

Trends in Etiologies and Multidrug Resistance in Urinary Tract Infection among Females in Nepal

Srijana Ranjit¹, Sunima Maskey², Ruchi Shrestha³

¹ Department of Microbiology, Kathmandu University School of Medical Sciences, Kathmandu, Nepal

² Department of Anatomy, Kathmandu University School of Medical Sciences, Kathmandu, Nepal

³ Department of Pharmacology, Kathmandu University School of Medical Sciences, Kathmandu, Nepal

Article Info:

Received Date: January, 2026

Acceptance Date: March, 2026

Corresponding Author:

Dr. Srijana Ranjit

Assistant Professor

Department of Microbiology,
Kathmandu University School of
Medical Sciences, Kathmandu, Nepal
Email: srijana@kusms.edu.np

Funding sources: None

Conflict of interest: None

Abstract

Introduction: Urinary Tract Infections are one of the most common bacterial infections affecting women globally. Increasing antimicrobial resistance has posed a significant challenge in treatment where the empirical use of antibiotics is widespread. This study aimed to evaluate the bacterial etiology, antimicrobial susceptibility patterns and prevalence of multidrug resistance among female urinary isolates in Nepal.

Methods: A retrospective study was conducted at Dhulikhel Hospital from August 2022 to August 2025. All the urine samples from female patients submitted for culture and sensitivity testing were included. Standard microbiological methods were used for bacterial isolation, identification, and antimicrobial susceptibility testing following CLSI guidelines. Data were analysed to determine species distribution, sensitivity patterns, and MDR prevalence across age groups.

Results: Of the 37,032 samples processed, 25,344 were from female patients. The culture positivity rate among female patients was 22.0%. Among gram negative isolates, *Escherichia coli* (44.5%) was the most predominant organism and showed high susceptibility to colistin (95-100%), amikacin (85-100%) and imipenem (81-100%). Among gram positive isolates, *Staphylococcus saprophyticus* (1.0%) was most frequent and vancomycin and linezolid were seen to be highly sensitive. The prevalence of multidrug-resistance among the females was 7.4%. The elderly population (11.3%) was more burdened (11.3%) than adults and pediatric patients ($p < 0.05$).

Conclusion: *Escherichia coli* remains the leading cause of UTI among females, with an alarming resistance to the first-line antibiotics. The findings in this study emphasizes the need for rational antibiotic use guided by local antimicrobial susceptibility patterns to limit the emergence and spread of multidrug-resistant organisms.

Keywords: Urinary Tract Infection, *Escherichia coli*, Antibiotic resistance, Multidrug resistance, Nepal

Access the article online



DOI: 10.70027/jrahs118

Introduction

Urinary Tract Infection (UTI) is one of the most common infections encountered in the community and is a common infection contributing to morbidity in outpatient and hospitalized patients.¹ UTI is quite frequently encountered

among people in developing countries compared to developed countries. The difference is mostly due to lack of proper information and education.² The burden of the disease is even more significant among female gender because of specific anatomical feature and hormonal changes occurring at different stages of development

Citation:

Ranjit S, Maskey S, Shrestha R. Trends in Etiologies and Multidrug Resistance in Urinary Tract Infection among Females in Nepal. JRAHS Journal of Rapti Academy of Health Sciences. 2025;2(2):1-6.

Copyright:

© Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under Creative Commons Attribution License CC - BY 4.0

of female.³ In Nepal, high occurrence of UTI has been linked with illiteracy among females and unavailability of toilets facility was found to be strongly associated with UTI.⁴ About half of the female population is estimated to experience UTI at least once in their lifetime and one in those three women receive antimicrobial therapy.⁵ Globally, the most common uropathogens has been found to be *Eshcherichia coli* (*E.coli*) followed by other enterobacteriaceae like *Klebsiella* spp. and *Proteus* spp.⁶ Increasing number of Gram Positive Cocci (GPCs) like *Staphylococcus saprophyticus* and *Enterococcus* spp. has been found as pathogens causing UTI.⁷

Antimicrobial Resistance (AMR) has also become alarmingly common public health threat especially in developing countries like Nepal where haphazard use of antibiotics, self-medication and poor infection-control practices is very common.^{8,9}

Regular and effective surveillance of antibiotic sensitivity patterns of uropathogens is important in dealing with emerging problem of Multidrug-Resistance (MDR) and also provides guidelines for more effective empirical treatment.¹⁰

Methods

This retrospective descriptive study was conducted in female patients visiting Dhulikhel Hospital between August 2022 and August 2025.

