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Microbiological profile and therapeutic management of urinary tract infections in pregnant women in Likasi, haut-Katanga (Democratic Republic of the Congo)

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Abstract

Introduction: Urinary tract infections (UTIs) represent a major infectious complication during pregnancy, associated with significant obstetric and neonatal risks. In the Democratic Republic of the Congo, limited access to microbiological diagnosis and rising antibiotic resistance greatly complicate their management.

Objective: To evaluate the prevalence, determine the microbiological profile, and analyze the antibiotic susceptibility of uropathogens isolated from pregnant women in Likasi in order to optimize local antibiotic therapy.

Methods: A descriptive, cross-sectional, and analytical study was conducted among pregnant women recruited via stratified random sampling in Likasi. Urine samples were analyzed using standardized urine culture (ECBU) at the AFRIDEX Polyclinic Laboratory. Isolation was performed according to CA-SFM/EUCAST guidelines, while identification and antimicrobial susceptibility testing were carried out using the automated VITEK 2 Compact system. Data were analyzed using Excel and SPSS.

Results: This study revealed a UTI prevalence of 43.3% in the overall population. The pregnant women had a mean age of 25.3 ± 6 years; the majority were housewives (50.0%) and were attending prenatal care (PNC) in the second trimester (74.1%), with the Panda district being the most represented (39.2%). No significant association was found between these characteristics and infection (p>0.05). The microbiological profile was dominated by *Escherichia coli* (46.2%), *Klebsiella pneumoniae* (15.4%), and *Proteus mirabilis* (9.6%). The highest susceptibility rates were observed for amikacin (76.9%), ertapenem (69.2%), and imipenem (63.5%), while vancomycin and linezolid were 100% effective against Gram-positive cocci. Conversely, high levels of resistance to ampicillin, amoxicillin, and ciprofloxacin were observed. These results highlight the need to strengthen routine urine culture screening and update local antibiotic treatment protocols for pregnant women.

Conclusion: The prevalence of urinary tract infections among pregnant women in Likasi is alarming. Given the documented critical resistance to aminopenicillins, implementing routine urine culture screening during prenatal visits and regulating empirical antibiotic therapy are essential in the region.

Keywords: Urinary tract infection, Pregnancy, Microbiological profile, Antibiogram, Likasi, DRC.

I. Introduction

Urinary tract infections (UTIs) are among the most common infectious complications during pregnancy, affecting approximately 5% to 10% of pregnant women worldwide (Hafsi et al., 2025). They encompass a range of clinical conditions—from asymptomatic bacteriuria to acute cystitis—that can progress to severe forms such as acute pyelonephritis or urosepsis (Kranz et al., 2024a). During gestation, significant physiological, hormonal (progesterone-induced reduction in ureteral peristalsis), and anatomical changes (mechanical compression of the urinary tract by the gravid uterus) promote urinary stasis and ascending bacterial colonization (Emami et al., 2020; Matuszkiewicz-Rowińska et al., 2015). Without prompt management, these infections expose both mother and fetus to severe complications, including preterm birth, low birth weight, and neonatal mortality (Alemu et al., 2012).

Across the African continent, the reported prevalence of UTIs among pregnant women ranges from 10% to 35%, depending on the region and diagnostic methods used (Getaneh et al., 2021). In the Democratic Republic of the Congo (DRC), the situation is exacerbated by limited access to urine culture and sensitivity testing, often delayed screening during prenatal care visits, and a high prevalence of self-medication (Öztürk et al., 2025). Furthermore, the global emergence of multidrug-resistant uropathogens directly threatens the efficacy of commonly prescribed empirical antibiotic therapies (WHO, 2025).

