**Definition**: The presence of a pure growth of more than 100,000 colony-forming units (cfu) of bacteria per milliliter of urine in a patient with clinical signs and laboratory values suggestive of UTI (positive urinalysis required). Lower counts of bacteria may be clinically important, especially in boys and specimens obtained by catheterization or suprapubic aspiration. \(^{(1,2)}\)

**Pathophysiology**: The disease is usually caused by a bacterial infection. *Escherichia coli* is the most common bacterial species identified. Other common gram negative species include *Klebsiella*, *Proteus*, *Enterobacter*, and *Citrobacter*. Gram positive species include *Staphylococcus saprophyticus* and *Enterococcus*. Pyelonephritis results from bacterial infection of the kidney.

**Inclusion Criteria** \(^{(1-3)}\)
- 1 month - 12 years
- Prepubertal children
- First episode of UTI
- Febrile

**Exclusion Criteria** \(^{(1-3)}\)
- Afebrile
- Conditions in which immunity may be compromised (e.g., transplant recipient [solid organ or hematopoetic], chronic renal insufficiency/kidney disease)
- Known major genitourinary anomalies
- Toxic-appearing
- Sepsis with shock or meningitis
- PICU or NICU 3/4 admission
- Extended-spectrum beta-lactamase (ESBL) producing bacteria
- Other severe comorbid conditions

**Renal abscess**
- Discitis

**Kidney stones**
- Trauma

**Sacroiliitis**
- Fever

**Vertebral osteomyelitis**
- Gastroenteritis

**Appendicitis**
- Vaginitis/Urethritis

**Diagnostic Evaluation**: Children with urinary tract infections have a risk of progressing to septic shock. Clinicians should immediately refer to the Septic Shock guideline and intervene rapidly if patient has toxic appearance, ill appearance, altered mental status, and/or compromised perfusion with abnormal vital signs.

**Vital Sign Changes of Sepsis** \(^{(4)}\)

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate</th>
<th>Resp Rate</th>
<th>Systolic BP</th>
<th>Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0d - 1m</td>
<td>&gt;205</td>
<td>&gt;60</td>
<td>&lt;60</td>
<td>&lt;36 or &gt;38</td>
</tr>
<tr>
<td>&gt;1m - 3m</td>
<td>&gt;205</td>
<td>&gt;60</td>
<td>&lt;70</td>
<td>&lt;36 or &gt;38</td>
</tr>
<tr>
<td>&gt;3m - 1y</td>
<td>&gt;190</td>
<td>&gt;60</td>
<td>&lt;70</td>
<td>&lt;36 or &gt;38</td>
</tr>
<tr>
<td>1y - 2y</td>
<td>&gt;190</td>
<td>&gt;190</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&gt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;2y - 4y</td>
<td>&gt;140</td>
<td>&gt;40</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&gt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;4y - 6y</td>
<td>&gt;140</td>
<td>&gt;34</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&gt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;6y - 10y</td>
<td>&gt;140</td>
<td>&gt;30</td>
<td>&lt;70 + (age in yr x 2)</td>
<td>&gt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;10y - 13y</td>
<td>&gt;100</td>
<td>&gt;30</td>
<td>&lt;90</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
<tr>
<td>&gt;13y</td>
<td>&gt;100</td>
<td>&gt;20</td>
<td>&lt;90</td>
<td>&lt;36 or &gt;38.5</td>
</tr>
</tbody>
</table>

**Signs and Symptoms of Shock** \(^{(4)}\)

<table>
<thead>
<tr>
<th>Exam Abnormalities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peripheral Pulses</strong></td>
<td>Decreased or weak</td>
</tr>
<tr>
<td></td>
<td>Bounding</td>
</tr>
<tr>
<td><strong>Capillary Refill</strong></td>
<td>≤3 sec</td>
</tr>
<tr>
<td>(central vs. peripheral)</td>
<td>Flash (&lt;1 sec)</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>Flushed, ruddy, erythroderma (other than face)</td>
</tr>
<tr>
<td></td>
<td>Petechiae below the nipple, any purpura</td>
</tr>
<tr>
<td><strong>Mental Status</strong></td>
<td>Decreased, irritability, confusion, inappropriate crying or drowsiness, poor interaction with parents, lethargy, diminished arousability, obtunded</td>
</tr>
</tbody>
</table>

Clinical history, physical examination, and labs are used to diagnose UTI.

