JPSIM Journal of Pakistan Society of Internal Medicine

Original Article

Incidence of Culture Proven UTI and Antimicrobial Sensitivity Pattern among the Adult Population in the Local Area

Ammara Asim, Rehman Javed, Aisha Aziz, Asma Kazi, Muhammad Riaz, Murad Ali Khan, Faisal Zarar

Arif Memorial Teaching Hospital, Rashid Latif Medical College, Lahore

Abstract

Objective: To determine the incidence of culture proven UTI and antimicrobial sensitivity patterns among adult population in local area of Lahore.

Methods: In this retrospective study, a total of 287 cases diagnosed with UTI were selected from Arif Memorial Teaching Hospital (AMTH) Lahore. Non probability sampling technique was applied and data was collected through structured questionnaire. Data for the factors associated with UTI was obtained from their respective files from the record room of AMTH. A computer software SPSS version 26.0 was used to analyze the data.

Results: Out of 287 sample cultures, 122 samples were positive for different uropathogens. 59.0% showed E. coli strains followed by Staph. Epidermidis (10.7%), Klebsiella (8.2%), Proteus (7.4%), Enterobacter (5.7%), Pseudomonas (4.9%) and Staph Aureus (4.1%). In addition, the isolates showed multi-drug resistance. Among 122 patients, 72.1% were females and 28.7% were 27-35 years old. The risk factors among these patients were pregnancy (38.5%), followed by, hypertension (33.6%) and diabetes (27.9%).

Conclusion: Study concluded that UTIs were more common amongst females. Frequent use of antimicrobials without culture and sensitivities has led to emerging resistance to multiple antimicrobials to a problematic extent. Hence a urine culture and sensitivity should be advised before the initiation of antimicrobial drugs among patients with UTI.

Keywords: Urinary tract infection, E. coli, drug resistant, antimicrobial sensitivity.

How to cite this:

Asim A, Javed R, Aziz A, Kazi A, Riaz M, Khan MA, Zarar F. Incidence of culture proven UTI and Antimicrobial Sensitivity Pattern among the Adult Population in the Local Area. J Pak Soc Intern Med. 2024;5(2): 496-501

Corresponding Author: Dr. Asma Kazi **Email:** docasmakazi@gmail.com

DOI: https://doi.org/10.70302/jpsim.v5i2.2429

Introduction

The UTIs are inflammatory ailments due to micro-organisms that have proliferated anomalously within the urinary system.[1] The symptoms of UTI are dysuria, loin pain, foul-smelling urine, polyuria, urine urgency as well as cloudy urine, tenderness and pain in the lower side of abdomen. There can also be fever, nausea, vomiting, chills and backache.[2] The UTIs are either hospital-acquired (HA) or community-acquired infections.[3] The infectivity of the urinary system originates among individuals either from community or from hospital environment. The UTI that is acquired from hospital emerges 48 hours following hospitalization and not incubating at the admission time or within three days after discharge. The UTIs could be symptomatic or asymptomatic, imposing a strain on the public healthcare and decreasing the quality of life.[1]

Urinary tract infection is clinically divided into two categories namely uncomplicated and complicated. Mostly the uncomplicated UTI affects healthy individuals without structural/ neurological urinary tract anomalies that comprise of pyelonephritis and cystitis while the complicated UTI is caused by reasons that compromise the urinary tract and cause urinary blockage, neurological diseases leading to urinary retention, renal failure, pregnancy, renal transplantation, and presence of foreign bodies for example; indwelling catheters, calculi or several other drainage devices.[4]

The UTIs are most common communicable diseases diagnosed globally, particularly among developing countries of the world.[5] It has been assessed that about 150 million individuals globally develop the UTIs yearly, with elevated costs, including medical as well as hospitalization expenses.[6,7] A urinary tract infection is considered the second most common bacterial infection that affects the people of all ages worldwide.[8,9]