The primary pathogens implicated belong predominantly to the *Enterobacteriaceae* family, with a clear predominance of *Escherichia coli*, followed by *Klebsiella pneumoniae*, *Proteus mirabilis*, and certain Gram-positive cocci (Habak et al., 2024; Isnard, 2015). Urinary tract infections remain highly frequent during pregnancy, and their bacterial epidemiology is dominated by Enterobacteriaceae. Antibiotic resistance is high, particularly to penicillin G and third-generation cephalosporins (Kadima Mutombo et al., 2015). In Likasi (Haut-Katanga), up-to-date local data regarding the bacterial ecology of UTIs in pregnant women and their antimicrobial susceptibility profiles remain limited. This lack of information hinders the development of treatment protocols tailored to the local context. To address this issue, the present study aimed to assess the prevalence, determine the microbiological profile, and analyze the antibiotic susceptibility of pathogens isolated from pregnant women in Likasi, with the goal of optimizing their clinical management.

II. Materials and methods

2.1. Study type and location

This is a descriptive, cross-sectional, and analytical study conducted among pregnant women visiting healthcare facilities in the city of Likasi (Haut-Katanga Province, DRC) between March and June 2026. Microbiological analyses were performed at the medical biology laboratory of the AFRIDEX Polyclinic (African Explosives Public Service), located in the Panda commune (Kakontwe neighborhood).

2.2. Sampling

- ✓ **Study population (Target)**: Pregnant women at all gestational ages attending prenatal care (PNC) services at selected medical facilities in Likasi during the study period.
- ✓ **Inclusion criteria**: Any pregnant woman who freely consented to participate in the study, completed the survey questionnaire, and provided a urine sample for analysis.
- ✓ **Exclusion criteria**: Non-pregnant women; pregnant women who refused to participate; or those currently undergoing or having recently undergone antibiotic therapy (within 14 days prior to sample collection).
- ✓ **Sample size**: Using the formula for estimating a proportion with a 95% confidence level, the sample size was set at 120 participants. A stratified random sampling method was adopted, using the trimester of pregnancy (1st, 2nd, and 3rd trimester) as the stratification criterion to ensure optimal representativeness for each stage of gestation.

2.3. Sample collection and macroscopic examination

Urine samples were collected in accordance with the recommendations of the Antibiogram Committee of the French Society for Microbiology (CA-SFM). Following a clear explanation of the protocol, participants were instructed to thoroughly cleanse the perineal area with soap and water. Midstream urine samples were collected in sterile, single-use containers, ideally after a four-hour period without voiding. Collected samples were transported to the laboratory within two hours. Upon receipt, a macroscopic examination was performed to assess the appearance of the urine (clear, cloudy, amber, presence of sediment). Samples not processed immediately were stored at 2°C–8°C for a maximum of 24 hours (Janvier et al., 2008).

2.4. Cytobacteriological examination and microbiological analyses

Quantitative inoculation was performed using a calibrated loop (1 µL or 10 µL) on a range of selective and differential media: CLED agar (Cystine Lactose Electrolyte Deficient), MacConkey agar (for the isolation of Gram-negative bacilli), Mannitol Salt Agar (MSA, for the selection of staphylococci), and Columbia agar enriched with 5% defibrinated blood (to detect hemolysis). Plates were incubated aerobically at 35–37°C for 18 to 24 hours (Bailey & Scott's, 2016). A culture was defined as positive (indicating significant bacteriuria) at a threshold of $\geq 10^5$ CFU/mL for asymptomatic patients, in accordance with standard criteria.

2.5. Bacterial identification and antimicrobial susceptibility testing

Bacterial identification and the determination of antibiotic susceptibility were performed entirely using the automated VITEK 2 Compact system (bioMérieux), utilizing biochemical identification cards and micro-cards for Minimum Inhibitory Concentration (MIC) determination. Interpretation of clinical susceptibility profiles (Susceptible/Resistant/Intermediate) strictly followed the updated CA-SFM/EUCAST guidelines (Amara et al., 2025). Regular quality control of the automated system was maintained throughout the analysis process.

2.6. Statistical analysis

Data were entered into Microsoft Excel before being exported to SPSS software for statistical analysis. Categorical variables were expressed as counts and percentages, while quantitative variables were presented as means ± standard deviation. Bivariate analysis to examine associations between culture positivity and the characteristics of the pregnant women in the study was conducted using Pearson's chi-squared test or Fisher's exact test, as required by validity conditions. The threshold for statistical significance was set at $p<0.05$.

