e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.12.143

International Journal of Pharmaceutical Quality Assurance 2025; 16(12); 908-914

Original Research Article

Prevalence and Clinical–Demographic Profile of Urinary Tract Infections among Children: A Retrospective Study

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Received: 19-11-2025 / Revised: 10-12-2025 / Accepted: 29-12-2025

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Conflict of interest: Nil

Abstract:

Background: Urinary tract infections (UTIs) are a common pediatric problem associated with significant morbidity and potential long-term renal complications.

Aim: To determine the prevalence and clinical–demographic profile of UTIs among children in a tertiary care setting.

Methodology: A retrospective observational study was conducted over six months including 70 children (1 month–17 years) with clinically and laboratory-confirmed UTIs. Data on demographics, clinical features, laboratory findings, urine culture, treatment, and outcomes were analyzed using descriptive statistics.

Results: Females predominated (65.7%), with the highest cases in 1–5 years (28.6%). Fever (82.9%) was the most common symptom. Positive urine cultures were found in 57.1%, with *Escherichia coli* (55%) as the leading pathogen. Mean hospital stay was 5.9±2.1 days. Cefotaxime (54.3%) was the most commonly used empirical antibiotic. Most patients (85.7%) recovered completely.

Conclusion: Pediatric UTIs are more frequent in females and young children, commonly presenting with fever. *E. coli* remains the predominant pathogen. Early diagnosis and appropriate antibiotic therapy result in favorable outcomes.

Keywords: Urinary tract infection, pediatrics, prevalence, *Escherichia coli*, clinical profile, antibiotics.

Introduction

The UTI is one of the most prevalent bacterial infections and a major cause of morbidity in the pediatric population. The urinary tract including kidneys, ureters, bladder and urethra is crucial to physiological homeostasis by excretion of the metabolic waste products and by regulating electrolyte balance, blood pressure and volume of fluid [1]. In the normal condition the urinary tract is sterile, but the urinary tract is vulnerable to the colonization of pathogenic microorganisms, especially the gastrointestinal bacteria.

UTIs are estimated to cause 150 to 250 million cases every year worldwide in all age groups, and it is observed that the burden is significant in children [2]. The clinical significance of PUTIs is of special concern because they are linked to both congenital and acquired renal issues of the urinary tract, recurrence, as well as the possibility of development of long-term complications, including renal scarring, hypertension, and chronic kidney disease (CKD). UTI epidemiology indicates a gender-specific difference: male infants are more susceptible to the condition at the neonatal stage, whereas females are more prone to UTI after infancy. This female vulnerability is mostly modified by anatomical and physiological influences such as a short urethra and its positioning close to the anal area that allows bacterial infection to ascend easily [3].

Pediatric UTIs are mainly bacterial in etiology with Escherichia coli causing about 80-90 percent. Other uropathogens that are often involved are Klebsiella pneumoniae, Proteus mirabilis, Enterococcus species and Pseudomonas aeruginosa [4]. The range of causative organisms is wider in the case of neonates

and young infants, which can include Gram-positive bacteria like Streptococcus agalactiae. Besides, Staphylococcus saprophyticus is commonly related to UTIs in sexually active adolescents. Viral and fungal types of pathogens, cytomegalovirus and Candida species, are rare, but may be noted in the immunocompromised or people with indwelling urinary equipment or previous instrumentation [5].

Clinical signs of UTIs in children differ greatly with age, and in younger ages it is especially difficult to diagnose a UTI condition. The symptoms are usually vague in nature, containing no specifics (poor feeding, vomiting, irritability, jaundice, or lack of thriving) in the cases of neonates and infants. The common feature of this age group is fever with no apparent course. Conversely, localized urinary symptoms, such as dysuria, higher urinary frequency, urgency, abdominal or flank pain, and foul-smelling urine are more likely to be observed in older children. Repeating UTIs in children can be pointing out to structural or functional defects of the urinary tract and requires additional diagnosis [6].

UTIs diagnosis is based on clinical suspicion and laboratory confirmation. Initial screening is done with urinalysis such as dipstick testing of leukocyte esterase, and nitrites, and urine microscopy. Nevertheless, urine culture is the gold standard in final diagnosis as well as in the administration of specific antimicrobial therapy. The validity of diagnosis mainly relies on the correct urine collection methods, particularly in the young children. Instances like catheterization or suprapubic aspiration are better techniques rather than those of urine collection bags because of the high chances of contamination in the latter technique.