About 40-50 percent of females and 5 percent males develop UTI at least once in their entire life. UTI affects both genders irrespective of their age, however, elevated incidence among females could be caused by anatomical structures or elevated bacterial load in the urothelial mucosa or other determinants for example, sexual activity, pregnancy and blocked urinary tract.[10,11] Meanwhile, certain factors such as age, sex, race, sexual activity and genetic factors are considered the risks for developing urinary tract infections.[12]

The bacterial pathogens responsible for UTIs are mostly Gram-negative bacteria, for example: E. coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Enterobacter species, Proteus and Citrobacter species. Among the Gram-positive bacteria, S. aureus, Enterococcus and Staphylococcus saprophyticus are mostly responsible for infections. Among bacteria, 75 to 95 percent of cases of UTI are due to E. coli.[13,14]

A precise and timely UTI diagnosis plays a significant part in avoiding the ascent of infectivity to upper urinary tract as well as renal failure. Several cases of UTI, resistant to the antibiotics are enhancing on daily basis. The inappropriate and extensive utilization of antibiotics has caused antibiotic resistance during current years that has become a global issue.[15] Knowledge regarding local susceptibility patterns is significant to select the proper empirical treatment of UTI. Reporting the updated local sensitivity patterns regarding most commonly isolated microorganisms from the samples of urine influence the general physician decisions on the therapeutic choices enabling to choose more accurate and efficacious treatments.[16]

Methods

Study setting: Data was collected of 287 patients with diagnosed UTI from the Department of Medicine, Arif Memorial Teaching Hospital, Lahore.

Study Duration: Two years (from July 2021 to September 2023).

Study design: Descriptive cross-sectional study.

Sampling technique: Non-probability (purposive) sampling technique.

Inclusion criteria: Patients presenting with clinical symptoms of UTI of either sex and above sixteen years of age having diabetes, hypertension and pregnancy were included.

Exclusion criteria: Patients presenting with clinical symptoms of UTI of either sex and below sixteen years of age and on steroid therapy, terminally ill and hospital acquired were excluded.

The study was ethically approved by the Institutional Review Board (IRB), Rashid Latif Medical College, Lahore. Identification of organisms and antimicrobial sensitivity test were performed in the Microbiology Lab, Department of Microbiology Rashid Latif Medical College. Urine samples were cultured on CLED agar. Only those cultured samples were included in the study, which showed the presence of uropathogens. An antimicrobial sensitivity test was performed using the nutrient agar. The antimicrobial agents tested for sensitivity were Ampicillin, Amoxil/Calv, Ceftriaxone, Meropenem, Imipenem, Gentamycin, Amikacin, Tobramycin, Ciprofloxacin, Fosfomycin, Nitrofurantoin, Septran, Tazobactam and Doxycycline.

All the data regarding percentages was analyzed using Microsoft Excel 2016 version. The chi-square test was applied to compare the antimicrobial sensitivity and resistance via computer software SPSS 26.

Results

Table-1 depicts that in a sample of 287, 122 (42.51%) were found positive for bacterial infections while the remaining 165 (57.49%) samples were negative for bacterial infections.

Table-2 demonstrates that among 122 samples, 72 (59.0%) showed E. coli strains followed by Staph. Epidermidis 13 (10.7%), Klebsiella 10 (8.2%), Proteus 9 (7.4%), Enterobacter 7 (5.7%), Pseudomonas 6 (4.9%) and Staph Aureus 5 (4.1%).

Table-3 highlights that among 122 patients, 34 (27.9%) were males and 88 (72.1%) were females.

Among these patients who were found with UTIs, 28 (23.0%) were 16-26 years old, 35 (28.7%) were 27-35 years old, 23 (18.9%) were 36-45 years old, 17 (13.9%) were 46-56 years old and 14 (11.5%) were 57-66 years old while 5 (4.0%) patients were 67-76 years old.