2.7. Ethical considerations

The study received approval from local health authorities, including the national ethics committee, the Haut-Katanga provincial health division, the Chief Medical Officers of the Likasi health zones, and the management of the targeted medical facilities. An information sheet, written in French and translated orally into Swahili and other locally spoken dialects, was presented to each participant. Informed consent—either written or verbal—was systematically obtained. For young women (aged 16–23), patient assent combined with the consent of a legal guardian was required. To ensure privacy, all data were anonymized using an alphanumeric coding system. In accordance with the principle of beneficence, results from positive urine cultures were immediately communicated to clinicians to ensure targeted therapeutic management.

III. Results

3.1. Sociodemographic and obstetric characteristics of the population

Table 1: Distribution of pregnant women according to sociodemographic and obstetric characteristics (n=120)

Variables	Categories	Count (n)	Percentage (%)
Average age	-	25,3±6	-
Age groups	16 – 23 years	57	47,5
	24 – 31 years	41	34,2
	32 – 39 years	22	18,3
Profession	Homemaker	60	50,0
	Self-employed (informal sector)	42	35,0
	Civil servant	18	15,0
Place of origin	Panda	47	39,2
	Kikula	30	25,0
	Likasi	27	22,5

	Shituru	16	13,3
Trimester of pregnancy	First quarter	13	10,8
	Second quarter	89	74,2
	Third quarter	18	15,0

Descriptive analysis results from Table 1, covering the 120 pregnant women included in the study, indicate a mean age of 25.3 ± 6 years (range: 16–39 years); the largest proportion of women fell within the 16–23 age bracket (47.5%), followed by the 24–31 age group (34.2%). Housewives accounted for half of the participants (50.0%). Regarding obstetric characteristics, 74.1% of the pregnant women were seen during the second trimester of pregnancy. All four of the city's communes were represented: Panda had the highest rate (39.2%), followed by Kikula (25.0%), with Likasi and Shituru following at 22.5% and 13.3%, respectively.

3.2. Prevalence of urinary tract infections and microbiological profile

Table 2: Microbiological profile of strains isolated from pregnant women (n=120)

Culture status	**Isolated organisms**	**Count (n)**	**Overall percentage (%)**	**Proportion among positives**
Negative (57,5%)	Aucun germe	68	56,7	-
Positive (42,5%)	Escherichia coli	24	20,0	46,2
	Klebsiella pneumoniae	8	6,7	15,4
	Proteus mirabilis	5	4,2	9,6
	Pseudomonas aeruginosa	4	3,3	7,7
	Citrobacter spp.	2	1,7	3,9
	Enterococcus faecalis	2	1,7	3,9
	Streptococcus agalactiae	1	0,8	1,9
	Enterobacter cloacae	1	0,8	1,9
	Enterobacter hafniae	1	0,8	1,9
	Klebsiella oxytoca	1	0,8	1,9
	Citrobacter freundii	1	0,8	1,9
	Streptococcus coagulase négative	1	0,8	1,9
	Enterococcus spp.	1	0,8	1,9
Total	**-**	**120**	**100%**	**100%**

Table 2 shows that out of 120 cytobacteriological examinations performed, 52 cultures tested positive, representing an overall prevalence of confirmed urinary tract infections of 43.3% (95% CI). Analysis of the epidemiological profile reveals a clear predominance of Gram-negative bacilli, primarily Enterobacteriaceae. *Escherichia coli* ranks first, isolated in 20.0% of the total population and accounting for 46.2% of positive cultures (24/52). It is followed by *Klebsiella pneumoniae* at 6.7% (15.4%) and *Proteus mirabilis* at 4.2% (9.6%), with *Pseudomonas aeruginosa* at 3.3% (7.7%). The remaining organisms showed a low overall percentage of 0.8% (1.9%), corresponding to 1.7% (3.9% of the proportion of isolates).

