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The First Scientific Conference of the Faculty of Science – Sirte University Environmental Pollution and Challenges of Environmental Sustainability (EPESC), Oct. 14, 2025

Urinary Tract Infections and Antimicrobial Resistance: Analysis of Pathogen Prevalence and Treatment Efficacy at Al Manar Laboratory in Derna City

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Abstract: This study investigates the prevalence and antibiotic sensitivity of bacterial pathogens responsible for urinary tract infections (UTIs) in patients at Al Manar Laboratory. Data were collected from 51 patients, comprising 44 women and 7 men, aged 15 to 45 years, over a one-month period. The study aimed to identify the bacterial species causing UTIs, assess the effectiveness of various antibiotics, and explore the relationship between gender and infection rates. The findings revealed a significant gender disparity, with 86.27% of UTI cases occurring in females. *Staphylococcus aureus* and *Escherichia coli* were the most prevalent pathogens, accounting for 39.21% and 35.29% of the infections, respectively. Antibiotic sensitivity testing showed that Meropenem was the most effective treatment for both S. aureus and E. coli, with sensitivity rates of 93.75% and 100%, respectively. In contrast, other antibiotics like Trimethoprim-Sulfamethoxazole and Clindamycin demonstrated low sensitivity, indicating significant resistance. The study underscores the importance of targeted antibiotic therapy based on sensitivity testing to combat antimicrobial resistance and improve treatment outcomes for UTIs. Additionally, it highlights the need for tailored prevention strategies, particularly for women, who are disproportionately affected by UTIs.

Introduction

Urinary tract infections (UTIs) are among the most prevalent bacterial infections worldwide, affecting millions annually. These infections can impact any component of the urinary system—ranging from the kidneys to the urethra—although they most frequently affect the lower urinary tract, such as the bladder and urethra. Due to anatomical differences, females tend to be more susceptible to UTIs than males (Stamm & Norrby, 2001). In the United States alone, approximately 10.5 million medical visits were linked to UTI symptoms in 2007 (Schappert & Rechtsteiner, 2011; Foxman, 2010). UTIs pose significant health risks across various age groups, including infants, elderly men, and women of all ages. If left untreated, complications may arise, including recurrent infections, upper urinary tract involvement (pyelonephritis), kidney damage in children, and challenges related to antibiotic resistance and secondary infections such as Clostridium difficile colitis (Hooton, 2012; Nielubowicz & Mobley, 2010).

A wide range of bacterial pathogens can cause UTIs, with Gram-negative organisms such as Escherichia coli, Proteus, Klebsiella, Pseudomonas aeruginosa, and Acinetobacter species being the most frequent. Gram-positive bacteria, including *Staphylococcus saprophyticus*, *Enterococcus*, and coagulase-negative *Staphylococcus*, are also commonly implicated (Tanagho et al., 2004; Momoh et al., 2011). These pathogens often possess specialized virulence mechanisms—such as pili, capsules, and endotoxins—that enhance their ability to adhere to host tissues, evade immune defenses, and establish infection (Tanagho et al., 2004). Certain physiological and anatomical factors, particularly the shorter urethra in females, contribute to increased infection risk (Schnarr, 2008). Understanding these risk factors, alongside bacterial profiles and antibiotic susceptibility patterns, is essential to improving treatment outcomes.

The objective of this study was to investigate the nature of urinary tract infections by analyzing clinical data from infected patients. Specifically, the study aimed to identify the bacterial strains responsible for UTIs, evaluate their sensitivity to various antibiotics, and examine the association between gender and infection rates. By assessing bacterial resistance profiles and determining the prevalence of specific pathogens, this research contributes to a better understanding of infection dynamics and supports more informed antibiotic use in clinical settings

Material & Methods

Study Population

This study included individuals diagnosed with urinary tract infections who attended Al-Manar Laboratory for Medical Analysis between May 11 and June 10, 2024. A total of 51 patients were evaluated, comprising 44 females and 7 males aged between 15 and 45 years. The collected data were used to determine the causative bacterial species, explore gender-related patterns in infection, and assess bacterial responses to various antibiotics.

