

# Prevalence of Urinary Tract Infections Among Patients Attending Some Selected Hospitals in Akure, Ondo State, Nigeria

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## ABSTRACT

**Background and Objective:** Urinary Tract Infections (UTIs) can occur in any part of the urinary system, including the urethra, bladder, ureters, and kidneys. They are among the most common infections and are increasingly resistant to antimicrobial agents. This study aimed to determine the prevalence of UTIs to socio-demographic characteristics among the patients in the study area. **Materials and Methods:** A cross-sectional study was carried out between May to October, 2023 among the patients, and socio-demographic data were collected. Collection of urine samples (mid-stream) were done aseptically, and general urine microscopic examination and culture were carried out. A total of 473 urine samples were collected from patients attending selected Government hospitals in Akure, Ondo State. Isolation of the organisms was done using standard microbiological methods. The data analysis was done in percentages, with a confidence level of 95%. **Results:** Out of 473 urine samples analyzed, 338 (71.45%) were females and 135 (28.54%) were males. The age range of the participants in this study were between 10 and 60. In relation to age group, the highest prevalence rate (31.97%) was obtained among the participants of 20-29 years, while the lowest prevalence rate of UTI (8.42%) was among the age of 10-29 years. The most predominant bacteria was *Staphylococcus aureus* with the highest occurrence (24.92%), and also *Micrococcus luteus* (1.34%) with the lowest occurrence of the samples. **Conclusion:** Urinary Tract Infections (UTIs) have become difficult to treat due to pathogens increasing resistance to antimicrobial agents. Infections can occur at any age in both genders, but are more prevalent among women. Therefore, there is a need for screening to avoid complications of these infections, which tend to pose serious public health issues.

## KEYWORDS

Urinary Tract Infections (UTIs), prevalence, socio-demographic characteristics, antimicrobial resistance, microbiological analysis, public health

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## INTRODUCTION

Infection of the urinary tract presents serious challenges to public health worldwide. Urinary tract infections are often caused by a diverse range of microorganisms, which include both Gram-positive and Gram-negative bacteria and fungi that are among the prevailing infections which often affect the urethra, bladder, kidney, and ureter. Urinary tract infections represent approximately 25% of bacterial infections



in the female population<sup>1</sup>. The clinical manifestations are influenced by the specific region of the urinary tract that is infected, the type of organism involved, the severity of the infection, and the capacity of the host's immune response<sup>2</sup>.

The UTIs can be caused by various microorganisms, including bacteria, fungi, and viruses. Among these microorganisms, bacteria are the most common cause of UTI, with *Escherichia coli* being the predominant pathogen responsible for up to 80% of community-acquired UTI cases<sup>3</sup>.

The increasing prevalence of antibiotic-resistant bacteria has become a significant public health concern, as it limits the effectiveness of antibiotics in treating bacterial infections. Urinary tract infections have posed a significant and serious health-related issue in individuals of all genders and age groups<sup>4,5</sup>. However, women are at high risk of having UTIs compared to men, because of the anatomical structure and shorter distance of the urethra<sup>6</sup>. The occurrence of UTIs has been identified as one of the most prevalent infectious diseases, placing a substantial financial burden on society. Clinical Urinary Tract Infections (UTIs) are classified as either uncomplicated or complicated. Uncomplicated UTIs typically occur in individuals who are in good health and do not have any structural or neurological abnormalities in their urinary tract<sup>7,8</sup>. There are several risk factors associated with cystitis, such as being female, having previous UTIs, engaging in sexual activity, having vagina infections, having diabetes, obesity and having a genetic predisposition<sup>9</sup>. The research aimed to determine the prevalence and associated risk factors of urinary tract infections concerning socio-demographic characteristics among patients attending some selected hospitals in Akure.

## MATERIALS AND METHODS

**Study area:** This study was carried out in three selected hospitals, which are the University of Medical Science Teaching Hospital (UNIMED) from May to October, 2023, Basic Health centers Isolo and Orita-Obele in Akure, Ondo State, located in the central part of Ondo State, South West Zone of Nigeria.