3.3. Antibiotic susceptibility and resistance profile

Table 3: Overall antibiotic susceptibility rates of isolated bacterial strains (n=52)

Antibiotic classes	Molecules tested	Number of susceptible strains (n)	Overall susceptibility percentage (%)
Aminoglycosides	Amikacin	40	76,9
	Tobramycin	18	34,6
	Gentamicin	15	28,8
	Streptomycin	3	5,7
Carbapenems	Ertapénèm	36	69,2
	Imipenem	33	63,5
Penicillins & Inhibitors	Piperacillin/Tazobactam	18	34,6
	Amoxicillin	11	21,2
	Ampicillin	6	11,5
	Ticarcillin	4	7,7
Cephalosporins	Ceftriaxon	17	32,6
	Céfoxitin	16	30,6
	Cefoperazon	11	21,2
	Ceftazidime	8	15,4
	Cefepim	6	11,5
Fluoroquinolones	Lévofloxacin	15	28,8
	Ciprofloxacin	5	9,6
	Moxifloxacin	2	3,8
	Nalidix acid	7	13,5
Glycopeptides & Lipopeptides	Vancomycin	5	9,5
	Linezolid	5	9,5
	Tigecyclin	3	5,7
Others	Fosfomycin	7	13,5
	Nitrofurantoïn	5	9,5
	Erythromycin	5	9,5
	Clindamycin	2	3,8
	Oxacillin	2	3,8
	Contrimoxazole(TMP/SMX)	2	3,8

Table 3 presents the susceptibility profile established for all 52 isolated strains. It shows the highest overall susceptibility rates for carbapenems and aminoglycosides: amikacin at 76.9% (40/52 susceptible strains), followed by ertapenem at 69.2% (36/52) and imipenem at 63.5% (33/52), with tobramycin (34.6%), piperacillin/tazobactam (34.6%), and ceftriaxone (32.6%) also listed. Regarding resistance rates, ampicillin (11.5% overall susceptibility) and amoxicillin (21.2%) demonstrate critical therapeutic ineffectiveness. Fluoroquinolones also show reduced activity (9.6% susceptibility for ciprofloxacin). For agents specific to Gram-positive bacteria (*E. faecalis*, *S. agalactiae*), vancomycin and linezolid showed limited overall susceptibility (9.5%) but 100% efficacy against the isolated cocci.

3.4. Bivariate analyses: Factors associated with a positive culture

Table 4: Association between bacterial culture positivity and sociodemographic and obstetric variables (n=120)

Variables	Categories	Negative Culture (%)	Positive culture (%)	Total n (%)	p-value
Age group	16 – 23years	34 (28,3)	23 (19,2)	57 (47,5)	0,711
	24 – 31years	22 (18,3)	19 (15,8)	41 (34,1)	
	32 – 39years	12 (10,0)	10 (8,3)	22 (18,3)	
Quarter	First quarter	8 (6,7)	5 (4,2)	13 (10,9)	0,473
	Second quarter	52 (43,3)	37 (30,8)	89 (74,1)	
	Third quarter	8 (6,7)	10 (8,3)	18 (15,0)	
Profession	Homemaker	22 (18,3)	20 (16,7)	42 (35,0)	0,214
	Self-employed (informal sector)	38 (31,7)	22 (18,3)	60 (50,0)	
	Civil servant	8 (6,7)	10 (8,3)	18 (15,0)	
Place of origin	Kikula	16 (13,3)	14 (11,6)	20 (24,9)	
	Likasi	18 (15,0)	9 (7,5)	27 (22,7)	
	Panda	25 (20,8)	22 (18,3)	47 (39,1)	
	Shituru	9 (7,5)	7 (5,8)	16 (13,3)	
Total		**68 (56,6)**	**52 (43,3)**	**120 (100%)**	

The results presented in Table 4—from the bivariate analysis exploring correlations between bacterial culture results and participant characteristics—revealed no statistically significant associations. The risk of urinary tract infection was evenly distributed, regardless of age group (p=0.711), trimester of pregnancy (p=0.473), employment status (p=0.214), or geographical origin (p=0.743).