Statistical Analysis

The collected data were processed using Microsoft Excel. Variables such as patient gender, bacterial isolates, and antibiotic susceptibility were systematically entered into spreadsheets. To enhance clarity, information was organized into categorized tables and visual tools such as bar charts and graphs were used to illustrate patterns in bacterial distribution and antibiotic effectiveness. Basic statistical functions within Excel were employed to calculate the sensitivity rates of each bacterial type, enabling a clear interpretation of the infection trends observed in the sample.

Results

Table 1. Distribution of Urinary Tract Infection Cases by Gender with Corresponding Percentages

Sex	Number of Infected Individuals	Percentage
Female	44	86.27%
Male	7	13.72%
Total	51	

Based on Table (1), the analysis of urinary tract infection (UTI) cases by gender reveals a notable difference in prevalence. Females represented the majority of infections, accounting for 86.27% (44 out of 51 cases), while males made up only 13.72% (7 cases). This pattern reflects a well-documented tendency for higher UTI occurrence in females, which is often attributed to anatomical characteristics such as a shorter urethra that facilitates bacterial access. The results underscore the importance of focusing on preventive and therapeutic approaches for women, while also acknowledging that UTIs, though less frequent, still affect a portion of the male population.

Table 2. Distribution and Proportion of Bacterial Species Identified in Urinary Tract Infection Cases

Bacterial Types	Number of Infected Individuals	Percentage
Staphulococcus aureus	20	39.21%
E.coli	18	35.29 %
Staphylococcus epidermidis	5	09.08 %
Streptococcus agalactiae	3	05.88 %
Pseudomonas aeruginosa	2	03.92 %
proteus sp.	1	01.96 %
Lactobacilli	1	01.96 %
Klebsiella sp.	1	01.96 %

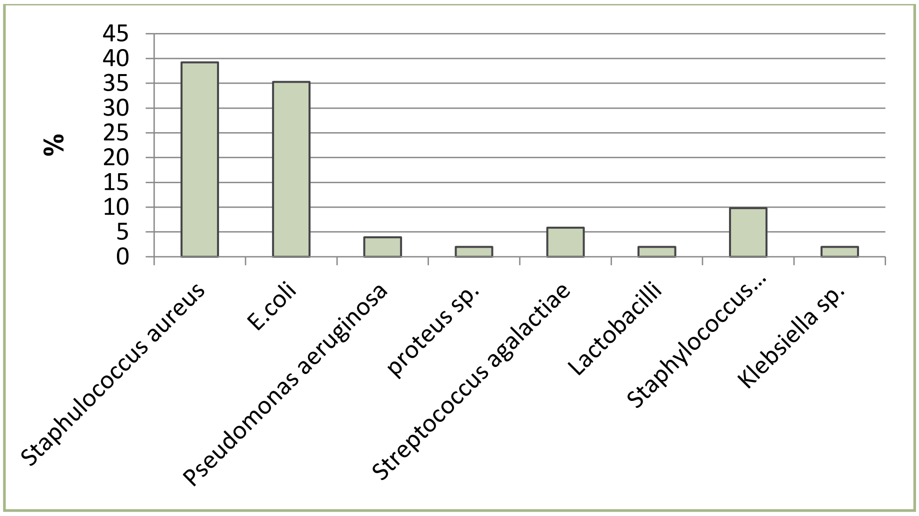

Figure 1. Distribution of Bacterial Types Responsible for Urinary Tract Infections

Based on the data in Table (2) and Figure (1), urinary tract infections (UTIs) are caused by a variety of bacterial species. Staphylococcus aureus emerged as the most common pathogen, found in 39.21% of the cases (20 patients), followed by Escherichia coli, which accounted for 35.29% (18 cases). Staphylococcus epidermidis was identified in 9.08% (5 cases), while Streptococcus agalactiae appeared in 5.88% (3 cases). Pseudomonas aeruginosa affected 3.92% of the individuals (2 cases). Meanwhile, Proteus species, Lactobacilli, and Klebsiella species were each isolated in 1.96% of the cases (1 case each). These findings demonstrate the wide range of bacterial agents responsible for UTIs and reinforce the importance of accurate microbial identification for effective clinical management.

Table 3. Sensitivity percentage of Staphylococcus aureus to various antibiotics in infected Individuals .

