Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 4 (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Bacteriological Profile and Antibiotic Susceptibility in UTI Patient Visiting Antenatal Clinic at A Tertiary Care Hospital

Ms. Sayashree Patgiri[*1], Dr. Mohammad Suhaib[2], Dr. Supriya Mahajan[3], Dr. Dalip K Kakru[4]

[*1]Pg student, Department of Microbiology, School of Medical Sciences and Research Sharda University, Greater Noida, Idia.

[*2]Associate Professor, Department of Microbiology, School of Medical Sciences and Research Sharda University, Greater Noida, India.

[3]Assistant Professor, Department of Microbiology, School of Medical Sciences and Research Sharda University, Greater Noida, India.

[4]Professor and Head, Department of Microbiology, School of Medical Sciences and Research Sharda University, Greater Noida, India.

***Corresponding Author:**

Ms. Sayashree patgiri

Email ID: Patgiri.saya@gmail.com

Cite this paper as: Ms. Sayashree Patgiri, Dr. Mohammad Suhaib, Dr. Supriya Mahajan, Dr. Dalip K Kakru, (2025) Bacteriological Profile and Antibiotic Susceptibility in UTI Patient Visiting Antenatal Clinic at A Tertiary Care Hospital. *Journal of Neonatal Surgery*, 14 (4), 570.-576

ABSTRACT

Introduction: Urinary tract infections (UTIs) are among the most common infections in humans. Approximately, 150 million UTIs occur every year worldwide, resulting in more than 6 billion US dollars in direct healthcare costs. The emergence of antibiotic-resistant bacterial strains is a serious problem and greatest challenge in public health care.

Aim and Objective: To determine the bacteriological profile along with the antibiotic susceptibility of the isolates in UTI patients visiting antenatal clinic at tertiary care hospital.

Material and Methods: This wasa Observational Cross sectional study carried out in the Departmentof Microbiology at Central Laboratory, Sharda Hospital.The study was conducted on all the urine samples received in bacteriology laboratory of Sharda Hospital. A total of 264 urine sample (including IPD and OPD) were included.The samples were processed according to the biochemicals and theantimicrobial sensitivity testing was performed according to the CLSI guidelines 2024.

Results: In the present study 264 urine samples with significant bacterial colony count i.e. 10^5 CFU/ml, 172(65.15%) showed growth of Gram-negative bacilli whereas 92(34.84%) were Gram-positive cocci.The age-wise distribution of the bacterial isolates among different pregnancy age groups shows that the maximum number of isolates were received from age group 21-30 with GNB (63.3%) and GPC (36.7%).

Conclusion: There is a critical need for enhanced public health initiatives focusing on sanitation,hydration, and hygiene, alongside holistic clinical management strategies that address both the infectionand its broader health impacts. Future research should aim at developing innovative prevention andtreatment strategies, with a particular focus on high-risk groups such as pregnant women, to mitigate theburden of UTIs in India.

Keywords: *Bacteriological Profile, Antibiotic Susceptibility, UTI, CLSI, IPD, OPD*

1. INTRODUCTION

Urinary tract infection (UTI) is one of the most common infections in clinical practice worldwide inboth healthcare and community settings causing significant morbidity and mortality[1]. Urinary tract infections (UTIs) are common infections that are caused by bacteria,often through invasion from the perineum or rectum, when they enter the urethra and infect the urinary tract. The infectionscan affect urethra (urethritis), bladder(cystitis), ureter(urethritis), kidney(pyelonephritis),butthe most common type is cystitis [2,3].

Urinary tract infection (UTI) is caused due to bacteria from the gastro-intestinal tract which spread towards the urethra and multiply to cause UTI. Bacteria invade the urinary tract mainly by two routes ascending and descendingroutes causing lower and upper UTIs respectively.Organisms causing UTI are primarily spread from the vaginal, perineal, fecal flora and gastro-intestinal tract. Gram negative bacteria cause urinary tract infection more frequently than gram positive organisms including *Escherichia coli*being most common uropathogen, subsequently followed by *Staphylococcus saprophyticus, Klebsiella species, Pseudomonas aeruginosa,Proteus mirabilis, Enterobacter species, Enterococci, Gardnerella vaginalis, Ureaplasma urelyticum, Staphylococcus aureus*[4].UTIis considered as one of the most common medical complications during pregnancy. Risk of UTI is 2–10 times higher in pregnant than in the non-pregnant females.Duringpregnancythere are manyanatomicalandhormonalchanges in women which make them susceptible to develop UTI [5,6].

