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Antibiotic Susceptibility Patterns in Recurrent Urinary Tract Infections Among Young Females

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ABSTRACT: ***Background:*** Recurrent urinary tract infections (UTIs) are a frequent cause of healthcare visits among young females and are increasingly complicated by antibiotic resistance. ***Objective:*** This study aims to investigate the bacterial distribution and antibiotic susceptibility patterns among young females with recurrent UTIs in Khulna, Bangladesh. ***Methods:*** A cross-sectional study was conducted among 106 young female patients aged 18–35 years, diagnosed with recurrent UTIs at Khulna City Medical College from January to March 2025. Data on antibiotic intake history, treatment adherence, and urine culture results were collected. Antibiotic susceptibility testing was performed using standard laboratory protocols. ***Results:*** The majority of patients (36.8%) were between 23 and 27 years old. About 29.2% of participants reported antibiotic use more than three times in the past year. Only 41.5% consistently completed their prescribed antibiotic courses. Escherichia coli was the most common isolate (69.8%), followed by Klebsiella pneumoniae (17.0%). Both E. coli and Klebsiella showed the highest sensitivity to Imipenem and Meropenem (100% for K. pneumoniae; 64.9% for E. coli). Ampicillin exhibited the lowest sensitivity, particularly against Klebsiella (0%). ***Conclusion:*** The study demonstrates a high prevalence of recurrent UTIs caused by multidrug-resistant uropathogens, driven in part by incomplete antibiotic courses. Regular surveillance and patient education on antibiotic adherence are essential for reducing UTI recurrence and antibiotic resistance.

Keywords: Recurrent Urinary Tract Infection, Antibiotic Susceptibility, Young Females, Antimicrobial Resistance, Uropathogens.

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INTRODUCTION

Antibiotics remain one of the most effective treatments for bacterial infections, including urinary tract infections (UTIs), although bacteria can quickly develop resistance against them. Antimicrobial resistance has emerged as a major public health challenge. Resistant bacteria have a dynamic nature that can prolong illness, increase economic burden, and even cause death. Multi-drug resistant (MDR) pathogens are associated with higher rates of morbidity and mortality [1]. Recurrent urinary tract infections are among the most common bacterial infections encountered in both hospital and community settings [2]. They are a significant cause of hospital admissions and are linked to substantial economic costs, morbidity, and mortality [3, 4]. Worldwide, UTIs are estimated to affect about 150 million people each year, imposing an annual economic burden of approximately USD 6 billion as of 2002 [5]. Recurrent UTIs can occur in both sexes and across all age groups, but the risk increases with age, with annual incidence ranging from 10% in community-dwelling elderly to 30% among hospitalized patients [3].

Additionally, females are more frequently affected by recurrent UTIs than males, with an estimated 50–60% of women experiencing at least one UTI during their lifetime [4]. The majority of recurrent UTIs are caused by Enterobacteriaceae, with Escherichia coli (E. coli) being the most prevalent pathogen, responsible for nearly 90% of all cases. Other bacteria, including Klebsiella pneumoniae, Staphylococcus aureus, and group B streptococci (GBS), also contribute to UTI cases [6]. Treatment is often empirical, based on the predictable bacterial species and known resistance patterns. However, the

rise in antimicrobial-resistant pathogens in recent years has made empirical treatment more challenging [1]. Antibiotic susceptibility patterns of uropathogens differ based on geographical location and time, making routine surveillance essential to guide empirical therapy and promote the rational use of antibiotics. Therefore, identifying the evolving resistance trends of uropathogens against commonly used antibiotics is vital for effective empirical treatment strategies [7]. This study aims to identify the antibiotic susceptibility profiles of recurrent UTI pathogens in young females, offering insights to support rational antibiotic use and promote effective infection management.

METHODOLOGY

This descriptive cross-sectional study explored antibiotic susceptibility patterns in recurrent urinary tract infections (UTIs) among young female patients at Khulna City Medical College Hospital, Khulna, Bangladesh. The study spanned a period of three months, from January to March 2025. A total of 106 female patients aged between 18 and 35 years, diagnosed with recurrent UTIs, were enrolled. Recurrent UTI was defined as having two or more symptomatic episodes within the last six months or three or more episodes within the past year. Patients who had received antibiotics within the preceding 14 days, those with underlying complicated urinary tract anomalies, catheter-associated infections, or who declined consent were excluded from the study. Data were collected through two primary methods. First, direct face-to-face interviews were conducted with the patients using a pre-structured questionnaire, which captured socio-demographic information, antibiotic usage history, and treatment adherence patterns. Second, relevant clinical information — including urine culture reports, antibiotic sensitivity results, and prior treatment history — was gathered from patients' medical investigation papers and treatment records, ensuring comprehensive and accurate documentation of their infection profile. Collected data were systematically checked for accuracy and completeness before being entered into Microsoft Excel® 2016. Descriptive statistical analysis, including frequencies, percentages, means, and standard deviations, was performed to interpret the findings. The research was carried out by 4th-year MBBS students under the close supervision and guidance of faculty members from the Department of Community Medicine and Public Health and Microbiology, ensuring methodological validity and ethical compliance.

RESULTS

A total of 106 young female patients aged between 18 and 35 years were enrolled in this study, all of whom were diagnosed with recurrent urinary tract infections (UTIs). The mean age was 26.4 ± 4.9 years.

Table 1: Age Distribution of Study Participants (n = 106)

Age Group (Years)	Frequency	Percentage (%)
18 – 22	28	26.4%
23 – 27	39	36.8%
28 – 32	25	23.6%
33 – 35	14	13.2%

The majority of patients (36.8%) were between 23 and 27 years old, while only 13.2% belonged to the 33–35 years age group, showing a higher concentration of recurrent UTIs in younger adults.