IV. Discussion

4.1. Sociodemographic profile and sample characteristics

Descriptive analyses reveal a generally young study population (mean age: 25.3 ± 6 years), characterized by a predominance of housewives or homemakers (50.0%). The study population consists of young pregnant women, corroborating the findings of Ejerssa et al. (2021) in Ethiopia, who reported a marked predominance of the 23–27 age group and a majority of women working in the informal sector or as homemakers. Regarding obstetric care, the study highlights a pattern of delayed healthcare seeking (Ejerssa et al., 2021). The majority of the pregnant women included were attending their first antenatal care (ANC) visit and were registered late, during the second trimester of pregnancy (74.1%). This delay deviates from the continuum of care recommended by the WHO, which mandates screening and rigorous monitoring starting in the first trimester to prevent the occurrence of pregnancy complications (Chelkeba et al., 2022).

4.2. High prevalence of urinary tract infections

The prevalence documented in this study stands at 42.5%. This rate is particularly alarming and confirms that UTIs constitute a major public health issue among pregnant women in Likasi. Similar prevalence rates were observed in Ethiopia (39.8%) by Assefa Ayele et al. (2022), while a meta-analysis in sub-Saharan Africa reported overall rates of approximately 32% (Medina & Castillo-Pino, 2019). This high prevalence is driven by pathophysiological factors inherent to pregnancy: progesterone-mediated ureteral hypotonia, bladder stasis caused by mechanical compression from the gravid uterus, and physicochemical changes in the urine (increase... ...of pH and glucosuria) that create an ideal microenvironment for bacterial proliferation (American College of Obstetricians and Gynecologists, 2023; European Association of Urology, 2025).

The absence of a significant association between culture positivity and sociodemographic or obstetric variables (p>0.005) highlights the universal nature of infection risk during pregnancy. This finding aligns with the work of Ngong et al. (2021) in Cameroon, confirming that physiological changes expose all women equally, regardless of age, occupation, or geographic origin. Consequently, screening should not target a specific subgroup but should be universally applied to all pregnant women (Matuszkiewicz-Rowińska et al., 2015).

4.3. Bacterial ecology and the dominance of Enterobacteriaceae

The microbial ecology of UTIs in Likasi is largely dominated by Gram-negative bacilli, foremost among them *Escherichia coli* (20.0% of the total sample; 47.1% of isolates). This result is entirely consistent with international literature, which attributes 70–90% of community-acquired UTIs in pregnant women to this pathogen (Flores-Mireles et al., 2015; Bonkat et al., 2025). This dominance of *E. coli* is explained by specific virulence mechanisms, notably the presence of adhesins (P-fimbriae) that facilitate attachment to uroepithelial receptors, the ability to form protective biofilms, and the production of siderophores (Flores-Mireles et al., 2015). The identification of *Klebsiella pneumoniae* (6.7%) and *Proteus mirabilis* (4.2%) completes this classic profile of ascending infections of gastrointestinal origin.

4.4. Critical antibiotic resistance profile

Analysis of the antibiogram highlights data crucial for guiding local empirical antibiotic therapy. Ampicillin (11.5% susceptibility) and amoxicillin (21.2%) prove completely ineffective as first-line treatments. This critical resistance reflects the excessive, uncontrolled, and repeated use of these drugs for self-medication in the region. This phenomenon aligns with the global trend reported by the WHO (GLASS Report), warning of the declining therapeutic efficacy of aminopenicillins against Enterobacteriaceae (WHO, 2024; Delzell & Lefevre, 2000).

Conversely, amikacin (76.9% susceptibility) and carbapenems (ertapenem 69.2%, imipenem 63.5%) retain excellent bactericidal activity against urinary isolates, representing the ultimate therapeutic arsenal for severe complications (pyelonephritis, risk of urosepsis). However, these injectable drugs—which are costly and have restricted hospital availability—cannot serve as a routine option for the outpatient treatment of uncomplicated lower urinary tract infections.

4.5. Strengths and limitations of the study

Strengths: The originality of this study lies in the rigor of its diagnostic methodology. Unlike many surveys based solely on clinical criteria or the use of urine dipsticks with low positive predictive value (leukocyturia), the 42.5% prevalence rate was rigorously confirmed through quantitative urine culture (ECBU), precise identification, and automated susceptibility testing using the VITEK 2 Compact system.