The use of imaging studies is done selectively depending on the age of the patient, the severity of the infection, and the likelihood of spreading. Renal and bladder ultrasonography, voiding cystourethrography (VCUG), and dimercaptosuccinic acid (DMSA) renal scans are modalities that play an important role in determining structural abnormalities, vesicoureteral reflux (VUR), and renal parenchymal damage [7] or incomplete. It is important to detect such abnormalities at an early stage to avoid recurrent infections and reduce long-term complications of the kidneys.

Pediatric UTIs are managed by instating empirical antibiotic therapy immediately, which eventually follows the culture and sensitivity results. The patterns of local antimicrobial resistance play a major role in the selection of empirical therapy. Parenteral antibiotics including ampicillin with aminoglycosides or the third-generation cephalosporins are advised in the case of neonates and infants under the age of three months because of the higher chances of systemic infection and kidney involvement [8]. As soon as a clinical improvement is noted, patients can be shifted to oral antibiotic therapy to complete the treatment regimen.

The increased attention to the issue of antimicrobial resistance in the world community also highlights the need to use antibiotics reasonably. Prophylactic antibiotics to prevent recurrent UTIs is still debatable with clinical practice today showing an increasing trend towards close monitoring and correction of predisposing risk factors as opposed to routine prophylaxis. Preventive measures such as better hygiene measures, early detection and treatment of underlying abnormalities are required in lowering the disease burden.

The pediatric UTI burden in the Indian case, especially in the semi-urban and rural areas such as Muzaffarpur, Bihar may be affected by various factors such as socioeconomic status, access to healthcare, nutrition, hygiene and awareness. Although UTIs occur frequently and are complicated in children, few region-specific data are available to cover their clinical and demographic trends, alongside the trends in antimicrobial resistance.

Thus, this retrospective study is set to consider the prevalence, etiological profile, clinical manifestation, laboratory results, patterns of antibiotic resistance, and treatment modalities in children with UTI. This investigation will contribute to the development of evidence-based measures to effectively diagnose, manage, and prevent pediatric UTIs in the region, as it will help to increase the knowledge about the local epidemiology of the disease and its treatment.

Methodology

Study Design: This study was designed as a retrospective, observational study aimed at determining the prevalence and evaluating the clinical–demographic profile of urinary tract infections (UTIs) among children. The retrospective nature of the study allowed for the analysis of already recorded patient data without any direct intervention.

Study Area: The study was conducted in the Department of Pediatrics at Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India

Study Duration: The study was carried out over a period of six months from April 2025 to September 2025.

Sample Size: A total of 70 pediatric patients diagnosed with urinary tract infections during the study period were included in the analysis. The sample size was determined based on the availability of eligible patient records that met the inclusion criteria.

Study Population: The study population comprised children aged between 1 month and 17 years who were diagnosed with urinary tract infections during the study period. Both male and female patients were included to assess gender distribution and to

better understand the demographic and clinical characteristics associated with UTIs in children.

Data Collection: Data were collected retrospectively from patient medical records and case files maintained in the hospital's record department. Information extracted included demographic details such as age and gender, clinical presentation including symptoms and duration of illness, and laboratory findings such as complete blood count, C-reactive protein levels, blood urea, serum creatinine, and urine examination and culture reports. In addition, microbiological data regarding causative organisms and their antimicrobial sensitivity patterns were recorded wherever available. Details regarding treatment, including empirical and definitive antibiotic therapy, were also documented.

Inclusion Criteria

- Children aged 1 month to 17 years
- Patients with clinically and laboratory-confirmed UTI (positive urine examination and/or culture)
- Availability of complete medical records

Exclusion Criteria

- Patients with incomplete or missing medical records
- Cases without confirmatory laboratory evidence of UTI
- Children with known congenital urinary tract anomalies

Procedure

The procedure involved identifying pediatric patients diagnosed with urinary tract infections during the study period from hospital records. These records were screened according to the inclusion and exclusion criteria. Relevant demographic, clinical, and laboratory data were systematically extracted using a structured format. Urine culture reports were reviewed to identify the causative organisms and their antimicrobial susceptibility patterns. The collected data were then organized and prepared for statistical analysis.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software such as SPSS. Descriptive statistical methods were applied to summarize the data. Categorical variables, including gender distribution, presenting symptoms, and causative organisms, were expressed as frequencies and percentages. Continuous variables, such as age and laboratory parameters, were presented as mean and standard deviation. The findings were illustrated using tables and charts where necessary. As the study primarily aimed to describe prevalence and clinical patterns, no advanced inferential statistical tests were performed."

