Knowledge and practice of antimicrobial use fortreatment of urinary tract infections among female medical students in Enugu, Nigeria: A cross-sectional study

Abstract

Background: Urinary tract infections (UTI) are a significant clinical problem empirically treated empirically with antibiotics that could worsen rising prevalence of antibiotics resistance.

Objective: We described the knowledge, attitude, and treatment practices of UTI among female medical students in Enugu, southeast Nigeria.

Method: A cross-sectional, questionnaire-based survey involving female medical students at Enugu State University of Technology, in Enugu, Nigeria was conducted in October 2023. Overall, 180students were enrolled. The questionnaires were constructed after systematically reviewing the literature. The data were analyzed by calculating frequencies and means.

Result: Our study sample includes 174 female medical students(Response rate, 96.7%). Most of the students are aged 20–24 years (63.2%), with mean (standard deviation) of 23.5 (± 4.6) years, single (86.8%), Igbo (97.1%), and Christian (97.7%). Most students (166 students, 95.4%)had adequate knowledge of UTI, but a minority of students (45.5%) sought treatment from a trained healthcare provider for proper laboratory investigation, diagnosis, and treatment of their previous UTI episodes. Among those that did not seek care with trained healthcare providers, most, 27 (75.0%), self-treated. Most students (27 students, 90.0%) positivelypracticedcompletion of theirprescribed drugs. The most commonly drugs used for self-medication of UTI were Amoxicillin, Canesten cream, Ciprofloxacin, and Gentamycin.

Conclusion: Our study suggests the need for improved education on antibiotics stewardship, including among medical students,to address the increasing trend in antimicrobial resistance.

Keywords: Antibiotics resistance; Knowledge, Attitudes, Practice; Urinary tract infections;Medical students; Nigeria

Introduction

Urinary tract infections (UTIs) occur when microbial pathogens invade the urinary tract, causing symptoms. Cystitis affects the lower urinary tract, while pyelonephritis affects the upper tract[1–5]. UTIs are one of the common bacterial infections seen in primary health care, second only to infections of the respiratory tract[4]. UTIs are common bacterial infections, especially among women, with an incidence of about 1% in school-aged girls and 4% in women of childbearing age[3,4]. The incidence increases with sexual activity and childbearing, reaching 25-30% in women aged 20-40[3]. Escherichia coli is the most common cause of uncomplicated UTIs, but other pathogens include Enterococcus faecalis, Enterobacter species, Staphylococcus saprophyticus, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas species, fungi (candidiasis), and protozoa (Trichomonas vaginalis)[3,5,6].

Symptoms in adults include dysuria, urinary urgency, frequency, nocturia, painful voiding, bladder discomfort, and stranguria[3–5,7]. Pain at the start or during urination suggests a urethral issue, while post-voiding pain indicates bladder or prostate problems[2,4,7]. Women are more prone to UTIs due to their shorter urethra and proximity to the anus, along with factors like inadequate bladder emptying, instrumentation, urinary tract calculi, indwelling catheters, urinary obstruction, contraceptive use, anal intercourse, constipation, pregnancy, and immunosuppression[1,2,5,8,9].

Antimicrobials are crucial for treating infections, including UTIs[1,2,5]. However, antimicrobial resistance (AMR) is a significant challenge, especially in developing countries where antibiotics are easily accessible without prescriptions[5]. Inappropriate use of antimicrobials, such as self-medication, can lead to harmful effects like diarrhoea and skin rashes and exacerbate AMR[1,5].

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Comment [U5]: Conclusion isn't clear, be more specific and try to explain it more elaborately by adding 1-2 more sentences.

Comment [U6]: Please include the percentage of the patients with UTI worldwide

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Global actions to combat AMR include improving awareness, understanding misuse effects, communication, education, and training[10]. This global action plan to tackle AMRis strongly linked with the drive towards universal health coverage (UHC).Tackling AMR is crucial for maintaining the effectiveness of antibiotics, which are essential for treating infections and enabling other medical procedures. This directly supports the goals of UHC by ensuring that effective treatments remain available and affordable for all[11–13].

This study focuses on the knowledge, attitude, and practice of inappropriate antibiotic use for UTIs among female medical students, highlighting the need for better awareness and management. Our study findings could inform health policy on interventions to tackle AMR in the region.

