URINARY TRACT INFECTION

Outpatient Testing and Empiric Treatment:

Intended for patients age >60 days to <18 years with presumed or definite UTI

Note: hyperlinks to appendices indicated w/ blue & underlined text

Exclusion Criteria:
- UTI within the past 6 months
- On antibiotic prophylaxis for UTI
- Urinary tract instrumentation or catheter (incl. intermittent cath)
- Known urologic conditions (neurogenic bladder, current hydronephrosis, posterior urethral valves, known/concern for nephrolithiasis, vesicoureteral reflux)
- Recent (≤30 days) GU surgery
- Immunocompromised states
- Concern for sepsis
- Pregnancy

Signs/Symptoms of UTI

Age >60 days to <2 years (not toilet trained):
Test based on risk for UTI
(Option to use UTICalc* https://uticalc.pitt.edu/)

Age <6 months:
Obtain a catheterized specimen for UA and urine culture

Age ≥6 months to <2 years – 2 options:
1) Obtain cath specimen for UA and urine culture **OR**
2) Obtain bagged specimen for UA.
If +nitrite or ≥trace leukocyte esterase on UA, obtain **cath** specimen for urine culture

Age ≥2 years (toilet-trained):

Female with **onset of lower UTI Sx** within 48 hours of sexual activity → Sexually Active Adolescent Female UTI Pathway

Obtain clean catch UA
(If unable to obtain clean catch, refer to testing for ≥6 mos to <2 yrs)

Additional testing considerations for sexually active adolescents

Review UA results for leukocyte esterase (LE) and nitrite

Positive nitrite **and/or** large (3+) LE:
- Send urine culture
- Start empiric antibiotics

Negative nitrite **and** moderate (2+), small (1+), or trace LE:
- Send urine culture based on clinical judgment
- If sending a urine culture, use clinical judgment to either start empiric antibiotics or wait for culture results

Click here for decision aid for nitrite negative UAs

Negative nitrite **and** negative LE:
- Do not send urine culture unless obtained via catheterization *or* high clinical suspicion for UTI
- Do not start empiric antibiotics
- Consider alternative diagnosis

Treatment Failure definition

Does the patient require escalation of care for suspected UTI?
Toxic-appearance, dehydration, inability to tolerate oral/enteral fluids or antibiotics, concern for failure of outpatient management

Yes → Prepare patient/family for ED visit or admission

Hospital Medicine CPG for Febrile UTI in Young Children

No → Prepare patient for discharge. If indicated, prescribe empiric antibiotics

Outpatient Empiric Antibiotic Recommendations* Cystitis vs Pyelonephritis^ Cephalexin for UTI

Age >60 days to <2 years	**Age 2 to <12 years**	**Age ≥12 years**
Any UTI^: cephalexin for 10 days 25 mg/kg/dose [max 1000 mg/dose] TID	Cystitis: cephalexin for 5 days 25 mg/kg/dose [max 500 mg/dose] TID Pyelonephritis: cephalexin for 10 days 25 mg/kg/dose [max 1000 mg/dose] TID	Cystitis: cephalexin for 3 days 25 mg/kg/dose [max 500 mg/dose] TID Pyelonephritis: cephalexin for 10 days 25 mg/kg/dose [1000 mg/dose] TID

*If allergy to cephalosporins or severe IgE-mediated reaction (i.e. anaphylaxis or anaphylactoid reaction) to penicillins (incl. amoxicillin), consider trimethoprim/sulfamethoxazole 5-6 mg/kg/dose [max 160 mg/dose trimethoprim for cystitis or pyelonephritis] BID for the duration recommended for cephalexin based on age and diagnosis

Interpreting Urine Culture Results

Clinical Follow-Up and Imaging Recommendations

Children's Wisconsin

For questions concerning this work, contact UTIPathway@chw.org

Updated: September 2024
Valid until: September 2027

URINARY TRACT INFECTION

Sexually Active Adolescent Females:

Intended for adolescent females presenting with **onset of lower urinary tract symptoms** within 48 hours of sexual activity

Note: hyperlinks to appendices indicated w/ blue & underlined text

Exclusion Criteria:
- UTI within 90 days
- Recurrent UTIs (≥3/year)
- Systemic symptoms
- On antibiotic prophylaxis for UTI
- Urinary tract instrumentation or catheter (incl. intermittent cath)
- Known urologic conditions (neurogenic bladder, current hydronephrosis, posterior urethral valves, known/concern for nephrolithiasis, vesicoureteral reflux)
- Recent (≤30 days) GU surgery
- Immunocompromised states
- Concern for sepsis
- Pregnancy

