

Prevalence of Multidrug-Resistant *Escherichia coli* among Urinary Tract Infection Patients in Rawalpindi & Islamabad, Pakistan

Umar Aziz¹, Nadia Shah², Umm-e-Alina³, Jamal Nasar¹, Aqsa Javed³

¹College of Medical Technology, Bacha Khan Medical College, Mardan, KPK, Pakistan.

²Medical Laboratory Technologist, Islamabad Diagnostic Center, Islamabad, Pakistan.

³University Institute of Medical Lab Technology University of Lahore, Islamabad Campus.

Corresponding Author: Umar Aziz, Email: umaraziz.mlt@gmail.com

ABSTRACT

Background: A common infection known as a urinary tract infection arises when bacteria enter the urethra and infect the urinary system. These germs are usually from the skin or the rectum. Antibiotic resistance is one of the world's most concerning topics due to its severity. This study assessed the trends of antibiotic resistance in *E. coli* isolates from UTI Individuals. Examining the incidence of uropathogenic *E. coli* and their multidrug resistance pattern in Islamabad and Rawalpindi.

Methods: A 6-month duration-based cross-sectional study was carried out at the microbiology department of Pakistan Institute of Medical Sciences (PIMS) Hospital in Islamabad, Pakistan from July to November 2023. Non-probability sampling, specifically convenient sampling, was used in the study. Collected data was analyzed using SPSS software version 20.

Result: The analysis of UTI prevalence by age and gender showed that women (68.3%) were more likely to become infected than males (31.6%), with the incidence of infection being highest in the 31–40 age range. Cefixime resistance was greatest at 95%, followed by ceftriaxone resistance at 88.33% and amoxicillin resistance at 78%. 46.6% of them have more than five medication resistance.

Conclusion: The results of the study will help the health department create guidelines for antibiotic prescriptions that will aid medical officers in choosing the appropriate antimicrobial treatment. Education programs that focus on raising knowledge are crucial for preventing *E. coli* infections and lowering the need for Cefixime and other highly resistant medications. Regular monitoring of antimicrobial susceptibility is necessary.

Keywords: Multidrug resistance, Urinary Tract Infection, Cysteine Lactose Electrolyte Deficient, Uropathogen, Antibiotic.

HOW TO CITE: Aziz U, Shah N, Alina U, Nasar J, Javed A. Prevalence of Multidrug-Resistant *Escherichia coli* among Urinary Tract Infection Patients in Rawalpindi & Islamabad, Pakistan. National Journal of Life and Health Sciences. 2023 Dec; 2(2), 56-59.

DOI: <https://doi.org/10.62746/njlhs.v2n2.44>

Date of Submission: 15/10/2023

Date of Revision: 12/12/2023

Date of Acceptance: 23/12/2023

INTRODUCTION

One of the key reasons of illness globally, urinary tract infections (UTIs) harm almost 150 million individuals annually and account for 8.1 million trips to medical professionals.¹ This illness affects people of all ages and genders.² UTIs are thought to affect 50% of women worldwide at some point in their lives, and they are more frequent in those between the ages of 16 and 64. It is possible to become reinfected with the same or other germs.³ Pregnancy, sexual activity, and the close closeness of the genital system and small urethra have all been implicated in this. UTIs are linked to end-stage renal disease and compromised renal function in pediatric patients, and they increase the risk of pyelonephritis, early birth, and fetal death in pregnant women.⁴ Urinary tract infections can be asymptomatic or symptomatic, and they can be classified as complicated or uncomplicated.⁵ One of the most common illnesses in the community is also a community-acquired UTI.⁶ Both Gram-positive and Gram-negative bacteria can cause urinary tract infections.⁷ The overuse and abuse of antibiotics are

thought to be important contributors to the growth of uropathogenic bacteria with multidrug resistance (MDR).⁸ MDR Worldwide expansion of *E. coli* is seen, including the resistant *E. coli* sequence type 131 (ST131). Because of this strain's capacity to interchange genetic material and resistance to several antibiotics, therapy can be more challenging.⁹ Therefore, it is imperative to consistently track the growing medication resistance of uropathogens. This will help choose the right antimicrobial treatments, which will lower the number of nosocomial infections brought on by microorganisms that are resistant to drugs.⁴ As a result, it is critical to consistently track the rise in uropathogenic medication resistance. Drug-resistant bacteria that cause nosocomial infections will be less common thanks to this assistance in choosing the right antimicrobial medicines.¹⁰ Monitoring the emergence of antibiotic resistance in bacteria is essential, especially when it comes to commonly used medications like antibiotics. Although wealthy nations have conducted a great deal of study on this subject, less focus has lately been placed on developing nations.

