Urinary Tract Infection (UTI)
Clinical Practice Guideline
Background

Monroe Carell Jr. Children's Hospital at Vanderbilt

Table 1 - Local Outpatient Antibiogram Data for Microorganisms Associated with UTI, 2022

ORGANISM % UTI Pathogen*	Number of Isolates	Gentamicin	Ampicillin or Amoxicillin	Cefazolin or Cephalexin	Ceftriaxone, Cefdinir or Cefixime	Ciprofloxacin	Levofloxacin	Nitrofurantoin	Tetracycline	Trimethoprim-Sulfamethoxazole
Escherichia coli **(approx. 65%)**	423	89	47	89	94	77	87	98	73	67
Klebsiella **sp. (approx. 5%)**	67	94	R	89	89	86	91	44	83	79

*Percentages based on local outpatient urine culture data, 2022

***Inclusion Criteria**

Patients >60 days of age with most or all of the following:

- Fever ≥ 38 degrees Celsius
- Dysuria
- Urinary frequency
- Flank pain
- Vomiting

Note: if <60 days, refer to febrile young infant pathway

Exclusion Criteria

- Major comorbidity (immunocompromise, malignancy etc.)
- Known urinary tract abnormalities
- Neurogenic bladder
- Chronic/complex conditions (i.e. spina bifida, indwelling or intermittent urinary catheter, hardware. Etc.)
- Recent GU surgery or instrumentation
- Critical illness

Definition of a UTI:

Compatible clinical syndrome plus the following laboratory abnormalities:

- *Catheterized specimen or suprapubic aspiration*
  - Definite: > 50,000 cfu/mL
  - Possible: > 10,000 cfu/mL
- *Clean-catch specimen*
  - Definite: > 100,000 cfu/mL
  - Possible: >50,000 cfu/mL

Considerations:

- Poly-microbial cultures in an otherwise healthy child should be considered contaminated and do not warrant treatment with antibiotics.

Rare Pathogenic Organsims	Other Organisms Considered Contaminants
Group B *Streptococci*	"Other Gram positives" *Lactobacillus*
Staphylococcus saprophyticus	*Corynebacteria,* diptheroids
Candida (in premature) infants)	*Micrococcus* sp.
Pseudomonas sp.	*Bacillus* sp.
Enterobacter sp.	Coagulase-negative *Staphylococci*
Staph aureus	

This guideline does not take into account individual patient situations, and does not substitute for clinical judgment

Urinary Tract Infection
Clinical Practice Guideline
Antibiotic Therapy

Monroe Carrell Jr. Children's Hospital at Vanderbilt

Inpatient treatment

- <28 days of age: refer to Fever in Young Infants guideline
- ≥28 days of age: Ceftriaxone 50 mg/kg/day, max 1000 mg/day, once daily
- For step-down therapy, see outpatient treatment recommendations below

Outpatient treatment- refer to **Table 2** for dosing

- Uncomplicated UTI:
  - 1st choice - cephalexin (based on local outpatient antibiogram data)
  - 2nd choice - nitrofurantoin
  - 3rd choice - cefixime
  - 4th choice - ciprofloxacin
- Complicated UTI (i.e. pyelonephritis)
  - Use culture results to guide therapy.
  - Bactrim, ciprofloxacin or levofloxacin are preferred over beta-lactams due to better kidney penetration.
  - If isolate is susceptible (MIC <2), consider cephalexin (has good kidney penetration)

Considerations:

- If previous UTI, review previous organism & susceptibilities
- If patient is on UTI prophylaxis, do not use the same antibiotic for treatment
- For all patients treated empirically, check urine culture results to assure appropriate antibiotic therapy.
- Do not obtain a follow up urinalysis if clinically improved with appropriate antibiotic treatment.
- Stop empiric treatment if culture results as contaminant or negative
- Check response to treatment within 48 hours.
- Targeted antibiotic therapy should be based on organism ID and susceptibility.
- For bacteremia, renal abscess or resistant organisms, including ESBL producers, consult infectious diseases for treatment recommendations.
- *Consider upper tract infection (pyelonephritis) if signs/symptoms of fever, flank pain, or ill appearance*