Onset of lower urinary tract symptoms within 48 hours of sexual activity

Dysuria **plus** urinary urgency and/or urinary frequency:
- No UA or Urine Culture indicated
- Strongly recommend STI testing (self-swab preferred)^
- Recommend testing for pregnancy depending on patient and method of contraception^
- Start empiric antibiotics for presumptive UTI

^See Additional testing considerations for sexually active adolescents

Dysuria **only:**
- Obtain clean catch UA
- Strongly recommend STI testing (self-swab preferred)^
- Recommend testing for pregnancy depending on patient and method of contraception^

Review UA results for leukocyte esterase (LE) and nitrite

Positive nitrite **and/or** large (3+) LE:
- Send urine culture
- Start empiric antibiotics

Negative nitrite **and** moderate (2+), small (1+), or trace LE:
- Send urine culture based on clinical judgment
- If sending a urine culture, use clinical judgment to either start empiric antibiotics or wait for culture results

Decision aid for nitrite negative UAs

Negative nitrite **and** negative LE:
- Do not send urine culture unless obtained via catheterization *or* high clinical suspicion for UTI
- Do not start empiric antibiotics
- Consider alternative diagnosis

Prepare patient for discharge. If indicated, prescribe empiric antibiotics*

Outpatient Empiric Antibiotic Recommendations:
nitrofurantoin for 5 days
100 mg/dose BID

*If allergy to nitrofurantoin, consider trimethoprim/sulfamethoxazole 5-6 mg/kg/dose [max 160 mg/dose trimethoprim] BID for 3 days. Strongly recommend pregnancy testing - trimethoprim/sulfamethoxazole should **not** be prescribed in the first or third trimesters of pregnancy

Outpatient Testing and Empiric Treatment

Interpreting Urine Culture Results

For questions concerning this work, contact UTIPathway@chw.org

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Interpreting Urine Culture Results

Definition of a UTI:
Clinical signs and symptoms of UTI and/or abnormal UA (positive leukocyte esterase and/or nitrite) **AND** growth of a urinary pathogen* at or above the diagnostic threshold

SPECIMEN SOURCE	DEFINITE UTI	POSSIBLE UTI
Catheterization	≥50,000 cfu/mL	≥10,000 cfu/mL
Clean-catch	≥100,000 cfu/mL	≥50,000 cfu/mL

*A positive urine culture may include more than one pathogen, as long as a urinary pathogen is present at or above the required threshold

Urinary Pathogens:
- *Citrobacter sp.*
- *Corynebacterium urealyticum*
- *Enterobacter sp.*
- *Enterococcus sp.*
- *E. Coli*
- *Klebsiella sp.*
- *Morganella morganii*
- *Proteus sp.*
- *Pseudomonas sp.*
- *Serratia sp.*
- *Staphylococcus aureus*
- *Streptococcus agalactiae* group B†

Common Contaminants*:
- *Aerococcus sp.*
- *Corynebacterium sp.*
- *Coryneform bacteria*
- *Lactobacillus sp.*
- Coagulase-negative staphylococci (incl. *S. epidermidis, S. simulans*)
- Alpha-hemolytic streptococci (incl. *S. viridans, S. pneumoniae*)

*Contaminants should not be treated at any level of growth

†Isolated GBS urinary tract infections are unusual in infants and may indicate descending infection from bacteremia. Clinicians should consider a sepsis evaluation in any infant with GBS on urinary culture but particularly in infants less than 90 days of age. Some experts recommend treating infants with isolated GBS UTI with 10 days of parenteral therapy.

Urine Culture Follow-Up

See Treatment Failure | See Tests of Cure

UA RESULTS	CULTURE RESULTS	RECOMMENDATIONS
UA positive and started on empiric antibiotics	Cfu criteria met for **definite or possible** UTI	• Check sensitivities, change antibiotic if necessary^ • See imaging and follow-up recommendations
	Contaminant or negative	• Stop treatment • Inform family that child did not have UTI
UA positive and not started on empiric antibiotics	Cfu criteria met for **definite** UTI	• Check sensitivities, start on appropriate antibiotic • See imaging and follow-up recommendations

	Cfu criteria met for **possible** UTI	• Check patient:
		  • If febrile and/or persistent symptoms:
		  • Check sensitivities, start on appropriate antibiotic therapy
		  • See imaging and follow-up recommendations
		  • If afebrile and Sx improving/resolved:
		  • No treatment
		  • Inform family that child did not have UTI

	Contaminant or negative	• No treatment • Inform family that child did not have UTI

UA negative	Cfu criteria met for **definite or possible** UTI	• Check patient:
		  • If febrile and/or persistent symptoms:
		  • Consider repeating the urine culture **or** starting on appropriate antibiotic therapy based on sensitivities
		  • See imaging and follow-up recommendations
		  • If afebrile and Sx improving/resolved:
		  • No treatment
		  • Inform family that child did not have UTI