Result

Table 1 presents the demographic characteristics of 70 patients. Females constituted the majority with 46 patients (65.7%), while males accounted for 24 (34.3%). In terms of age distribution, the largest group was children aged 1–5 years (20, 28.6%), followed by 1–12 months (18, 25.7%), 6–10 years (17, 24.3%), and 11–17 years (15, 21.4%). This indicates a higher proportion of female patients and a relatively even distribution across pediatric age groups, with a slight predominance in early childhood.

Table 1: Demographic Characteristics of Study Population (N = 70)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	24	34.3
Female	46	65.7
Age Group		
1–12 months	18	25.7
1–5 years	20	28.6
6–10 years	17	24.3
11–17 years	15	21.4

Table 2 presents the clinical features of 70 patients. Fever was the most common symptom, observed in 58 patients (82.9%), followed by dysuria in 32 (45.7%) and abdominal pain in 29 (41.4%). Increased urinary frequency was reported in 26 patients (37.1%), while vomiting occurred in 21 (30%). Irritability was seen in 19 patients (27.1%), and poor feeding, particularly in infants, was noted in 14 cases (20%). This indicates that fever was the predominant presenting symptom, with a range of urinary and systemic features also commonly observed.

Table 2: Clinical Presentation of Patients (N = 70)		
Clinical Feature	**Frequency (n)**	**Percentage (%)**
Fever	58	82.9
Dysuria	32	45.7
Abdominal pain	29	41.4
Vomiting	21	30
Increased frequency	26	37.1
Poor feeding (infants)	14	20
Irritability	19	27.1

Table 3 shows the duration of hospital stay among 70 patients. The majority of patients stayed for 6–7 days (24, 34.3%), followed by 4–5 days (20, 28.6%). Shorter stays of 2–3 days were observed in 12 patients (17.1%), while 14 patients (20%) required hospitalization for more than 7 days. The mean duration of stay was 5.9 ± 2.1 days, indicating that most patients had a moderate hospital stay of around 6 days.

Table 3: Duration of Hospital Stay (N = 70)		
Duration (Days)	**Frequency (n)**	**Percentage (%)**
2–3 days	12	17.1
4–5 days	20	28.6
6–7 days	24	34.3
>7 days	14	20
Mean ± SD	**5.9 ± 2.1 days**	

Table 4 presents the laboratory findings of the 70 patients. The mean hemoglobin level was 10.8 ± 1.6 g/dL, indicating relatively lower values suggestive of mild anemia. The total white blood cell count was elevated at 12.5 ± 3.4 ×10⁹/L, and C-reactive protein (CRP) was also raised at 16.2 ± 5.1 mg/L, both reflecting an ongoing inflammatory or infectious process. Blood urea levels averaged 32.6 ± 10.2 mg/dL, while serum creatinine was 0.62 ± 0.21 mg/dL, indicating generally preserved renal function in most patients.

Table 4: Laboratory Findings (N = 70)	
Parameter	**Mean ± SD**
Hemoglobin (g/dL)	10.8 ± 1.6
Total WBC (×10⁹/L)	12.5 ± 3.4
CRP (mg/L)	16.2 ± 5.1
Blood Urea (mg/dL)	32.6 ± 10.2
Creatinine (mg/dL)	0.62 ± 0.21

Table 5 presents the urine culture results among 70 patients. Positive cultures were found in 40 patients (57.1%), indicating confirmed urinary infections in more than half of the cases. In contrast, 30 patients (42.9%) showed no growth on culture. This suggests that while a majority had microbiologically proven infections, a substantial proportion did not yield detectable organisms.

Table 5: Urine Culture Results (N = 70)		
Culture Result	**Frequency (n)**	**Percentage (%)**
Positive culture	40	57.1
No growth	30	42.9

Table 6 shows the distribution of uropathogens among 40 positive urine cultures. The most common organism was Escherichia coli, isolated in 22 cases (55%), followed by Klebsiella species in 10 cases (25%). Proteus species accounted for 4 cases (10%), while Pseudomonas aeruginosa and Enterococcus species were each identified in 2 cases (5% each). This indicates that E. coli was the predominant uropathogen, with other organisms contributing to a smaller proportion of infections.

