

## **Prevalence and Management of Pediatric Urinary Tract Infections in Wasit Governorate, Iraq**

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**Abstract:** Urinary tract infections (UTIs) represent a significant health concern among pediatric populations, contributing to considerable morbidity in both boys and girls. This study aimed to isolate and identify the most common bacterial pathogens associated with UTIs in children in the city of Kut, Iraq. A total of 105 urine samples were collected from pediatric patients aged between 4 days and 10 years, who were admitted to Al-Zahra General Hospital and Kut Maternity and Pediatric Hospital, during the period from October 2023 to February 2024. Out of the total samples, 45 (38.09%) were confirmed as positive bacterial isolates, including *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*. The results demonstrated a higher prevalence of infection among females (55.23%) compared to males (44.79%), and younger age groups showed higher infection rates than older children. Antibiotic therapy was the most commonly prescribed treatment (95%), with amoxicillin and trimethoprim being the most frequently administered. Non-steroidal anti-inflammatory drugs (NSAIDs), such as paracetamol, were used in 57% of cases, while surgical intervention, particularly circumcision, was considered the most effective treatment in 8% of cases.

**Keywords:** Pediatric UTI; *Escherichia coli*; Antibiotic resistance; Iraq; Prevalence; Children.

### **Introduction**

Urinary tract infections (UTIs) are among the most common bacterial infections in childhood, representing a significant health problem that can lead to serious complications if not promptly diagnosed and treated. The condition arises when pathogenic microorganisms invade the urinary tract, including the kidneys, ureters, bladder, and urethra, with *Escherichia coli* being the most frequently implicated pathogen, responsible for up to 80–90% of pediatric cases (Foxman, 2014; Zorc et al., 2005). Other causative agents include *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and coagulase-negative staphylococci (Baraboutis et al., 2010; Hryniwicz et al., 2001).

UTIs in children are more prevalent among females due to anatomical and physiological factors, such as a shorter urethra and its proximity to the anus, which facilitates bacterial colonization (Shaikh et al., 2008). In neonates and infants, the risk is particularly high, especially among uncircumcised males under the age of one year (Georgieva et al., 2019). Clinical manifestations vary according to age, ranging from non-specific symptoms such as fever, irritability, vomiting, and poor feeding in infants, to classic urinary symptoms such as dysuria, frequency, and suprapubic pain in older children (Roberts, 2011; Korbel et al., 2007).

Recurrent UTIs can result in long-term renal damage, including scarring and chronic kidney disease, thus highlighting the importance of accurate diagnosis and appropriate treatment (Keren

et al., 2015). Diagnosis typically involves urine analysis, culture, and antimicrobial sensitivity testing, which guide the selection of appropriate antibiotic therapy. Amoxicillin and trimethoprim remain among the most commonly prescribed antibiotics, although resistance rates are increasing worldwide (Edlin et al., 2013).

Despite global advances in pediatric care, UTIs remain a major public health challenge in many developing regions, including Iraq. Local epidemiological studies are therefore essential to determine the most prevalent bacterial pathogens, their antimicrobial resistance patterns, and the clinical features of affected children. This study was conducted to isolate and identify the most common bacterial agents causing UTIs among children in the city of Kut, Iraq, and to evaluate the therapeutic approaches currently in use.

## Materials and Methods

### Study Design and Setting

This cross-sectional study was conducted in Al-Zahraa Teaching Hospital for Maternity and Children in Kut City, Wasit Governorate, Iraq, over a period of six months (from October 2023 to February 2024). The hospital serves as a referral center for pediatric patients in the region, making it an appropriate site for studying the epidemiology of urinary tract infections (UTIs) in children.

### Study Population and Sample Collection

A total of 105 pediatric patients, aged between 4 days and 10 years, who presented with clinical signs and symptoms suggestive of UTI (such as fever, dysuria, urinary frequency, suprapubic pain, or unexplained irritability in infants), were included in the study. Patients with known congenital anomalies of the urinary tract, recent antibiotic therapy (within the last 72 hours), or chronic kidney disease were excluded.

