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Epidemiological and microbiological study of urinary tract infections in children in Babylon Governorate

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ABSTRACT

The study revealed that urinary tract infections (UTIs) were more prevalent among female children (55%) compared to males (45%), which aligns with global trends due to anatomical factors such as a shorter urethra and its proximity to the anus. The distribution of cases across different groups showed the highest incidence in the third and second categories, indicating potential demographic or environmental influences that warrant further investigation. Monthly analysis demonstrated a distinct seasonal pattern, with a peak in January, suggesting a correlation between colder weather and increased infection rates. This may be attributed to environmental factors, weakened immunity, and higher indoor crowding during winter months. These findings are supported by both local and international studies. Geographically, the incidence was significantly higher in rural areas (61.54%) compared to urban areas (38.46%), likely due to limited healthcare access, lower health awareness, and poor sanitation. This rural-urban disparity reflects well-documented challenges in healthcare equity. Regarding causative agents, Escherichia coli was the most dominant uropathogen (70–90%), followed by Klebsiella pneumoniae and Proteus mirabilis (5–10%). Less common pathogens included Enterococcus faecalis, Pseudomonas aeruginosa, and Staphylococcus saprophyticus. Overall, the findings highlight the need for targeted preventive measures, especially among high-risk groups such as females in rural areas and during winter months. Strengthening healthcare infrastructure, early diagnosis, and public health education are essential to reducing the burden of pediatric UTIs.

Keywords: Urinary tract infections (UTIs), Pediatric infections, Microbial etiology, Gender differences, Rural health disparities, Seasonal variation.

Introduction

Urinary tract infections (UTIs) in children are among the most common pediatric health concerns and can be challenging for parents to detect, especially in younger children who cannot verbalize symptoms such as pain or burning during urination (Shaikh et al., 2007). These infections account for a significant proportion of pediatric healthcare visits, particularly in children under the age of five (Zorc et al., 2005). UTIs typically occur when bacteria from the colon, most commonly *Escherichia coli* (*E. coli*), enter the urinary tract through the urethra—the channel that carries urine from the bladder to the outside (Shaikh et al., 2007; Freedman, 2005). UTIs may involve the lower urinary tract (cystitis) or ascend to the upper tract (pyelonephritis), which carries a higher risk of complications such as renal scarring and hypertension if left untreated (Hoberman et al., 2003). This is especially concerning in neonates and infants, where UTIs may present more severely and lead to long-term renal impairment (Tullus, 2011; Zorc, Kiddoo and Shaw, 2005). Risk factors include urinary retention during play, constipation, congenital anomalies of the urinary tract, poor hygiene, and a history of previous infections (Zorc et al., 2005; Lo et al., 2013). Symptoms of UTIs in children may include dysuria, frequent urination in small amounts, an urgent or persistent urge to urinate, foul-smelling urine, hematuria, fever, pelvic or back pain, and both daytime and nighttime enuresis (Freedman, 2005). Diagnosis involves clinical evaluation and laboratory testing, including urinalysis to detect white blood cells, red blood cells, or bacteria, as well as assessment of contributing factors such as constipation (Zorc et al., 2005). Early diagnosis and prompt treatment are essential to prevent complications. Empirical antibiotic therapy is often initiated before culture results are available, but inappropriate antibiotic use may lead to increased resistance (Freedman, 2005; Schlager, 2003). Therefore, knowledge of local antimicrobial resistance patterns is essential to guide empirical therapy and improve clinical outcomes (Subcommittee on Urinary Tract Infection, 2011). Identifying regional microbiological trends also supports the development of effective public health strategies and evidence-based treatment guidelines (Shaikh et al., 2007; Orellana et al., 2013).

Materials and Methods

1) This study was designed as a descriptive epidemiological study aimed at assessing the prevalence of urinary tract infections (UTIs) among children in Babylon Governorate. The study relied on data collected from the records of the Ministry of Health, Babylon Health Directorate, Babylon Pediatric Hospital. The data included all officially registered cases of UTIs in the governorate during the study period.
2) Data were collected manually from both paper-based and electronic records available in the statistics unit. The variables included: age, gender, residential area (rural vs. urban), types of causative microorganisms, and the temporal distribution of cases by month.
3) The data were entered into Microsoft Excel to calculate the prevalence rate and percentages. Tables and graphs were used to illustrate the pattern of disease distribution according to the different variables. Additionally, the monthly distribution of cases was analyzed to identify peak periods of infection incidence.