Therefore, this study aims to investigate the effectiveness of common medications used in treating urinary tract infections.

MATERIALS AND METHODS

A cross-sectional study was carried out at the microbiology department of Pakistan Institute of Medical Sciences (PIMS) Hospital in Islamabad, Pakistan from July to November 2023 for 6 months duration base study. The Hospital chosen should have adequate facilities for collecting and processing urine samples, as well as laboratory facilities for bacterial identification and antibiotic susceptibility testing. Non-probability sampling, specifically convenient sampling, was used in the study.

Islamabad and Rawalpindi residents were included. Non-residents of Islamabad, Rawalpindi, and the patient have recently used antibiotics for a minimum of 72 hours before testing was excluded.

During collection in the laboratory, the containers will be marked with a specific sample number, the date, and the time. After informing patients on the right urine collection technique, each patient will have between five and ten milliliters (5–10 ml) of clean-catch midstream urine samples obtained in a sterilized screw-capped wide-mouth container. Using a wire loop and the striking method, urine samples were gathered and spread out on a CLED agar plate. Following that, the plates were incubated aerobically for 24 hours at 37°C. The uropathogen that were isolated and had a colony count of at least 10⁵ CFU/ml were further identified employing gram staining, biochemical assays, and cultural features. Following CLSI recommendations, Enterobacteriaceae isolates susceptibility to antibiotics was determined using the Kirby-Bauer Disc diffusion method. Several antibiotics were examined, which are available in the laboratory including co-trimoxazole, nitrofurantoin, ciprofloxacin, amikacin, ceftriaxone, amoxicillin+clavulanic acid, cefixime, meropenem, and cefoperazone+sulbactam. The zones of inhibition were measured and examined following a 24-hour incubation period using the guidelines supplied by the Clinical and Laboratory Standards Institute.

The collected data was analyzed using SPSS software version 20. A p value of ≤ 0.05 was deemed to indicate statistical significance. Descriptive statistical analysis (Mean, percentages and frequency) was used. Analysis was summarized in Tabular, Graphical and chart form. The t-test was utilized to compare the means, and the chi-square test was utilized to demonstrate a correlation.

The study conducted at PIMS Hospital Islamabad was approved by the ethical committee. Before collecting samples, participants or their attendants were given a brief overview of the study's purpose, and written informed consent was obtained. All participants

provided samples and were assured that their information would be kept confidential for research purposes, using relevant methods and guidelines.

RESULTS

A total of 60 samples were analyzed at PIMS Hospital, Islamabad for six months. Out of a total of 60 samples, 19 were males (31.66%) and 41 were females (68.33%).

Table 1: Prevalence of UTI according to Gender.

Gender	Males	Females
Number of Patients	19	41
Total <i>E.coli</i> Positive cases	60	60
Prevalence %	31.66%	68.33%

For age distribution, patients were divided into different categories of age: 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 years. In this study, the highest occurrence of UTI patients was found in the age group of 31-40 (26.66%) and 61-70 years (23.33%) Followed by 21-30 (15%), 41-50 (11.66%), 51-60 (6.66%), 11-20 (5%), and 1-10 (3.33%) (Table 2).

Table 2: Prevalence of UTI in different age groups

Age Group	Total <i>E.coli</i> Positive Cases	Frequency Distribution	Prevalence (%)
1-10	60	02	3.33%
11-20	60	03	5%
21-30	60	09	15%
31-40	60	16	26.66%
41-50	60	07	11.66%
51-60	60	04	6.66%
61-70	60	14	23.33%
71-80	60	05	8.33%

The antibiotic susceptibility pattern of urinary tract *E.coli* was established using the Kirby-Bauer disk diffusion method. According to their zone of inhibition, all the drugs had different resistance. The 60 *E.coli* isolates were tested for their resistance against 10 different antibiotics i.e. Amikacin, Ceftriaxone [rocephine], Amoxicillin+ Clavulanic Acid, Cefixime, Meropenam, SXT-Co-trimoxazole, F-Nitrofurantoin, Ciprofloxacin, Tobramycin, Cefoperazone+Sulbactam (Sulzone). Detailed analysis of the susceptibility pattern of *E.coli* strain showed 95% resistance for Cefixime, 88.33% for Ceftriaxone, and 78% resistance for Amoxicillin. The rest of the *E.coli* strains showed a resistant pattern in the range of 3% to 73%. In males most resistance was found against Ceftriaxone which is about 94.7% whereas in females the resistance against Ceftriaxone was 82%, ciprofloxacin in males was 84.2% but in females it was 68% resistant, and SXT-Co-trimoxazole is about 47% in males and 70% in females (Fig 1).