Midstream urine samples were collected from toilet-trained children under aseptic conditions. For non-toilet-trained infants, urine specimens were obtained using sterile urine collection bags after thorough perineal cleaning. In selected cases, catheterization was employed to ensure accurate sampling. Each specimen was transported immediately to the microbiology laboratory for processing within two hours of collection.

### Laboratory Procedures

Urine samples were cultured on MacConkey agar, blood agar, and CLED agar plates using the calibrated loop technique (0.001 mL loop). Plates were incubated aerobically at 37°C for 24–48 hours. Significant bacteriuria was defined as  $\geq 10^5$  colony-forming units (CFU)/mL for midstream samples and  $\geq 10^4$  CFU/mL for catheter-obtained specimens, in accordance with international guidelines (Roberts, 2011; Alsaywid et al., 2023).

Isolated organisms were identified by standard microbiological techniques, including colony morphology, Gram staining, and biochemical tests (e.g., indole, citrate utilization, urease production, oxidase, and triple sugar iron agar reactions). Further confirmation of *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* was performed using API 20E and API Staph systems (bioMérieux, France).

### Antimicrobial Susceptibility Testing

Antibiotic susceptibility patterns were determined using the Kirby–Bauer disk diffusion method on Mueller–Hinton agar, following the Clinical and Laboratory Standards Institute (CLSI, 2023) guidelines. The antibiotics tested included: ampicillin, amoxicillin–clavulanic acid, cefuroxime, cefotaxime, ceftazidime, ciprofloxacin, trimethoprim–sulfamethoxazole, gentamicin, amikacin, and imipenem. The results were interpreted as “susceptible,” “intermediate,” or “resistant” according to CLSI breakpoints. Multidrug resistance (MDR) was defined as resistance to three or more classes of antimicrobial agents (El Zein et al., 2025).

## Data Analysis

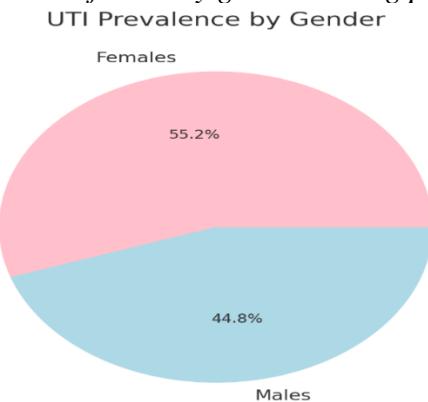
Data were recorded, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics (frequency, percentage, mean  $\pm$  SD) were used to summarize demographic and clinical variables. Chi-square test was applied to assess associations between categorical variables, and a p-value of  $<0.05$  was considered statistically significant.

## Results

### Demographic Characteristics

A total of 105 pediatric patients, aged between 4 days and 10 years, were included in the study. Of these, 55.23% were females and 44.79% were males, yielding a female-to-male ratio of approximately 1.2:1 (Figure 1). The majority of cases occurred in younger children (<5 years).

Figure 1. Prevalence of UTIs by gender among pediatric patients



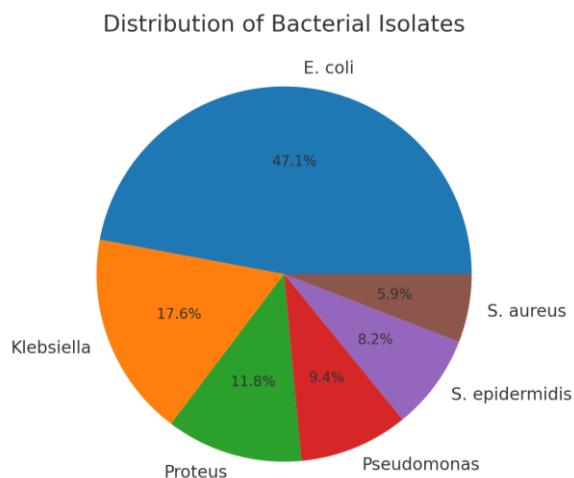
### Bacterial Isolates

Out of the 105 urine samples, 45 (38.09%) yielded positive bacterial cultures. *Escherichia coli* was the predominant pathogen, accounting for 40% of isolates, followed by *Klebsiella pneumoniae* (15%), *Proteus mirabilis* (10%), *Pseudomonas aeruginosa* (8%), *Staphylococcus epidermidis* (7%), and *Staphylococcus aureus* (5%) (Table 1, Figure 2).