**Sample size determination:** Using Andrew Fisher's formula with a 95% confidence level, the sample size of the urine samples collected for the study was calculated and shown below<sup>10</sup>:

$$\text{Sample size} = \frac{(Z - \text{score})^2 \times \text{Standard deviation} \times (1 - \text{standard deviation})}{(\text{Confidence interval})^2}$$

at 95% confidence level (z-score 1.96), standard deviation 0.5 and confidence interval (margin error) of  $\pm 5\%$ :

$$n = \frac{1.96^2 \times 0.50 (1 - 0.50)}{0.05^2}$$

$$n = 385$$

**Study design:** A total of 473 urine samples were collected from patients attending selected government hospitals which are University of Medical Science Teaching Hospital (UNIMED), Basic Health centers Isolo and Orita-Obele in Akure, Ondo State, Nigeria and the laboratory analysis was carried out at Federal University of Technology, Department of Microbiology between the periods of May to October, 2023.

**Inclusion criteria:** Fifty-seven patients with symptoms or suspected urinary tract infection (cystitis or pyelonephritis) and, history of recurrent urinary tract infection were included in this study.

**Exclusion criteria:** Patients on antibacterial drugs were excluded from this study.

**Subject recruitment:** A total number of 473 urine samples were collected from three selected government hospitals, University of Medical Science Teaching Hospital (UNIMED), Basic Health centers Isolo and Orita-Obele in Akure, Ondo State, who visited the outpatient clinic and showed symptoms of UTIs were recruited for this study. The laboratory analysis was carried out at the Department of Microbiology, Federal University of Technology, Akure, Nigeria.

**Demographic data:** Demographic information was obtained and recorded on a prepared data collection form. Information such as the patient's name, age, gender, educational background, duration of infection, history of infection, history of UTIs, place of residence, and marital status were collected using a well-structured questionnaire.

**Ethical consideration:** Ethical approval was obtained from the Ondo State Health Research Ethics Committee (OSHREC) and the University of Medical Sciences Teaching Hospital Ondo State with Protocol numbers OSHREC 15/04/2023 and UNIMEDTHC/028/083, respectively. The informed consent was filled before the collection of samples from the patients that were enrolled in this study. The recruited patients were given a standard questionnaire to gather their socio-demographic information.

**Collection of samples:** Midstream urine samples were collected in sterile, clean, leak-proof bottles from outpatients who visited the microbiology laboratory of the three selected hospitals. The urine specimens were collected from individuals of both genders and of all age groups. The urine samples were transported to the Medical Microbiology Laboratory of the Department of Microbiology, Federal University of Technology, Akure, Nigeria in ice packs for bacterial cultivation and identification.

**Isolation and identification of bacteria species:** The isolation of the organisms was done by using the calibrated wire loop method (0.01 mL) with a diameter of 4.0 mm. Urine samples were cultivated on standard culture media, such as nutrient agar, CLED (Cystine Lactose Electrolyte Deficient-Agar), blood agar, EMB (Eosin Methylene Blue agar), Mannitol salt agar, and MacConkey agar. All plates were incubated at 37°C aerobically for 24-48 hrs for visible growth. Urine samples showing a colony count of more than  $10^5$  CFU/mL were considered as positive isolates. Gram staining of the isolated organisms was subcultured on selective agar, and biochemical tests were carried out on pure bacterial isolates<sup>11</sup>.

**Data analysis:** The Data analysis was done in percentages, with a confidence level of 95%.

## RESULTS

**Socio-demographic characteristics:** Of the 473 participants that were recruited for this study, 338 (71.46%) were females while 135 (28.54%) were males, respectively. As 284 of the urine samples appeared to be amber yellow, 115 were cloudy, 12 were colorless while 20 appeared to be bloody (Table 1 and Fig. 1).

The age range of the all participants were between 10->60. About the age group, the highest prevalence rate was obtained among the age group of 20-29 years with the percentage of (30.97%) while the least prevalence rate of UTI (8.42%) was recorded among 10-19 years (Table 2).

The educational background shows that the majority of the participants (42.92 %) have a secondary school educational level while (6.97%) of the participants do not have any formal education (Fig. 2).

Among the 473 participants, 49% were married, 33% were single, 8% were widowed, and 11% were divorced (Fig. 3).