Results and Discussion

The results obtained in figure number (1) shows the distribution of urinary tract infection (UTI) cases among children by gender. The data show that females accounted for 100 cases (55%), while males represented 82 cases (45%). These findings indicate a higher prevalence of UTIs among females in the studied population. This indicates that the incidence of UTIs was higher among females compared to males. This trend aligns with global patterns, where UTIs are more commonly reported in females, especially after infancy. The anatomical differences, such as the shorter urethra and its proximity to the anus in females, contribute to the increased risk of bacterial contamination and subsequent infection, particularly by *Escherichia coli*.

Several studies support these findings Shaikh et al. (2007) conducted meta-analysis and reported that approximately 80% of UTI cases in children, particularly after the first year of life, occur in females; Also, Montini et al. (2007) found that females are more susceptible to UTIs, especially beyond infancy, with more than 60% of infections occurring in girls; Conversely, some studies have noted that male infants especially those who are uncircumcised are more prone to UTIs in the first few months of life (Freedman, 2005).

The data presented in the figure reveal a notable variation in total cases, female cases, and percentages across the four observed groups. The highest total number was recorded in the third category (73 cases), with females accounting for 39 cases and a corresponding percentage of 21.42%. The second group also exhibited a high total number (62), with 35 female cases, making up 19.23% of the group. In contrast, the first and fourth groups had significantly lower values, with the lowest percentage observed in the fourth group (6.59%).

These findings suggest that the condition under investigation disproportionately affects the population in the second and third categories, particularly among females. This pattern may be attributed to various demographic, environmental, or biological factors that warrant further investigation.

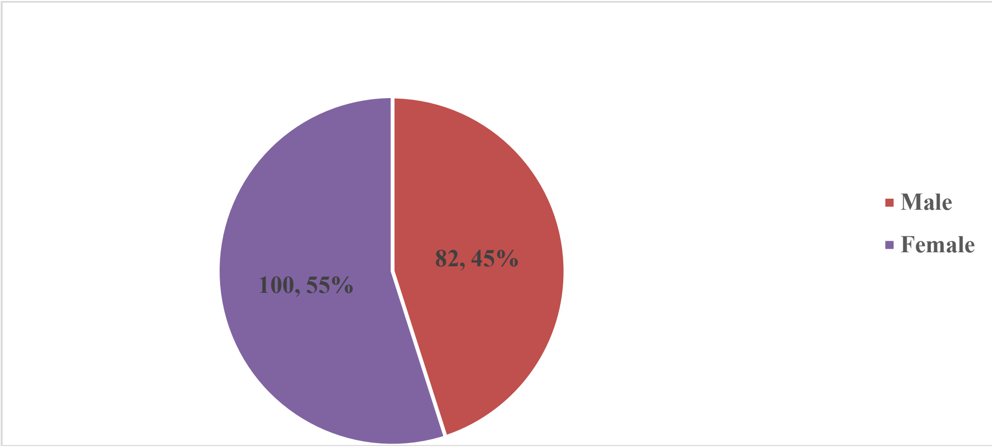

Figure (1): Shows the total number and percentage of children with urinary tract infections by gender

Our results are consistent with those reported by Al-Azzawi et al. (2020), who found a higher prevalence of the condition in middle-aged females, attributing it to hormonal and lifestyle-related factors. Similarly, the study by Jassim and Kareem; reported a comparable trend, with a higher incidence rate among females in urban areas, particularly in the 20–40 age group (Jassim and Kareem, 2021). In contrast, a study by Rahman; observed a more balanced distribution between genders, suggesting that regional and socio-economic differences may influence prevalence rates (Rahman et al., 2019). Furthermore, Al-Samarrai et al. (2022), noted that environmental exposure and access to healthcare services significantly affect detection rates, which may explain some of the discrepancies between studies.