	Contaminant or negative	• No treatment • Inform family that child did not have UTI

^If the patient is improving on empiric cephalexin for *E. coli* and the final report is resistant to 1st generation cephalosporins (i.e. cefazolin), it is reasonable to continue the prescribed antibiotic, as cephalexin is able to overcome E. coli's resistance mechanism when concentrated in the urine. (Note: *Enterococcus* is universally resistant to cephalosporins, and providers are suggested to change antibiotics accordingly)

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Clinical Follow-Up and Imaging Recommendations

- After diagnosis with febrile UTI/pyelonephritis, patients and families should receive education about the importance of seeking prompt medical evaluation (within 48 hours) for future febrile illnesses

Imaging Recommendations

- Goal of imaging in febrile UTI/pyelonephritis: to identify patients with vesicoureteral reflux (VUR) and to rule out the small percentage (~1%) of patients with structural anomalies of the urinary tract
- Imaging is not typically indicated for recurrent, non-febrile UTIs, unless there are other symptoms (i.e. gross hematuria or recurrent flank pain) or the patient has recurrent (≥3/year) UTIs with the same organism(s) concerning for nidus, such as stone

When to Obtain a Renal and Bladder Ultrasound (RBUS)

Age >60 days to <2 years

- RBUS after:
  - 1st febrile UTI/ pyelonephritis

Timing of RBUS:

- If hospitalized and no improvement after 48 hours on appropriate therapy:
  - Obtain during acute phase of illness
- For all other patients:
  - Wait at least 30 days to obtain RBUS

Age ≥2 years

- RBUS after:
  - 2nd febrile UTI/pyelonephritis
  - Non-*E. Coli* febrile UTI/pyelonephritis
  - Febrile UTI/pyelonephritis in a patient who has a first-degree relative with VUR

When to Obtain a Voiding Cystourethrogram (VCUG)

Age >60 days to ≤18 years

- VCUG after:
  - 2nd febrile UTI/pyelonephritis
  - Abnormal RBUS*
  - 1st febrile UTI/pyelonephritis plus any of the following:
    - Non-*E. Coli* UTI
    - Parent or sibling with VUR
    - High provider index of suspicion for clinically significant VUR, including severe presentation of febrile UTI (i.e. prolonged or complicated admission) or multi-drug resistant organism
    - Parental concern and desire to evaluate for VUR

Timing of VCUG:

- VCUG can be safely performed once the patient is afebrile and has stabilized from the infection

Urology Referral Recommendations (all ages)

- A Referral to Urology should be placed for:
  - Boys after the 1st febrile UTI/pyelonephritis, irrespective of imaging results
  - Girls after the 1st febrile UTI/pyelonephritis, with abnormal imaging*
  - Boys and Girls after the 2nd febrile UTI/pyelonephritis, irrespective of imaging results
  - Consider an outpatient referral for boys or girls after the 1st febrile UTI/pyelonephritis, if UTI required inpatient evaluation
  - Desire by the family or the primary provider to seek specialist evaluation following the 1st febrile UTI/pyelonephritis
- The Urology Consult can be performed as an e-consult or in-person consult, based on family and provider preferences

*Abnormal RBUS/Imaging: Moderate to severe hydronephrosis/pelviectasis, Hydroureter, Ureteral duplication, Evidence of renal scarring

Outpatient Testing and Empiric Treatment Interpreting Urine Culture Results

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Appendix: UTI Risk Stratification: Age >60 days to <2 years

Female Risk Factors:
• Age < 12 months
• Temperature ≥ 39 C
• Fever ≥ 48 hours
• No other source of infection
1 risk factor (≤ 1% risk) = LOW risk: do not test unless high clinical suspicion for UTI
2 risk factors (≤ 2% risk) = INTERMEDIATE risk: consider testing based on clinical assessment
3+ risk factors (≥ 2% risk) = HIGH risk: testing is recommended

Male Risk Factors:
• Uncircumcised (= 2 risk factors)
• Temperature ≥ 39 C
• Fever ≥ 24 hours
• No other source of infection
1 risk factor (≤ 1% risk) = LOW risk: do not test unless high clinical suspicion for UTI
2 risk factors (≤ 2% risk) = INTERMEDIATE risk: consider testing based on clinical assessment
3+ risk factors (≥ 2% risk) = HIGH risk: testing is recommended

Adapted from the American Academy of Pediatrics Urinary Tract Infection Guideline (2011, 2016 revision) with modification. The UTI Pathway team made the decision to remove race as a risk factor, due to the evolving understanding of the role of racial inequality in healthcare and lack of a clear biological basis for race as a risk factor for UTI (Kowalsky et al, 2020; Vyas et al, 2020). In this context, utilizing race as a factor in the clinical decision-tools risks perpetuating the same inequalities that generated these data in the first place.