Table 6: Distribution of Uropathogens (n = 40 Positive Cultures)		
Organism	**Frequency (n)**	**Percentage (%)**
Escherichia coli	22	55
Klebsiella spp.	10	25
Proteus spp.	4	10
Pseudomonas aeruginosa	2	5
Enterococcus spp.	2	5

Table 7 shows the pattern of empirical antibiotic therapy among 70 patients. The most commonly used antibiotic was Cefotaxime (IV), administered to 38 patients (54.3%). Ceftriaxone (IV) was used in 18 patients (25.7%), while Amikacin was given to 8 patients (11.4%). Other antibiotics were used in 6 patients (8.6%). This indicates that third-generation cephalosporins, particularly cefotaxime, were the preferred empirical treatment in the majority of cases.

Table 7: Empirical Antibiotic Therapy (N = 70)		
Antibiotic Used	**Frequency (n)**	**Percentage (%)**
Cefotaxime (IV)	38	54.3
Ceftriaxone (IV)	18	25.7
Amikacin	8	11.4
Others	6	8.6

Table 8 presents the outcomes of 70 patients. The majority, 60 patients (85.7%), recovered completely. A smaller proportion, 8 patients (11.4%), showed improvement but had not fully recovered, while 2 patients (2.9%) were referred to higher centers for further management. This indicates a high rate of favorable outcomes, with most patients achieving full recovery.

Table 8: Outcome of Patients (N = 70)		
Outcome	**Frequency (n)**	**Percentage (%)**
Recovered	60	85.7
Improved	8	11.4
Referred	2	2.9

Discussion

The present study shows a distinct female prevalence (65.7) among pediatric cases of UTI which is extremely coherent with other literature that has reported a higher vulnerability of females to anatomical and periurethral factors. Similar studies by Chang and Shortliffe (2006) [3] and Silva and Oliveira (2015) [6] also showed that the incidence was higher in girls past the age of infancy, which they explained by shorter urethra and higher chances of ascending infections. Other studies have however portrayed a comparatively higher prevalence in male infants especially during the first year of life and is usually related to congenital anomalies or absence of circumcision (Zorc et al., 2005) [9]. As opposed to such results, despite infants making up 25.7 percent of our cohort, the predominance of females as a whole indicates that the gap between genders increases as the age advances, which is also consistent with the global epidemiological patterns (Shaikh and Hoberman, 2018) [4]."

The age distribution in our research showed that children aged 1-5 years constituted the greatest proportion (28.6%), infants closely followed accounting to 25.7% which reveals that young children constitute a considerable percentage of the UTI cases. Other similar observations were made in the works by Robinson et al. (2014) [10] and Stephens et al. (2015) [11], according to which the early childhood was recognized as a high-risk period because of the lack of bladder control, bad personal hygiene, and underdeveloped immune system. On the other hand, reports have also recorded a bimodal distribution with infancy and school-aged children recording the highest number (Morello et al., 2016) [12]. Although older age groups occurred in our research in a significant percentage as well, younger age groups were the most dominant, which supports the necessity of early diagnostic attention, particularly when the symptoms may be considered unspecific.

Fever was the most prevalent presenting symptom in our study (82.9%), which aligns with the results of several studies, which discover fever to be the manifestation of pediatric UTI, especially in children of early age (Robinson et al., 2014) [10]. Dysuria, pain in the abdomen, and frequent micturition were also common symptoms, which are classical symptoms of lower urinary tract in older children (Leung, 2012) [13]. But signs of irritability, vomiting, and poor feeding were more evident in our cohort of infants, with age-specific changes in clinical manifestation. No specific features observed in younger children are expected, as previous studies have

stressed that diagnosis in this age group is quite problematic (Arshad and Seed, 2015) [8]. In comparison to these studies, our findings with relatively high prevalence of gastrointestinal symptoms such as vomiting (30%), is an indication of a more systemic manifestation in a subgroup of patients.

Our study showed an average of 5.9 + 2.1 days of hospitalization, which can be compared to the results of other studies of this kind in hospitals, with an average of 4 to 7 days (Clark et al., 2010) [14] on average. The increase in longer hospital stay (> 7 days) in 20% of our patients could be due to severe disease, late onset of the disease or intravenous antibiotic treatment. Conversely, a few newer studies support the notion of shorter hospitalization period and early switching to oral therapy especially where the cases are simple (Benador et al., 2001) [14]. This inconsistency indicates that the length of hospitalization might be affected by institutional policies and clinical opinion, and individual patient characteristics.