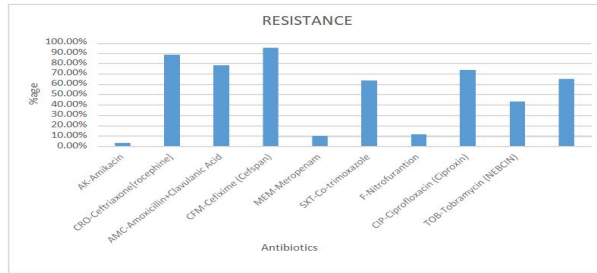


Fig 1: Resistance of different drugs

The *E.coli* isolate resistance to more than 5 antimicrobials (belonging to 3 or <3 different classes of antimicrobials) was referred to as MDR *E.coli*. Hence of the 60 isolates tested, 46.6% (28) were resistant to more than 5 drugs whereas 28.3% (17) isolates were resistant to 5 drugs, and 25% (15) were resistant to less than 5 drugs (Table 3).

Table 3: Multi-Drug Resistance

Antibiotic Resistance	Patients/Cases	Percentage
<5 Drugs	15	25%
5 Drugs	17	28.3%
>5 Drugs	28	46.6%

DISCUSSION

The high prevalence of infections in both community and hospital settings has resulted in a significant burden for the healthcare system from urinary tract infections.¹¹ The effective treatment of people with bacterial UTI usually depends on figuring out which pathogen is causing the illness and then choosing the right medication. The continuous monitoring of urinary tract bacteria' antibiotic susceptibility patterns in specific areas aids in this process.¹³ The present study findings provide insight into the patterns of antimicrobial resistance seen in Rawalpindi and Islamabad, two areas with a dearth of data on antimicrobial resistance surveillance.

Comparing the prevalence of MDR profiles in this community with that of other communities presents difficulties because there haven't been many similar community-level studies on the main bacteria that cause UTIs. However, with regards to the major bacteria linked to UTIs, *E.coli*, comparable studies show that isolates of *E.coli* resistant to ciprofloxacin also exhibited concomitant resistance to ampicillin and SXT.¹² A follow-up investigation revealed that *E.coli* bacteria resistant to fluoroquinolones also showed resistance to AMC and SXT.¹³

In line with results from prior research, those between the ages of 21 and 30 had the greatest age-specific prevalence—73 instances, or 22.5%—of all age groups. This is consistent with the knowledge that women and other sexually active groups are more likely to get urinary tract infections.¹⁴ Our analysis shows that a high incidence rate of 26.66% is seen among those

aged 31 to 70. 95% of patients had resistance to cefixime, and 46.6% had resistance to more than five medications.

The treatment and management of urinary tract infections particularly those caused by multidrug-resistant urinary tract bacteria would be significantly impacted by these results. The fact that urinary tract infections can be caused by both relatively common and isolated urinary tract pathogens should be of utmost importance to clinicians. Furthermore this study high rate of multidrug resistance highlights a significant obstacle in the management of UTIs. A methodical approach is needed to address this problem one that aims to either reduce the use of broad-spectrum antibiotics or mitigate the rates of antibiotic resistance.¹⁵

Lastly rapid diagnostic testing has to be given priority to provide targeted and timely medication in the face of multidrug resistance. A drug control system that maximizes drug consumption and allows for a customized approach to suggested therapies is also required.¹⁵

Urinary tract infections are in our opinion a viable target audience for health education initiatives. These initiatives seek to enhance patient welfare and lower the frequency of disease in communities, particularly in low- and middle-income countries.

CONCLUSION

In conclusion our study provides valuable insights into the prevalence of urinary tract infections (UTIs) caused by *E.coli* across different genders and age groups. We observed that UTI prevalence was higher among females compared to males with the highest incidence occurring in individuals aged 31 to 40 years and 60 to 70 years. Furthermore our findings revealed a concerning level of resistance particularly against Cefixime, with a striking 95% resistance rate and a substantial proportion of cases exhibiting resistance to multiple drugs. These findings are instrumental for health departments in formulating antibiotic prescription regulations and aiding medical practitioners in selecting appropriate antimicrobial therapy. To mitigate *E.coli* infections and curb the demand for highly resistant medications like Cefixime there is an urgent need for educational campaigns and enhanced hygiene practices. Moreover regular monitoring of antimicrobial susceptibility is imperative to address emerging resistance patterns effectively.

FUNDING SOURCES

There was no grant support for this study.