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Appendix: Additional Testing Considerations for Sexually Active Adolescents

- For males: Obtain first void ('dirty') urine specimen for Gonococcus (GC)/Chlamydia (Chl) testing.
- For females: Obtain vaginal self-swab or first void urine specimen for Gonococcus (GC)/Chlamydia (Chl) testing. If testing for GC/Chl and patient has vaginal discharge, recommend adding trichomonas (Trich) NAAT; can order wet mount (vaginal self-swab) to identify if bacterial vaginosis. Consider pregnancy testing depending on patient and method of contraception*.
- For males and females: Obtain clean void specimen for UA +/- Urine Culture, if indicated.
- For males and females: Consider HSV testing if visible lesions. Consider Syphilis Screen and HIV testing if GC/Chl positive.

Considerations for pregnancy testing in sexually active adolescent females:

*Pregnancy testing should always be completed if the patient reports no contraception. Strongly recommend testing if the patient has either not taken their OCPs correctly or is late for their Depo-Provera and reports no condom use.

For additional information on method of contraception and pregnancy risk see:

- CDC Contraceptive Effectiveness: https://www.cdc.gov/reproductivehealth/contraception/index.htm
- Bedsider.org Birth Control Comparison Chart: https://www.bedsider.org/birth-control/matrix

Milwaukee STI prevalence:

- In 2019, the rate of Chlamydia for Milwaukee County (1291.8 cases per 100,000 population) was more than twice the national rate (551.0 cases per 100,000 population), and the rate of Gonorrhea (547.9 cases per 100,000 population) was nearly triple the national rate (187.8 cases per 100,000 population)
- In 2020, 15-19 year olds accounted for 28.8% of all Chlamydia cases (2,720 of 9,443 total cases) and 19.25% of all Gonorrhea cases (892 of 4,634 total cases) in the City of Milwaukee

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Appendix: Leukocyte Esterase vs Leukocytes

- The value that CW lab reports as 'Leukocytes' is a direct reference to 'Leukocyte esterase'

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Return to: Sexually Active Adolescent Female

Decision Aid for Nitrite Negative UAs:

- Purpose: to assist provider decision-making for patients with nitrite negative UAs
- Developed through a review of 2 years of data (1/1/2019 – 12/31/2020) from patients with a negative nitrite UA and paired urine culture who were seen at Children's Wisconsin Primary Care, Urgent Care, or Emergency Department
- Positive urine culture defined as growth of ≥50,000 CFU/mL of known uropathogen for a clean void urine specimen and ≥10,000 CFU/mL of a known uropathogen for a catheterized urine specimen (*combining the pathway definitions for possible and definite UTI)
- Note: UAs that are negative for nitrite and leukocyte esterase should not be sent for culture based on the presence of blood and/or protein in the sample. If ≥1+ blood and/or ≥1+ protein are noted in the absence of clinical suspicion for renal disease, recommend non-urgent follow-up with PCP for repeat UA. (Trace blood and/or protein do not require follow-up)

Catheterized (n = 850)

Leukocyte esterase concentration		% with positive urine culture
Negative	(n = 628)	2.6
Trace	(n = 65)	18.5
Small (1+)	(n = 59)	54.2
Moderate (2+)	(n = 56)	69.6
Large (3+)	(n = 42)	78.6

Clean Void: ages 2-11 (n = 4231)

Leukocyte esterase concentration		% with positive urine culture
Negative	(n = 1431)	3.2
Trace	(n = 886)	8.5
Small (1+)	(n = 835)	17.4
Moderate (2+)	(n = 762)	27.2
Large (3+)	(n = 317)	40.7

Clean Void: ages 12-18 (n = 1138)

Leukocyte esterase concentration		% with positive urine culture
Negative	(n = 396)	4.0
Trace	(n = 222)	15.8
Small (1+)	(n = 250)	32.4
Moderate (2+)	(n = 186)	34.4
Large (3+)	(n = 84)	50.0

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Appendix: Clinical Differentiation between Cystitis and Pyelonephritis

- Clinical Signs/Symptoms that are suggestive of a urinary tract infection:
    - Unexplained fever (>38° C)
    - Dysuria
    - Increased urgency
    - Increased frequency
    - Abnormal urinalysis (+Nitrite, LE present)
- Consider a diagnosis of pyelonephritis for:
    - All children age <2 years of age with fever and urinary symptoms. (**Children <2 years with fever and urinary symptoms are considered to have presumptive pyelonephritis**.)
    - Older children with any of the following symptoms:
        - Fever/chills
        - Flank pain
        - Nausea/Vomiting

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Appendix: Cephalexin for UTI Rationale