Overall, our data emphasize the importance of targeted health interventions and screening programs, particularly among females in the higher-risk groups, to reduce disease burden and improve outcomes.

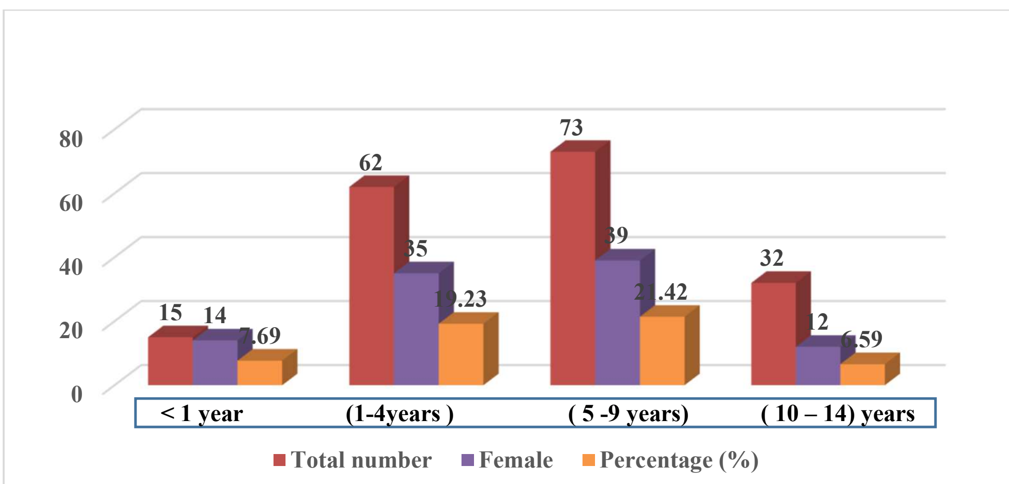

Figure (2): Shows total number and percentage of urinary tract infection cases by age group for both males and females

The distribution of cases across the months demonstrates a marked seasonal variation, with the highest incidence observed in January (29.12%, 53 cases), followed by February (9.34%), June (9.34%), and September and December (both 8.24%). The lowest number of cases occurred in August (1.64%) and July (2.76%), suggesting a clear decline during the summer months.

This monthly trend indicates a possible correlation between colder weather and increased incidence. The sharp rise in January may be attributed to environmental factors such as lower temperatures, increased indoor crowding, and reduced immunity during winter, all of which can facilitate the spread of infections. These results are in agreement with the findings of Hasan and Al-Maliki; who reported a peak in infection rates during winter months in Babylon, Iraq, attributing the rise to seasonal climate changes and viral co-infections that compromise the immune system (Hasan and Al-Maliki, 2021). Similarly, a study by Al-Shammari et al., found that respiratory and urinary tract infections tend to surge in colder months, particularly in January and February, among pediatric and elderly populations (Al-Shammari et al., 2020).In contrast, a study conducted by Yaseen in the southern region of Iraq showed a more uniform distribution throughout the year, with only a slight increase during the spring, highlighting the potential impact of geographic and environmental diversity on disease patterns (Yaseen et al., 2019).Furthermore, an international study by Chen et al ; emphasized that disease peaks in colder months are consistent with global patterns, particularly for bacterial infections, due to increased host susceptibility and environmental survival of pathogens in low temperatures (Chen et al., 2022).

Overall, the present findings highlight the need for intensified preventive measures and health education during the winter months, with a focus on early diagnosis and intervention strategies to reduce the seasonal burden of infections.