Table exhibits the risk factors among these patients and found that most of them 47 (38.5%) had pregnancy, followed by, hypertension 41 (33.6%) and diabetes 34 (27.9%).

Table-4 asserts the antimicrobial sensitivity pattern in urine culture and found that E.coli was resistant to Penicillin, Cephalosporin, Carbapenems, Aminoglycoside, Fluoroquinolones, Miscellaneous among 110 (93.2%), 46 (83.6%), 4 (8%), 55 (52.8%), 79 (77.4%), 29 (23.7%) cases; Enterobacter was resistant among 9 (69.2%), 2 (50%), 2 (20%), 12 (80%), 6 (54.4%), 6 (46.1%) cases; Klebsiella among 15 (93.7%), 5 (45.4%), 7 (28%), 6 (54.5%), 7 (46.6%), 9 (64.2%) cases; Proteus among 17 (94.4%), 1 (25%), 1 (20%), 9 (64.2%), 13 (92.8%), 11 (50%) cases; Pseudomonas among 10 (91%), 1 (33.3%), 2 (40%), 4 (40%), 6 (60%), 6 (37.5%) cases and Staph. aureus among 14 (94.3%), 0 (0.0%), 0 (0.0%), 5 (71.4%), 4 (80%), 9 (52.9%) cases while Staph. epidermidis among 23 (100%), 1 (50%), 0 (0. 0%), 11

(64.7%), 11 (45.8%), 13 (44.8%) cases, respectively.

Table 1: *Incidence of culture proven UTI*

	Frequency	Percentage
Positive	122	42.51
Negative	165	57.49
Total	287	100.0

Table 2: *Pathogens in urine samples*

	Frequency	Percentage
E. coli	72	59.0
Staph. Epidermidis	13	10.7
Klebsiella	10	8.2
Proteus	9	7.4
Enterobacter	7	5.7
Pseudomonas	6	4.9
Staph. Aureus	5	4.1
Total	122	100.0

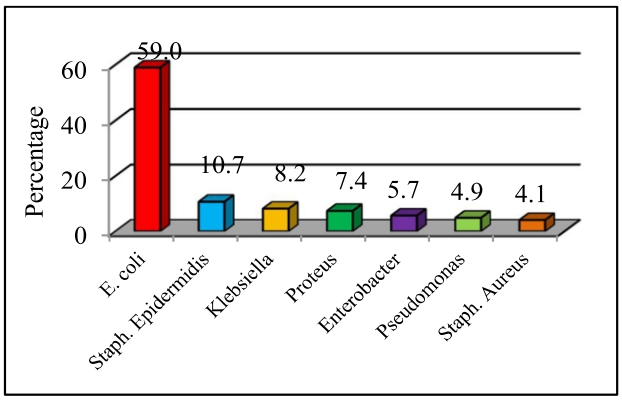

Figure-1: *Pathogens in urine samples*

Table 3: *Information of cases*

	Frequency	Percentage
Gender		
Male	34	27.9
Female	88	72.1
Total	122	100.0
Age (years)		
16-26	28	23.0
27-35	35	28.7
36-45	23	18.9
46-56	17	13.9
57-66	14	11.5
67-76	5	4.0
Total	122	100.0
Risk factors		
Pregnancy	47	38.5
Hypertension	41	33.6
Diabetes	34	27.9
Total	122	100.0