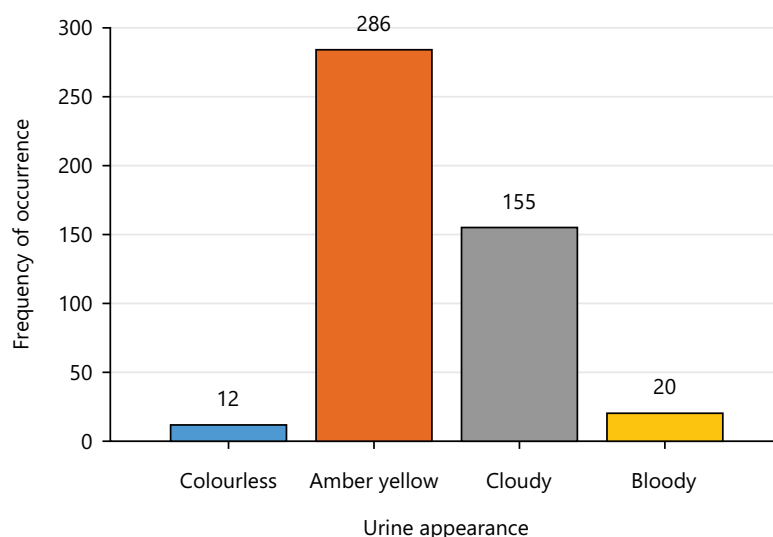


Fig. 1: Frequency in the appearance of the urine samples

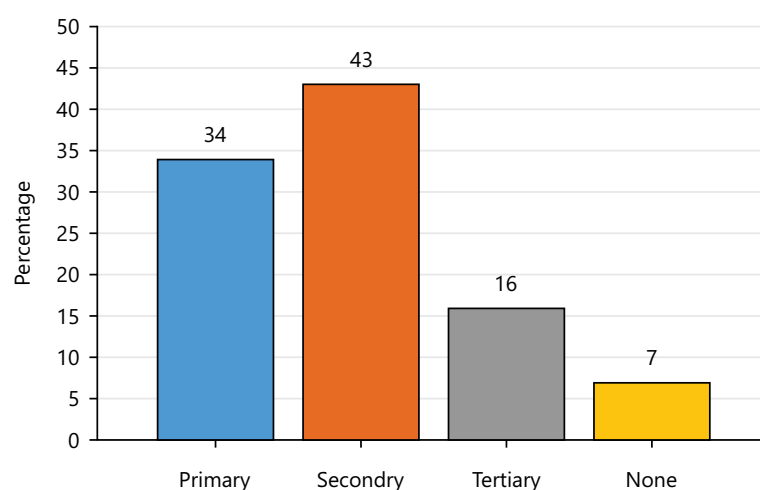


Fig. 2: Educational background of the participants

Table 1: Prevalence of urinary tract infections to gender distribution

Gender	Number of samples examined	Number of positive samples	Percentage of positive samples
Female	338	215	72.4
Male	135	82	27.6
Total	473	297	100

Table 2: Prevalence rate of urinary tract infections with age

Age range	Positive UTI (%)	Negative UTI (%)	Total (%)
10-19 years	25 (8.42)	34 (19.32)	59 (12.47)
20-29 years	92 (30.97)	40 (22.73)	132 (27.91)
30-39 years	65 (21.88)	30 (17.05)	95 (20.08)
40-49 years	44 (14.82)	25 (14.20)	69 (14.60)
50-59 years	34 (11.45)	26 (14.77)	60 (12.68)
≥60 years	37 (12.46)	21 (11.93)	58 (12.26)
Total	297	176	473

**Biochemical and morphological profile of isolated bacteria:** Table 3 represents the morphology and biochemical profile of the bacteria isolated from urine samples. After isolation, the bacteria were identified using Gram staining and biochemical tests. Both Gram-negative and Gram-positive bacteria were identified.