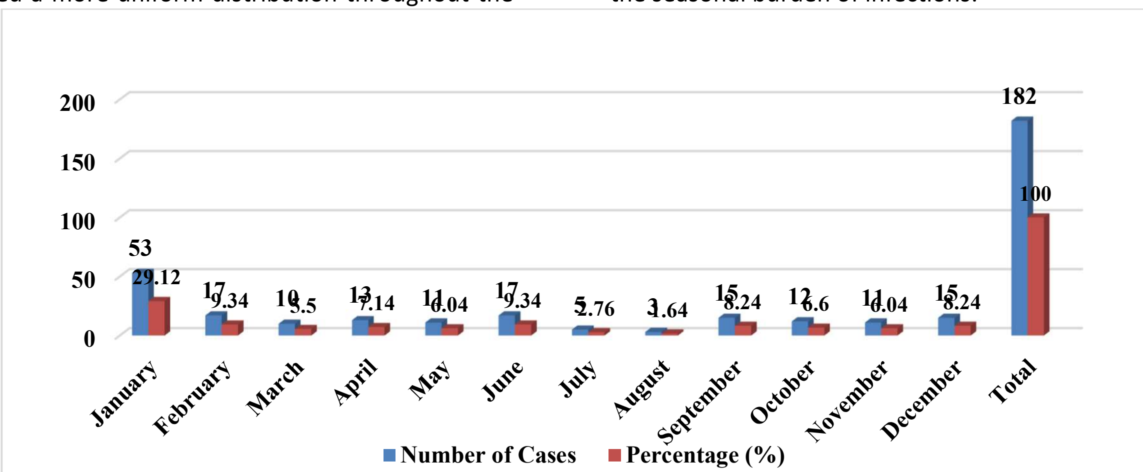

Figure (3): Distribution of cases of children with urinary tract infections by month

The results indicate a significantly higher number of cases in rural areas (112 cases, 61.54%) compared to urban areas (70 cases, 38.46%). This discrepancy suggests that individuals living in rural settings are more vulnerable to the condition under investigation. Several contributing factors may account for this disparity, including limited access to healthcare services, lower levels of health education, poor sanitation, and insufficient preventive measures in rural environments. These findings are consistent with the study by Al-Taie et al. (2020); which demonstrated a higher prevalence of infectious diseases in rural districts of Iraq, particularly due to inadequate water quality and poor hygiene practices. Likewise, a study by Mahmoud and Al-Dabbagh; found a strong association between rural residency and increased infection rates, highlighting the role of environmental and socioeconomic determinants in disease transmission (Mahmoud and Al-Dabbagh, 2019). In contrast, some studies conducted in more urbanized regions of Iraq, such as the one by Salman and Khalaf ; reported relatively equal distribution between urban and rural areas, attributing this pattern to improved infrastructure and outreach health campaigns in rural zones (Salman and Khalaf, 2021). Nevertheless, in the context of the current study area, the rural burden remains clearly higher.

International literature supports this rural-urban divide as well. For example, a study by Kumar and Singh (2022), in India revealed that rural populations often face systemic challenges in disease prevention, including delayed diagnosis and reduced immunization coverage. These results underline the importance of enhancing rural healthcare services, increasing awareness programs, and implementing targeted interventions in under-resourced areas to reduce health disparities and improve overall outcomes.

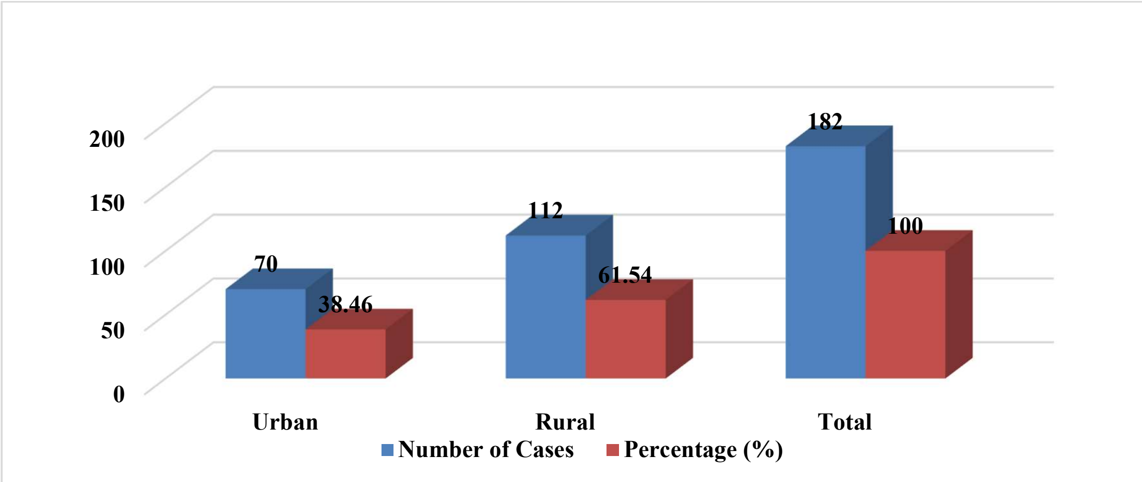

Figure (4): Distribution of urinary tract infection cases in children by residential area

