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Original Article

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A Decade of Antibiotic Resistance in E. Coli in Urinary Tract Infections : A Study from a Tertiary Care Hospital in Bangladesh

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Abstract

Introduction: *This study aimed to discern evolving bacteriology and antibiotic resistance trends of E.coli among uropathogens, contrasting with a previous study.* ***Materials and Methods:*** *This study was conducted at Cumilla Medical College Hospital, Bangladesh, between June 2011 and June 2021, it encompassed three phases: 2011, 2016, and 2021, with participant counts of 551, 658, and 2312, respectively. Notably, females exhibited higher UTI prevalence.* ***Results:*** *Urine samples, 551 (2011), 658 (2016), and 2312 (2021), were cultivated for E. coli resistance assessment. Predominantly, females (18-40 years old, rural, married, sexually active, middle-income) exhibited symptoms like dysuria, fever, urgency, and abdominal pain. In 2021, UTI prevalence was higher in females (32.06%) than males (22.86%). E. coli dominated isolates, constituting 61.6% (2021), 86.0% (2016), and 75.5% (2011). Antibiotic susceptibility tests on 410 E. coli isolates from 2021 unveiled high resistance to cephalosporins (61.75-83.33%), fluoroquinolones (43.36-51.72%), macrolides (89.49%), cotrimoxazole (52.79%), and nitrofurantoin (25.38%). Resistance rates were lower for carbapenems (1.47-3.92%), aminoglycosides (5.91-20.79%), and piperacillin/tazobactam (11.55%). Comparing the three phases highlighted escalating E. coli resistance from 2011 to 2021: imipenem (0 to 4.2%, p=0.007), meropenem (2.0 to 3.4%, p=0.021), amikacin (2.0 to 6.2%, p=0.017), gentamicin (14.0 to 23.7%, p=0.043), and nitrofurantoin (9.0 to 31.2%, p=0.002). Amoxicillin/clavulanic acid resistance decreased (24.0 to 17.4%, p=0.036).* ***Conclusion:*** *In summary, this study illuminated burgeoning E. coli resistance in UTIs, notably against common oral antibiotics. The findings underscore the indispensability of urine culture and susceptibility tests in steering appropriate empirical antibiotic therapies.*

Keywords: *Antibiotic resistance, E.coli, Bangladesh, urinary tract infection, tertiary care.*

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Introduction:

Urinary tract infections (UTIs) stand as one of the most prevalent and recurrent bacterial afflictions within the realm of clinical practice. They account for a substantial one-third fraction of all infections, be they acquired within the community or contracted within the confines of medical institutions[1]. Per the literary echelons, it becomes apparent that the surge of bacterial maladies is on an ascendant trajectory in South Asia, paralleling the global trend[2]. Within the constellation of pathogens capable of inducing UTIs, a myriad of bacterial contenders exists, yet preeminently, it is Escherichia coli (E. Coli) that claims the spotlight[1]. A pivotal stride in the annals of modern medicine was the unearthing of antibiotics; however, the omnipresence and escalated deployment thereof have precipitated a gradual march towards microbial defiance, effectively rendering them less efficacious for patients[3]. Illumination

