

## Causative Organisms of Urinary Tract Infection and Antibiotic Susceptibility Among Patients Attending in Tertiary Care Hospitals of Bangladesh

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### Abstract

**Background:** Urinary tract infections (UTIs) are considered to be the chronic public health problem due to morbidity and financial cost as urological diseases causes the highest health care cost. UTI is known as one of the most common diseases today. UTI can occur in both men and women, but studies found that the incidence of UTI is more common in women especially among the sexually active women. **Material & Methods:** This study was a retrospective cross-sectional study which was conducted at the department of Medicine in Tairunnessa Memorial Medical College and Hospital, Gazipur, obstetrics and gynecology in Bikrampur Bhuiya Medical College and Hospital, Munshiganj and Medicine in City Medical College and Hospital, Gazipur. The study was conducted during the period of February 2018- January 2022. The total sample size for this study was 131. **Results:** Most of the respondents 56(42.7%) were aged from 26-35 years. Majority of them 117(89%) were female whereas only 14(11%) were male. Burning sensation of micturition was found in 115 patients where 46(40%) had burning for 0-3 days, 63(54.8%) for 4-7 days and 6(5.2%) for >7 days. In most cases causative organism was E. Coli in this study. According to sensitivity patterns of E. Coli Amoxiclav was used in 77(59%) cases and followed by Amikacin in 94(72%), Azithromycin in 120(92%), Cefixime in 130(99.2%), Ceftriaxone in 83(63.3%), Cefuroxime in 37(28.2%), Imipenem in 62(47%), Ciprofloxacin 64(49%), and Gentamicin in 38(29%) cases. In assessing the antibiotic resistance pattern of E. coli Ampicillin was used in 55(42%) cases and followed by Amoxycillin in 98(75%), Colchicine in 13(10%), Linezolid in 35(26.2%), Amoxiclav in 54(41.2%), Colistin in 16(12.2%), Imipenem in 69(53%) and Novobiocin in 62(47%) cases. **Conclusions:** Antibiotics are considered to be the only treatment for UTI. But antibiotic resistance is highly prevalent in bacterial isolates around the world, especially in developing countries.

**Keywords:-** Urinary Tract Infection (UTI), Causative organisms, Antibiotics susceptibility, E. coli.

### INTRODUCTION

Urinary tract infections (UTIs) are considered to be chronic public health problem due to morbidity and financial cost as urological diseases causes the highest health care cost.<sup>[1]</sup> A study reported that UTI infects around 150

million each year worldwide and hence, UTI is known as one of the most common diseases today.<sup>[2]</sup> UTI can occur in both men and women, but studies found that the incidence of UTI is more common in women especially among the sexually active women.<sup>[3]</sup> The incidence of uncomplicated UTIs is found

50/1000 per year in healthy women.<sup>[4]</sup> Studies have found that about 50% of women experience UTI at least one time in their lifetime whereas the prevalence was 20% in men and 20% of female and 40% of male experience repeated infection.<sup>[5,6,7]</sup> Women are more vulnerable than men because of the anatomic difference, hormonal effects and behavioral pattern.<sup>[8]</sup> UTI occurs when pathogenic organisms are spotted in the urine, urethra, bladder, kidney or prostate. There are some pathogens which causes UTI like E. coli and Pseudomonas spp, Proteus spp, klebsiella spp etc.<sup>[9]</sup> Among them, E. coli is supposed to be the most common causative agent. The study of Haque et al. found that 78.8% of the E. coli infection were presented in women where the study of Nahar and Selim reported it 70.9%.<sup>[10,11]</sup> UTI can affect the kidney (causing pyelonephritis) and develop bladder infections in future.<sup>[12]</sup> Besides, UTI has serious impact on the socioeconomic life and also requires antibacterial drug consumption.<sup>[13]</sup> UTI is primarily treated by antibiotics based on the information obtained from antimicrobial susceptibility pattern of the urinary pathogens.<sup>[13]</sup> But, widespread use of these antimicrobial agents may cause antibiotic resistant pathogens and results in increasing demand for new drugs.<sup>[14]</sup> The antibiotic resistance in treating UTI has become a major public health concern mostly in the developing countries. Besides, high level of poverty, ignorance, poor hygiene knowledge and wide circulation of fake and spurious drugs in the markets also add to the complications.<sup>[15]</sup> Hence, early diagnosis of UTI is important.<sup>[16]</sup> To ensure proper treatment, knowledge of causative agents of UTI and their antibiotic susceptibility is required.<sup>[17]</sup> The aim of the

study was to find the causative organisms of urinary tract infection and antibiotic susceptibility of urinary pathogens among the patients.