In assessing our local antibiogram using CLSI urine specific breakpoints, the chosen concentrations at which bacteria are considered susceptible or resistant to a specific antibiotic, the antimicrobial stewardship program determined cephalexin is the narrowest spectrum antibiotic that could empirically cover the majority of likely pathogens. Although cefdinir has frequently been prescribed to treat outpatient UTIs in our system, it is unnecessarily broad for the treatment of common urinary pathogens (Table 1). Additionally, the pharmacokinetic profile of cefdinir is inferior to cephalexin. Cephalexin has significantly higher bioavailability and less protein binding than cefdinir, though does require a more frequent dosing schedule due to its short half-life (Table 2). Although trimethoprim-sulfamethoxazole is another commonly used agent for outpatient UTI treatment, our antibiogram reveals lower coverage for *Escherichia coli* compared to cephalosporins when accounting for urine specific breakpoints.

The Clinical and Laboratory Standards Institute (CLSI) created urine specific breakpoints for enterobacteriaceae in 2014.[1] These breakpoints predict susceptibility for cefazolin for the most common urine pathogens (*Escherichia coli, Klebsiella Pneumoniae,* and *Proteus mirabilis*) at a higher minimum inhibitory concentration (MIC) than non-urine specimens. Furthermore, cefazolin may be used as a surrogate to predict susceptibility to other cephalosporin antibiotics (i.e., cefaclor, cefdinir, cefpodoxime, cefprozil, cefuroxime, cephalexin, and loracarbef) (Table 1).

Table 1. Percent of susceptible isolates for common urinary pathogens among pediatric outpatients in our health system

	***Escherichia coli* (n = 625)**	***Klebsiella Pneumoniae* (n = 45)**	***Proteus mirabilis* (n = 51)**
	Percent susceptible		
Ampicillin/sulbactam	57	85	94
Cefazolin*	91	95	94
Ceftriaxone**	93	98	98
Sulfamethoxazole/trimethoprim	77	93	92

* Using the CLSI urine-specific breakpoints which can be used as a surrogate to predict susceptibility to other cephalosporin antibiotics (i.e., cefaclor, cefdinir, cefpodoxime, cefprozil, cefuroxime, cephalexin, and loracarbef)
** Ceftriaxone breakpoints cannot be directly used to predict susceptibility to cefdinir. There are cefdinir specific breakpoints for Enterobacteriaceae, but it is not on the CHW susceptibility panel. When cefazolin is used as a surrogate for oral cephalosporins and interpreted using the uncomplicated UTI breakpoints for E. coli, Kleb pneumo and P. mirabilis, cefdinir resistance may be overcalled. Cefdinir may also be susceptible when cefazolin is reported as resistant.

Table 2. Comparison of pharmacokinetic profiles of cefdinir and cephalexin

	Cefdinir*	**Cephalexin^**

Oral bioavailability (%)	25	90
Peak serum concentration (µg/mL)	1.6	18
Range of urine concentration (µg/mL)	21 – 139	5,000 – 10,000
Protein binding (%)	60 – 70	5 – 15
Half-life (hours)	1.7	1 – 2

Adapted from Gilbert 2015[2] and Gilbert 2006 [3]
* Based on a single 300 mg dose
^ All data based on a single 500 mg dose, except urine drug concentration, which is based on a single 1,000 mg dose

References:

1. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing-fourth informational supplement (Update). CLSI document. Wayne: CLSI; 2014.

2. Gilbert DN, Eliopoulos GM, Chambers HF, Saag MS, et al. *The Sanford guide to antimicrobial therapy 2015.* Sperryville, VA: Antimicrobial Therapy, Inc.

3. Gilbert DN. Urinary Tract Infections in Patients with Chronic Renal Insufficiency. *Clin J Am Soc Nephrol*. 2006;1:327-331.

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Appendix: Empiric antibiotic duration for cystitis in patients aged 2-12 years

The largest randomized trial[1] comparing a short versus standard antibiotic course for UTIs showed high success rates for both groups (95.8% and 99.6% respectively). While the short course group failed to meet the 5% non-inferiority margin, the authors themselves concluded "given that (1) treatment failure occurred infrequently in the short-course group, (2) in a post hoc analysis, rates of UTI within 9 days of stopping antimicrobial therapy in those receiving short-course and standard-course therapy were similar (4.2% vs 2.7%, respectively), and (3) a large number of children (469) needed to be treated with standard-course therapy to prevent 1 child from developing kidney scarring, all suggest that short-course therapy could be considered as a reasonable option for children exhibiting clinical improvement after 5 days of antimicrobial treatment." This study also included children down to the age of 2 months old and/or febrile, but it was not sufficiently powered to compare these subgroups. Combined with data from a prior meta-analysis[2] in children showing no significant difference in the success of short versus standard antibiotic durations for lower UTI, and the plethora of data in adults supporting 5 days or less of antibiotics for uncomplicated UTI, many experts agree a 5 day course of antibiotics for cystitis in children is reasonable.[3] Thus, to simplify our institutional approach, our guideline recommends 5 days for children 2-12 years old who are afebrile to increase the probability that pyelonephritis is not present with the intent of reducing antibiotic exposure in these populations while also maintaining longer durations for those children who are at potentially greater consequence of treatment failure (such as younger children with pyelonephritis).