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emanating from the written word intimates that approximately 15% of all antibiotic prescriptions are earmarked for the rectification of UTIs[4]. Alarming estimates postulate that roughly 20–50% of all antibiotic regimens are administered without precise justification, thereby exacerbating the specter of adverse reactions, augmented treatment expenditures, and elevated drug resistance[5]. Central to the therapeutic schema for bacterial UTIs is the initiation of treatment with a potent antibiotic. Yet, the crux of the matter resides in the selection of the apt antibiotic, particularly in the precincts of primary health care (PHC), where treatment transpires prior to the isolation of the culpable agent and subsequent sensitivity testing. While the inclination is to deploy broad-spectrum antibiotics to combat UTIs, a nuanced consideration reveals that a narrower-spectrum counterpart might suffice for efficacious intervention[6]. Notably, the unwarranted widespread dissemination of antibiotics has unfurled the banner of antibiotic resistance on a global scale, thereby transmuting it into an epochal quandary in recent years[7, 8]. Antibiotic resistance conveys itself as a pivotal and profoundly weighty conundrum in Bangladesh, a region saddled with a substantial burden of infectious diseases. A recent probe across the seas in the United Kingdom has unveiled a wane in the prescription of antibiotics within primary care circles. A contrary tale unfolds within the Bangladeshi milieu, where antibiotic prescriptions continue to hold fort[9]. A disconcerting predilection among numerous medical practitioners in Bangladesh entails prescribing antibiotics based on the symptomatology of UTIs, sans recourse to a diagnosis grounded in urinary culture. Regrettably, the panorama in rural pockets of Bangladesh remains bereft of culture facilities, a lacuna that might usher in a reign of self-medication and unwarranted antibiotic exploitation[10,11]. The canvas of antibiotic resistance is a mutable tableau, swayed by the tides of time and the nuances of geographic locale[12]. Furthermore, the landscape of UTIs is entwined with the factors of age and gender, precipitating the necessity for physicians to apprise themselves of the prevailing strains and their antibiotic resistance profiles within the local ambit. This cognizance serves as the keystone for the judicious and efficacious management of patients[13]. Currently, there is a widespread global occurrence of recurring and chronic urinary tract infections (UTIs), with Escherichia coli (E. coli) being the primary causative agent. E. coli resistance trend is responsible for up to 80% of UTIs, making it the predominant bacterial contributor to this common infectious disease[14]. A previous research 15 provided a detailed analysis of bacteriology and antibiotic resistance patterns among uropathogens over a 10-year period, focusing specifically on patients with positive urine cultures. In this current investigation, we extend our exploration to encompass the entire dataset, including both positive and negative urine cultures. This broader perspective allows for a comprehensive examination of sociodemographic and clinical characteristics, offering insights into the nuanced dynamics surrounding UTIs beyond cases with confirmed growth of microorganisms. Furthermore, our focus in the present study shifts specifically to the resistance trend of Escherichia coli, a predominant uropathogens. While our previous work addressed multiple uropathogens, the current manuscript hones in on E. coli, providing a detailed analysis of its antibiotic resistance patterns[15]. By isolating and analyzing the temporal trends in resistance of this E.coli, we aim to contribute valuable insights for guiding empirical antibiotic use in UTIs. The inclusion of both positive and negative urine cultures in our analysis allows for a more inclusive understanding of UTIs, considering cases where cultures did not yield growth. This approach provides a holistic view of trends and patterns, enhancing our ability to inform clinical practices and public health policies. This endeavor also strives to unravel the tapestry of antibiotics resistance patterns within a tertiary healthcare institution in Bangladesh, poised against the backdrop of an antecedent study conducted within the same precincts in 2011 and 2016[16,17]. The findings of this study bear the potential to furnish enlightenment in the sphere of empirical antibiotic choices for UTI treatment, not merely within the expanse of this tertiary facility but also at the broader national echelon. Our current study builds upon our prior research by broadening the scope of our analysis, emphasizing resistance trend of Escherichia coli, and offering a more comprehensive understanding of the sociodemographic and clinical landscape of UTIs.

Materials & Methods:

It was a cross sectional study conducted in the department of medicine of Cumilla medical college hospital, Bangladesh during the period of June 2011-June 2021. Data were collected in three phases with five years interval in 2011, 2016 and 2021. All the patients aged above 12 years visiting the outpatient and inpatient department of the study center with a suspected diagnosis of UTI (dysuria, frequency, fever and pain in lower abdomen) and undergone urine culture test were included in the study. Patients with active menstruation, PID, tubo-ovarian disease, appendicitis, colitis, epididymitis, orchitis identified clinically or by examinations were excluded from this research. Patients who were on antibiotics told to cease taking them for 48 hours before participating in this study.