About 10%-25% of those with asymptomatic bacteriuria develop symptomatic bacteriuria during pregnancy. Complications associated with asymptomatic bacteriuria in pregnancy are preterm labor, low birth weight infants, intrauterine growth retardation, fetal death, pregnancy induced hypertension (PIH) etc. [7]. Majority of pregnant womenwith UTI report in the third trimester of pregnancy in form of External Consultation, rather than being admitted as inpatients.It necessitates screening of all pregnant mothers for urinary tract infection during the first antenatal visit. Bacteriuria may remain alive after delivery and may result into chronic infections. Around 20% ofthe pregnant women are reported to have UTI and it is the most common cause for IPD admission in obstetric wards. Physiological changes during pregnancy such asureteral dilatation and incomplete emptying of the bladder may contribute to thedevelopment and spread of UTIs. Apart from the physiological state, there areadditionalriskfactorsforUTIinpregnancy,suchasapasthistoryofUTI,advanced maternalage,loweducationallevel,lowsocioeconomicstatus,smoking,unsatisfactorypersonalhygiene,anemia,multiparity,aswellasdiabetesandsickle celldisease [8,9].

Urine culture continues to be the gold standard for diagnosis of UTI. The treatment of UTI in pregnancy must ensure safety of the mother, the fetus and prevent the development of anti-microbial resistance in uropathogens.

Emergence of resistance has significantly deterioted the outcome of chemotherapeutic management. Increased empirical use of the first-line antibiotics in the treatment of UTIs caused by *E. coli*, such as imipenem, nitrofurantoin, amikacin,chloramphenicol and ciprofloxacin, has resulted in the occurrence of an increasing problem of antimicrobial resistance.Bacterial strains demonstrating resistance to three or more antibiotics were classified as multidrug-resistant (MDR) [10].

The microbial profile of UTI has never been constant and has been everchanging with variations in the geographical location, so the identification of the etiological agent is important for the condition and antibiotic therapy. To ensure appropriate therapy, current knowledge of the organism that causes the UTIs and their anti-biogram pattern is very much needed [11]. Therefore, the present study was undertaken to determine the bacteriological profile along with the antibiotic susceptibility of the isolates in UTI patients visiting antenatal clinic at tertiary care hospital.

2. MATERIAL AND METHODS

Study Design & Setting: A cross-sectional observational study was carried out in the Department of Microbiology at Sharda Hospital, a tertiary care center in Greater Noida, from October 2023 to October 2024.

Inclusion Criteria: Pregnant women aged 18–45 years with suspected UTI symptoms or undergoing routine antenatal screening.

Exclusion Criteria: Women with known pelvic inflammatory disease or non-bacterial urinary conditions.

Identification & AST: Isolates were identified via Gram staining and standard biochemical tests. Antibiotic susceptibility testing was done by the Kirby-Bauer disk diffusion method per CLSI 2024 guidelines[12].

3. RESULT

A total number of 2469 urine samples were received between October 2023 to October 2024 at Bacteriology lab, Department of Microbiology, Central Laboratory, School of Medical Sciences and Research (SMSR), Sharda Hospital, Greater Noida, out of which 264 samples having significant bacteriuria were included in the study. All the samples were processed for urine culture & sensitivity test as per CLSI guidelines to know the significance of the uropathogens. All the observations were statistically analyzed and tabulated into bar graphs and histograms.

In the present study 264 urine samples with significant bacterial colony count i.e. 10^5 CFU/ml, 172(65.15%) showed growth of Gram-negative bacilli whereas 92(34.84%) were Gram-positive cocci.The majority of patients had Symptomatic bacteriuria which was 229 (86.74%) while 35 (13.26%) had asymptomatic bacteriuria.

Table 1. Distribution of isolates based on Gram stainsymptomatic and asymptomatic bacteriuria.

Organisms	No. of isolates	Percentage (%)
GNB	172	65.15
GPC	92	34.84
Symptomatic	229	86.74
Asymptomatic	35	13.26

Demographic Profile

The age-wise distribution of the bacterial isolates among different pregnancy age groups shows that the maximum number of isolates were received from age group 21-30 with GNB (63.3%) and GPC (36.7%). It was subsequently followed by 31-40yrs age group where GNB (62.01%) and GPC (37.69%) distributed and <20 where GNB n=19 and GPC n=1.