Literature Review

UTIs are caused by pathogenic invasion of the urothelium, leading to inflammation in both the upper and lower urinary tracts[2,4]. UTIs are the most common bacterial infections in humans and are frequently seen in hospitals, accounting for about 40% of all nosocomial bacterial infections worldwide[14,15]. They are a leading cause of morbidity and mortality, particularly in the first two years of life, in women, and in the elderly, with significant financial implications[15,16]. UTIs are also a common reason for outpatient visits, making up over 20% of such visits to general practitioners[1,7].Epidemiological studies show that about 33% of women will experience at least one UTI in their lifetime, requiring antibiotic treatment[2]. Recurrence within six months of the initial infection occurs in 20-50% of cases[5,14]. UTIs significantly impact quality of life, affecting social, relational, and occupational activities[15].

UTIs can be classified based on severity levels, presence of risk factors, and microbiological classification of pathogens[7,17]. Clinically, UTIs can present as cystitis, pyelonephritis, or urosepsis[5,7,15]. Asymptomatic bacteriuria, while not an infection, is a risk factor for UTIs in certain situations[7]. The severity of UTIs varies:Cystitis is less severe than pyelonephritis, which can range from mild to severe.Urosepsis is the most severe form, with severity graded similarly to sepsis: sepsis, severe sepsis, and septic shock.UTIs are also categorized as: uncomplicated which occurs in healthy individuals with normal urinary tracts; and complicated involve abnormal urinary tract anatomy or function, concomitant diseases, or failed previous treatments[7,17].

Women are at higher risk for UTIs due to their shorter urethra and certain behaviours, such as delayed micturition, sexual activity, and use of diaphragms and spermicides[5,15]. Infections often result from bacteria entering the urethra and ascending to the bladder, commonly linked to sexual activity or catheterization[4]. Postmenopausal women are also at higher risk due to factors like bladder or uterine prolapse, loss of oestrogen, and higher likelihood of medical conditions like diabetes[5].Studies indicate a seasonal peak in UTI incidence, particularly in the post-summer months[18,19].Antibiotics are essential for treating symptomatic UTIs, with choices based on pathogen susceptibility, efficacy, resistance potential, safety, side effects, cost, and availability[5]. Recommended regimens for uncomplicated cystitis and pyelonephritis in premenopausal women include:Fosfomycin trometamol, Nitrofurantoin, Pivmecillinam, and Trimethoprim/sulfamethoxazole[20,21]. Empiric treatment for uncomplicated UTIs often starts with trimethoprim/sulfamethoxazole in communities with low resistance rates. In resistant areas, fluoroquinolones like ciprofloxacin, levofloxacin, norfloxacin, and ofloxacin are used[5,7].

Diagnosing a UTI requires laboratory tests on urine samples. Urine microscopy can reveal red and white blood cells, indicating infection[3,5]. A urine culture is positive if it shows a bacterial colony count of at least 10,000 colony-forming units per ml. These cultures also help determine antibiotic sensitivity, guiding treatment choices[5]. Women with recurrent UTIs can often self-diagnose based on symptoms, with an 84% accuracy rate[14]. Positive predictors for recurrent UTIs include symptoms after intercourse, a history of pyelonephritis, absence of nocturia, and quick symptom resolution after treatment. Negative predictors include nocturia and persistent symptoms between infections.Urinalysis is essential for patients with dysuria, with the gold standard being a spun midstream clean-catch urine specimen. Bacteria or pyuria (or both) are typically present in UTI cases. Leukocyte esterase is 75% sensitive and 98% specific for UTI detection, while positive nitrite is 90% specific but only 30% sensitive. Urine culture is generally unnecessary for patients with consistent symptoms and a positive dipstick test unless there are risk factors for complicated infections[1,2,5,7].

Inappropriate antimicrobial use is common among female university students, with studies showing a tendency towards self-medication, especially among pharmacy students[22]. This behaviour can significantly impact future antimicrobial use, particularly for UTI treatment. The misuse of antibiotics is a global issue, prevalent in both developing and developed countries, including Pakistan, Nepal, Eritrea, Uzbekistan, Oman, Sudan, Jordan, Lebanon, Yemen, and Nigeria[23].Commonly used antibiotics for UTIs includeAmpicillin, Amoxicillin, Cefotaxime, Ceftriaxone, Ciprofloxacin, Gentamicin, Cefoxitin, Erythromycin, Tetracycline, and Vancomycin. Recommended regimens for acute uncomplicated cystitis and pyelonephritis include short-course treatments (single dose to 5 days), which are as effective as longer regimens with fewer side effects[5,23].