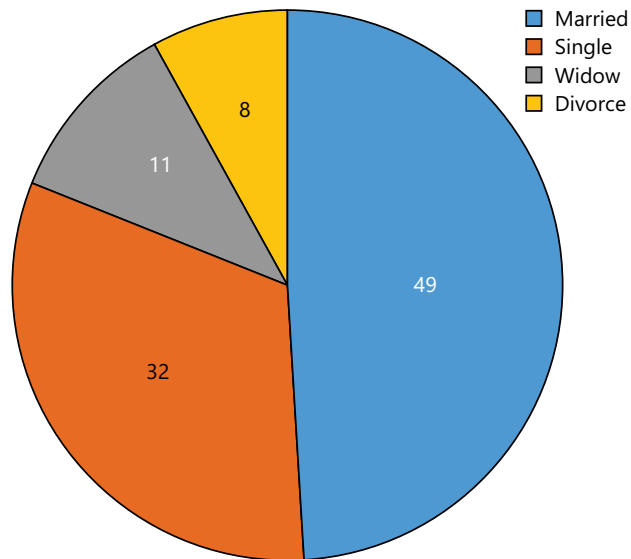


Fig. 3: Marital status of the participants

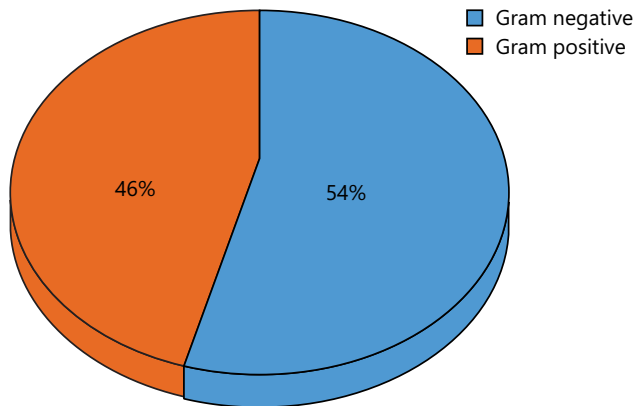


Fig. 4: Percentage occurrence of gram-positive and gram-negative isolated from urine samples

Table 3: Biochemical characteristics of bacteria isolated from urinary tract infections

Gram	Cell staining shape	Catalase	Citrate	Oxidase	Coagulase	Motility	Indole	Urease	H <sub>2</sub> S	Gas	Glucose	Lactose	Mannitol	Sucrose	MIR	VP	Presumptive identification
-	Rd	+	-	-	N	+	+	-	-	+	+	+	-	+	+	-	<i>Escherichia coli</i>
-	Rd	+	+	-	N	-	-	+	-	+	+	+	-	-	-	+	<i>Klebsiella pneumoniae</i>
+	Cc	+	+	-	+	-	-	+	-	-	+	+	+	+	+	+	<i>Staphylococcus aureus</i>
-	Rd	+	+	-	N	+	-	-	-	+	+	+	+	+	-	+	<i>Enterobacter aerogenes</i>
-	Rd	+	+	+	-	+	-	-	-	-	-	-	+	-	-	-	<i>Pseudomonas aeruginosa</i>
+	Cc	+	+	-	+	-	-	+	-	-	+	+	+	+	+	+	<i>Staphylococcus saprophyticus</i>
-	Rd	+	+	-	N	+	-	+	+	+	+	-	-	-	+	-	<i>Proteus mirabilis</i>
+	Cc	-	-	-	N	-	-	-	-	-	+	+	+	+	-	+	<i>Enterococcus faecalis</i>
+	Cc	+	-	+	+	-	-	+	-	-	-	-	-	-	-	-	<i>Micrococcus luteus</i>
-	Rd	+	-	-	N	+	+	+	+	+	+	-	-	-	+	-	<i>Proteus vulgaris</i>

-: Negative and +: Positive

Table 4: Prevalence of bacteria isolated from the urinary tract of positive patients

Isolates	Total	Percentage
<i>Escherichia coli</i>	61	20.54
<i>Klebsiella pneumoniae</i>	31	10.44
<i>Staphylococcus aureus</i>	74	24.92
<i>Enterobacter aerogenes</i>	17	5.72
<i>Pseudomonas aeruginosa</i>	10	3.37
<i>Staphylococcus saprophyticus</i>	34	11.45
<i>Proteus mirabilis</i>	40	13.47
<i>Enterococcus faecalis</i>	26	8.75
<i>Micrococcus luteus</i>	4	1.34
<i>Proteus vulgaris</i>	12	4.04
Total	297	100

**Prevalence of bacteria isolated from the urinary tract of positive patients:** The most common uropathogens isolated were *Staphylococcus aureus* 74 (24.92%), followed by *Escherichia coli*, 61 (20.54%). Other organisms isolated were *Staphylococcus saprophyticus* 34 (11.45%), *Proteus mirabilis* 28 (9.43%), *Klebsiella pneumoniae* 31 (10.44%), *Enterococcus faecalis* 26 (8.75%), *Enterobacter aerogenes* 17 (5.72%), *Proteus vulgaris* 12 (4.04%), *Pseudomonas aeruginosa* 10 (3.37%) and *Micrococcus luteus* 4 (1.34%) Table 4.

Among the bacteria isolated, Gram-negative bacteria showed the highest occurrence of organisms isolated from urine sample followed by the Gram-positive bacteria, respectively (Fig. 4).