The trimester-wise distribution of the bacterial isolates among different trimester shows that the maximum number of samples received as well as isolates were from third trimester 138(52.27%), followed by second trimester 106(40.15%) and first trimester 20(7.57%).

Table 2. Trimester-wise distribution of the total no. of isolates

Trimester	Total no of sample received (%)	No. of isolates (%)
1st	538(21.79%)	20 (7.57%)
2nd	697(28.23%)	106(40.15%)
3rd	1234(49.97%)	138(52.27%)

Overall, among the 264 bacterial isolates, *E. coli* 126(47.72%) was the most frequently isolated organism followed by *Enterococcus spp.* 67(25.37%), *Pseudomonas spp.* 19(7.19%), *Klebsiella spp.* 18(6.81%), *Staphylococcus aureus* 24(9.09%), *Acinetobacter spp.* 4(1.51%) and *Proteus spp.* 4(1.51%) respectively. whereas, *Citrobacter spp.* 2(0.75%) was the least isolated organism.

Antimicrobial susceptibility patterns

The antibiotic susceptibility profile of all the bacterial isolates (n= 264) was determined by the CLSI disk diffusion method (2024).

TABLE 3: Antimicrobial susceptibility pattern of Enterobacterales

Antimicrobial agent	E. *coli (n=126)*	*Klebsiellaspp.(n=18)*	*Citrobacter spp. (n=2)*	*Proteus spp. (n=4)*
Ampicillin (Amp)	11.1%	-	-	-
Gentamicin (Gen)	65.1%	50%	100%	75%
Tobramycin (Tob)	57.1%	38.9%	100%	75%
Piperacillin/ Tazobactam (PIT)	37.3%	11.2%	50%	100%

Cefotaxime (CTX)	20.6%	22.2%	50%	50%
Cefepime (CPM)	38%	22.2%	50%	50%
Imipenem (IPM)	69%	50%	50%	100%
Meropenem (MRP)	68.3%	55.6%	50%	100%
Amikacin (AK)	46%	72.2%	100%	50%
Ciprofloxacin (CIP)	23.8%	22.2%	50%	50%
Levofloxacin (LE)	26.2%	33.3%	100%	50%
Nitrofurantoin (NIT)	92.1%	83.3%	100%	50%
Cotrimoxazole (COT)	24.6%	34%	50%	25%
Fosfomycin (FO)	51.6%	75%	50%	75%

TABLE 4:Antimicrobial susceptibility pattern of gram-positive cocci

Antimicrobial agents	Enterococcus spp. (n=67)	Staphylococcus aureus (Methicillin resistant) n=6	Staphylococcus aureus (Methicillin sensitive) n=18
Penicillin (P)	19.4%	50%	33.3%
Ampicillin (AMP)	35.8%	-	-
High level Gentamicin (HLG)	31.3%	83.3%	55.5%
Ciprofloxacin (CIP)	6%	33.3%	50%
Levofloxacin (LE)	6%	33.3%	55%
Vancomycin (VA)	91%		
Linezolid (LZ)	91%	100%	94.4%
Nitrofurantoin (NIT)	86.6%	100%	100%
Cotrimoxazole (COT)	-	16.1%	72.2%
Fosfomycin (FO)	23.9%	50%	77.8%