Limitations: The sample size was modest (n=120) relative to the total population of the city of Likasi, Haut-Katanga. Furthermore, the majority of pregnant women contacted during the study period sought care late—specifically during the second trimester (74.2%)—which precluded an assessment of the incidence of urinary tract infections from the very beginning of pregnancy. Finally, the failure to collect detailed behavioral or environmental variables (such as perineal hygiene habits or access to potable water) limits the in-depth identification of avoidable risk factors.

V. Conclusion, Future Outlook, And Recommendations

Conclusion

This study highlighted an alarmingly high prevalence of urinary tract infections caused by Gram-negative bacteria among pregnant women in Likasi. The microbiological profile was dominated by *Escherichia coli*, *Klebsiella pneumoniae*, and *Proteus mirabilis* as causative agents. First-line antibiotics (ciprofloxacin, ampicillin, and amoxicillin) proved ineffective. Given the documented critical resistance to aminopenicillins, implementing systematic urine culture (ECBU) screening during prenatal consultations and regulating empirical antibiotic therapy are essential in the region. However, imipenem, ertapenem, and amikacin ensure effective management. To preserve last-resort drugs and avoid ineffective empirical treatments, systematic urine culture screening must be implemented for pregnant women, and local empirical antibiotic protocols must be revised to limit obstetric and neonatal complications.

Recommendations and Future Outlook

To safeguard fetal and maternal health outcomes and curb the spread of bacterial resistance, the following measures are imperative:

- ✓ Early screening: Systematic implementation of urine culture (ECBU) testing for all pregnant women starting in the first trimester.
- ✓ Protocol revision: Urgent updating of local empirical antibiotic therapy guidelines, excluding obsolete drugs in favor of alternatives suited to the current susceptibility profile.

Outlook and Recommendations

In light of the concerning rise in antibiotic resistance and the associated obstetric risks, urgent and coordinated action is essential in Likasi:

For health authorities:

- ✓ Implement a revised national policy mandating routine screening for urinary tract infections via urine culture (ECBU) for all pregnant women at their first prenatal visit (ideally during the first trimester).

- ✓ Establish a sustainable local epidemiological surveillance system for antibiotic resistance to ensure that empirical prescribing guidelines are regularly updated.
- ✓ Implement a continuous monitoring system for bacterial resistance at both hospital and regional levels.
- ✓ Regulate local access to antibiotics to drastically restrict the purchase of medications without a medical prescription.

To prenatal care clinicians and professionals:

- ✓ Strictly prohibit the empirical use of aminopenicillins (ampicillin or amoxicillin alone) as a first-line treatment for urinary tract infections in pregnant women in Likasi.
- ✓ Antibiotic susceptibility test results must be awaited before prescribing any drug, except in cases of clinical severity (e.g., suspected pyelonephritis), where empirical antibiotic therapy—chosen to be safe for the fetus—must be initiated urgently pending subsequent adjustment.

To researchers:

- ✓ Initiate larger-scale multicenter studies involving larger cohorts and evaluating specific environmental and behavioral factors (hygiene practices, history of UTIs) to more effectively guide regional prevention strategies.

Author contributions

All authors contributed to the design of this systematic review.

Mukumbi Mwanabute Donatien: participated in the literature search, study selection, data extraction and analysis, and manuscript drafting.

Arold Fazili Ozenga: contributed to the interpretation of results, the formatting of the review, and the analysis in accordance with PRISMA guidelines.

Armand Abasi Saleh: contributed to the drafting, data analysis using Rayyan, and revision of the manuscript.

Mudogo Virima: contributed to academic supervision, critical revision, and scientific validation of the manuscript.

Ngbolua Koto-te-Nyiwa Jean-Paul: provided scientific supervision and methodological guidance for the study.

All authors have read and approved the final version of the manuscript.