### Objective of the Study

The objective of this study was to find the causative organisms of urinary tract infection and antibiotic susceptibility of urinary pathogens among the patients attending in tertiary care level hospitals of Bangladesh.

### MATERIAL AND METHODS

This study was a retrospective cross-sectional study which was conducted at the department of Medicine in Tairunnessa Memorial College and Hospital, Gazipur, Obstetrics and Gynecology department in Bikrampur Bhuiya Medical College and Hospital, Munshiganj and Medicine department in City Medical College and Hospital, Gazipur. The study was conducted during the period of February 2018-January 2022. The total sample size for this was 131.

#### Inclusion criteria:

- The patients who were aged 15 years or more.
- The patients having Burning sensation of micturition, lower abdominal pain and fever.
- The patients having one time or recurrent episode of UTI.
- Pregnant patients with UTI.

#### Exclusion criteria:

- The patients who were less than 15 years.

- The patients who had the history of hospital admission a week before their presentation in OPDs.
- The patients on antibiotic therapy.

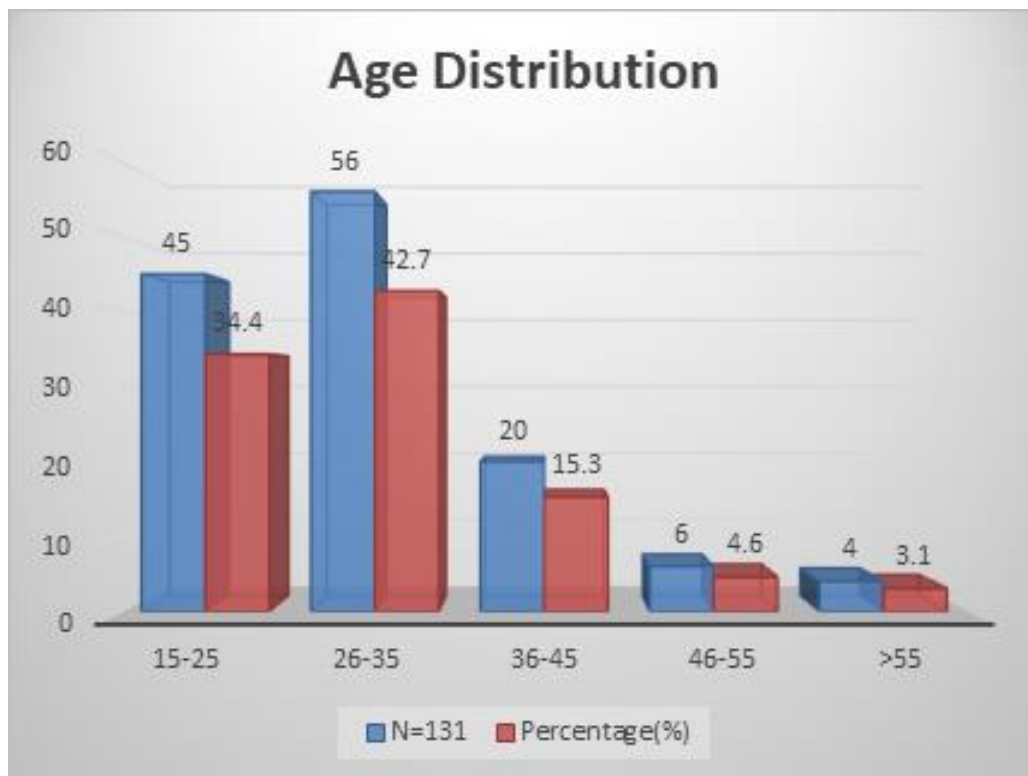
All the patients were undergone through antimicrobial sensitivity testing which was performed using Kirby Bauer disc diffusion method as suggested by the National Committee for Clinical Laboratory Standard (presently called Clinical Laboratory Standard Institute). Sensitive or Resistant was measured on the basis of the diameters of zone of inhibition of bacterial growth according to the recommendation of disc manufacturer. Besides, ESBL phenotypic confirmatory test was done using the disk diffusion method on Muller-Hinton agar plates. The antibiotics used

for susceptibility testing were Amoxicillin, Ciprofloxacin, Cefixime, Ceftriaxone, Cefepime, Gentamicin, Amikacin, Nitrofurantoin, Cotrimoxazole, Imipenem and Meropenem etc.