Ethical approval was obtained from Institutional Review Committee of Kathmandu University School of Medical Sciences (KUSMS) before the study was conducted. (IRC-KUSMS Approval No. 205/25)

The analysis of the report was performed at department of Microbiology, Dhulikhel Hospital. All positive urine and culture sensitivity reports of female patients were included in the study. All age groups of patients were selected. The samples were plated on Cystine Lactose Electrolyte deficient Media (CLED) and MacConkey Agar by semi-quantitative method using the calibrated loop technique. The plates were incubated overnight at 37C. Pure growth of an isolate with a count of >105 Colony forming Unit (CFU) was considered significant and further biochemical tests were performed for identification of the bacteria. Antibiotic susceptibility test were performed for all bacterial isolates using a modified Kirby – Bauer disk diffusion method according to the guidelines of Clinical and Laboratory Standard Institute (CLSI) on Mueller Hinton Agar.

We manually reviewed laboratory paper records to select urine cultures. The selected culture reports were viewed and extracted into a computerized database (Statistical Package for Social Sciences, Version 16.0) as the primary data source. True positive cultures were those with

identified bacteria and corresponding susceptibility results. Multidrug-resistance was defined as resistance to at least one agent in three or more antimicrobial classes. Categorical variables were summarized using frequencies and percentages. The chi-square test was applied to assess the association between age groups and MDR status, with $p < 0.05$ considered statistically significant. The quality of the abstracted data was assessed by comparing paper records with electronic entries. Disagreements between the data were resolved by confirming with the data entry team. The extracted information included patient demographics, bacterial isolates and their antibiogram. Culture and sensitivity of urine culture reports from the department of Microbiology were excluded from entry based on incomplete data, if results regarding the positivity are inconclusive. Confidentiality was maintained throughout the study.

Results

A total of 37,032 samples were processed over the three-year period, among which 25,344 were female. The number of positive isolates among female patients were 5,595, which is 22% of total females tested.

Among all the bacterial pathogens, *E.coli* was the most frequent organism covering 44.5% of total organisms followed by *Klebsiella* spp. occupying around 7% of the total bacterial organism and then *Proteus mirabilis* (2.1%), *Staphylococcus saprophyticus* (1.0%) and *Enterococcus* spp. (0.7%) respectively.

Gram negative bacteria were highly sensitive to colistin (95-100%), amikacin (85-100%) and imipenem (81-100%) but exhibited noticeable resistance to ampicillin and 3rd generation cephalosporins (35-45%). Vancomycin and linezolid were highly sensitive to gram-positive organisms.

The prevalence of MDR among the females was 7.4%. The elderly population was seen to be more burdened (11.3%) than adults (6.8%) and pediatric patients (6.2%) ($p < 0.05$).

Table 1: Distribution of pathogens in Female Isolates

Pathogen	Count	Percentage (%)
<i>Escherichia coli</i>	2677	44.65
<i>Pseudomonas</i>	41	0.68
<i>Acinetobacter</i>	49	0.82
<i>Citrobacter</i>	30	0.5
<i>Proteus mirabilis</i>	37	0.67
<i>Proteus vulgaris</i>	16	0.27
<i>Klebsiellaoxytoca</i>	27	0.45
<i>Klebsiellapneumoniae</i>	431	7.19
<i>Enterobacter</i>	42	0.7
<i>Enterococcus</i>	547	9.12
<i>Methicillin resistant Staphylococcus aureus</i>	13	0.22
<i>ESBL</i>	235	3.92
<i>Staphylococcus aureus</i>	31	0.52
<i>Staphylococcus saprophyticus</i>	62	1.03