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Methods

Study Design

This descriptive cross-sectional study was conducted in October 2023, focusing on female medical students at Enugu State University Teaching Hospital. All eligible female medical students were included, following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure proper reporting of the study's design, conduct, and findings[24].

Study Setting

The study took place at ESUT Teaching Hospital, located in Parklane GRA, Enugu, the capital of Enugu State, Nigeria. Enugu State, with an estimated population of 5.2 million in 2023, is known for its coal deposits and is often referred to as the 'Coal City State'. The state borders Abia and Imo to the south, Ebonyi to the east, Benue to the northeast, Kogi to the northwest, and Anambra to the west[25]. It features highlands in Awgu, Udi, and Nsukka to the east and the Oji River basin to the west. The economy is primarily rural and agrarian, with significant trading and civil service sectors[26,27]. The population is predominantly Christian, with a minority practicing Islam and African traditional religions. The state has two main tertiary health centres: ESUT Teaching Hospital and the University of Nigeria Teaching Hospital (UNTH), along with several private and missionary primary and secondary healthcare centres[26].

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ESUT Teaching Hospital has approximately 1,061 students, though the exact number fluctuates due to admissions, transfers, and suspensions. ESUT Teaching Hospital has three major hostels for medical students, while those studying Anatomy and Medical Laboratory Science live off-campus. The student body is mostly Igbo, and the primary languages spoken are Igbo and English.

Study Participants

All female medical students at ESUT Teaching Hospital, regardless of age, class, or residence, were eligible to participate. Exclusions included female anatomy and medical laboratory science students and those who opted out of the study.

Comment [U10]: Mention why only female participants were targeted

Sample Size

Based on an 82% prevalence rate from a previous study[28], the sample size was calculated using a design effect (DEFF) of 1.05, a 5% significance level, a 5% margin of error, and a 10% inflation to account for non-response. The minimum estimated sample size was 180.

Sampling Procedure

A simple random sampling technique was used to select participants. Stratified sampling ensured representation across all departments and levels within the university. To avoid bias, participants were not informed in advance. The purpose of the questionnaire was explained, and participation was voluntary. Questionnaires were distributed randomly to students in class, collected after 30 minutes, and followed by an educational session on UTIs, their diagnosis, and antibiotic treatment.

Study Instrument

Data were collected using a self-administered structured questionnaire, distributed to students in their respective departments. The questionnaire was divided into four sections. Section A: Socio-demographic variables (age, marital status, religion, ethnicity, year of study).Section B: Knowledge variables (awareness and knowledge of UTI, initial source of information, definition of UTI).Section C: Attitudinal variables (history of UTI, symptoms, diagnosis).Section D: Practice variables (hospital visits for diagnosis and treatment, completion of prescribed dosage, alternative treatments, and drugs used).

Data Analysis and presentation

Simple frequency tables with percentages were produced using IBM SPSS®.

Results

Sociodemographic Characteristics of Study Participants

The most common age group among the study participants was 20-24 years (63.2%), with a mean age of 23.5 years (± 4.6) – **Table 1**. Most participants were single (86.8%), Igbo (97.1%), and Catholic (58.6%). A significant proportion were in their fifth year of study (44.3%) – **Table 1**.

Knowledge of UTI Among Study Participants

Most participants had knowledge of UTIs (97.1%), with the majority learning about the symptoms and treatment from school (64.4%) – **Table 2**. The majority accurately identified that a UTI is an infection of the urethra, bladder, ureter, and kidney (95.4%), and most had adequate knowledge of UTI symptoms.

Attitude of Study Participants Towards UTI

Figure 1 shows a Likert chart illustrating the attitudes of study participants towards UTIs. Generally, participants had a positive attitude towards using antimicrobials for UTI treatment.

Practice of Study Participants Towards UTI

Most participants had never experienced a UTI (62.1%) – **Table 3**. Among those who had, most did not seek medical treatment from a trained healthcare provider (54.5%). Of those who received a prescription from a trained healthcare provider, most completed their prescribed medication (90.0%). Among participants with a history of UTIs, most self-treated with a cocktail of antibiotics (75.0%) – **Table 3**. Those who did not seek treatment from a trained healthcare provider often cited financial constraints as the reason – **Table 4**.