4. DISCUSSION

Bacteriuria, either symptomatic or asymptomatic, is common in pregnancy. UTIs are challenging, not only because of the large number of infections that occur each year but also because their diagnosis is not always straightforward. UTI must be differentiated from other diagnosis like Pelvic inflammatory diseases in females [13, 14]. In this study, out of 2469 antenatal women who were enrolled, 264 women i.e., 10.7% were UTI positive while 2205 women i.e., 89.3% did not showed any growth in urine samples. A total number of 264 sampleswith significant growth where patients having symptomatic bacteriuria and asymptomatic bacteriuria were86.74% and 13.26% respectively. Similar results were also reported byRajshekhar D. Kereru et. al.where 65% had symptomatic UTI while 35% had asymptomatic UTI [15,16].In this study, there was a higher prevalence of UTI in pregnant women in third trimester (52.27%), followed by women in second and first trimesters (40.15%, 7.57% respectively). This finding is similar to the results obtained by the study conducted by Ranjan et. Al [17]. The increased incidence during third trimester may relate to increased mechanical obstruction due to gravid uterus. In our study, *E.coli* (47.72%) was predominantly isolated organisms in pregnant women with UTI followed by *Enterococcusspp.* (20.38%), *Pseudomonas spp.* (7.20%) and *Klebsiella spp.* (6.81%), *Staphylococcus aureus* (9.09%), *Proteus spp.* (1.51%), *Acinetobacter spp.* (1.51%). Similar study was performed by another research investigor in 2024 where 367 isolates, *K. pneumoniae* was the most frequently isolated organism ($n = 152$; 41.4%), followed by *E. coli* ($n = 40$; 10.9%) and *E. cloacae* ($n = 35$; 9.5%)[18]. Additionally, the present study also focuses on understanding the trends in the susceptibility pattern of the uropathogens. Among the isolates of *E. coli* n=126, the most sensitive drug turned out to be

nitrofurantoin 92.10% followed by meropenem 68.3% while the most resistant drug was ampicillin 88.9%. Antibiotic resistance in *E. coli*, which causes UTIs, is on the rise all over the world[19]. When comparing the current study with the study carried out by Shaki et al in Southern Israel, ampicillin and cotrimoxazole had the highest rate of *E. coli* resistance. Similarly, in numerous other studies throughout the world, such as Guzman's (96.1%), Alanazi's (82.76%), and others, the proportion of *E. coli* resistant to ampicillin was high [20,21]. In our study, isolates of *E. coli* showed higher resistance to fluoroquinolones and cephalosporins in coherence with a study by Prasad, et al. which also showed increasing resistance to cephalosporins [22]. Among Gram-positive cocci *Enterococcus spp.*n=67, were found to be the most frequently identified Gram-positive bacteria, closely followed by *Staphylococcusaureus n=24.* This was consistent with the findings of the 2020 study by Shuvankar Mukherjee [23]. However, it differed from the 2018 study by Anusuya Devi D et al., which reported that *Staphylococcus* spp. was the most common, followed by *Enterococcus spp*.In terms of antibiotic susceptibility, we observed that linezolid demonstrated 91% sensitivity, while vancomycin also showed 91% sensitivity against Enterococcus species.For Staphylococcus species, both vancomycin and linezolid exhibited a 100% sensitivity, which was consistent with a study conducted by Anusuya Devi D et al. (2018), reporting a 100% sensitivity to linezolid and vancomycin for both *Enterococcus spp*. and *Staphylococcus spp.*[24].Antimicrobial sensitivity and resistance patterns vary from community to community and from hospital to hospital due to the development of resistant strains caused by mis-usage of antibiotics.This study also showed that there was significant resistant to cephalosporins but cephalosporins are relatively safer in pregnancy than the administration of fluroquinolone.The need for a better knowledge of the microorganisms that cause UTIs and their pattern of antibiotic susceptibility should be highlighted by drug-resistant bacterial strains and the increased frequency of UTIs [25,26].

Urinary tract infections (UTIs) remain one of the most prevalent bacterial infections globally, with an estimated annual incidence exceeding 150 million cases, imposing substantial healthcare and economic burdens [27]. In pregnant women, the risk of developing UTIs is significantly elevated—reported to be 2–10 times higher compared to non-pregnant women—owing to physiological and hormonal changes that promote urinary stasis and ascending bacterial colonization [28,29]. Common etiological agents include *Escherichia coli,* Klebsiella spp., Enterococcus spp., *Pseudomonas aeruginosa*, and *Staphylococcus saprophyticus,* with *E. coli* consistently identified as the leading uropathogen worldwide [30,31].

Recent surveillance data from multiple regions, including South Asia, highlight alarmingly high resistance rates to first-line antimicrobials such as ampicillin, cotrimoxazole, and fluoroquinolones among *E. coli* and *Klebsiella pneumoniae* isolates . A 2024 multicentric study in India found nitrofurantoin and fosfomycin to retain good efficacy against common uropathogens in pregnancy, aligning with global stewardship recommendations [32]. Furthermore, evolving classifications of UTIs in 2025 have underscored the need to move beyond the simplistic "complicated" vs. "uncomplicated" categorization to incorporate host factors, microbiological data, and resistance patterns for more precise clinical management [33].