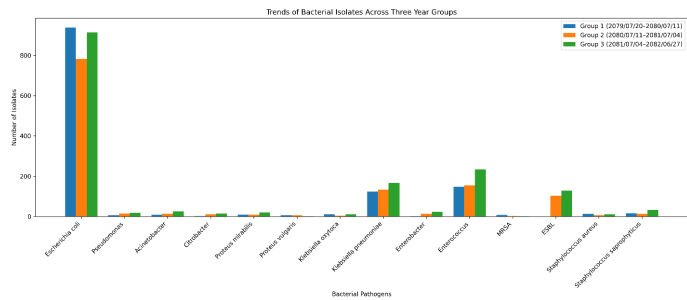


Figure 1: Bacterial trend analysis in period of three years

Table 2: Antibiotic Susceptibility of Gram Negative organisms

Antibiotic	<i>Escherichia coli</i> (n=2677)	<i>Citrobacter</i> (n=30)	<i>Proteus vulgaris</i> (n=16)	<i>Proteus mirabilis</i> (37)	<i>Pseudomonas</i> (n=41)	<i>Klebsiella oxytoca</i> (n=27)	<i>Klebsiella pneumoniae</i> (n=431)	<i>Enterobacter</i> (n=42)	<i>Acinetobacter</i> (n=49)
Ciprofloxacin	1169(43.7 %)	12(42.9 %)	9(57.1 %)	23(62.5 %)	18(44.4 %)	10(40.0 %)	212(49.4 %)	29(69.2 %)	23(47.6 %)
Norfloxacin	1531(57.2 %)	15(50.0 %)	10(62.5 %)	24(66.7 %)	0(0.0 %)	13(50.0 %)	246(57.1 %)	29(71.4 %)	21(44.4 %)
Nitrofurantoin	1884(70.4 %)	17(57.1 %)	2(14.3 %)	4(11.1 %)	32(80.0 %)	16(60.0 %)	191(44.4 %)	7(16.7 %)	0(0.0 %)
Cotrimoxazole	1697(63.4 %)	9(33.3 %)	6(42.9 %)	18(50.0 %)	16(40.0 %)	18(66.7 %)	265(61.5 %)	29(71.4 %)	26(55.0 %)
Cefixime	939(35.1 %)	12(42.9 %)	6(42.9 %)	27(75.0 %)	0(0.0 %)	4(16.7 %)	152(35.3 %)	21(50.0 %)	0(0.0 %)
Cefoperazone	1121(41.9 %)	22(75.0 %)	13(83.3 %)	27(75.0 %)	0(0.0 %)	0(0.0 %)	172(40.0 %)	31(75.0 %)	0(0.0 %)
Ceftriaxone	1177(44.0 %)	18(60.0 %)	13(83.3 %)	27(75.0 %)	0(0.0 %)	4(16.7 %)	151(35.1 %)	19(46.2 %)	2(5.3 %)
Ceftazidime	1873(70.0 %)	0(0.0 %)	16(100.0 %)	0(0.0 %)	20(51.2 %)	27(100.0 %)	0(0.0 %)	0(0.0 %)	21(44.4 %)
Ampicillin	685(25.6 %)	8(28.6 %)	0(0.0 %)	8(22.2 %)	27(66.7 %)	0(0.0 %)	92(21.5 %)	0(0.0 %)	7(15.8 %)
Piperacillin-tazobactam	2031(75.9 %)	9(33.3 %)	16(100.0 %)	37(100.0 %)	24(60.0 %)	18(66.7 %)	170(39.5 %)	21(50.0 %)	30(61.9 %)
Gentamicin	2390(89.3 %)	24(80.0 %)	13(85.7 %)	27(75.0 %)	21(53.5 %)	18(66.7 %)	281(65.2 %)	29(71.4 %)	52.2 %
Amikacin	2283(85.3 %)	30(100.0 %)	12(80.0 %)	0(0.0 %)	24(59.5 %)	27(100.0 %)	195(45.3 %)	25(60.0 %)	25(55.0 %)
Imipenem	2168(81.0 %)	30(100.0 %)	8(50.0 %)	0(0.0 %)	5(13.0 %)	10(40.0 %)	199(46.2 %)	25(60.0 %)	22(45.0 %)
Meropenem	2125(79.4 %)	30(100.0 %)	5(33.3 %)	18(50.0 %)	6(16.7 %)	10(40.0 %)	215(50.0 %)	25(60.0 %)	26(55.0 %)
Colistin	2561(95.7 %)	30(100.0 %)	0(0.0 %)	0(0.0 %)	41(100.0 %)	27(100.0 %)	383(88.9 %)	21(50.0 %)	44(90.0 %)