REFERENCES

1. Nobel F, Akter S, Jebin R, Sarker T, Rahman M, Zamane S, Islam K, Sabrina S, Akther N, Islam A, Hasan M. Prevalence of multidrug resistance patterns of *Escherichia Coli* from suspected urinary tract infection in Mymensingh city,

- Bangladesh. Journal of Advanced Biotechnology and Experimental Therapy. 2021;4(3):256-64.
2. Odongo I, Ssemambo R, Kungu JM. Prevalence of *Escherichia Coli* and its antimicrobial susceptibility profiles among patients with UTI at Mulago Hospital, Kampala, Uganda. Interdisciplinary perspectives on infectious diseases. 2020 Feb 1;2020.
 3. Muhammad A, Khan SN, Ali N, Rehman MU, Ali I. Prevalence and antibiotic susceptibility pattern of uropathogens in outpatients at a tertiary care hospital. New Microbes and new infections. 2020 Jul 1;36:100716.
 4. Tuem KB, Desta R, Bitew H, Ibrahim S, Hishe HZ. Antimicrobial resistance patterns of uropathogens isolated between 2012 and 2017 from a tertiary hospital in Northern Ethiopia. Journal of global antimicrobial resistance. 2019 Sep 1;18:109-14.
 5. Girma A, Aemiro A. The bacterial profile and antimicrobial susceptibility patterns of urinary tract infection patients at Pawe General Hospital, Northwest Ethiopia. Scientifica. 2022 Apr 25;2022.
 6. Tajbakhsh R, Firoozeh F. Multidrug-Resistance Among Uropathogenic *Escherichia Coli* Strains. Int J Enteric Pathog. 2020;8(1):1-2.
 7. Kotb DN, Mahmoud MS, Mahdi WK, Khairy RM. Prevalence and Antimicrobial Resistance of Urinary tract Infections in Upper Egypt. Minia Journal of Medical Research. 2019 Oct 1;30(4):78-85.
 8. Mazzariol A, Bazaj A, Cornaglia G. Multi-drug-resistant Gram-negative bacteria causing urinary tract infections: a review. Journal of Chemotherapy. 2017 Dec 22;29(sup1):2-9.
 9. Shitu S, Gambo BA, Musa MO, Abubakar AA, Attahiru M. Prevalence of Multidrug-Resistant *Escherichia Coli* In Suspected Cases of Urinary Tract Infection Among Patients Attending Ahmadu Bello University Medical Center, Zaria. UMYU Journal of Microbiology Research (UJMR). 2020 Dec 30;5(2):123-30.
 10. Islam MA, Islam MR, Khan R, Amin MB, Rahman M, Hossain MI, Ahmed D, Asaduzzaman M, Riley LW. Prevalence, etiology and antibiotic resistance patterns of community-acquired urinary tract infections in Dhaka, Bangladesh. Plos one. 2022 Sep 15;17(9):e0274423.
 11. Stamm WE, Hooton TM. Management of urinary tract infections in adults. New England journal of medicine. 1993 Oct 28;329(18):1328-34.
 12. Karlowsky JA, Hoban DJ, DeCorby MR, Laing NM, Zhanel GG. Fluoroquinolone-resistant urinary isolates of *Escherichia Coli* from outpatients are frequently multidrug resistant: results from the North American Urinary Tract Infection Collaborative Alliance-Quinolone Resistance study. Antimicrobial agents and chemotherapy. 2006 Jun;50(6):2251-4.
 13. Van der Starre, W. E., Van Nieuwkoop, C., Paltansing, S., Van't Wout, J. W., Groeneveld, G. H., Becker, M. J., ... & Van Dissel, J. T. (2011). Risk factors for fluoroquinolone-resistant *Escherichia Coli* in adults with community-onset febrile urinary tract infection. Journal of Antimicrobial Chemotherapy, 66(3), 650-656.
 14. Van der Starre WE, Van Nieuwkoop C, Paltansing S, Van't Wout JW, Groeneveld GH, Becker MJ, Koster T, Wattel-Louis GH, Delfos NM, Ablj HC, Leyten EM. Risk factors for fluoroquinolone-resistant *Escherichia Coli* in adults with community-onset febrile urinary tract infection. Journal of Antimicrobial Chemotherapy. 2011 Mar 1;66(3):650-6.
 15. Fenta A, Dagnaw M, Eshetie S, Belachew T. Bacterial profile, antibiotic susceptibility pattern and associated risk factors of urinary tract infection among clinically suspected children attending at Felege-Hiwot Comprehensive and Specialized Hospital, Northwest Ethiopia. A prospective study. BMC infectious diseases. 2020 Dec;20:1-0.
 16. Alasmay MY. Antimicrobial Resistance Patterns and ESBL of Uropathogens Isolated from Adult Females in Najran Region of Saudi Arabia. Clinics and Practice. 2021 Sep 14;11(3):650-8.