Ethical Approval: The ethical permission received from the ethics review committee of Cumilla medical college, Cumilla, Bangladesh. A formal letter of approval was given prior to data collection. Prior to data collection, patients were told about the project and consented, and anonymity was maintained throughout the study by removing their names and other personal identifiers. Confidentiality was strictly maintained during data processing and report writing. Our study was conducted in accordance with the Declaration of Helsinki. This research is fully compliant with the STROCSS 2021 criteria[18].

Urine Sample collection : Clean voided mid-stream urine (MSU) specimens were collected in sterile tubes from UTI suspect patients by the patient's family members with the assistance of a nurse and an investigator and transferred to the laboratory within 2 hours of collection. Contamination was controlled by providing clear instructions on how to collect the sample properly. Catheters were utilized when the patient was unable to deliver a urine sample.

Culture and identification techniques : Using a calibrated inoculating loop with a capacity of 0.001 ml, urine from each patient was inoculated onto cysteine-lactose-electrolyte deficient agar CLED/ (Oxoid, Basingstoke, Hampshire, England) plates. The inoculation plates were aerobically incubated for 24–48 hours at 37 °C. If growth observed, Plates with a colony count of ≥105cfu/ml were considered significant bacteriuria[19]. Then sub-cultured to Mac-Conkey agar (Oxoid, Basingstoke, Hampshire, England) and 5% sheep blood agar (Oxoid, Basingstoke, Hampshire, England)[19]. Gram stain and biochemical tests were used to characterize/identify bacterial isolates; for Gram-positive bacteria, catalase, novobiocin disk, and coagulase tests were performed; for Gram-negative bacteria, triple sugar iron agar test, indole motility test, citrate agar test, lysine decarboxylase agar test, urea agar test, and oxidase tests were performed.

Antimicrobial susceptibility testing (AST): On Muller Hinton agar, an antimicrobial susceptibility test was performed using the Kirby-Bauer disc diffusion technique according to Clinical Laboratory Standards Institute (CLSI) standards[20]. A suspension of 3–5 colonies of freshly grown test organism was introduced, corresponding to 0.5 McFarland standards. By spinning the swab with the suspension, the surface of the Muller-Hinton agar was thoroughly covered. After allowing the plates to dry for 3–5 minutes, the discs were equally spread on the inoculation plate with sterile forceps and incubated at 37 °C for 18–24 hours. A ruler was used to measure the diameter of the zone of inhibition surrounding the disc. Based on the CLSI 2018 guidelines, the results were classified[20]. The following routinely used antimicrobials were tested: ampicillin [10 µg], gentamycin [10 µg], amox-clav [20/10 µg], cefoxitin [30 µg], cefotaxime [30 µg], ciprofloxacin [5 µg]; meropenem [10 µg], cotrimoxazole [trimethoprim, 1.25/sulfamethoxazole, 23.75 µg], ceftazidime [30 µg], chloramphenicol [30 µg], tetracycline [30 µg], nitrofurantoin [300 µg], and erythromycin [15 µg][20].

Statistical analysis: Data entry and analysis were done by using SPSS version 25.0. Descriptive statistics were used to summarize socio-demographic data, bacterial profile and susceptibility patterns of isolates. The results are summarized and presented by age groups, sex with other demographic variables and isolation types. The prevalence rate of the isolates, frequency, susceptibility and resistance patterns and other descriptive statistics were computed. Chi-square test was used to compare antibiotic resistance pattern in three phases. P-value <0.05 was considered as statistically significant. Graphical analyses were conducted in R version 4.2.2 using "ggplot2" package.

Results:

A total of 3521 patients (2312 patients in 2021, 658 patients in 2016 and 551 patients in 2011) were screened and undergone urine culture test. Among their urine sample, a total of 995 (28.3%) yielded growth of microorganisms. Table I describes the demographic and clinical characteristics of the study participants across the 3 time periods. The majority of UTI patients were females in the age group 18-40 years. Most resided in rural areas, had middle incomes, were married and sexually active. The most frequently reported UTI symptoms were dysuria (69.8-77.9%), urgency (68.5-78%), fever (66.4-77.9%), and abdominal pain (68.8-76.9%). About 40-48% had already taken antibiotics prior to urine culture.