Antibiotics Types	Sensitivity percentage of Staphylococcus aureus
AMC: Amoxicillin-Clavulanate	90%
Mer: Meropenem	93.75%
Va: Vancomycin	82.5%
F: Fosfomycin	37.5%
Do: Doxycycline	63.75%
CRO: Ceftriaxone	52.5%
Cip: Ciprofloxacin	37.5%
G: Gentamicin	48.75%
SxT: Trimethoprim-Sulfamethoxazole	5%
Lev: Levofloxacin	47.5%
CTX: Cefotaxime	46.25%
Nor: Norfloxacin	26.25%
cl: Clindamycin	25%
Ax: Amoxicillin	18.75%

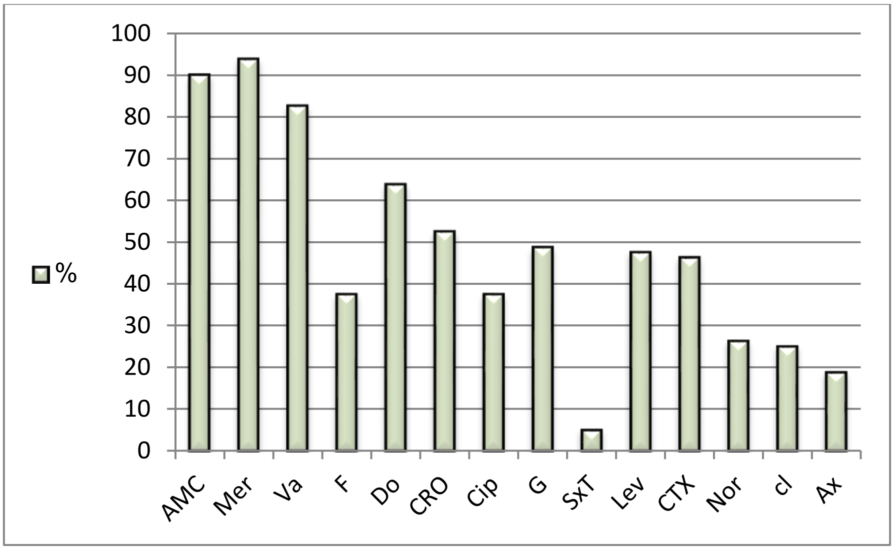

Figure 2. Sensitivity percentage of *Staphylococcus aureus* to various antibiotics.

An analysis of *Staphylococcus aureus* antibiotic sensitivity among UTI cases from Al Manar Laboratory revealed significant differences in drug effectiveness. The highest sensitivity was observed with Meropenem (93.75%) and Amoxicillin-Clavulanate (90%), indicating their strong potential for managing these infections. Vancomycin also showed substantial activity (82.5%), though its slightly lower rate may reflect emerging resistance. In contrast, marked resistance was found against Fosfomycin (37.5%) and Trimethoprim-Sulfamethoxazole (5%), suggesting these drugs may be less suitable for treatment. Moderate responses were recorded for Doxycycline, Ceftriaxone, and Ciprofloxacin, with sensitivity ranging from 37.5% to 63.75%. These findings emphasize the importance of performing antibiotic susceptibility tests before initiating treatment, as resistance trends can vary considerably as shown in Table (3) and Figure (2).

Table.4 Sensitivity percentage of E.coli to various antibiotics in infected Individuals

Antibiotics Types	Sensitivity percentage of E.coli
AMC: Amoxicillin-Clavulanate	51.56%
Mer: Meropenem	100%
Va: Vancomycin	6.25%
F: Fosfomycin	37.5%
Do: Doxycycline	53.12%
CRO: Ceftriaxone	39.06%
Cip: Ciprofloxacin	23.43%
G: Gentamicin	70.31%
SxT: Trimethoprim-Sulfamethoxazole	21.87%
Lev: Levofloxacin	20.31%

CTX: Cefotaxime	26.56%
Nor: Norfloxacin	51.56%
cl: Clindamycin	4.68%
Ax: Amoxicillin	7.81%