Given these epidemiological trends and therapeutic challenges, continuous local surveillance of the bacteriological profile and antibiotic susceptibility patterns in antenatal populations is essential for guiding empirical treatment.

5. CONCLUSION

Urinary tract infections (UTI) are one of the most common infectious diseases diagnosed in outpatients as well as in hospitalized patients they can lead to significant morbidity and sometimes even mortality. Several conventional and rapid methods have been developed for the diagnosis of urinary tract infections such as microscopic examination; culture sensitivity and automated systems could assist as a reliable tool in the initial diagnosis of UTIs especially in low-resource settings.

The high resistance rates to commonly used antibiotics underscore the growing threat of antimicrobial resistance, which can complicate management during pregnancy. Based on these results, strengthening routine urine culture screening during antenatal visits and promoting rational antibiotic use are crucial steps toward improving maternal and fetal health outcomes along with confronting emergence of resistance.

6. DECLARATIONS

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work.

REFERENCES

[1] Bahadi A, El Kabbaj D, Elfazazi H, et al. Urinary tract infection in pregnancy;2022

[2] Lee,A.C.; Mullany,L.C.; Koffi,A.K.;Rafiqullah,I.; Khanam,R.; Folger,L.V.;Rahman, M.; Mitra,D.K.;Labrique,A.;Christian,P.;etal.UrinarytractinfectionsinpregnancyinaruralpopulationofBangladesh:Po

pulationbasedprevalence,riskfactors,etiology,andantibioticresistance.BMCPregnancyChildbirth2020

[3] KariukiS,RevathiG,CorkillJ,KiiruJ,MwituriaJ,MirzaN,HartCA.Escherichia coli from community-acquiredurinary tract infections resistant tofuoroquinolonesandextended-spectrumbeta-lactams.JInfectDevCtries.2007

[4] Study on the Bacteriological Causes of UTI in Pregnant Women and Their Current Resistance Pattern Shivani Gour , Vasundhara Sharma , Imran Ahamad , Umar Farooq , Sudhir Singh , Shweta R Sharma;2022

[5] A Clinico-microbiological Study of Urinary Tract Infections in Pregnant Women attending Antenatal Clinic of a Tertiary-level Hospital with Special Reference to Antimicrobial Sensitivity Pattern Soham Basu,Abirlal Sanyal, Kumkum Bhattacharyya;2024.

[6] Bacteriological profile and anti-biogram pattern of asymptomatic UTI in pregnant Women at Tertiary Care Teaching Hospital, Vadodara, Gujarat Hetal G. Vaghela, Hitesh R. Ahir; 2016

[7] Nicolle LE. Urinary tract infections in special populations: diabetes, renal transplant, HIV infection, and spinal cord injury. Infect Dis Clin North Am. 2014;28:91–104.

[8] Calbo E, Romaní V, Xercavins M, Gómez L, Vidal CG, et al. Risk factors for community-onset urinary tract infections due to Escherichia coli harbouring extended-spectrum beta-lactamases. J Antimicrob Chemother. 2006;57:780–783.

[9] Borah VV, Saikia KK, Chandra P, Hazarika NK, Chakravarty R. New Delhi metallo-β-lactamase and extended spectrum β-lactamases co-producing isolates are high in community-acquired urinary infections in Assam as detected by a novel multiplex polymerase chain reaction assay. Indian J Med Microbiol. 2016;34:173–182.

[10] Saha S, Nayak S, Bhattacharyya I, Saha S, Mandal AK, et al. Understanding the patterns of antibioticsusceptibility of bacteria causing urinary tract infection in West Bengal, India. Front Microbiol. 2014;5:1–7.

[11] Shaikh S, Arora S, Pandya H. A 4-year study of community acquired urinary tract infections from atertiary diagnostic centre in mumbai with special reference to MIC values. J Kidney. 2018;04:04.

[12] Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. 28th ed. M100. Wayne: Clinical and Laboratory Standards Institute (CLSI); 2023. p. 38.

[13] Ranjan A, Sridhar ST, MattaN, et. al; Prevalence of UTI among pregnant women and it's complications in new borns, Indian Journal of pharmaceutical practice, 2017 Jan.

[14] Ozma MA, Abbasi A, Asgharzadeh M, Pagliano P, Guarino A, Köse Ş, Samadi Kafil H. Antibiotic therapy for pan-drug-resistant infections. Infez Med. 2022 Dec 1;30(4):525-531.