Table 1. Distribution of bacterial isolates among pediatric patients with UTIs

Pathogen	Percentage (%)
<i>Escherichia coli</i>	40
<i>Klebsiella pneumoniae</i>	15
<i>Proteus mirabilis</i>	10
<i>Pseudomonas aeruginosa</i>	8
<i>Staphylococcus epidermidis</i>	7
<i>Staphylococcus aureus</i>	5

Figure 2. Distribution of bacterial isolates causing UTIs in children



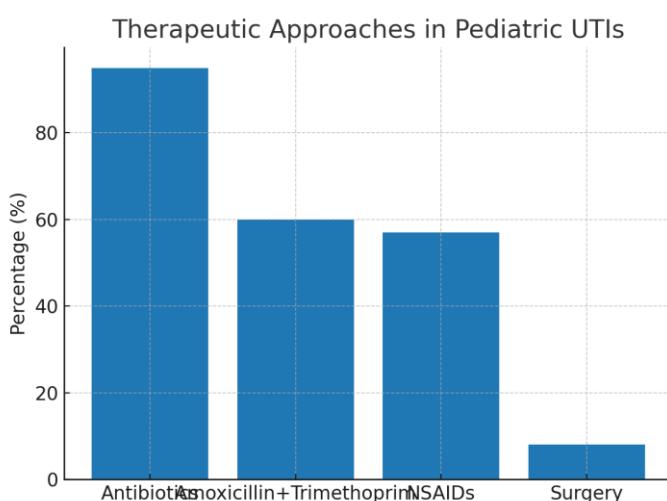
## Antibiotic and Treatment Approaches

Antibiotic therapy was the primary treatment modality, prescribed in 95% of cases. The most frequently used antibiotics were amoxicillin and trimethoprim, reported in approximately 60% of patients. Non-steroidal anti-inflammatory drugs (NSAIDs), primarily paracetamol, were administered in 57% of cases, mainly for fever and symptomatic relief. Surgical intervention (circumcision) was reported in 8% of male patients (Table 2, Figure 3).

Table 2. Therapeutic approaches among pediatric UTI patients

Treatment modality	Percentage (%)
Antibiotics (overall)	95
Amoxicillin & Trimethoprim	60
NSAIDs (Paracetamol)	57
Surgical intervention (Circumcision)	8

Figure 3. Distribution of treatment methods in pediatric UTIs



## Key Findings

- UTIs were more frequent among females compared to males.
- *E. coli* was the leading pathogen, followed by *K. pneumoniae* and *P. mirabilis*.
- High reliance on antibiotics was noted, with amoxicillin and trimethoprim being the most commonly prescribed drugs.
- NSAIDs were widely used as supportive therapy, and circumcision was considered in selected male patients.

## Discussion

Urinary tract infections (UTIs) represent one of the most common bacterial infections in the pediatric age group and remain a major public health concern worldwide. In the present study, a total of 105 pediatric patients were evaluated, with a higher prevalence observed among females (55.23%) compared to males (44.79%). This gender-related difference is consistent with findings from Shaikh et al. (2008) and Alsaywid et al. (2023), who reported that the shorter female urethra and its proximity to the perineum facilitate bacterial colonization, leading to a higher risk of infection.

The highest prevalence was documented in children under the age of five years, which is in agreement with previous studies indicating that younger children are particularly vulnerable due

to immature immune responses and difficulties in maintaining hygiene (Georgieva et al., 2019; Daniel et al., 2023).