Table 3: Antibiotic Susceptibility of gram positive organisms

Antibiotic	<i>Enterococcus</i> (n=547)	<i>Staphylococcus aureus</i> (n=31)	<i>Staphylococcus saprophyticus</i> (n=62)
Ciprofloxacin	196(36.0 %)	12(40.0 %)	54(87.5 %)
Norfloxacin	547(100.0 %)	0(0.0 %)	0(0.0 %)
Nitrofurantoin	415(76.0 %)	31(100.0 %)	62(100.0 %)
Ampicillin	357(65.3 %)	0(0.0 %)	0(0.0 %)
Gentamicin	368(67.3 %)	31(100.0 %)	62(100.0 %)
Cloxacillin	0(0.0 %)	22(71.4 %)	34(55.6 %)
Erythromycin	0(0.0 %)	12(40.0 %)	20(33.3 %)
Vancomycin	505(92.5 %)	31(100.0 %)	62(100.0 %)
Linezolid	547(100.0 %)	31(100.0 %)	62(100.0 %)

Table 4: MDR among culture-positive female patients

Age Group	Multidrug Resistant n (%)	Non-Multidrug Resistant n (%)	Total	p-value	Remark
Pediatric (<15 yrs)	63 (6.2%)	947 (93.8%)	1010	<0.05	Significant
Adult (15–59 yrs)	252 (6.8%)	3453 (93.2%)	3705		
Elderly (≥60 yrs)	99 (11.3%)	781 (88.7%)	880	<0.05	Significant
Total	414 (7.4%)	5181 (92.6%)	5595		

Discussion

This study has confirms that female population are more prone to urinary tract infection than males which aligns with findings from studies across Nepal and other countries.^{11,12,13} The various anatomical factors like shorter urethra, pregnancy and hormonal variations enhance the higher rate of infection in females.^{3,13}

As with most global and regional studies 14–17 *E. coli* was found to be the most common uropathogen in our study. Its predominance is attributed to various factors such as adhesins, fimbriae and biofilm formation that facilitates colonization of the urinary tract.¹⁸ The second most common isolate was *Klebsiella pneumoniae*, which also was consistent with other studies and has been increasingly isolated in both community and hospital acquired UTIs.¹⁹

The antimicrobial resistance profile revealed in this study is a serious public health concern. High resistance to ampicillin and cephalosporins seen in our study is similar to the results reported across other South Asian countries, where there is widespread empirical use of β -lactams and fluoroquinolones.^{16,20} Carbapenems and aminoglycosides are still the most effective antimicrobial agents against Gram-negative bacteria despite reports of emerging resistance, which suggests dissemination of carbapenemase genes.²¹ Similarly, the high sensitivity of Gram-positive bacteria to linezolid and vancomycin favor their use as last-resort antimicrobials.²²

A disturbing observation in this study was rising trend of Extended Spectrum Beta-Lactamase (ESBL) producing

and MDR isolates over the study period. The emergence of ESBL from nil in the first year to 128 in the third year reflects an alarming rising trend of multidrug resistance in females. Similar results have been reported in other studies across the countries.^{11,12,23} This might be the result the of the haphazard use of antibiotics due to lack of monitoring and proper knowledge about the use, which has escalated the rising trend of multidrug-resistant organisms. This study has revealed that 7.4% the isolates were multidrug-resistant. The higher MDR prevalence among elderly females observed in this study (11.3%) is similar to previous findings that indicate that advanced age, comorbidities and recurrent antibiotic exposure increase resistance risk.^{23,24} The significant difference in MDR across age groups ($p < 0.05$), shows the importance of antibiotic selection based on patient demographics.