[15] Mahor S, Malviya R, Goyal R. Study of incidence of urinary tract infection during pregnancy and its effect on maternal and perinatal outcome. Int J Reprod Contracept Obstet Gynecol. 2021;10(4):1497-502.

[16] L Thompson et al.; Urinary Tract infections in pregnant individuals, The American college of Obstetricians and Gynaecologists, 2023

[17] KantS, LohiyaA, KapilA, GuptaSK. Urinary tract infection among pregnant women at a secondary level hospital in Northern India. Indian health.2017Apr1

[18] Julius Ojulong et al. Prevalence of Antimicrobial Resistance in *Klebsiella pneumoniae*, *Enterobacter cloacae*, and *Escherichia coli* Isolates among Stillbirths and Deceased Under-Five Children in Sierra Leone: Data from the Child Health and Mortality Prevention Surveillance Sites from 2019 to 2022. Microorganisms. 2024 Aug 13;12(8):1657.

[19] Fatima, Tahira & Rafiq, Sabika & Iqbal, Atia & Hasnain, Shahida. (2020). Prevalence and Antibiogram of MDR E. coli Strains Isolated from UTI Patients—1-Year Retrospective Study at Nishtar Medical Hospital, Multan. SN Comprehensive Clinical Medicine. 2. 10.1007/s42399-020-00246-8.

[20] Wilson ML, Gaido L. Laboratory diagnosis of urinary tract infections in adult patients. Clin Infect Dis. 2004 Apr 15; 38 (8): 1150-8. Epub 2004 Apr 6.

[21] Jennifer L. Young and David E. Soper. Urinalysis and urinary tract infection: update for clinicians. Infect Dis Obstet Gynecol 2001; 9(4):249–255.

[22] Mlugu, E.M., Mohamedi, J.A., Sangeda, R.Z. et al. Prevalence of urinary tract infection and antimicrobial resistance patterns of uropathogens with biofilm-forming capacity among outpatients in Morogoro, Tanzania: a cross-sectional study. BMC. Infect Dis 23, 660 (2023).

[23] G Bonkat T Cai C Galeone B Koves F Bruyere Adherence to European Association of Urology Guidelines and State of the Art of Glycosaminoglycan Therapy for the Management of Urinary Tract Infections: A Narrative

Review and Expert Meeting. Report Eur Urol Open Sci2022443745

[24] Javiya VA, Ghatak SB, Patel KR, Patel JA. Antibiotic susceptibility patterns of Pseudomonas aeruginosa at a tertiary care hospital in Gujarat, India. Indian J Pharmacol. 2008 Oct;40(5):230-4.

[25] Bonkat G., Bartoletti R., Bruyère F., et al. European Association of Urology; Arnhem, The Netherlands: 2024. EAU guidelines on urological infections.

[26] Gernot Bonkat et al. Classification of Urinary Tract Infections in 2025: Moving Beyond Uncomplicated and Complicated. Eur Urol Open Sci. 2025 Apr 6; 75:44–47.

[27] Bonkat G, Bartoletti R, Bruyère F, et al. EAU guidelines on urological infections. Arnhem, The Netherlands: European Association of Urology; 2024.

[28] Lee AC, Mullany LC, Koffi AK, et al. Urinary tract infections in pregnancy in rural Bangladesh: prevalence, risk factors, etiology, and antibiotic resistance. BMC Pregnancy Childbirth. 2020;20(1):740.

[29] L Thompson et al. Urinary tract infections in pregnant individuals. Am Coll Obstet Gynecol. 2023.

[30] Julius Ojulong et al. Prevalence of antimicrobial resistance in K. pneumoniae, E. cloacae, and E. coli among stillbirths and deceased children. Microorganisms. 2024;12(8):1657.

[31] Gour S, Sharma V, Ahamad I, et al. Bacteriological causes of UTI in pregnant women and current resistance patterns. 2022.

[32] Basu S, Sanyal A, Bhattacharyya K. Clinico-microbiological profile of UTIs in pregnant women and antimicrobial sensitivity pattern. 2024.

[33] Bonkat G, et al. Classification of urinary tract infections in 2025: moving beyond uncomplicated and complicated. Eur Urol Open Sci. 2025;75:44–47.