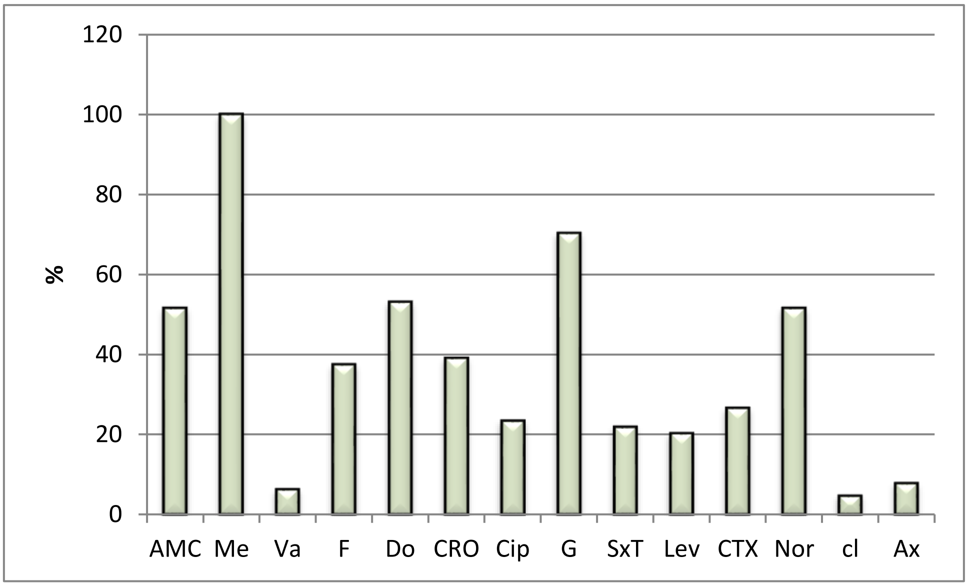

Figure. 3 Sensitivity percentage of E.coli to various antibiotics in infected Individuals

The antibiotic susceptibility profile of E. coli from urinary tract infection samples at Al Manar Laboratory shows varying levels of effectiveness. Meropenem displayed complete sensitivity (100%), indicating its strong efficacy and absence of resistance in the tested strains. Gentamicin followed with a sensitivity rate of 70.31%, making it a dependable choice. Moderate sensitivity was recorded for Amoxicillin-Clavulanate and Doxycycline, at 51.56% and 53.12% respectively, reflecting partial effectiveness and some resistance. However, Vancomycin and Clindamycin exhibited minimal effectiveness, with sensitivity rates as low as 6.25% and 4.68%. Similarly, Ciprofloxacin, Trimethoprim-Sulfamethoxazole, and Levofloxacin showed limited activity, with rates ranging between 20% and 23%. These findings highlight the variability in E. coli resistance patterns and reinforce the importance of sensitivity testing when selecting appropriate treatment options Table(4) and Figure (3).

Discussion

The results of this research highlight a marked predominance of urinary tract infections (UTIs) among female patients, supporting prior studies that attribute this pattern to anatomical characteristics, including the shorter female urethra, which makes bacterial entry more likely (Schnarr, 2008). This observation is consistent with earlier findings documenting a higher UTI frequency in women across different age categories (Stamm & Norrby, 2001). Among the bacterial isolates, *Staphylococcus aureus* and Escherichia coli emerged as the most common pathogens, aligning with existing reports that identify these species as leading causes of UTIs (Tanagho et al., 2004). The current study also revealed differences in how bacterial strains respond to antibiotics, where

Meropenem showed high effectiveness, while agents like Trimethoprim-Sulfamethoxazole and Clindamycin demonstrated notably lower efficacy. This pattern reflects the broader concern of increasing antimicrobial resistance (AMR), as previously discussed in the literature (Linder et al., 2005). Given these findings, there is a pressing need to support antimicrobial stewardship programs, which are essential in promoting rational antibiotic use and preventing further resistance development (Foxman, 2002; Wagenlehner et al., 2018).

The variability in antibiotic susceptibility observed here further emphasizes the importance of individualized treatment based on laboratory sensitivity testing, as empiric or indiscriminate antibiotic use can result in suboptimal outcomes and exacerbate resistance issues.Moreover, the patterns of resistance identified in this local context reinforce the importance of maintaining up-to-date treatment protocols that reflect current susceptibility trends, especially in regions where resistance profiles can differ significantly (Ahmed et al., 2017; Al-Badr and Al-Shaikh, 2013).In conclusion, this study contributes valuable data that can help refine treatment strategies and support public health efforts to manage UTIs more effectively, while also addressing the growing threat of antibiotic resistance.