Table I: Sociodemographic and clinical characteristics of the patients

Characteristics	2021		2016		2011	
	n	%	n	%	n	%
Age						
<18	377	16.04	65	14.13	83	15.06
18-40	995	42.34	204	44.35	236	42.83
41-60	633	26.94	106	23.04	130	23.59
>60	345	14.68	85	18.48	102	18.51
Sex						
Female	1497	64.75	326	70.87	330	59.89
Male	815	35.25	134	29.13	221	40.11
Residence						
Urban	746	31.74	136	29.57	170	30.85
Rural	1604	68.26	334	72.61	381	69.15
Education						
Educated	1658	70.55	303	65.87	331	60.07
Not educated	692	29.45	157	34.13	220	39.93
Marital status						
Married	1745	74.26	338	73.48	392	71.14
Unmarried	605	25.74	122	26.52	159	28.86
Sexual activity						
Active	1645	70.00	285	61.96	345	62.61
Not active	705	30.00	175	38.04	206	37.39
Economic status						
Lower class	493	20.98	49	10.65	78	14.16
Middle class	1576	67.06	393	85.43	422	76.59
Higher class	281	11.96	18	3.91	51	9.26
Co-morbid condition						
DM	247	10.51	55	11.96	61	11.07
HTN	124	5.28	15	3.26	34	6.17
IHD	65	2.77	8	1.74	18	3.27
Others	98	4.17	34	7.39	27	4.90
Clinical feature						
Dysuria	1696	72.17	321	69.78	429	77.86
Urgency	1610	68.51	359	78.04	397	72.05
Fever	1832	77.96	336	73.04	366	66.42
Abdominal pain	1642	69.87	354	76.96	379	68.78
Treated with antibiotics						
Yes	923	39.28	221	48.04	226	41.02
No	1427	60.72	239	51.96	325	58.98
Growth in culture						
Positive	666	28.79	198	30.09	131	23.77
Negative	1647	71.21	460	69.01	420	76.22

Table II shows the gender-wise distribution of positive urine cultures. In 2021, 22.9% of males and 32.1% of females had positive cultures, indicating a higher prevalence of UTIs in females. Overall culture positivity rates were 28.79% in 2021, 31% in 2016, and 23.77% in 2011.

Table II: Gender distribution for rate of isolation in urine culture during different point of time

Sex	Growth of uropathogens, n (%)		
	2021	2016	2011
Male	186 (22.82)	75 (38)	35 (26.7)
Female	480 (32.06)	123 (62)	96 (73.3)
Total	666 (28.79)	198 (31)	131 (23.77)

Table III gives the frequency of E. coli among the positive urine cultures. E. coli was the predominant uropathogen in all 3 time periods, being isolated from 61.6% cultures in 2021,86% in 2016, and 75.5% in 2011.

Table III: Distribution of E.coli microorganism among patients with urinary tract infection.

Organism	2021	2016	2011
Escherichia coli	410 (61.6)	171 (86.0)	98 (75.5)

Table IV elaborates the antibiotic resistance profile of the 410 E. coli isolates from 2021. Very high resistance rates (>80%) were seen for cephalosporins like cefradine (83.3%) and cefixime (77.9%), fluoroquinolones like nalidixic acid (83.4%), and macrolides like azithromycin (89.5%). Moderate resistance (50-80%) was observed for ceftazidime, cefuroxime, ceftriaxone, cefepime, ciprofloxacin, cotrimoxazole and doxycycline. Low resistance rates (<10%) were found for carbapenems, amikacin, amoxicillin/clavulanate, vancomycin, linezolid and tigecycline. Figure 1 graphically depicts the resistance patterns.