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Bibliography

1. Alemu, A., Moges, F., Shiferaw, Y., Tafess, K., Kassu, A., Anagaw, B., & Agegn, A. (2012). Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at University of Gondar Teaching Hospital, Northwest Ethiopia. *BMC Research Notes*, 5, 197. https://doi.org/10.1186/1756-0500-5-197

2. Amara, M., Barraud, O., Cadenet, J., Cattoir, V., Dortet, L., Dupieux, C., Goutelle, S., Jeannot, K., Lepeule, R., Lina, G., Marchandin, H., Poitrenaud, D., Schramm, F., & Tazi, A. (2025). *Recommandations du Comité de l'Antibiogramme de la Société Française de Microbiologie (CA-SFM/EUCAST)*, V.1.1.

3. American College of Obstetricians and Gynecologists. (2023). Urinary Tract Infections in Pregnant Individuals. *Obstetrics & Gynecology*, 142(2), e66–e86.

4. Assefa Ayele, A., et al. (2022). Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women in sub-Saharan Africa: A systematic review. *BMC Women's Health*, 22, 104.

5. Bailey & Scott's Diagnostic Microbiology. (2016). 14th Edition. Elsevier. https://shop.elsevier.com/books/bailey-and-scotts-diagnostic-microbiology/tille/978-0-323-35482-0

6. Bonkat, G., Burgos, J. G., Ruepp, R., & Browne, K. (2026). The European Association of Urology Guidelines on Urological Infections: Bridging Regulatory Strategy with Proactive Clinical Leadership. *European Urology Focus*, 12(2), 297-298. https://doi.org/10.1016/j.euf.2025.11.005

7. Delzell, J. E., & Lefevre, M. L. (2000). Urinary tract infections during pregnancy. *American Family Physician*, 61(3), 713-721.

8. Ejerssa, A. W., Gadisa, D. A., & Orjino, T. A. (2021). Prevalence of bacterial uropathogens and their antimicrobial susceptibility patterns among pregnant women in Eastern Ethiopia: Hospital-based cross-sectional study. *BMC Women's Health*, 21, 291. https://doi.org/10.1186/s12905-021-01439-6

9. Emami, A., Javanmardi, F., & Pirbonyeh, N. (2020). Antibiotic resistant profile of asymptomatic bacteriuria in pregnant women: A systematic review and meta-analysis. *Expert Review of Anti-Infective Therapy*, 18(8), 807-815. https://doi.org/10.1080/14787210.2020.1759420

10. European Association of Urology. (2025). *EAU Guidelines on Urological Infections*. EAU Guidelines Office.

11. Flores-Mireles, A. L., Walker, J. N., Caparon, M., & Hultgren, S. J. (2015). Urinary tract infections: Epidemiology, mechanisms of infection and treatment options. *Nature Reviews Microbiology*, 13(5), 269–284. https://doi.org/10.1038/nrmicro3432

12. Foxman, B. (2014). Urinary Tract Infection Syndromes. *Infectious Disease Clinics of North America*, 28(1), 1-13. https://doi.org/10.1016/j.idc.2013.09.003

13. Getaneh, T., Negesse, A., Dessie, G., Desta, M., & Tigabu, A. (2021). Prevalence of Urinary Tract Infection and Its Associated Factors among Pregnant Women in Ethiopia: A Systematic Review and Meta-Analysis. *BioMed Research International*, 2021, 6551526. https://doi.org/10.1155/2021/6551526

14. Habak, P. J., Carlson, K., & Robert P. Griggs, J. (2024). Urinary Tract Infection in Pregnancy. In *StatPearls [Internet]*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK537047/

15. Hafsi, M., Houssem, R., & Zouaghi, A. (2025). Prévalence et gestion des infections urinaires en grossesse dans une cohorte obstétricale. *Gynécologie Obstétrique Fertilité & Sénologie*, 53(11), 627. https://doi.org/10.1016/j.gofs.2025.09.049

16. Isnard, C. (2015). Infections du tractus urinaire à pathogènes émergents. *Journal des Anti-infectieux*, 17(4), 152-161. https://doi.org/10.1016/j.antinf.2015.10.002