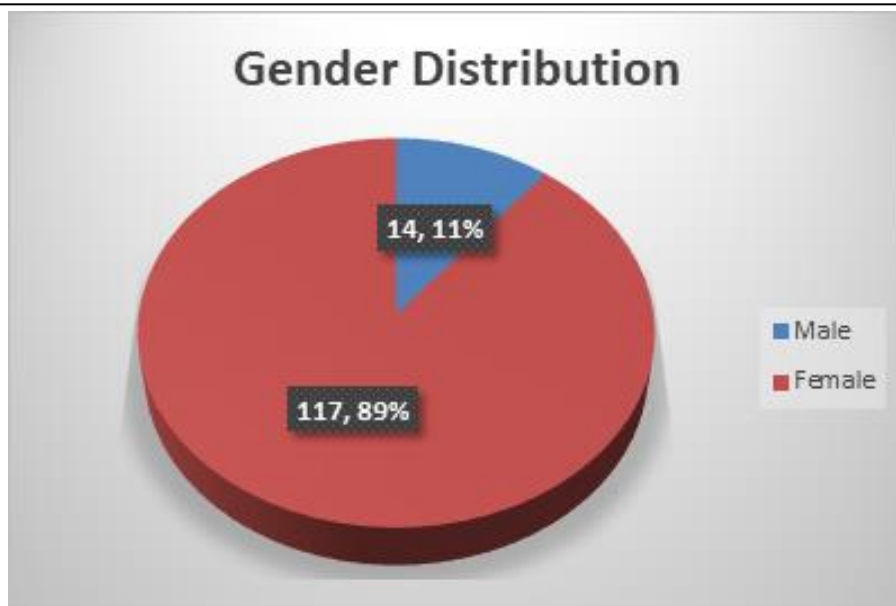
## RESULTS

[Figure 1] shows the age distribution of the study people. Most of the respondents 56(42.7%) were aged from 26-35 years and followed by 45(34.4%) were 15-25 years, 20(15.3%) were 36-45 years, 6(4.6%) were 46-55 years and 4(3.1%) were >55 years.

[Figure 2] shows the gender distribution of the study people. Most of the respondents 117(89%) were female where only 14(11%) were male.



**Figure 1:** Age Distribution of the Study People



**Figure 2:** Gender Distribution of the Study People

**Table 1:** Chief Complaints

| Chief Complaints                         | Duration     | N  | Percentage (%) |
|--|--------------|----|----------------|
| Burning sensation of micturition (N=115) | for 0-3 days | 46 | 40.0           |
|  | 4-7 days     | 63 | 54.8           |
|  | >7 days      | 6  | 5.2            |
| Lower abdominal pain (N=100)             | for 0-3 days | 64 | 64.0           |
|  | 4-7 days     | 32 | 32.0           |
|  | >7 days      | 4  | 4.0            |
| Fever (N=60)                             | for 0-3 days | 31 | 51.7           |
|  | 4-7 days     | 27 | 45.0           |
|  | >7 days      | 2  | 3.3            |

**Table 2:** Antibiotic sensitivity pattern of E. coli

| Antibiotic sensitivity pattern of E. coli | N   | Percentage (%) |
|---|-----|----------------|
| Amoxiclav                                 | 77  | 59             |
| Amikacin                                  | 94  | 72             |
| Azithromycin                              | 120 | 92             |
| Cefixime                                  | 130 | 99.2           |
| Ceftriaxone                               | 83  | 63.3           |
| Nitrofurantoin                            | 9   | 7              |
| Cefuroxime                                | 37  | 28.2           |
| levofloxacin                              | 4   | 3.1            |
| Novobiocin                                | 69  | 53             |
| Imipenem                                  | 62  | 47             |



|                |    |    |
|----------------|----|----|
| Ciprofloxacin  | 64 | 49 |
| Co-trimoxazole | 17 | 13 |
| Ampicillin     | 76 | 58 |
| Gentamicin     | 38 | 29 |

**Table 3:** Antibiotic Resistance pattern of E. coli

| Antibiotic Resistance pattern of E. coli | N   | Percentage (%) |
|--|-----|----------------|
| Ampicillin                               | 55  | 42             |
| Amoxicillin                              | 98  | 75             |
| Colchicine                               | 13  | 10             |
| Linezolid                                | 35  | 26.2           |
| Amikacin                                 | 37  | 28.2           |
| Co-trimoxazole                           | 114 | 87             |
| Ceftriaxone                              | 48  | 37             |
| Ciprofloxacin                            | 67  | 51.1           |
| Amoxiclav                                | 54  | 41.2           |
| Colistin                                 | 16  | 12.2           |
| Imipenem                                 | 69  | 53             |
| Novobiocin                               | 62  | 47             |