Table IV: Antibiotic resistance pattern of E.coli isolated from the urine specimen of the patients (combined of all years

Antibiotic	E.coli
	R (%)
Carbapenem	
Imipenem	3.92
Meropenem	1.47
Cephalosporin	
Cephradine	83.33
Cefotaxime	61.75
Ceftazidime	50.00
Cefuroxime	65.77
Ceftriaxone	58.62
Cefixime	77.94
Cefepime	50.51
Quinolone	
Ciprofloxacin	51.72
Levofloxacin	43.36
Nalidexic Acid	83.38
Aminoglycoside	
Amikacin	5.91
Gentamycin	20.79
Penicillin	
Amoxiclav	35.38
Amoxycillin	NA
Ampicilin	62.50
Macrolides	
Azithromycin	89.49
Erythromycin	NA
Clindamycin	NA
Others	
Nitrofurantion	25.38
Cotrimoxazole	52.79
Piperacillin/ Tazobactum	11.55
Vancomycin	2.82
FusidicAcid	NA
Doxycycline	46.00
Linezolid	1.35
Tigecycline	0.00

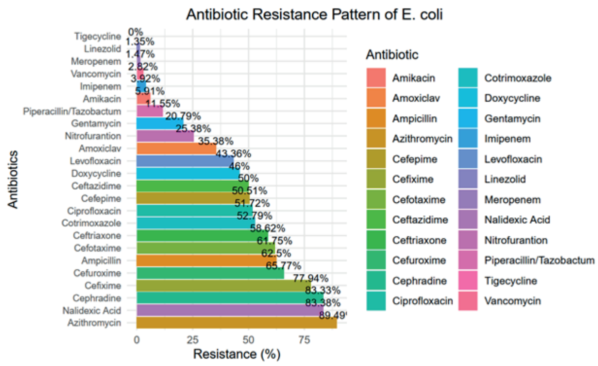

Figure 1: Antibiotic resistance pattern of E.coli isolated from the urine specimen

Comparisons between the three time periods found significant increases in E. coli resistance from 2011 to 2021 for imipenem (0 to 4.2%, p=0.007), meropenem (2.0 to 3.4%, p=0.021), amikacin (2.0 to 6.2%, p=0.017), gentamicin (14.0 to 23.7%, p=0.043), and nitrofurantoin (9.0 to 31.2%, p=0.002). A significant decrease was seen for amoxicillin/clavulanic acid (24.0 to 17.4%, p=0.036) (Table 5). Table 5 statistically compares the E. coli resistance rates between 2011, 2016 and 2021 for key antibiotic classes. Significant increases were seen over the 10 years for imipenem, meropenem, amikacin, gentamicin and nitrofurantoin. Amoxicillin/clavulanate resistance significantly declined. No significant changes were noted for cephalosporins, fluoroquinolones and cotrimoxazole.

Table V: Comparison of antibiotic resistance pattern of UTI causing organism during different point of time

Name of antibiotics				p-value
	2021	2016	2011	
Carbapenem				
Imipenem	4.2	0.5	0.0	0.007
Meropenem	3.4	0.0	2.0	0.021
Cephalosporin				
Cephradine	81.6	65.0	63.0	0.782
Cefotaxime	61.6	58.0	61.0	0.241
Cefuroxime	64.3	55.0	63.0	0.638
Ceftriaxone	58.8	55.0	60.0	0.078
Cefixime	78.9	60.0	70.0	0.254
Quinolone				
Nalidexic acid	86.5	55.0	75.0	0.440
Ciprofloxacin	52.8	48.0	66.0	0.084
Aminoglycosides				
Amikacin	6.2	1.0	2.0	0.017
Gentamycin	23.7	10.0	14.0	0.043
Penicillin				
Amoxyclav	77.4	76.0	24.0	0.036
Amoxycillin	NA	86.0	87.0	0.990
Others				
Nitrofurantoin	31.2	12.0	9.0	0.002
Cotrimoxazole	58.7	47.0	62.0	0.089

In summary, very high and increasing E. coli antibiotic resistance was observed, especially for commonly used oral drugs like cephalosporins, fluoroquinolones, and cotrimoxazole. This indicates the need for culture-guided UTI treatment. Carbapenems and aminoglycosides retained low resistance likely due to restricted use, making them suitable for empirical therapy.