Conclusion

The findings highlight the urgent need for antimicrobial stewardship programs (ASP) and periodic resistance surveillance at both institutional and national levels. Rationalizing the empirical use of broad-spectrum antibiotics, developing and regularly updating local antibiograms, and reinforcing infection control practices are essential to restrict AMR in Nepal. Clear reporting of ESBL- and MDR-producing isolates is crucial for accurate interpretation and comparison across studies. Furthermore, integration of molecular diagnostics to detect ESBL, AmpC, and carbapenemase genes would enhance resistance surveillance and support targeted therapeutic strategies.

Acknowledgment

We would like to thank Department of Microbiology, Kathmandu University School of Medical Sciences, IT department of Dhulikhel hospital and our family members for their continuous support and valuable suggestions regarding this research.

Reference

1. Das R N, Chandrashekhar T S, Joshi H S, Gurung M. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. *Singapore Med J* 2006;47(4):281-5.
2. Gupta P, Gupta K. The profile of uropathogens and their antibiotic susceptibility in ipd adults in a tertiary care hospital in North India. *Int. J. Curr. Microbiol. App. Sci* 2018; 7(6):3190-7. DOI: [10.20546/ijcmas.2018.706.374](https://doi.org/10.20546/ijcmas.2018.706.374)
3. Jaiswal S, Gupta UP, Thapa L. Prevalence of Urinary Tract Infection among Suspected Female Patients Attending Manipal Teaching Hospital, Pokhara, Nepal. *Journal of Microbiology and Virology*.
4. Paudel L, Manandhar N, Shah S et al. Prevalence of urinary tract infection and associated risk factors among women in Sindhupalchowk district, Nepal. *Int J Community Med Public Health* 2018;5(7):2714-9. DOI: [10.18203/2394-6040.ijcmph20182604](https://doi.org/10.18203/2394-6040.ijcmph20182604)
5. Foxman B. Epidemiology of urinary tract infections: Incidence, morbidity, economic Costs. *Dis Mon* 2003;49:53-70. DOI: [10.1067/mda.2003.7](https://doi.org/10.1067/mda.2003.7) PMID: 12601337
6. Gupta K, Hooton TM, Naber KG, et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women. *Clin Infect Dis*. 2017;52(5):e103-e20. DOI: [10.1093/cid/ciq257](https://doi.org/10.1093/cid/ciq257) PMID: 21292654
7. Alkahtani AM, Alqahtani, Alamri A. Burden of gram-positive bacteria from urinary tract infection: A four-year retrospective study in a tertiary health setting in southern Saudi Arabia. 2025;20(80). DOI: [10.1371/journal.pone.0328042](https://doi.org/10.1371/journal.pone.0328042) PMID: 40748877 PMCID: PMC12316280
8. WHO. Global Action Plan on Antimicrobial Resistance. World Health Organization; 2015.
9. Laxminarayan R, Duse A, Wattal C, et al. Antibiotic resistance-the need for global solutions. *Lancet Infect Dis*. 2013;13(12):1057-98. DOI: [10.1016/S1473-3099\(13\)70318-9](https://doi.org/10.1016/S1473-3099(13)70318-9) PMID: 24252483 PMCID: PMC6771635
10. Shakya S, Edward H, Gupte S et al. High multidrug resistance in urinary tract infections in a tertiary hospital, Kathmandu, Nepal. *Public Health Action* 2021;1(11):24-31. DOI: [10.5588/pha.21.0035](https://doi.org/10.5588/pha.21.0035) PMID: 34778012 PMCID: PMC8575380