[Table 1] shows the chief complaints. Burning sensation of micturition was found in 115 patients where 46(40%) had burning for 0-3 days, 63(54.8%) for 4-7 days and 6(5.2%) for >7 days. Lower abdominal pain was found in total 100 cases where 64(64%) had pain for 0-3 days, 32(32%) for 4-7 days and 4(4%) for >7 days. Fever was seen in 60 cases where 31(51.7%) had fever for 0-3 days, 27(45%) for 4-7 days and 2(3.3%) for >7 days.

[Table 2] represents the antibiotic sensitivity pattern of E. coli. Amoxiclav was used in 77(59%) cases and followed by Amikacin in 94(72%), Azithromycin in 120(92%), Cefixime in 130(99.2%), Ceftriaxone in 83(63.3%), Nitrofurantoin in 9(7%), Cefuroxime in 37(28.2%), levofloxacin in 4(3.1%), Novobiocin in 69(53%), Imipenem in 62(47%), Ciprofloxacin 64(49%), Co-trimoxazole in

17(13%), Ampicillin in 76(58%) and Gentamicin in 38(29%) cases.

[Table 3] represents the antibiotic resistance pattern of E. coli where resistance in Ampicillin was found in 55(42%) cases and followed by Amoxicillin in 98(75%), Colchicine in 13(10%), Linezolid in 35(26.2%), Amikacin in 37(28.2%), Co-trimoxazole in 114(87%), Ceftriaxone in 48(37%), Ciprofloxacin in 67(51.1%), Amoxiclav in 54(41.1%), Colistin in 16(12.2%), Imipenem in 69(53%) and Novobiocin in 62(47%) cases.

## DISCUSSION

Escherichia coli is the most commonly reported cause of UTI is also the major aerobic organism which resides in the intestine and is a common fecal contaminant.<sup>[18,19]</sup> Most of the respondents 42.7% were aged from 26-35 years and followed by 34.4% were 15-25 years, 15.3%



were 36-45 years, 4.6% were 46-55 years and 3.1% were >55 years. [Figure 1] The study of B H N Yasmeen et al. also showed consistence age group like the present study where majority of the cases were in the age group of 21 to 30 years and least patients were in more than 70 years of age group.<sup>[20]</sup> Oli et al. in their study found most of the patients 92.31% were in the age group 32 – 36 years.<sup>[21]</sup> Studies had found that adult women have a higher prevalence of UTI than men, principally due to anatomical and physical factors.<sup>[22]</sup> The study observes that the prevalence of UTI is high among females as most of the respondents 89% were female where only 11% were male. [figure II] The study of B H N Yasmeen et al. also found relatively a greater number of female patients compared with male.<sup>[20]</sup> Patel P.K. et al in their study found 56.19% were female where only 43.81% were male.<sup>23</sup> The chief complaints of study patients in the present study was Burning sensation of micturition which was found in 115 patients where 40% had burning for 0-3 days, 54.8% for 4-7 days and 5.2% for >7 days. Lower abdominal pain was found in total 100 cases where 64% had pain for 0-3 days, 32% for 4-7 days and 4% for >7 days. Fever was seen in 60 cases where 51.7% had fever for 0-3 days, 45% for 4-7 days and 3.3% for >7 days. [Table 1] The study of Sadia Saber reported Burning sensation of micturition in 41% cases and fever was seen in 63% cases.<sup>[24]</sup> The study of Fadhl A.S. Al-Gasha'a et al. reported Burning sensation of micturition in 193 cases and lower back pain was seen in 216 cases.<sup>[25]</sup> The antibiotic sensitivity pattern of E. coli. was measured in accordance with the antibiotic use of treatment. Amoxiclav was used in 59% cases and followed by Amikacin in 72%,