Discussion:

Owing to the widespread pervasiveness of infections in both communal and medical environments, urinary tract infections (UTIs) have imposed a substantial fiscal burden upon the healthcare system[21]. The efficacious treatment of individuals afflicted with bacterial UTIs frequently hinges upon the accurate identification of pathogens and the judicious selection of antibiotics. This selection is guided by the constant vigilance over the susceptibility patterns of urinary tract pathogens within distinct geographical areas[22]. The findings from the present investigation have illuminated the landscape of antimicrobial resistance within Bangladesh, a nation characterized by limited data on antimicrobial resistance surveillance. Our current investigation, building upon our earlier work[15], brings forth several noteworthy contributions to the understanding of urinary tract infections (UTIs). The decision to include the entire dataset, incorporating both positive and negative urine cultures, allows for a more comprehensive exploration of the sociodemographic and clinical characteristics related to UTIs. This approach provides a nuanced view of the landscape, capturing aspects beyond confirmed growth of microorganisms. Within the purview of this inquiry, it was observed that within the annals of the year 2021, a total of 666 urine specimens (constituting 28.79%) manifested considerable microbial proliferation, while 1647 samples exhibited an absence of bacterial growth (comprising 71.21%). This prevalence rate is strikingly akin to the metrics of the year 2016, which were documented at 31%[16]. Nevertheless, it surges above the figures reported for 2011, which stood at 23.77%, with a discernibly upward trajectory in the trend[17]. Furthermore, these observations harmonize with multiple reports hailing from Bangladesh, India, and Pakistan[22,23]. Upon an analysis spanning a decade, the distribution of uropathogens favored female patients over their male counterparts (Table: II), an outcome attributed to an array of predisposing factors contributing to the higher incidence of UTIs among women[25]. The well-recognized gender disparity in UTI prevalence, with its greater occurrence in females, finds endorsement within our data, corroborating the findings of a prior study conducted by Deshpande et al.[26]. Moreover, the prevalence trends concerning uropathogens align seamlessly with an assemblage of antecedent reports[27]. The observed trend in Escherichia coli (E. coli) resistance is a noteworthy aspect in the context of this study[14]. Analyzing the patterns and dynamics of E. coli resistance trend over time provides valuable insights into the evolving nature of antimicrobial resistance, influencing the efficacy of treatment strategies and public health interventions. As the calendar of 2021 unfolded, the age bracket most susceptible to UTIs emerged as the 18-40 years cohort, constituting 42.34% of cases, followed by individuals aged 41-60 years (26.94%), those below 18 years (16.4%), and lastly, those aged above 60 years (14.68%). It is noteworthy that the elderly demographic displayed a heightened vulnerability to UTIs, a phenomenon possibly influenced by genitourinary atrophy and postmenopausal vaginal prolapse, both of which conspire to alter vaginal pH and diminish the normative vaginal flora. This perturbation creates a conducive milieu for the proliferation of Gram-negative bacteria, heralding them as uropathogens[28]. Within the contours of our investigation, an intricate tapestry of antibiotic resistance among E. coli isolates garnered from UTI cases in Bangladesh was meticulously woven, all the while considering the patients' ages and genders. Among the pantheon of antibiotic therapies, meropenem and imipenem stood forth as beacons of high susceptibility percentages among the isolates. Nonetheless, given their intravenous administration route, a stringent oversight becomes imperative. Additionally, their elevated cost renders them infrequent contenders for routine UTI management. Echoing harmonious sentiments, antecedent research has also unveiled parallel findings regarding meropenem and imipenem[29-32]. In the realm of bacterial resistance, E. coli conspicuously exhibited multifaceted resistance, with upwards of 70% of the isolates displaying resistance to over five classes of antibiotics. This congruence aligns neatly with a study conducted in a tertiary hospital situated in Pakistan 28.The historical dominance of cotrimoxazole as a frontline therapeutic choice