCCLS approved standard M100-S9. National Committee for Clinical Laboratory Standards, Wayne, PA.

Nicolle LE. (2008). "Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis". *Urol Clin North Am.* 35 (1): 1–12.

Nwachukwu E, Onyebuchi O, Michael O. (2018). Prevalence of urinary tract infections in pregnant women in Onitsha, Nigeria. J Bacteriol Mycol Open Access. 6(5):284-285

Ochei J, Kolhatkar A. (2000). Medical Laboratory Science: Theory and Practice. Tata McGraw-Hill Publishing Company Limited. New Delhi. Pp. 788-851

Odoki M, Aliero AM, Tibyangye J, Maniga JNM, Wampande E, Kato CD, Agwu E, Bazira J. (2019). Prevalence of Bacterial Urinary Tract Infections and Associated Factors among

Patients Attending Hospitals in Bushenyi District, Uganda. International Journal of Microbiology. 2019.

Okonko IO, Donbraye-Emmanuel OB, Ijandipe LA, Ogum AA, Adedeji AO, Uteze AO. (2007). Antibiotics Sensitivity and Resistance Patterns of Uropathogens to Nitrofurantoin and Nalidixic Acid in Pregnant Women with Urinary Tract Infection in Ibadan, Nigeria. Middle-East Journal of Science and Research. 4 (2): 105 – 109.

Oladeinde BH, Omoregie R, Olley M, Anunibe JA. (2011). Urinary tract infection in a rural community of Nigeria. North America Journal of Medical Sciences. 3(2): 75–77.

Omar MA. (2014). Extended spectrum beta-lactamase urinary tract infections [online]. Urol Ann. 6(2): 114–115.

Omeregie R, Ohiotenuanigbarumah I, AyeEgbe C, Ogefere H. (2010). Urinary Tract Infections Among the Elderly in Benin City, Nigeria. Fooyin Journal of Health Sciences. 2 (3-4): 90-93

Phipps S, Lim YN, McClinton S, Barry C, Rane A, N'Dow J. (2006). Phipps, Simon, ed. "Short term urinary catheter policies following urogenital surgery in adults". Cochrane Database of Systematic Reviews (2): CD004374.

Rizyi M, Khan F, Shukla I, Malik A, Shaheen. (2011). Rising Prevalence of Antimicrobial Resistance in Urinary Tract Infections During Pregnancy: Necessity for Exploring Newer Treatment Options. J. Lab. Physicians; 3(2): 98–103.

Salvatore S, Salvatore S, Cattoni E, Siesto G, Serati M, Sorice P, Torella M. (2011). "Urinary tract infections in women". European journal of obstetrics, gynecology, and reproductive biology. 156 (2): 131–6.

Sheyin Z, Olowolafe CO, Essien UC, Shindang J, Ede FR, Bigwan EI. (2018). Prevalence of Urinary Tract Infection in HIV Patients on Antiretroviral Drugs in Jos Metropolis, Nigeria. World Journal of Public Health. 3(2). 57 – 60.

Shopova E, Dimitrov A, Nikolov A. (2004). Causes of urinary tract infection in pregnant women. Akush Ginekol: 43 (3). 17 – 20. https://www.ncbi.nlm.nih.gov/pubmed/15341251

Smaill F, Vazquez JC. (2007). "Antibiotics for asymptomatic bacteriuria in pregnancy". Cochrane Database Syst Rev (2): CD000490.

Woodford HJ, George J. (2011). "Diagnosis and management of urinary infections in older people" *(PDF)*. Clinical Medicine. London. 11 (1): 80–3.