Azithromycin in 92%, Cefixime in 99.2%, Ceftriaxone in 63.3%, Nitrofurantoin in 7%, Cefuroxime in 28.2%, levofloxacin in 3.1%, Novobiocin in 53%, Imipenem in 47%, Ciprofloxacin 49%, Co-trimoxazole in 13%, Ampicillin in 58% and Gentamicin in 29% cases. [Table 2] In this study, the antibiotic resistance pattern of E. coli was also measured. Resistance in Ampicillin was found 42% and followed by Amoxicillin in 75%, Colchicine in 10%, Linezolid in 26.2%, Amikacin in 28.2%, Co-trimoxazole in 87%, Ceftriaxone in 37%, Ciprofloxacin in 51.1%, Amoxiclav in 41.2%, Colistin in 12.2%, Imipenem in 53% and Novobiocin in 47% cases. [Table 3] The study of Rama Biswas et. al. in their study reported that E. coli showed high sensitivity (100%) to meropenem, imipenem and amikacin followed by Gentamicin (94.1%), Cephalosporin (82.35%), Ciprofloxacin (88.23%), Nitrofurantoin (90%), Amikacin (83.3%), Meropenem (100%), Nitrofurantoin (86.6%), Gentamicin (53.33%). The isolates show low degree of susceptibility to Amoxicillin (11.81%), Cefixime (34.54%), Cefepime (44.54%), Ceftriaxone (36.37%) and cotrimoxazole (31.81%).<sup>[26]</sup> The study of Iregbu KC in their study showed the sensitivity in Ampicillin was found 1% and followed by Amoxicillin in 27%, Colchicine in 82.4%, Amikacin in 98%, Ceftriaxone in 67%, Ciprofloxacin in 53%, Imipenem in 89% cases.<sup>[27]</sup>

## CONCLUSIONS

Antibiotics are considered to be the only treatment for UTI. But antibiotics resistance is highly prevalent in bacterial isolates around the world, especially in developing countries. E. coli is found to be the most common

causative organism for UTI. The lack of adequate facilities for proper microbial isolation, antimicrobial susceptibility testing, low-income level, past history of UTI, ignorance about personal hygiene, low educational status, and pregnancy are the main factors for the development of UTI. Besides, physicians need to know local antibiotic microbial sensitivity patterns and cost effectiveness for selecting proper drug. Moreover, periodic evaluation of antimicrobial activity of different antibiotics is important as the pattern of antibiotic sensitivity may vary over time.

## REFERENCES

1. Gales AC, Sader HS, Jones RN. The SENTRY Participants Group (Latin America). Urinary tract infection trends in Latin American hospitals: Report from the SENTRY antimicrobial surveillance program (1997-2000). *Diagn Microbiol Infect Dis.* 2002; 44:289-99
2. Karlowsky JA, Kelly LJ, Thornsberry C, Jones ME, Sahm DF. Trends in antimicrobial resistance among urinary tract infection isolates of *Escherichia coli* from female outpatients in the United States. *Antimicrob Agents Chemother.* 2002;46(8):2540-2545. doi:10.1128/AAC.46.8.2540-2545.2002
3. Karki A, Tiwari BR, Pradhan SB. Study of bacteria Isolated from Urinary Tract Infections and Their Sensitivity Pattern. *J Nepal Med Assoc.* 2004; 43:200-203.
4. De Backer D, Christiaens T, Heytens S, De Sutter A, Stobberingh EE, Verschraegen G. Evolution of bacterial susceptibility pattern of *Escherichia coli* in uncomplicated urinary tract infections in a country with high antibiotic consumption: a comparison of two surveys with a 10 year interval. *J Antimicrob Chemother.* 2008;62(2):364-8. doi: 10.1093/jac/dkn197.
5. Rock W, Colodner R, Chazan B, Elias M, Raz R. Ten years surveillance of antimicrobial susceptibility of community-acquired *Escherichia coli* and other uropathogens in northern Israel (1995-2005). *Isr Med Assoc J.* 2007;9(11):803-5.
6. Sood S, Gupta R. Antibiotic resistance pattern of community acquired uropathogens at a tertiary care hospital in jaipur, rajasthan. *Indian J Community Med.* 2012;37(1):39-44. doi:10.4103/0970-0218.94023
7. Litwin MS, Saigal CS, Yano EM, Avila C, Geschwind SA, Hanley JM, et al; Urologic Diseases in America Project. Urologic diseases in America Project: analytical methods and principal findings. *J Urol.* 2005;173(3):933-7. doi: 10.1097/01.ju.0000152365.43125.3b.
8. Hooton TM. Pathogenesis of urinary tract infections: an update. *J Antimicrob Chemother.* 2000;46 Suppl 1:1-7; discussion 63-5.
9. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. *Nat Rev Microbiol.* 2015;13(5):269-284. doi:10.1038/nrmicro3432
10. Medina M, Castillo-Pino E. An introduction to the epidemiology and burden of urinary tract infections. *Ther Adv Urol.* 2019;11:1756287219832172. doi:10.1177/1756287219832172
11. Hoque N, Kibria G, Begum SN. Prevalence of urinary tract infection in adult women. *Bangladesh Med Res Counc Bull.* 1976;2(2):75-85.
12. Rahman SR, Ahmed MF, Begum A. Occurrence of urinary tract infection in adolescent and adult