The data illustrate that *Escherichia coli* is the most prevalent pathogen, accounting for 70–90% of cases, particularly among female children. This dominance is well-documented in the literature and is attributed to anatomical and behavioral factors, such as a shorter urethra in girls and poor perineal hygiene practices in early childhood. The findings align with those of Al-Khafaji et al.; who reported *E. coli* as the leading uropathogen in 83% of pediatric UTI cases in central Iraq (Al-Khafaji et al., 2020). *Klebsiella pneumoniae* and *Proteus mirabilis* both account for 5–10% of cases. These organisms are commonly associated with hospital-acquired infections or recurrent UTIs. *Proteus mirabilis*, in particular, is noted for its role in increasing urinary pH and promoting stone formation, which complicates treatment in children with recurrent infections. This is consistent with the findings of Saleh and Hadi (2019); who emphasized the significance of *P. mirabilis* in children with urinary tract anomalies and recurrent UTIs. *Enterococcus faecalis* (3–7%) is also of clinical importance, especially in children with structural abnormalities of the urinary tract. Its resistance patterns often make treatment more challenging. This agrees with a study conducted by Hammoudi et al. (2021), who identified *E. faecalis* as a frequent isolate in pediatric patients with vesicoureteral reflux. Less frequently, *Pseudomonas aeruginosa* (2–5%) and *Staphylococcus saprophyticus* (<2%) are isolated. The presence of *P. aeruginosa* is typically linked to catheter use or nosocomial infections, reinforcing the need for stringent infection control protocols. *S. saprophyticus*, though rare in young children, becomes more common in post-pubertal females, as also noted by (El-Najjar et al., 2022). Overall, the microbial profile observed in this study reflects global patterns in pediatric UTIs, with variations influenced by age, gender, anatomical anomalies, and hospital exposure. Understanding these patterns is essential for guiding empirical antibiotic therapy and infection prevention strategies .

Table (1): Prevalence and clinical notes of uropathogens causing urinary tract infections in children

Organism	Prevalence (%)	Notes
Escherichia coli	70–90%	Most common cause, especially in girls.
Klebsiella pneumonia	5–10%	Frequently associated with nosocomial infections.
Proteus mirabilis	5–10%	Known to cause alkaline urine and urinary stones.
Enterococcus faecalis	3–7%	Common in children with structural urinary anomalies.
Pseudomonas aeruginosa	2–5%	Often linked to catheter use or hospital-acquired infections.
Staphylococcus saprophyticus	<2%	Rare in children; more common in adolescent females.

References

Al-Azzawi, LAM, Ahmed SM, Hussein AS. (2020). Gender-based prevalence of intestinal infections in urban populations of Iraq. Iraqi J Med Sci., 18(2):115–121.

Al-Khafaji, ZM, Salman HM, Al-Dulaimi AA. (2020). Etiological agents of urinary tract infections in

Iraqi pediatric patients. Iraqi J Med Sci., 18(1):23–29.

Al-Samarrai, SH, Naji ZT, Al-Janabi RA. (2022). Environmental determinants of disease prevalence in central Iraq: a multi-year survey. J Environ Public Health., 1–8. doi:10.1155/2022/7851247.

Al-Shammari, MM, Hussein MZ, Kareem MJ. (2020). Monthly distribution of infectious diseases in children and elderly: a hospital-based study in Iraq. Baghdad Sci J., 17(4):877–884.

Al-Taie, AK, Jassim NA, Al-Sabah RH. Prevalence and risk factors of communicable diseases in rural communities of Iraq. Iraqi J Med Sci. 2020;18(3):165–172.