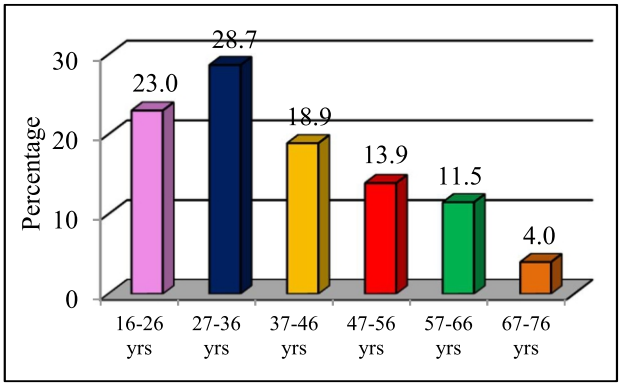

Figure-2: *Frequency distribution of patients according to gender*

Table 4: *Antimicrobial sensitivity urine culture*

Organisms		Penicillins	Cephalosporins	Carbapenems	Aminoglycoside	Fluoroquinolones	Misc.
E.coli	S	8(6.7%)	9(16.3%)	46(92%)	49(47.1%)	23(22.5%)	93(76.2%)
	R	110(93.2%)	46(83.6%)	4(8%)	55(52.8%)	79(77.4%)	29(23.7%)
Enterobacter	*S*	4(30.7%)	2(50%)	8(80%)	3(20%)	5(45.5%)	7(53.8%)
	R	9(69.2%)	2(50%)	2(20%)	12(80%)	6(54.4%)	6(46.1%)
Klebsiella	S	1(6.2%)	6(55.5%)	18(82%)	5(45.5%)	8(53.3%)	5(35.7%)
	R	15(93.7%)	5(45.4%)	7(28%)	6(54.5%)	7(46.6%)	9(64.2%)
Proteus	S	1(5.5%)	3(75%)	4(80%)	5(35.7%)	1(7.1%)	11(50%)
	R	17(94.4%)	1(25%)	1(20%)	9(64.2%)	13(92.8%)	11(50%)
Pseudomonas	*S*	1(9%)	2(66.6%)	3(60%)	6(60%)	4(40%)	10(62.5%)
	R	10(91%)	1(33.3%)	2(40%)	4(40%)	6(60%)	6(37.5%)
Staph. Aureus	S	1(6.6%)	0(0)	1(100%)	2(28.5%)	1(20%)	8(47%)
	R	14(94.3%)	0(0)	0(0)	5(71.4%)	4(80%)	9(52.9%)
Staph. epidermidis	S	0(0)	1(50%)	13(100%)	6(35.2%)	13(54.1%)	16(55.1%)
	R	23(100%)	1(50%)	0(0)	11(64.7%)	11(45.8%)	13(44.8%)

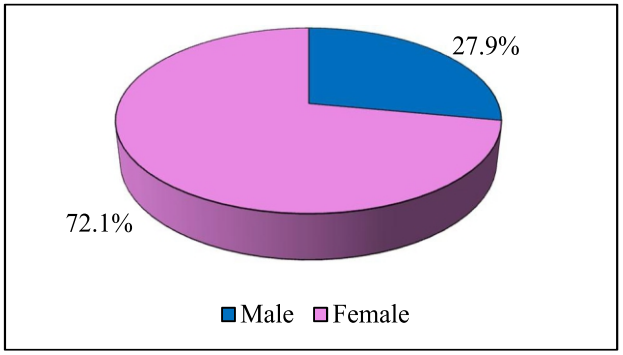

Figure-3: *Frequency distribution of patients according to age*

Discussion

Urinary tract infections are among the most common infections in developing countries like Pakistan. The current study was carried out to know the incidence of culture proven UTI and antimicrobial sensitivity pattern among the adult population in a local area of Lahore. To acquire appropriate outcomes, total 287 patients were included in the study and the incidence of culture proven UTI was evaluated. Study revealed that among the samples, 122 were found positive for different uropathogens.