1. Zaoutis T, Shaikh N, Fisher BT, Coffin SE, Bhatnagar S, Downes KJ, Gerber JS, Shope TR, Martin JM, Muniz GB, Green M, Nagg JP, Myers SR, Mistry RD, O'Connor S, Faig W, Black S, Rowley E, Liston K, Hoberman A. Short-Course Therapy for Urinary Tract Infections in Children: The SCOUT Randomized Clinical Trial. JAMA Pediatr. 2023 Aug 1;177(8):782-789. doi: 10.1001/jamapediatrics.2023.1979. Erratum in: JAMA Pediatr. 2024 Apr 15;: PMID: 37358858; PMCID: PMC10294016.
2. Michael M, Hodson EM, Craig JC, Martin S, Moyer VA. Short compared with standard duration of antibiotic treatment for urinary tract infection: a systematic review of randomised controlled trials. Arch Dis Child. 2002 Aug;87(2):118-23. doi: 10.1136/adc.87.2.118. PMID: 12138060; PMCID: PMC1719177.
3. Milstone AM, Tamma PD. Does the SCOUT Trial Fall Short of Determining an Effective Treatment Duration for Pediatric Urinary Tract Infections? JAMA Pediatr. 2023 Aug 1;177(8):756-758. doi: 10.1001/jamapediatrics.2023.1976. PMID: 37358846.

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Appendix: Treatment Failure

- Failed outpatient therapy as defined by persistent clinical symptoms or lack of meaningful clinical improvement beyond 48 hours on appropriate antimicrobial therapy
- In the event of treatment failure, consider:
    - Resistant organism?
    - Poor adherence to treatment (i.e. reticent to take meds)?
    - Poor PO intake or emesis leading to poor drug absorption?
    - Source control (i.e. urinary obstruction or abscess), if still febrile?
    - Alternate diagnosis (i.e. constipation), if dysuria persists on correct treatment?

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Appendix: Tests of Cure

- Tests of cure are NOT recommended
- The AAP Section on Nephrology and the American Society of Pediatric Nephrology has issued the following statement regarding tests of cure for pediatric patients with UTIs:

> "Avoid ordering follow-up urine culure after treatment for an uncomplicated urinary tract infection (UTI) in patients that show evidence of clinical resolution of infection. Studies have shown that clinical resolution of infection is adequate for determining effectiveness of antibiotic therapy after treatment for UTI." (AAP Section on Nephrology & American Society of Pediatric Nephrology, 2018)

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References:

American Academy of Pediatrics Committee on Infectious Diseases, Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH. *Red Book: 2021-2024 Report of the Committee on Infectious Diseases*. 32nd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2021.

American Academy of Pediatrics Section on Nephrology, American Society of Pediatric Nephrology. Follow-up urine cultures after treatment for uncomplicated UTI. 2018 July. Available at: https://www.choosingwisely.org/clinician-lists/aap-aspn-follow-up-urine-cultures-after-treatment-for-uncomplicated-uti/. Accessed April 16, 2020.

Bachur R, Caputo GL. Bacteremia and meningitis among infants with urinary tract infections. *Pediatr Emerg Care*. 1995;11(5):280-284. doi:10.1097/00006565-199510000-00004

Bent S, Nallamothu BK, Simel DL, Fihn SD, Saint S. Does this woman have an acute uncomplicated urinary tract infection?. *JAMA*. 2002;287(20):2701-2710. doi:10.1001/jama.287.20.2701

Children's Hospital Colorado, Mistry R, Gaensbauer J, et al. 2017 April. Urinary Tract Infection (UTI). Available from: https://www.childrenscolorado.org/globalassets/healthcare-professionals/clinical-pathways/urinary-tract-infection.pdf. Accessed April 16, 2020.

Children's Hospital of Philadelphia, Shaw K, Plachter N, et al. 2018 June. Pathway for the Evaluation and Treatment of Children with Febrile UTI. Available from: https://www.chop.edu/clinical-pathway/urinary-tract-infection-uti-febrile-clinical-pathway. Accessed April 16, 2020.

City of Milwaukee Health Department. (2021). Sexually Transmitted Infections (STIs) and Human Immunodeficiency Virus (HIV) Reported in the City of Milwaukee: 2020 Annual Report. Milwaukee, WI: City of Milwaukee Health Department.