has waned, as contemporary realities betray its susceptibility limitations in the context of UTI patients[33]. Nalidixic acid and ciprofloxacin rose to prominence, though within our study, resistance to these agents, alongside third-generation antibiotics like cefixime and ceftriaxone, emerged prominently. Cotrimoxazole's resistance rate in our sample mirrors figures from Senegal, Spain, and Taiwan, yet it remains significantly lower than that observed in India a decade prior[33,34]. Previous scrutiny had unearthed high E. coli resistance rates against nitrofurantoin[36], a precedent that finds resonance within our study, wherein nitrofurantoin resistance surpassed even the elevated figures from a parallel 2015 study conducted in Sudan. On a heartening note, our findings celebrate the susceptibility of E. coli from UTIs to amikacin, meropenem, and imipenem. While Akram et al. had documented markedly higher bacterial resistance to amikacin in 2007 (51%), a more sanguine scenario materialized regarding imipenem resistance in India[37]. Furthermore, our focused analysis on Escherichia coli in the present study offers a deeper insight into the temporal trends of antibiotic resistance specific to this key uropathogen. By isolating and examining the resistance patterns of E. coli, we aim to guide empirical antibiotic use more effectively, addressing the evolving challenges posed by antimicrobial resistance in the context of UTIs. The present investigation boasts several salient strengths. Notably, our study offers a pioneering elucidation of the antibiotic susceptibility and resistance profiles of E. coli isolates stemming from UTI cases, with meticulous considerations of age and gender disparities. Such findings are of pronounced significance to the medical fraternity, constituting a cornerstone for judicious antibiotic prescription, thereby forestalling the emergence of novel antibiotic-resistant strains fostered by improper usage. In summation, the prevalence of E. coli-induced UTIs has exhibited an unequivocal uptrend within the year 2021. This study substantiates an escalating trajectory of resistance across all antibiotic categories under examination. Noteworthy surges in sensitivity patterns emerged for imipenem, meropenem, tazobactam, amikacin, and nitrofurantoin. A comparative analysis spanning 2021, 2016, and 2011 unfurled a conspicuous amplification in resistance to diverse antibiotic classes among the study participants, particularly within the carbapenem and aminoglycoside clusters. The resistance to both imipenem and meropenem, nearly negligible in earlier years, soared to approximately 4% in 2021. A corollary surge was also detected in the instances of amikacin, gentamycin, amoxiclav, and nitrofurantoin. In summary, the current study not only broadens the scope of our analysis but also sharpens the focus on E. coli, contributing valuable insights that extend beyond our previous work. These findings enhance our understanding of UTIs and provide a basis for informed decision-making in clinical practices and public health strategies.

Conclusion:

The discernible resistance exhibited against antibiotics entrenched in routine practice conveys a sobering reality. This underscores the salience of antibiotic resistance within the context of Bangladesh. The quagmire of antibiotic resistance can be attributed to manifold factors: inadequacies in treatment regimens, patient non-adherence, the unregulated flow of drugs in the market, and the specter of antibiotic scarcity coupled with compromised quality. It behooves us, therefore, to curtail the incidence of urinary tract infections and to perpetually monitor the susceptibility of key microorganisms to commonly administered antibacterial agents. These findings are not merely insightful but also wield the potential to steer local policies, objectives, and practices. The need of the hour is for large healthcare establishments to proactively monitor and analyze the emergent patterns and trends of antimicrobial resistance, culminating in the formulation, prioritization, and enforcement of health facility-centric antimicrobial stewardship guidelines and policies.Ultimately, the exigency for an exhaustive inquiry and comprehensive research dedicated to unraveling the labyrinthine tapestry of antibiotic resistance resonates strongly, as it holds the promise of comprehending this national crisis and conceiving pragmatic solutions for its management.

Conflict of Interest: None.

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