11. Gurung K, KC R, Patel I et al. Antibiotic Susceptibility Pattern of Bacteria Causing Urinary Tract Infection at Nepalgunj Medical College. 2022;20(1): 35-38. DOI: [10.3126/jngmc.v20i1.48245](https://doi.org/10.3126/jngmc.v20i1.48245)
12. Sherchan JB, Dongol A, Humagain S et al. Antibiotic Susceptibility Pattern of Bacteria Causing Urinary Tract Infection. *J Nepal Health Res Counc*. 2022; 20 (54): 218-24 L. DOI: [10.33314/jnhrc.v20i01.4142](https://doi.org/10.33314/jnhrc.v20i01.4142) PMID: 35945879
13. Griebing TL. Urologic diseases in America project: UTI in women. *Urol Clin North Am*. 2008;35(1):1-13. DOI: [10.1016/j.ucl.2007.09.010](https://doi.org/10.1016/j.ucl.2007.09.010) PMID: 18061020
14. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms, and treatment options. *Nat Rev Microbiol*. 2015;13 (5):269-84. DOI: [10.1038/nrmicro3432](https://doi.org/10.1038/nrmicro3432) PMID: 25853778 PMCID: PMC4457377
15. Mahaseth BK, Verma P, Malla T. Urinary Tract Infection, Incidence, Uropathogens and Antibiotic Sensitivity in Females. *Journal of Nepalgunj Medical College*.
16. Parajuli NP, Maharjan P, Joshi G, et al. High rates of multidrug resistance among uropathogenic E. coli in Nepal. *BMC Infect Dis*. 2017;17:583.
17. Kline KA, Lewis AL. Gram-positive uropathogens, polymicrobial urinary tract infection, and the emerging microbiota of the urinary tract. *Microbiol Spectr*. 2016;4(2):1-31. DOI: [10.1128/microbiolspec.UTI-0012-2012](https://doi.org/10.1128/microbiolspec.UTI-0012-2012) PMID: 27227294 PMCID: PMC4888879
18. Terlizzi ME, Gribaudo G, Maffei ME. Uropathogenic Escherichia coli (UPEC) infections: virulence factors, bladder responses, antibiotic, and non-antibiotic antimicrobial strategies. *Front Microbiol*. 2017;8:1566. DOI: [10.3389/fmicb.2017.01566](https://doi.org/10.3389/fmicb.2017.01566) PMID: 28861072 PMCID: PMC5559502
19. Podschun R, Ullmann U. Klebsiella spp. as nosocomial pathogens: epidemiology, taxonomy, typing methods, and pathogenicity factors. *Clin Microbiol Rev*. 1998;11(4):589-603. DOI: [10.1128/CMR.11.4.589](https://doi.org/10.1128/CMR.11.4.589) PMID: 9767057 PMCID: PMC88898
20. Tadesse BT, Ashley EA, Ongarello S, et al. Antimicrobial resistance in Africa: a systematic review. *BMC Infect Dis*. 2017;17:616. DOI: [10.1186/s12879-017-2713-1](https://doi.org/10.1186/s12879-017-2713-1) PMID: 28893183 PMCID: PMC5594539

21. Nordmann P, Naas T, Poirel L. Global spread of carbapenemase-producing Enterobacteriaceae. *Emerg Infect Dis.* 2011;17(10):1791-8.
DOI: [10.3201/eid1710.110655](https://doi.org/10.3201/eid1710.110655)
PMID: 22000347 PMCID: PMC3310682
22. Arias CA, Murray BE. The rise of the Enterococcus: beyond vancomycin resistance. *Nat Rev Microbiol.* 2012;10(4):266-78.
DOI: [10.1038/nrmicro2761](https://doi.org/10.1038/nrmicro2761)
PMID: 22421879 PMCID: PMC3621121
23. Nicolle LE. Urinary tract infections in the older adult. *Clin Geriatr Med.* 2016;32(3):523-538.
DOI: [10.1016/j.cger.2016.03.002](https://doi.org/10.1016/j.cger.2016.03.002)
PMID: 27394021
24. Rowe TA, Juthani-Mehta M. Urinary tract infection in older adults. *Aging Health.* 2013;9(5):519-28.
DOI: [10.2217/ahe.13.38](https://doi.org/10.2217/ahe.13.38)
PMID: 24391677 PMCID: PMC3878051