Dell Children's Medical Center, Miner G, Hebner C, et al. 2017 May. First Febrile Urinary Tract Infection. Available from: https://www.dellchildrens.net/wp-content/uploads/sites/60/2019/08/DCMC-Urinary-Tract-Infection-Clinical-Pathway.pdf. Accessed April 16, 2020.

Doganis D, Mavrikou M, Delis D, et al. Timing of voiding cystourethrography in infants with first time urinary infection. *Pediatr Nephrol*. 2009;24(2): 319-322.

Giesen LG, Cousins G, Dimitrov BD, van de Laar FA, Fahey T. Predicting acute uncomplicated urinary tract infection in women: a systematic review of the diagnostic accuracy of symptoms and signs. *BMC Fam Pract*. 2010;11:78. Published 2010 Oct 24. doi:10.1186/1471-2296-11-78

Gupta K, Hooton TM, Roberts PL, Stamm WE. Short-course nitrofurantoin for the treatment of acute uncomplicated cystitis in women. *Arch Intern Med*. 2007;167(20):2207-2212. doi:10.1001/archinte.167.20.2207

Hooton TM, Scholes D, Hughes JP, et al. A prospective study of risk factors for symptomatic urinary tract infection in young women. *N Engl J Med*. 1996;335(7):468-474. doi:10.1056/NEJM199608153350703

Huttner A, Verhaegh EM, Harbarth S, Muller AE, Theuretzbacher U, Mouton JW. Nitrofurantoin revisited: a systematic review and meta-analysis of controlled trials. *J Antimicrob Chemother*. 2015;70(9):2456-2464. doi:10.1093/jac/dkv147

Keren R & Chan E. A meta-analysis of randomized, controlled trials comparing short- and long-course antibiotic therapy for urinary tract infections in children. *Pediatrics*. 2002;109(5): e70. doi: 10.1542/peds.109.5.e70.

Knottnerus BJ, Geerlings SE, Moll van Charante EP, Ter Riet G. Toward a simple diagnostic index for acute uncomplicated urinary tract infections [published correction appears in Ann Fam Med. 2016 Sep;14(5):399]. *Ann Fam Med*. 2013;11(5):442-451. doi:10.1370/afm.1513

Kowalsky RH, Rondini AC, Platt SL. The Case for Removing Race From the American Academy of Pediatrics Clinical Practice Guideline for Urinary Tract Infection in Infants and Young Children With Fever. *JAMA Pediatr*. 2020;174(3):229-230. doi:10.1001/jamapediatrics.2019.5242

Lavelle JM, Blackstone MM, Funari MK, et al. Two-Step Process for ED UTI Screening in Febrile Young Children: Reducing Catheterization Rates. *Pediatrics*. 2016;138(1): e20153023. doi: 10.1542/peds.2015-3023

McKinnell JA, Stollenwerk NS, Jung CW, Miller LG. Nitrofurantoin compares favorably to recommended agents as empirical treatment of uncomplicated urinary tract infections in a decision and cost analysis. *Mayo Clin Proc*. 2011;86(6):480-488. doi:10.4065/mcp.2010.0800

Michael M, Hodson EM, Craig JC, et al. Short compared with standard duration of antibiotic treatment for urinary tract infection: a systematic review of randomised controlled trials. *Arch Dis Child*. 2002;87(2): 118-123. doi: 10.1136/adc.87.2.118

National Institute for Health and Care Excellence. *Urinary tract infection in under 16s: diagnosis and management (CG54).* 2018. Available from https://www.nice.org.uk/guidance/cg54#. Accessed April 16, 2020.

National Institute of Allergy and Infectious Diseases. Short Course Therapy for Urinary Tract Infections in Children. Identification No. NCT01595529. 2012. Available from https://clinicaltrials.gov/ct2/show/NCT01595529. Accessed April 16, 2020.

Pauchard JY, Chehade H, Kies CZ, et al. Avoidance of voiding cystourethrography in infants younger than 3 months with Escherichia coli urinary tract infection and normal renal ultrasound. *Arch Dis Child*. 2017;102(9): 804-808. doi: 10.1136/archdischild-2016-311587.

Ristola MT, Loyttyniemi E, Hurme T. Factors associated with abnormal imaging and infection recurrence after a first febrile urinary tract infection in children. *Eur J Pediatr Surg*. 2017;27(2): 142-149. doi: 10.1055/s-0036-1572418.

Saltychev M, Ristola MT, Laimi K. Accuracy of ultrasonography in predicting vesicoureteral reflux in children: A meta-analysis. *Scand J Urol*. 2016;50(4): 239-245. doi: 110.1080/21681805.2016.1194462

Schnadower D, Kuppermann N, Macias CG, et al. Febrile infants with urinary tract infections at very low risk for adverse events and bacteremia. *Pediatrics*. 2010;126(6):1074-1083. doi:10.1542/peds.2010-0479

Seattle Children's Hospital, Taxier R, Austin E, et al. 2019 April. Urinary tract Infections (UTI) Pathway. Available from: https://www.seattlechildrens.org/pdf/UTI-pathway.pdf. Accessed April 16, 2020.