Comment [U11]: please mention more clearly and elaborately , which antibiotics are included

Discussion

Our study shows that the majority of female medical studies have good knowledge of UTI, with most of them receiving their first information from school. Our study contrasts with a study of healthcare students at the University of Science and Technology, Ajman, UAE, which found 92.3% of students using antimicrobials irrationally[22]. In our study, 54.5% of students used antimicrobials inappropriately, indicating a significant decline in misuse.In a survey at a urinary tract infection/AIDS clinic at Konfo Anokye Teaching Hospital in Kumasi, Ghana, 74.5% of patients admitted to self-medicating before visiting the clinic, similar to the 75.0% in our study[29]. However, the prevalence of self-medication in our study is higher than the prevalence reported in a similar study in Bahrain which reported a prevalence of 44.8% [30].

This difference may be attributed to our academic environment, where there is greater awareness of drug use and its harmful side effects.The irrational use of antimicrobials among female undergraduates is common, often due to economic factors, time constraints, and the desire to take responsibility for one's health[6,28]. However, this practice can lead to hazardous consequences such as misdiagnosis[14]. The problem is more prevalent in developing countries where antimicrobials are

available without prescription[3]. The prevalence of self-medication in our study is comparable to that reported among female students in Egypt, Ethiopia, India, Saudi Arabia, and Uganda, but higher than in many European countries and lower than among Palestinian female students[6,9,31–33].

Factors contributing to the high prevalence of self-medication include lack of time to visit a clinic, high economic status, overconfidence among students, prescribing patterns of general practitioners, and liberal dispensing by pharmacists. This is alarming given the high awareness of microbial resistance associated with misuse. More than one-third of Palestinian students admitted not completing their prescribed dosage, higher than 10.0% of ESUT Teaching Hospital students[34].Our findings suggest that liberal dispensing by pharmacists contributes to antimicrobial misuse. Incorporating topics on the rational use of drugs and prescription writing into health science curricula could reduce inappropriate use. Efforts by health authorities and academic circles to increase public awareness are essential.

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The most commonly self-used antimicrobials were Ciproxin, Amoxicillin, Canesten cream, and Ampiclox, likely due to frequent prescribing by physicians and liberal dispensing by pharmacists. Some students (19.4%) relied on advice from pharmacists and patent medicine dealers, highlighting the important roles of these professionals in promoting responsible self-medication.

Based on our findings, we recommend a multifaceted approach to address the misuse of antimicrobials and improve the diagnosis and treatment of UTIs. This includes disseminating information on the hazards of antimicrobial misuse and the importance of proper diagnosis and treatment through various channels such as health talks, seminars, flyers, student forums, and media programs. Additionally, we advocate for incorporating health education on the irrational use of antimicrobials at all educational levels in Nigeria to foster a better understanding from an early age. Furthermore, we suggest monitoring the activities of medicine dealers to ensure they provide accurate information and guidance, thereby increasing public knowledge on the proper approach to diagnosing and managing UTIs. This comprehensive strategy aims to enhance awareness, education, and regulation to combat antimicrobial resistance effectively.

Comment [U13]: Please add more references in discussion part. antibiotic resistance is a global concern so compare your data from other studies from different countries.

Conclusion

In conclusion, while many students are aware of UTIs, misconceptions persist, and some students resort to self-medication or patent medicine dealers instead of seeking medical attention. This leads to undiagnosed cases and partial treatments. There is a lack of knowledge about the long-term complications of UTIs and the adverse effects of self-medication. Health education in higher institutions is crucial to reducing negative health attitudes and improving overall public health in Nigeria.

Declarations

Ethics approval

Permission was obtained from ESUT Teaching Hospital. The aim and nature of the study was also explained to the participants and Informed consent obtained prior to administration of the questionnaire.

Data availability statement

The datasets analyzed in this study are available from the corresponding author on reasonable request.

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Figure 1: Attitude of female medical students in Enugu State University Teaching Hospital towards UTI, 2023