Microbiological analysis revealed that *Escherichia coli* was the predominant pathogen (40%), followed by *Klebsiella pneumoniae* and *Proteus mirabilis*. This distribution corresponds to the classical epidemiology of pediatric UTIs reported globally (Foxman, 2014; Kawalec et al., 2023). The predominance of *E. coli* may be attributed to its unique virulence factors such as fimbriae, adhesins, and toxins, which enhance its ability to colonize and invade the urinary tract (Korbel et al., 2007). The presence of non-*E. coli* pathogens such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* is also noteworthy, as these organisms are often associated with complicated or recurrent infections (Baraboutis et al., 2010; Kılıç & Küçükkelepçe, 2025).

With respect to treatment, antibiotics were administered in 95% of cases, with amoxicillin and trimethoprim being the most frequently prescribed. However, increasing resistance rates against these agents have been reported worldwide (Edlin et al., 2013; Mahajan et al., 2024). Recent studies emphasize that while aminoglycosides (amikacin) and carbapenems (imipenem) remain effective, the global emergence of multidrug-resistant strains poses a serious therapeutic challenge (El Zein et al., 2025; Maringhini et al., 2024). These observations highlight the need for judicious antibiotic use and the implementation of antibiotic stewardship programs in pediatric care settings.

In addition to antimicrobial therapy, non-steroidal anti-inflammatory drugs (NSAIDs) such as paracetamol were commonly used in this cohort (57%), primarily for symptomatic relief of fever and pain. Surgical intervention in the form of circumcision was reported in 8% of male patients. This finding aligns with evidence that circumcision reduces the risk of recurrent UTIs in male infants, particularly those under one year of age (Roberts, 2011; Keren et al., 2015).

Overall, the results of this study are comparable to international findings, indicating that UTIs in children are predominantly caused by Gram-negative bacteria, particularly *E. coli*, with high prevalence in females and younger children. However, the increasing trend of antimicrobial resistance remains a major concern, reinforcing the importance of regional surveillance studies to guide empirical therapy.

## Conclusion

This study highlights the significant burden of urinary tract infections among pediatric patients in Wasit Governorate, Iraq. The findings demonstrated that UTIs are more common in females than males, with the highest prevalence observed in children under the age of five years. *Escherichia coli* was identified as the leading causative pathogen, consistent with global epidemiological patterns, while other Gram-negative bacteria and *Staphylococcus* species were also isolated.

Antibiotic therapy constituted the cornerstone of treatment, with amoxicillin and trimethoprim being the most commonly prescribed agents. However, the increasing rates of antimicrobial resistance observed in recent years raise serious concerns regarding treatment efficacy and highlight the necessity for continuous local and regional surveillance. Supportive measures, including NSAIDs for symptom relief and circumcision as a preventive strategy in male patients, were also part of the management approach.

The study underscores the importance of early diagnosis, appropriate antibiotic selection, and preventive measures to reduce the morbidity associated with pediatric UTIs.

## Recommendations

- Strengthen surveillance systems: Regular monitoring of bacterial isolates and their antimicrobial resistance patterns is essential to guide empirical therapy in pediatric UTIs.
- Promote antibiotic stewardship: Judicious prescription of antibiotics should be encouraged to limit the emergence of multidrug-resistant organisms.

- Enhance diagnostic capacity: Laboratories should be equipped with advanced diagnostic tools to ensure timely and accurate identification of pathogens.
- Focus on preventive strategies: Public health interventions such as health education for parents on hygiene practices, adequate hydration, and timely circumcision in male infants can help reduce UTI incidence.
- Further research: Large-scale, multicenter studies are recommended to better understand the epidemiology, resistance trends, and clinical outcomes of pediatric UTIs in Iraq and the region.
- Clinical guidelines: Development of updated, evidence-based clinical guidelines for the management of pediatric UTIs in Iraq is strongly advised.

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