Conclusions

This study highlights the considerable burden of urinary tract infections (UTIs), especially among women, and identifies Staphylococcus aureus and Escherichia coli as the most frequently isolated pathogens. The variation in antibiotic susceptibility, with notable resistance to commonly prescribed drugs such as Trimethoprim-Sulfamethoxazole and Clindamycin, underscores the importance of conducting routine antibiotic sensitivity tests prior to treatment. High sensitivity rates to Meropenem suggest its potential as an effective option, particularly in resistant cases, though careful monitoring is necessary to prevent overuse. To improve UTI management and reduce the risk of antimicrobial resistance (AMR), it is essential to implement antimicrobial stewardship programs, ensure periodic updates to treatment protocols based on current resistance trends, and promote awareness about the responsible use of antibiotics. In addition, encouraging good hygiene practices and supporting ongoing surveillance and research will contribute to more effective infection control and better clinical outcomes in the long term.

Conflict of Interest: The authors declare that there are no conflicts of interest.

References

Ahmed, H., Davies, F., Francis, N., Farewell, D., Butler, C., & Paranjothy, S. (2017). Long-term antibiotics for prevention of recurrent urinary tract infection in older adults: Systematic review and meta-analysis of randomised trials. *BMJ Open, 7*(5), e015233. https://doi.org/10.1136/bmjopen-2016-015233

Al-Badr, A., & Al-Shaikh, G. (2013). Recurrent urinary tract infections management in women: A review. *Sultan Qaboos University Medical Journal, 13*(3), 359–367.

Foxman, B. (2002). Epidemiology of urinary tract infections: Incidence, morbidity, and economic costs. *The American Journal of Medicine, 113*(1), 5–13. https://doi.org/10.1016/s0002-9343(02)01054-9

Foxman, B. (2010). The epidemiology of urinary tract infection. *Nature Reviews Urology, 7*(12), 653–660. https://doi.org/10.1038/nrurol.2010.190

Hooton, T. M. (2012). Uncomplicated urinary tract infection. *New England Journal of Medicine, 366*(11), 1028–1037. https://doi.org/10.1056/NEJMcp1104429

Linder, J. A., Huang, E. S., Steinman, M. A., Gonzales, R., & Stafford, R. S. (2005). Fluoroquinolone prescribing in the United States: 1995 to 2002. *The American Journal of Medicine, 118*(3), 259–268. https://doi.org/10.1016/j.amjmed.2004.09.015

Momoh, A. R. M., Orhue, P. O., Idonije, O. B., Oaikhena, A. G., Nwoke, E. O., & Momoh, A. A. (2011). The antibiogram types of *Escherichia coli* isolated from suspected urinary tract infection samples. *Journal of Microbiology and Biotechnology Research, 1*(3), 57–65.

Nielubowicz, G. R., & Mobley, H. L. (2010). Host–pathogen interactions in urinary tract infection. *Nature Reviews Urology, 7*(8), 430–441. https://doi.org/10.1038/nrurol.2010.101

Schappert, S. M., & Rechtsteiner, E. A. (2011). Ambulatory medical care utilization estimates for 2007. *Vital and Health Statistics. Series 13, Data from the National Health Survey, (169)*, 1–38.

Schnarr, J., & Smaill, F. (2008). Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. *European Journal of Clinical Investigation, 38*(s2), 50–57. https://doi.org/10.1111/j.1365-2362.2008.02009.x

Stamm, W. E., & Norrby, S. R. (2001). Urinary tract infections: Disease panorama and challenges. *The Journal of Infectious Diseases, 183*(Supplement_1), S1–S4. https://doi.org/10.1086/318850

Tanagho, E. A., McAninch, J. W., & Smith, D. R. (Eds.). (2004). *Smith's general urology* (16th ed.). McGraw-Hill.

Wagenlehner, F., Wullt, B., Ballarini, S., Zingg, D., & Naber, K. G. (2018). Social and economic burden of recurrent urinary tract infections and quality of life: A patient web-based study (GESPRIT). *Expert Review of Pharmacoeconomics & Outcomes Research, 18*(1), 107–117.