- women of shanty town in Dhaka City, Bangladesh. *Ethiop J Health Sci.* 2014;24(2):145-152. doi:10.4314/ejhs.v24i2.7
13. Melaku S, Kibret M, Abera B, Gebre-Sellassie S. Antibigram of nosocomial urinary tract infections in Felege Hiwot referral hospital, Ethiopia. *Afr Health Sci.* 2012;12(2):134-139. doi:10.4314/ahs.v12i2.9
14. Goldstein FW. Antibiotic susceptibility of bacterial strains isolated from patients with community-acquired urinary tract infections in France. Multicentre Study Group. *Eur J Clin Microbiol Infect Dis.* 2000;19(2):112-7. doi: 10.1007/s100960050440.
15. Khameneh ZR, Afshar AT. Antimicrobial susceptibility pattern of urinary tract pathogens. *Saudi J Kidney Dis Transpl.* 2009;20(2):251-3.
16. Schmiemann G, Kniehl E, Gebhardt K, Matejczyk MM, Hummers-Pradier E. The diagnosis of urinary tract infection: a systematic review. *Dtsch Arztebl Int.* 2010;107(21):361-367. doi:10.3238/arztebl.2010.0361
17. Ashkenazi S, Even-Tov S, Samra Z, Dinari G. Uropathogens of various childhood populations and their antibiotic susceptibility. *Pediatr Infect Dis J.* 1991;10(10):742-6. doi: 10.1097/00006454-199110000-00005.
18. Foxman B. The epidemiology of urinary tract infection. *Nat Rev Urol.* 2010;7(12):653-60. doi: 10.1038/nrurol.2010.190.
19. Oli AN, Okafor CI, Ibezim EC, Akujiobi CN, Onwunzo MC. The prevalence and bacteriology of asymptomatic bacteriuria among antenatal patients in Nnamdi Azikiwe University Teaching Hospital Nnewi; South Eastern Nigeria. *Niger J Clin Pract.* 2010;13(4):409-12.
20. Yasmeen BHN, Islam S, Islam S, Uddin MM, Jahan R. Prevalence of urinary tract infection, its causative agents and antibiotic sensitivity pattern: A study in Northern International Medical College Hospital, Dhaka. *North Int Med Coll J.* 2015;7(1):105-109.
21. Oli AN, Akabueze VB, Ezeudu CE, et al. Bacteriology and Antibigram of Urinary Tract Infection Among Female Patients in a Tertiary Health Facility in South Eastern Nigeria. *Open Microbiol J.* 2017;11:292-300. doi:10.2174/1874285801711010292
22. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in J N M C Hospital Aligarh, India. *Ann Clin Microbiol Antimicrob.* 2007;6:4. doi: 10.1186/1476-0711-6-4.
23. Patel PK, Pattani MH. A study on prevalence of bacterial isolates causing urinary tract infection at tertiary care hospital, Rajkot, Gujarat, India. *Trop J Pathol Microbiol.* 2019;5(7):454-460.
24. Saber S, Yasmin N, Alam MT, Hossain MM, Alam RF. Study on Urinary Tract Infection Among Females of Reproductive Age Group in Tertiary Care Teaching Hospital, Dhaka, Bangladesh. *EJMED.* 2021;85-89. DOI: <http://dx.doi.org/10.24018/ejmed.2021.3.1.680>
25. Odoki M, Almstapha Aliero A, Tibyangye J, et al. Prevalence of Bacterial Urinary Tract Infections and Associated Factors among Patients Attending Hospitals in Bushenyi District, Uganda. *Int J Microbiol.* 2019;2019:4246780. doi:10.1155/2019/4246780
26. Majumder MI, Ahmed T, Hossain D, Begum SA. Bacteriology and antibiotic sensitivity patterns of urinary tract infections in a tertiary hospital in Bangladesh. *Mymensingh Med J.* 2014;23(1):99-104.
27. Taneja N, Chatterjee SS, Singh M, Singh S, Sharma M. Pediatric urinary tract infections in a tertiary care center from north India. *Indian J Med Res.* 2010;131:101-5.

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