The findings of our study demonstrated that most of the samples showed E. coli strains (59%), followed by Staph. Epidermidis (10.7%), Klebsiella (8.2%), Proteus (7.4%), Enterobacter (5.7%), Pseudomonas (4.9%) and Staph Aureus (4.1%). The results of a recent study carried out in Pakistan by Idrees and teammates (2022) indicated that most prevalent uropathogens were Escherichia coli (51.2%) followed by Klebsiella (15.4%), Enterococcus (15.4%), Pseudomonas (9.4%), Staphylococcus aureus (3.2%), Coagulase Negative Staphylococci (3.0%) and Proteus (2.5%).[12] Another study performed by Zahideen and fellows (2022) demonstrated that most common bacteria were E.coli (63.7%), followed by, K. pneumonia (11.0%), P. aeruginosa (8.2%), E. faecalis (8.2%), S. aureus (3.9%), P. mirabilis (2.2%), Acinetobacter (1.1%), Enterobacter (1.1%) and S. epidermidis (0.6%).[11] A study done by Pardeshi (2018) highlighted that E.coli was the most common isolate leading to UTI (53.8%) while second most common isolate was K. pneumoniae (27.4%), followed by, P. aeruginosa (8.6%), Proteus (4.8%), Enterobacter (1.7%) and S. aureus (1.5%).[4] The results of a study undertaken by Abedin and comrades (2022) highlighted that among 1288 samples, 398 showed positive growth with numerous pathogens. The most common pathogen was E.coli (82.41%), followed by, Klebsiella, E. faecalis, P. aeruginosa and Proteus.[17] A most recent study undertaken by Firissa and companions (2023) reported that E. coli was found to be major isolate (50 percent), followed by, Enterococcus (12 percent), Enterobacter (12 percent), and Klebsiella (8 percent).[18]

In our study 72.1% patients were females and only 27.9% were males. The findings of our study are comparable with a study conducted by Abedin and comrades (2022) who also confirmed that most of the patients (72.6%) were females and remaining proportion (27.4%) was of male patients.[17] However, the results of another study performed by Zahideen and fellows (2022) indicated that UTI was prevalent among more than half (50.6%) of females and among 49.4% males.[11]

The results of our study confirmed that UTI was more common among young people as mainstream of the patients (70.6%) was upto 45 years old while remaining proportion (29.4%) of patients was above 45 years old. Similar results were also reported by a study carried out by Pardeshi (2018) who stated that majority (50.9%) of the patients were upto 45 years old and 49.1% were above 45 years old.4 But the findings of a study done by Oumer and coworkers (2022) exhibited a different scenario that 41.9% patients were upto 45 years old and 58.1% were above 45 years old.[19]

When the risk factors were assessed among patients, study disclosed that major risk factors among these patients were pregnancy (38.5%), followed by, hypertension (33.6%) and diabetes (27.9%). A study carried out by Mohapatra and associates (2022) highlighted that pregnancy (31.3%) and diabetes mellitus (3.2%) were the risk factors among patients with UTI.[20]

During study it was found that E.coli was more resistant to penicillins (93.2%), followed by cephalosporins (83.0%) and fluoroquinolones (77.4%). But a study carried out by Mubashir and collaborators (2021) indicated that E. coli was more resistant to cefotaxime (74.9%), followed by, ceftazidime (74.6%) and cefoxitine (70.1%).[10] The results of our study indicated that E. coli was sensitive to Carbapenems (92.0%). The findings of a study conducted Naqid and partners (2020) confirmed that E. coli was sensitive to ampicillin (84.8%).[7]

Result of our study showed that Enterobacter was resistant to Aminoglycoside (80.0%) and penicillins (69.2%) while sensitive to Carbapenems (80.0%). However, a study done by Pardeshi (2018) indicated that Enterobacter was sensitive to Gentamicin (60.0%), Cefepime (60.0%) and Meropenem (60.0%).[4]

Study revealed that Klebsiella was more resistant to penicillins (93.7%) followed by miscellaneous group (64.2%) while sensitive to Carbapenems (82.0%). Mubashir and collaborators (2021) reported in their study that Klebsiella was resistant to Cefoxitin (73.1%), followed by, Cefotaxime (64.2%) and Ceftazidime (64.2%).[10] However, in a study carried by Pardeshi (2018) Klebsiella was sensitive to Meropenem (70.6%) and Genta-

micin (68.1%).[4]