## DISCUSSION

Urinary tract infection is a serious health problem affecting millions of people annually. Urinary tract infections are caused by the presence of microorganisms such as bacteria and fungi, although viruses could be involved. In this study, females (72.4%) account for the highest prevalence of UTI compared to males (27.6%). This is in corroboration with the findings of Mlugu *et al.*<sup>12</sup>, the higher incidence of Urinary Tract Infections (UTI) in female participants could potentially be attributed to their shorter and broader urethra, which is located close to the anus, the absence of prostatic fluid, which functions as an antimicrobial agent, and their warm and moist urethra, which may promote optimal bacterial growth in comparison to males<sup>13</sup>. Other factors that contributed could be menopause, childbirth, and the usage of contraception<sup>14,15</sup>.

In this study, it was found that females within the age range of 20-29 and 30-39 years old had the highest bacteria in their urine. This finding is consistent with the findings of Ezugwu *et al.*<sup>16</sup>, who reported that women in the age groups of 31-40 and 21-30 years old showed a high percentage of bacterial count for urine sampling.

Also, the finding is in corroboration with Nwachukwu *et al.*<sup>17</sup>, which shows that UTI was more prevalent among women of 26-30 years. The high rate of untreated UTIs in women between the ages of 36 and 40 may be caused by diabetes mellitus, high blood pressure, poor personal cleanliness, and other factors. These are the main known risk factors for the prevalence of UTIs<sup>18</sup>.

The present investigation elucidates the prevalence of bacterial pathogens and the factors associated with bacteria derived from Urinary Tract Infections (UTIs), with *Staphylococcus aureus* (24.92%) recognized as the most frequently prevalent uropathogen, followed by *Escherichia coli* (20.54%). This is in agreement with the work of Mwaka *et al.*<sup>19</sup> and Ekwealor *et al.*<sup>20</sup> with the high rate of *Staphylococcus aureus* of 9/40 (22.5%) and 60/215 (28%), respectively. A research investigation carried out in Egypt revealed that the prevalence of *E. coli* was significantly higher among all microbial isolates<sup>21</sup>.

Among the bacteria isolated, Gram-negative bacteria (54%) showed a higher occurrence of organisms than Gram-positive bacteria (46%). The findings of this investigation align with those reported by Karzan *et al.*<sup>22</sup>, who observed that Gram-negative bacteria were more frequently isolated than Gram-positive bacteria among samples with positive urine results.

In this study, married participants (49%) had the highest prevalence of UTI while the divorcees (8%) had the lowest among the participants. Involvement of married individuals in sexual activity contributes to an increase in the risk of UTIs.

In general, comparable findings from other sources also showed that genitourinary tract abnormalities, age, female gender, marital status, hospitalization, catheterization, and catheter duration were statistically significant factors associated with UTIs.

Regardless of age, gender, educational background, and marital status, urinary tract infections need to be treated and managed promptly. Untreated urinary tract infections can result in pyelonephritis, premature labor in pregnant women, and Group B streptococcal infection in neonates<sup>23</sup>.

## CONCLUSION

This study revealed that age, gender, marital status, and educational background are the most important risk factors of urinary tract infections. *Staphylococcus aureus* was the most prevalent among the bacteria isolates from the selected hospital in Ondo State, followed by *Escherichia coli* while *Micrococcus luteus* was identified as the least commonly observed. According to this study, urinary tract infections are more common in female patients than in male patients. It is recommended that women should be educated regarding the need of maintaining proper hand washing and good hygiene to avoid the spread of bacteria. The process of collecting data from specific participants proved to be both challenging and time-intensive, largely influenced by their educational backgrounds. Additionally, some individuals declined to provide samples for inclusion in this study.

## SIGNIFICANCE STATEMENT

Urinary Tract Infections (UTIs) continue to pose a significant public health challenge, particularly in developing regions where access to healthcare and the prevalence of antimicrobial resistance pose significant challenges. This study focuses on the prevalence of UTIs among patients visiting selected hospitals in Akure, Ondo State, Nigeria, offering critical insights into infection patterns and risk factors. These findings can inform targeted interventions, enhance diagnostic protocols, and improve treatment strategies. Understanding the burden of UTIs in this area will contribute to evidence-based policymaking and resource allocation, ultimately improving patient management and developing preventive measures to reduce infection rates and their associated complications.

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