17. Janvier, F., Mbongo-Kama, E., Mérens, A., & Cavallo, J.-D. (2008). Les difficultés d'interprétation de l'examen cytobactériologique des urines. *Revue Francophone des Laboratoires*, 2008(406), 51-59. https://doi.org/10.1016/S1773-035X(08)74525-8

18. Kadima Mutombo, C., Mumba Mukandila, A., Biayi Mikenji, J., Ntambwe Katumbayi, G., & Mulowayi Kashi, F. (2015). Profil bactériologique de l'infection urinaire gravidique (Cas de l'hôpital Bonzola à Mbujimayi en RD Congo). *La Revue Médicale de Madagascar*, *5*(3). https://doi.org/10.62606/RMMao00168

19. Kranz, J., Bartoletti, R., Bruyère, F., Cai, T., Geerlings, S., Köves, B., Schubert, S., Pilatz, A., Veeratterapillay, R., Wagenlehner, F. M. E., Bausch, K., Devlies, W., Horváth, J., Leitner, L., Mantica, G., Mezei, T., Smith, E. J., & Bonkat, G. (2024a). European Association of Urology Guidelines on Urological Infections: Summary of the 2024 Guidelines. *European Urology*, 86(1), 27-41. https://doi.org/10.1016/j.eururo.2024.03.035

20. Matuszkiewicz-Rowińska, J., Małyszko, J., & Wieliczko, M. (2015). Urinary tract infections in pregnancy: Old and new unresolved diagnostic and therapeutic problems. *Archives of Medical Science*, 11(1), 67-77. https://doi.org/10.5114/aoms.2013.39202

21. Medina, M., & Castillo-Pino, E. (2019). An introduction to the epidemiology and burden of urinary tract infections. *Therapeutic Advances in Urology*, 11, 1–7. https://doi.org/10.1177/1756287219832172

22. Mian, B., Angoi, V., Yao, B. A., Loué, V., Kakou, C., & Boni, S. (2023). Les infections des voies urinaires chez la femme enceinte au centre hospitalo-universitaire de Cocody: Épidémiologie et données

de la prise en charge. *Annales de la SOGGO*, 18(41), 134-139.

23. Ngong, I. N., Fru-Cho, J., Yung, M. A., & Akoachere, J.-F. K. T. (2021). Prevalence, antimicrobial susceptibility pattern and associated risk factors for urinary tract infections in pregnant women attending ANC in some integrated health centers in the Buea Health District. *BMC Pregnancy and Childbirth*, 21(1), 673. https://doi.org/10.1186/s12884-021-04142-4

24. Omasombo Tshonda, J. (s. d.). *Haut-Katanga*. Musée royal de l'Afrique centrale. https://journals.openedition.org/lectures/39492

25. Öztürk, C., Kara, M., Akyol, R., & Bolacalı, M. (2025). Antimicrobial resistance and multidrug resistance patterns of uropathogens isolated from pregnant women with asymptomatic bacteriuria. *Journal of Turkish Society of Obstetric and Gynecology*. https://doi.org/10.4274/tjod.galenos.2025.29938

26. Sissoko, A., et al. (2026). Infection urinaire sur grossesse à la Clinique Périnatale Mohammed VI de Bamako, Mali. *Revue Malienne d'Infectiologie et de Microbiologie*, 21(1), 43-48. https://doi.org/10.53597/remim.v1i1.3322

27. Werter, D. E., Kazemier, B. M., Schneeberger, C., Mol, B. W. J., De Groot, C. J. M., Geerlings, S. E., & Pajkrt, E. (2021). Risk Indicators for Urinary Tract Infections in Low Risk Pregnancy and the Subsequent Risk of Preterm Birth. *Antibiotics*, 10(9), 1055. https://doi.org/10.3390/antibiotics10091055

28. World Health Organization. (2024). *Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2024*. Geneva: WHO.

29. World Health Organization. (2025). WHO warns of widespread resistance to common antibiotics worldwide. PAHO/WHO News. https://www.paho.org/en/news/13-10-2025-who-warns-widespread-resistance-common-antibiotics-worldwide