Study demonstrated that Proteus gram-negative organism was most resistant to penicillin (94.4%), followed by, fluoroquinolones (92.8%) and aminoglycoside (64.2%) when compared with another study carried out by Mubashir and collaborators (2021), it was found that Proteus was resistant to Augmentin (100.0%) and Nitrofurantoin (80.0%).[10] In our study Proteus was sensitive to Carbapenems (80.0%) and Cephalosporins (75.0%). Pardeshi (2018) confirmed in their study that Proteus was sensitive to Gentamicin (96.4%) followed by, Meropenem (96.4%) and Cefepime (60.7%).[4]

In our study Pseudomonas was found resistant to Penicillins (91.0%) and fluoroquinolones (60.0%). Mubashir and collaborators (2021) demonstrated in their study that Pseudomonas was resistant to Cefoxitin (100.0%), followed by, Nitrofurantoin (100.0%) and Augmentin (60.0%).[10] The findings of our study further highlighted that Pseudomonas was sensitive to Cephalosporins (66.6%), followed by, Carbapenems (60.0%) and Aminoglycoside (60.0%). Pardeshi (2018) reported that Pseudomonas was sensitive to Cefepime (34.0%) and Gentamicin (32.0%).[4]

The result of our study confirmed that Staph. Aureus was most resistant to penicillin (94.3%), followed by fluoroquinolones (80.0%) and aminoglycoside (71.4%). Mubashir and collaborators (2021) indicated in their study that Staph. Aureus was most resistant to Augmentin (100.0%), Cefoxitin (100.0%), Cefotaxime (100.0%) and Ceftazidime (100.0%). The findings of our study revealed that Staph. Aureus was sensitive to Carbapenems (100.0%) while Naqid and partners (2020) elucidated that Staph. aureus was sensitive to Benzylpenicillin (100.0%) and Clindamycin (80.0%).[7]

Study revealed that Staph. Epidermidis was maximally resistant to Penicillin (100.0%) and Aminoglycoside (64.7%) while sensitive to Carbapenems (100.0%). A study carried out by Naqid and partners (2020) asserted that Staph. Epidermidis was sensitive to Erythromycin (100.0%) and Carbapenems (87.5%).[7]

Conclusion

Study concluded that UTIs were more common among females. Frequent use of antimicrobials without culture and sensitivities has led to emerging resistance to multiple antimicrobials to a problematic extent. Hence a urine culture and sensitivity should be advised before the initiation of antimicrobial drugs among patients with UTI.