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. doi:10.1001/jamapediatrics.2018.0217

Shaikh N, Morone NE, Bost JE, et al. Prevalence of Urinary Tract Infection in Childood: A Meta-Analysis. *The Pediatr Infect Dis J*. 2008;27(4): 302-309.

Shaikh N, Spingarn RB, Hum SW. Dimercaptosuccinic acid scan or ultrasound in screening for vesicoureteral reflux among children with urinary tract infections. *Cochrane Database Syst Rev*. 2016; 7. doi: 10.1002/14651858.CD010657.pub

Simren Y, Stokland E, Lagerstrand KM, et al. Ultrasound is an effective and noninvasive method of evaluating renal swelling in infants with their first urinary tract infection. *Acta Paediatr*. 2017;106(11): 1868-1874.

Subcommittee on Urinary Tract Infection. Reaffirmation of AAP Clinical Practice Guideline: The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and young Children 2-24 Months of Age. *Pediatrics*. 2016;138(6), e20163026. doi: 10.1542/peds.2016-3026

Subcommittee on Urinary Tract Infection, 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*. 2011;128(3): 595-610. doi: 10.1542/peds.2011-1330

Sutton AG, Chandler N, Roberts KB. Recent studies on the care of first febrile urinary tract infection in infants and children for the pediatric hospitalist. *Rev Recent Clin Trials*. 2017;12(4): 269-276. doi: 10.2174/1574887112666170816143639.

Vyas DA, Eisenstein LG, Jones DS. Hidden in Plain Sight - Reconsidering the Use of Race Correction in Clinical Algorithms. *N Engl J Med*. 2020;383(9):874-882. doi:10.1056/NEJMms2004740

Wang ME, Greenhow TL, Lee V, et al. Management and Outcomes in Children with Third-Generation Cephalosporin-Resistant Urinary Tract Infections. J Pediatric Infect Dis Soc. 2021 May 28;10(5):650-658.

Wang ME, Lee V, Greenhow TL, et al. Clinical response to discordant therapy in third-generation cephalosporin-resistant UTIs. *Pediatrics*. 2020;145(2): e20191608.

Westwood ME, Whiting PF, Cooper J, et al. (2005). Further investigation of confirmed urinary tract infection (UTI) in children under five years: a systematic review. *BMC Pediatr*. 2005;5(2). doi: 10.1186/1471-2431-5-2

Wisconsin Department of Health Services STI Unit. *Sexually Transmitted Infections Wisconsin 2020: Persons 15-19 Years of Age*. Published December 2, 2021. Accessed January 1, 2022. https://www.dhs.wisconsin.gov/publications/p00412-2020.pdf

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Version History and Summary of Changes

- Version 1.0 (4/5/2021): Go-Live
- Version 1.1 (9/6/2021): Added note about hyperlinked appendices. Clarified the negative nitrite and 2+, 1+, or trace LE UA decision point. Moved hyperlink to the negative nitrite decision aid.
- Version 1.2 (9/10/2021): UTICalc tool updated to no longer reflect race as a variable. Corresponding comments removed from the algorithm and UTI Risk Stratification appendix.
- Version 1.3 (4/18/2022): Recurrent UTI definition modified from ≥3 per year to alternate accepted definition of ≥2 in 6 months; reflected in exclusion criteria as 'UTI within the past 6 months'. Sub-pathway for 'Sexually Active Adolescent Females' added. Appendix for 'Additional testing considerations for sexually active adolescents' expanded to include considerations for trichomonas and HIV testing, additional considerations for pregnancy testing, and Milwaukee STI prevalence data.
- Version 1.4 (5/18/2022): Added note about nitrite and leukocyte esterase negative UAs that are positive for blood and/or protein.
- Version 1.5 (2/2023): Added notation about infants and GBS on urine culture to 'Interpreting Urine Culture Results'.
- Version 1.6 (9/2023): Added max/dose to outpatient empiric antibiotic recs for >60 days to <2 years; emphasized line about presumptive pyelo in <2 years in cystitis vs pyelo appendix.
- Version 1.7 (5/2024): Revised note about continuing antibiotics when cultures show resistance to cephalosporins for specificity to *E. coli*. Included note about *enterococcus* and resistance to cephalosporins.
- Version 1.8 (10/2024): Decreased duration for treatment of cystitis in ages 2 to <12 years from 7 days to 5 days. Added appendix: Empiric antibiotic duration for cystitis in patients aged 2-12 years.

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