Our study laboratory results such as high levels of white blood cells, C-reactive protein, etc. are evidence of an ongoing inflammatory process, which are consistent with prior studies (Afzal et al., 2012) [16]. Nevertheless, as with other reports by the American Academy of Pediatrics (2016) [17], these markers, despite being helpful in the context of supporting the diagnosis, are limited by their specificity in relation to predicting the severity and outcomes of the disease. Mild anemia (mean hemoglobin 10.8 g/dL) is also present in our cohort, which has been reported in other studies, which may be due to nutritional deficiency or chronic infection (Leung et al., 2012) [13]. In our study, the parameters of renal functions were mostly within the normal range, which implies timely diagnosis and proper treatment, which is unlike those studies that found renal impairment due to late diagnosis or frequent infections (Roberts, 2014) [18].

Escherichia coli was the most common pathogen (55%), and then came Klebsiella species (25%), which is in agreement with the global statistics showing that E. coli is the most common cause of pediatric UTIs (Flores-Mireles et al., 2015) [2]. The same pattern of pathogen distributions has been described in both the community and hospital environment (Morello et al., 2016) [12]. Nevertheless, the percentage of Klebsiella in our study seems to be slightly elevated than in some of the studies in which it usually represents a lower percentage of cases. Such diversity can be due to a local epidemiological trend or greater exposure in the hospital. Other organisms like Proteus, Pseudomonas, and Enterococcus are also present but in lesser proportion and are also consistent with the findings of the previous literature especially in complicated infections or recurring infections (Fitzgerald et al., 2012) [19].

The culture positivity level of our study (57.1) is relatively low as compared to other studies, which commonly range between 70 and 80% (Zorc et al., 2005) [9]. This difference may be explained by the previous use of antibiotics, incorrect sampling, or drawbacks of the laboratory methods. The same problems have been mentioned in previous studies, where the standardization of diagnostic protocols is needed (Fritzenwanker et al., 2016) [20].

Regarding medications, the most typical antibiotics in our study were third-generation cephalosporins, specifically cefotaxime and ceftriaxone, which are in line with the recommended agents used in empirical treatment of pediatric UTIs (Stein et al., 2015) [21]. The pattern of prescribing was observed to be similar in several studies as it has a broad-spectrum activity and is safe. Nevertheless, the rise in antimicrobial resistance, especially to the most frequently used antibiotics, is well-reported and is an issue of concern (Roberts, 2014) [18]. Though we have not analyzed resistance patterns in much detail, the dependency on cephalosporins supports the significance of constant surveillance and antibiotic stewardship.

Our study was generally successful in terms of clinical capacity, and only the small percentage of patients needed referrals with 85.7% of them recovering fully. These results are aligned with the research results of the past that show that with early diagnosis and proper management, pediatric UTIs have a good prognosis (Hudson et al., 2017) [22]. Conversely, complications like scarring of the kidney and long-term morbidity have been linked to delayed diagnosis or frequent infection (Morello et al., 2016) [12]. Thus, our results highlight the effectiveness of timely intervention while also emphasizing the need for ongoing monitoring and preventive strategies.

Overall, the findings of this study are largely in agreement with existing literature, while certain variations in age distribution, pathogen prevalence, and culture positivity reflect local epidemiological differences. These similarities and contrasts underscore the importance of context-specific data in guiding clinical practice and improving outcomes in pediatric urinary tract infections.

Conclusion

This retrospective study highlights that urinary tract infections in children are more commonly observed in females and affect a wide pediatric age range, with notable occurrence even in early childhood. Fever emerged as the predominant presenting symptom, often accompanied by urinary and gastrointestinal complaints, indicating the varied clinical spectrum of the condition. The duration of hospitalization was generally moderate, reflecting effective inpatient management in most cases. Laboratory findings were suggestive of inflammatory response without significant renal impairment in the majority.

A considerable proportion of cases showed positive urine cultures, with Escherichia coli identified as the most common causative organism, followed by other gram-negative pathogens. Empirical antibiotic therapy was largely based on third-generation cephalosporins, which corresponded with favorable clinical outcomes, as most patients recovered or showed improvement. Overall, the study underscores the importance of early recognition, appropriate antimicrobial therapy, and careful clinical monitoring in managing pediatric urinary tract infections effectively.

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