Conflict of Interest: *None*

Funding Source: *None*

References

1. Bhargava K, Nath G, Bhargava A, Kumari R, Aseri GK, Jain N. Bacterial profile and antibiotic susceptibility pattern of uropathogens causing urinary tract infection in the eastern part of Northern India. Front Microbiol. 2022;13(1): 965053.
2. Begum A, Jabeen A, Lakho R, Zaheen Z, Bala M, Bhutto A. Prevalence of urinary tract infection during pregnancy at tertiary care hospital: a cross-sectional study. Pak J Med Health Sci. 2022; 16(5): 851-3.
3. Arooj I, Asghar A, Javed M, Elahi A, Javaid A. Prevalence and antibiotic susceptibility profiling of MDR pseudomonas aeruginosa from UTI patients of Southern Punjab, Pakistan. RADS J Biol Res Appl Sci. 2022; 13 (1): 1-9.
4. Pardeshi P. Prevalence of urinary tract infections and current scenario of antibiotic susceptibility pattern of bacteria causing UTI. Indian J Microbiol Res. 2018; 5(3): 334-8.
5. Mwang'onde BJ, Mchami JI. The aetiology and prevalence of urinary tract infections in Sub-Saharan Africa: a systematic review. J Health Biol Sci. 2022; 10(1): 1-7.
6. Chooramani G, Jain B, Chauhan PS. Prevalence and antimicrobial sensitivity pattern of bacteria causing urinary tract infection; study of a tertiary care hospital in North India. Clin Epidemiol Glob Health. 2020; 8(3): 890-3.
7. Naqid IA, Hussein NR, Balatay A, Saeed KA, Ahmed HA. Antibiotic susceptibility patterns of uropathogens isolated from female patients with urinary tract infection in Duhok Province, Iraq. Jundishapur J Health Sci. 2020; 12(3): e105146.
8. Majumder MMI, Mahadi AR, Ahmed T, Ahmed M, Uddin MN, Alam MZ. Antibiotic resistance pattern of microorganisms causing urinary tract infection: a 10-year comparative analysis in a tertiary care hospital of Bangladesh. Antimicrob Resist Infect Control. 2022; 11(1): 156.
9. Khan H, Javeed M, Javed A, Farooq N. Prevalence and multidrug resistance pattern of E. coli among UTI patients. J Biores Manag. 2021; 8(4): 104-12.
10. Mubashir F, Sattar M, Essa F, Hafiz S. Spectrum and antibiotic resistance pattern of uropathogens causing urinary tract infection among inpatients and outpatients: an experience of a tertiary care hospital in Karachi, Pakistan. Liaquat National J Prim Care. 2021; 3(1): 8-12.
11. Zahideen ZU, Ullah U, Ullah I, Javed K, Azra S. Distribution of urinary tract infections by sex, age group and type of bacteria in population of Islamabad, Pakistan. Gomal J Med Sci. 2022; 20(2): 62-6.
12. Idrees MM, Rasool MF, Imran I, Khalid A, Saeed A, Ahmad T, et al. A cross-sectional study to evaluate antimicrobial susceptibility of uropathogens from South Punjab, Pakistan. Infect Drug Resist. 2022; 15: 1845-55.

13. Iqbal Z, Sheikh AS, Basheer A, Hafsa HT, Ahmed M, Sabri AN, et al. Antibiotic drug resistance pattern of uropathogens in pediatric patients in Pakistani population. Antibiotics. 2023; 12: 395.

14. 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 New Infect. 2020; 36: 100716

15. Pervaiz S, Ikram S, Errum A, Iqbal S, Cheema SM, Javed N, et al. Frequency of isolation and antibiotic susceptibility of microorganisms causing urinary tract infections in children. P J M H S. 2021; 15(8): 2454-6.

16. Grados MC, Thuissard IJ, Alós JI. Stratification by demographic and clinical data of the antibiotic susceptibility of Escherichia coli from urinary tract infections of the community. Aten Primaria. 2019; 51(8): 494-8.

17. Abedin MZ, Ali KY, Akter KF, Oyes OM, Babul AM, Irfanul IM, Anisur RM, et al. Prevalence and antimicrobial susceptibility pattern of pathogens isolated from different age groups with urinary tract infection in Bangladesh. Res Square. 2022; https://doi.org/10. 21203/ rs.3.rs-1423342/v1

18. Firissa YB, Shelton D, Azazh A, Engida H, Kifle F, Debebe F. Prevalence and antimicrobial sensitivity patterns of uropathogens, in Tikur Anbessa Specialized Hospital Emergency Medicine Department Addis Ababa, Ethiopia. Infect Drug Resist. 2023; https:// doi.org/ 10. 2147/ IDR.S402472

19. Oumer O, Metaferia Y, Gebretsadik D. Bacterial uropathogens, their associated factors, and antimicrobial susceptibility pattern among adult diabetic patients in two health centers at Kombolcha town, Northeastern Ethiopia. SAGE Open Med. 2022;https://doi.org/10. 1177/20503121221139149

20. Mohapatra S, Panigrahy R, Tak V, Shwetha JV, Sneha KC, Chaudhuri S, et al. Prevalence and resistance pattern of uropathogens from community settings of different regions: an experience from India. Access Microbiol. 2022;https://doi.org/10.1099/acmi.0.000321