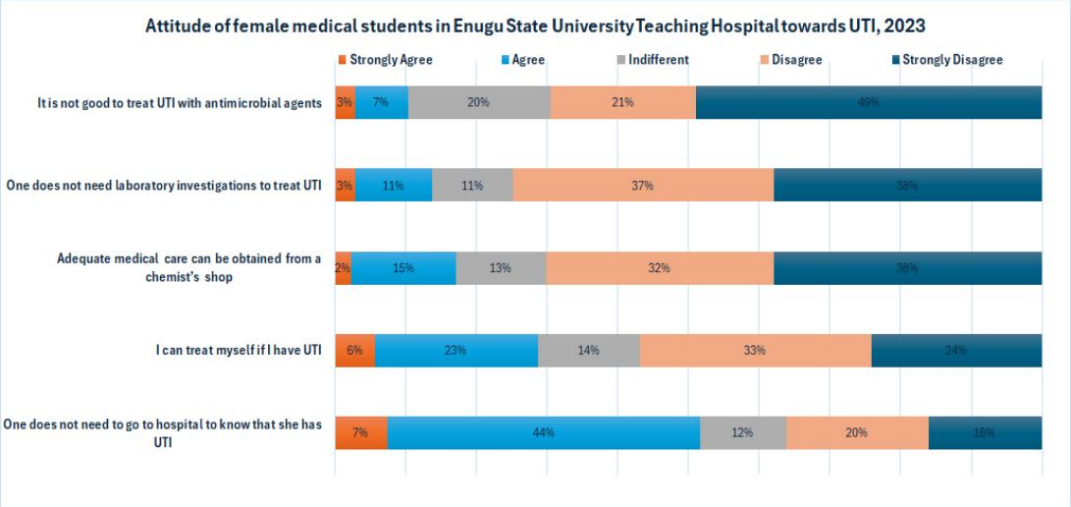

Table 1: Sociodemographic characteristics of study participants

	Frequency	Percent
Age		
° < 20 years	16	9.2%
° 20 – 24 years	110	63.2%
° 25 – 29 years	34	19.5%
° 30 – 34 years	9	5.2%
° 35 – 39 years	2	1.1%
° ≥ 40 years	3	1.7%
Marital status		
° Single	151	86.8%
° Married	22	12.6%
° Divorced/Widowed	1	0.6%
Religion		
° Catholic	102	58.6%
° Pentecostal/Protestants	68	39.1%
° Muslim	1	0.6%
° Africa Traditional Religion	3	1.7%
Ethnicity		
° Igbo	169	97.1%
° Yoruba	4	2.3%
° Others	1	0.6%
Year of study		
° Second year	14	8.0%
° Third year	18	10.3%
° Fourth year	38	21.8%
° Fifth year	77	44.3%
° Sixth year	27	15.5%

Comment [U14]: percentage

Table 2: Knowledge of UTI among female medical students

	Frequency	Percent
Ever heard of UTI		
° No	5	2.9%
° Yes	169	97.1%
First source of information		
° Radio	4	2.3%
° Television	9	5.2%
° Newspaper	2	1.1%
° School	112	64.4%
° Relatives	15	8.6%
° Friends	13	7.5%
° Spouse	1	0.6%
° Church	1	0.6%
° Hospital/Clinic	9	5.2%
° Others	8	4.6%
Knowledge of what UTI is		
° UTI is an airborne disease: Correct answer = No	172	98.9%
° UTI is an infection of the liver: Correct answer = No	171	98.3%
° UTI is an infection of the heart: Correct answer = No	168	96.6%
° UTI is an infection urethra, bladder, ureter, and/or kidney: Correct answer = Yes	166	95.4%
° UTI is transmitted through sexual intercourse: Correct answer = No	167	96.0%
Specific knowledge of UTI symptoms		
° Pain urination	137	78.7%
° Fever	99	56.9%
° Inability to hold urine	87	50.0%
° Discharge from urinary tract	125	71.8%
° Frequent urination	102	58.6%
° Having urgent urge to urinate	96	55.2%

Comment [U15]: percentage

Table 3: Practice of UTI among female medical students

	Frequency	Percent
Ever suffered from UTI		
° No	108	62.1%
° Yes	66	37.9%
Sought treatment in a hospital	n = 66	
° No	36	54.5%
° Yes	30	45.5%
Completed prescribed medications	n = 30	
° No	3	10.0%
° Yes	27	90.0%
What treatment did you get?	n = 36	
° I treated myself	27	75.0%
° Traditional healer	0	0.0%
° Patent medicine vendor (Chemist)	7	19.4%
° Ignored the symptoms	2	5.6%
Drugs used for self-medication	n = 27	
° Septrin	1	3.7%
° Ampiclox	3	11.1%
° Amoxicillin	9	33.3%
° Canesten cream	7	25.9%
° Ciproxin	17	63.0%
° Gentamycin injection	4	14.8%
° Others	1	3.7%

Table 4: Reasons for not seeking care with trained healthcare providers, n = 36

Reasons for not seeking care	No	Yes
° Against my faith	35 (97.2%)	1 (2.8%)
° I do not have money	34 (94.4%)	2 (5.6%)
° I do not have time	23 (63.9%)	13 (36.1%)
° I am shy to talk about it	32 (88.9%)	4 (11.1%)
° I believe it was sexually transmitted	33 (91.7%)	3 (8.3%)