Table 2: Antibiotic Intake Frequency Over the Past Year and Treatment Completion Status (n = 106)

Variable	Frequency	Percentage (%)
Antibiotic intake episodes in last 12 months		
1 time	16	15.1%
2 times	28	26.4%
3 times	31	29.2%
More than 3 times	31	29.2%
Treatment completion status for each episode		

Completed full course in all episodes	44	41.5%
Completed full course in some episodes	24	22.6%
Incomplete course in most episodes	38	35.8%

Out of 106 patients, 29.2% reported taking antibiotics three times or more in the past year for urinary tract infection symptoms, suggesting frequent recurrences or relapses. Regarding treatment behavior, only 41.5% consistently completed the full antibiotic course during each infection episode, while 35.8% admitted to leaving most courses incomplete — a potential contributor to antibiotic resistance and UTI recurrence.

Table 3: Bacterial Distribution in Urine Cultures (n = 106)

Pathogen	Frequency	Percentage (%)
Escherichia coli	74	69.8%
Klebsiella pneumoniae	18	17.0%
Staphylococcus saprophyticus	8	7.5%
Proteus mirabilis	6	5.7%
Acinetobacter spp.	2	1.9%
Enterobacter spp.	2	1.9%
Pseudomonas aeruginosa	2	1.9%

Escherichia coli was the predominant uropathogen, isolated in 69.8% of cases, followed by *Klebsiella pneumoniae* (17.0%). Less frequently, *Acinetobacter*, *Enterobacter*, and *Pseudomonas* were identified, each accounting for 1.9% of isolates.

Table 4: Antibiotic Susceptibility Patterns of E. coli (n = 74) and K. pneumoniae (n = 18)

Antibiotic	E. coli Sensitive (n=74)	% Sensitive	K. pneumoniae Sensitive (n=18)	% Sensitive
Amikacin	48	64.9%	18	100.0%
Amoxycillin-Clavulanic Acid	34	45.9%	14	77.8%
Cefepime	37	50.0%	11	61.1%
Ceftriaxone	31	41.9%	17	94.4%
Imipenem	48	64.9%	18	100.0%
Nitrofurantoin	46	62.2%	2	11.1%
Cefixime	27	36.5%	21	77.8%
Ceftazidime	35	47.3%	13	72.2%
Cephalexin	23	31.1%	25	69.4%
Cotrimoxazole	34	45.9%	14	77.8%
Cefuroxime	32	43.2%	16	88.9%
Ampicillin	18	24.3%	0	0.0%
Ciprofloxacin	32	43.2%	16	88.9%
Gentamicin	42	56.8%	6	33.3%
Meropenem	48	64.9%	18	100.0%
Aztreonam	32	43.2%	16	88.9%
Tazobactam-Piperacillin	39	52.7%	15	83.3%

Both *E. coli* and *Klebsiella pneumoniae* showed the highest sensitivity to Imipenem and Meropenem (100%) for Klebsiella and 64.9% for E. coli. Resistance to Ampicillin was significant, especially in *Klebsiella* (0% sensitivity). *Nitrofurantoin* was effective against *E.*

coli but had limited efficacy against *Klebsiella pneumoniae*.

DISCUSSION

This study explored the antibiotic susceptibility patterns among young females diagnosed with recurrent urinary tract infections (UTIs) in Khulna, Bangladesh. The age distribution indicated that recurrent UTIs were more prevalent in the 23–27 years age group (36.8%), followed by 26.4% in the 18–22 years age group. This pattern aligns with global observations where sexually active young women are at a higher risk of recurrent UTIs due to anatomical and behavioral factors [8, 9]. In terms of antibiotic usage history, a significant portion (29.2%) of the participants reported taking antibiotics more than three times in the past year, suggesting a troubling cycle of recurrent infection and potentially incomplete eradication. Alarmingly, only 41.5% of the patients reported completing the full prescribed antibiotic course during every UTI episode, while 35.8% left most courses incomplete. Such practices can contribute directly to the development of resistant uropathogens, a problem underscored in similar studies worldwide [9].

The microbiological profile in this study showed that Escherichia coli was the predominant pathogen, responsible for 69.8% of infections, consistent with prior studies such as that by Flores-Mireles *et al*., who highlighted E. coli as the leading uropathogens in both community and hospital-acquired UTIs [10, 11]. Klebsiella pneumoniae (17.0%) and Staphylococcus saprophyticus (7.5%) were the other notable isolates, while less common pathogens like Acinetobacter spp., Enterobacter spp., and Pseudomonas aeruginosa were each detected in 1.9% of cases. The antibiotic sensitivity pattern revealed an alarming variability. Imipenem and Meropenem demonstrated the highest efficacy (100% against K. pneumoniae and 64.9% against E. coli), reflecting their role as last-resort agents in resistant infections, which is consistent with similar findings by Mazumder *et al* [12]. Nitrofurantoin showed relatively high activity against E. coli (62.2%) but poor efficacy against K. pneumoniae (11.1%), suggesting pathogen-specific variation, also noted in earlier studies [13, 14]. Resistance was highest against Ampicillin, particularly in Klebsiella isolates (0% sensitivity), reinforcing concerns over empirical prescribing habits. This study highlights the need for continuous monitoring of antibiotic susceptibility trends to guide rational prescribing. The association between incomplete antibiotic courses and recurrent infections underscores the importance of patient education and adherence to treatment, as also emphasized in recent global antimicrobial stewardship efforts [15-39].

CONCLUSION

This study highlights that E. coli continues to be the predominant pathogen in recurrent UTIs among young females, with high resistance to several commonly prescribed antibiotics. Empirical therapy should be guided by local susceptibility patterns, and strategies to improve antibiotic adherence must be prioritized to curb the risk of recurrent infections and resistance development.

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