Table 2- Antibiotic Dosing

Antibiotic Name	Dose	Frequency & Duration for Uncomplicated UTI	Frequency & Duration for Complicated UTI (i.e. Pyelonephritis)	Relative Cost*	Notes
Cephalexin (Keflex®)	50mg/kg/DAY, max 4000mg/day	3 times a day Children: 7-10 days Adolescents: 3-7 days	4 times a day Children: 10-14 days Adolescents: 10-14 days	$	Good kidney penetration.
Nitrofurantoin (Macrodantin®)	< 30 kg OR cannot swallow capsules: 6 mg/kg/DAY, max 400mg/day	4 times a day Children: 7-10 days Adolescents: 5 days	*Do not use*	Cap: $$ Susp: $$$	Capsules can be sprinkled. Suspension may be difficult to obtain. Poor kidney penetration.
Nitrofurantoin (Macrobid®)	≥ 30 kg AND able to swallow capsules: 200 mg/DAY	Twice a day Children: 7-10 days Adolescents: 5 days	*Do not use*	$$	Poor kidney penetration.
Cefdinir (Omnicef®)	14mg/kg/DAY, max 600mg/day	Twice a day Children: 7-10 days Adolescents: 3-7 days	*Do not use*	$$	Poor kidney penetration.
Cefixime (Suprax®)	8mg/kg/DAY, max 400mg/day	Daily Children: 7-10 days Adolescents: 3-7 days	Daily Children: 10-14 days Adolescents: 10-14 days	$$$	On Medicaid formulary as of August 2020
Ciprofloxacin (Cipro®)	30mg/kg/DAY, max 1500mg/day	Twice a day Children: 7-10 days Adolescents: 3 days	Twice a day Children: 10-14 days Adolescents: 7 days	$$	Suspension not always available in pharmacies other than VCH outpatient pharmacy.
Levofloxacin (Levaquin®)	10mg/kg/DOSE max 750 mg/day	6 mo to < 5 years: Twice a day ≥ 5 years: Daily Children: 7-10 days Adolescents: 3 days	6 mo to < 5 years: Twice a day ≥ 5 years: Daily Children: 10-14 days Adolescents: 5 days	$$	Suspension not always available in pharmacies other than VCH outpatient pharmacy.
Cefprozil (Cefzil®)	30mg/kg/DAY, max 1000mg/day	Twice a day Children: 7-10 days Adolescents: 3-7 days	*Do not use*	$$$	Not always available in pharmacies. Poor kidney penetration.
Cefpodoxime (Vantin®)	10mg/kg/DAY, max 200mg/day	Twice a day Children: 7-10 days Adolescents: 3-7 days	*Do not use*	$	Not always available in pharmacies. Poor kidney penetration.
Trimethoprim-sulfamethoxazole (Bactrim®, Septra®)	10mg/kg/DAY, max 320mg/day	Twice a day Children: 7-10 days Adolescents: 3 days	Twice a day Children: 10-14 days Adolescents: 10-14 days	$$	Use with caution for empiric theray based on antibiogram data.

***Estimated average wholesale price per 10-day course**

This guideline does not take into account individual patient situations, and does not substitute for clinical judgment

REFERENCES
National Institute for Health and Care Excellence. Diagnosis of urinary tract infection in children. NICE Pathways. https://www.nice.org.uk/guidance/cg54/chapter/Recommendations. October 2018. Accessed June 10, 2019.
Shaikh N, Hoberman A, Hum SW, et al. Development and Validation of a Calculator for Estimating the Probability of Urinary Tract Infection in Young Febrile Children. JAMA Pediatr. 2018;172(6):550-556.
American Academy of Pediatrics Subcommittee on Urinary Tract. 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. 2011;128(3):595-610.
Glissmeyer EW, Korgenski EK, Wilkes J, et al. Dipstick screening for urinary tract infection in febrile infants. Pediatrics. 2014;133(5):e1121-1127.
Doern CD, Richardson SE. Diagnosis of Urinary Tract Infections in Children. J Clin Microbiol. 2016;54(9):2233-2242.
Roberts KB, Wald ER. The Diagnosis of UTI: Colony Count Criteria Revisited. Pediatrics. 2018; 141(2): e20173239.
Primack W, Bukowski T, Sutherland R, et al. What Urinary Colony Count Indicates a Urinary Tract Infection in Children? J Pediatr. 2017; 191: 259-261.
Strohmeier Y, Hodson EM, Willis NS, Webster AC, Craig JC. Antibiotics for acute pyelonephritis (Review). *Cochrane Database of Systematic Reviews*, 2014 (7). DOI: 10.1002/14651858.CD003772.pub4
Michael M, Hodson EM, Craig JC, Martin S, Moyer VA. Short versus standard duration oral antibiotic therapy for acute urinary tract infection in children. *Cochrane Database of Systematic Reviews*, 2003, Issue 1. Art. No.: CD003966. DOI: 10.1002/14651858.CD003966.
Gupta K, Hooton TM, Naber KG, Wult B, Colgan R, et al. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clinical Infectious Diseases*. 2011; 51(5); e103-e120.
Poole NM, Kronman MP, Rutmal L, et al. Improving Antibiotic Prescribing for Children with Urinary Tract Infection in Emergency and Urgent Care Settings. *Pediatr Emerg Care*, 2018 (epub ahead of print).
Fernandez M, Merkel KG, Ortiz JD and Quick RD. Oral Narrow-Spectrum Antibiotics for the Treatment of Urinary Tract Infection in Infants Younger than 60 Days. *JPIDS*, 2019 (epub ahead of print).
Afolabi TM, Goodlet KJ, Fairman KA. Association of antibiotic treatment duration with first recurrence of uncomplicated urinary tract infection in pediatric patients. Presented at: IDWeek 2018; October 3-7, 2018; San Francisco, California.
AAP Red Book Systems-Based Treatment Table, 32nd Edition, 2021-2024.

This guideline does not take into account individual patient situations, and does not substitute for clinical judgment