Chen, Y, Wang L, Xu Z. (2022). Global seasonal patterns of infectious diseases: A review of environmental determinants. Int J Infect Dis., 116:123–131. doi:10.1016/j.ijid.2022.01.037.

El-Najjar, F, Al-Rubaye RA, Shakir AA. (2022). Unusual pathogens in pediatric urinary tract infections: A case-based study. J Infect Dev Ctries., 16(3):243–249. doi:10.3855/jidc.16121.

Freedman, AL. (2005). Urologic diseases in North America Project: trends in resource utilization for urinary tract infections in children. J Urol., 173(3):949–54.

Hammoudi, D, Al-Hilli WM, Al-Jubouri LA. (2021). Microbial profile and risk factors in pediatric vesicoureteral reflux: A clinical review. Karbala J Med., 14(2):88–94.

Hasan, RA, Al-Maliki MZH. (2021). Seasonal variation in infection rates among hospitalized patients in Babylon Province. Iraqi J Commun Med., 34(1):45–50.

Hoberman, A, Charron M, Hickey RW, Baskin M, Kearney DH, Wald ER. (2003). Imaging studies after a first febrile urinary tract infection in young children. N Engl J Med., 348(3):195–202.

Jassim, RA, Kareem SA. (2021). Demographic and epidemiological factors associated with disease distribution in Babylon governorate. Babylon Med J., 18(3):142–149.

Kumar, A, Singh SK. (2022). Rural health inequality in developing countries: an epidemiological overview. Int J Public Health., 67:1604423. doi:10.3389/ijph.2022.1604423.

Lo, DS, Shieh HH, Ragazzi SL, Koch VH, Martinez MB. (2013). Predictive factors of therapeutic failure in children with community-acquired urinary tract infections. J Pediatr (Rio J). 89(5):503–9.

Mahmoud, HS, Al-Dabbagh SA. (2019). Epidemiological comparison of infectious diseases between urban and rural settings in Nineveh Governorate. Mosul Med J. 17(2):104–111.

Montini, G, Toffolo A, Zucchetta P, Destro R, Breda E, Longo M, et al. (2007). Antibiotic treatment for pyelonephritis in children: multicenter randomized controlled noninferiority trial. BMJ. 335(7616):386.

Orellana, MA, Herrera-León S, Herrera-León L, Gómez-Gil R, Chaves F. (2013). Prevalence of antimicrobial resistance and extended-spectrum beta-lactamases in Enterobacteriaceae causing urinary tract infections. Enferm Infecc Microbiol Clin., 31(3):165–9.

Rahman, HA, Ali NH, Mahmoud FA. (2019). A cross-sectional analysis of infectious disease trends across rural and urban Iraq. East Mediterr Health J., 25(4):305–312.

Saleh, RH, Hadi NI. (2019). Recurrent urinary tract infections in children: Role of Proteus mirabilis and associated risk factors. Babylon Med J., 16(4):311–317.

Salman, MA, Khalaf BA. (2021). Assessment of disease distribution in urban versus rural health sectors in Baghdad. Al-Kindy Coll Med J. 13(1):34–40.

Schlager, TA. (2003). Urinary tract infections in infants and children. Infect Dis Clin North Am. 17(2):353–65.

Shaikh, N, Morone NE, Lopez J, Chianese J, Sangvai S, D'Amico F, et al. (2007). Does this child have a urinary tract infection? JAMA. 298(24):2895–904.

Subcommittee on Urinary Tract Infection, (2011). Steering Committee on Quality Improvement and Management. Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. Pediatrics. 128(3):595–610.

Tullus, K. (2011). Difficulties in diagnosing urinary tract infections in small children. Pediatr Nephrol., 26(11):1923–6.

Yaseen, MA, Abed AH, Salim RA. Temporal distribution of infectious diseases in southern Iraq: a two-year surveillance report. Basrah J Health Sci. 2019;12(3):291–298.

Zorc, JJ, Kiddoo DA, Shaw KN. (2005). Diagnosis and management of pediatric urinary tract infections. Clin Microbiol Rev., 18(2):417–22.