**History: Assess for**
- Urinary symptoms (incontinence, lack of proper stream, withholding maneuvers, frequency, urgency, dysuria)
- Previous UTIs
- Vesicoureteral reflux (VUR)
- Previous undiagnosed febrile illnesses
- Family history of frequent UTIs, VUR, and other genitourinary abnormalities
- Constipation
- Sexual history

**Physical Examination**

Complete routine vital signs including blood pressure

**Assess for**
- Toxic appearance, irritable
- Fever
- Disinterested in feeding
- Lethargic
- Poor tone (floppy)
- Poor perfusion
- Sluggish capillary refill
- Tachycardia or bradycardia
- Tachypnea or apnea
- Sunken fontanelle
- Dry mucous membranes
- Jaundice
- Vomiting
- Suprapubic tenderness
- Abdominal/Flank tenderness
- Abdominal mass
- Failure to thrive

**Risk Factors For UTI** \(^{(5)}\)

**Girls**
- Age younger than 12 months
- Temperature of at least 102.2°F (39°C)
- Fever lasting at least two days
- Absence of another source of infection

**Boys**
- Temperature of at least 102.2°F (39°C)
- Fever lasting more than 24 hours
- Absence of another source of infection
- Uncircumcised
**Laboratory Tests** *(6,7)*
Urinalysis is positive if the sample is positive for leukocyte esterase (LE) or nitrates or microscopy is positive if WBCs (≥5 WBCs per high-power field) or bacteria. UTI is unlikely (<0.3%) if the urinalysis is negative.

**Sensitivity and Specificity of Urinalysis Components** *(1,8-10)*
Consider empiric treatment until culture results are available.

<table>
<thead>
<tr>
<th>Component</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dipstick</td>
<td>70%</td>
<td>98%</td>
<td>35</td>
<td>0.3</td>
</tr>
<tr>
<td>Dipstick &amp; Micro</td>
<td>80%</td>
<td>64%</td>
<td>2.2</td>
<td>0.3</td>
</tr>
<tr>
<td>0-1 mos</td>
<td>82%</td>
<td>92%</td>
<td>10</td>
<td>0.2</td>
</tr>
<tr>
<td>&gt;1-3 mos</td>
<td>82%</td>
<td>94%</td>
<td>13</td>
<td>0.07</td>
</tr>
<tr>
<td>Bag LE</td>
<td>76%</td>
<td>84%</td>
<td>4.75</td>
<td>0.29</td>
</tr>
</tbody>
</table>

If nitrates are positive, diagnosis of UTI is very likely.

*LR+: a positive test increases the odds that a patient has the disease by this factor
*LR-: a negative test decreases the odds that a patient has the disease by this factor

**Positive Urine Culture** *(1,3)*

<table>
<thead>
<tr>
<th>Procedure</th>
<th>threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheterization/Suprapubic Aspiration</td>
<td>≥50,000 cfu/mL</td>
</tr>
<tr>
<td>Midstream Clean Catch</td>
<td>≥100,000 cfu/mL</td>
</tr>
</tbody>
</table>

Urine specimens should be processed as expeditiously as possible. If the specimen is not processed promptly, then it should be refrigerated to prevent the growth of organisms. Urine specimens with ≥3 different colony types above the threshold will not be evaluated.

**Critical Points of Evidence** *

**Evidence Supports**
- Obtain a urine specimen via transurethral catheterization in non-toilet trained children and via midstream clean catch for toilet trained children. *(11-16)* – Strong recommendation, moderate quality evidence
  **Remarks:** The diagnosis of UTI cannot be established reliably through culture of urine collected in a bag. *(7)*
- For rapid diagnosis of UTI, utilize LE and nitrite testing. *(15,17-24)* – Strong recommendation, moderate quality evidence
- Administer oral antibiotics to toilet trained children and/or children >60 days who are tolerating PO. *(25-29)* – Strong recommendation, moderate quality evidence
- Administer oral antibiotics and consider outpatient management for non-toilet trained children and/or children 31-60 days who meet the following criteria: no elevated inflammatory markers, tolerating PO, wellhydrated, not tachycardic, adequate transportation, ability to follow up with PCP within 24-48 hours. *(25-31)* – Weak recommendation, low quality evidence
- Utilize short-course IV antibiotics followed by oral antibiotics (once afebrile and feeding adequately) in children who require admission. *(25-29)* – Strong recommendation, low quality evidence
- The health benefits of newborn male circumcision outweigh the risks and that the procedure’s benefits justify access to this procedure for families who choose it (per the AAP’s Circumcision Policy Statement). *(32-35)* – Strong recommendation, moderate quality evidence

**Evidence Against**
- Do not routinely administer prophylactic antibiotics to infants/children with their first febrile UTI with a normal renal ultrasound. *(36-42)* – Strong recommendation, moderate quality evidence
- Do not administer prophylactic antibiotics to infants/children with Grades I-III vesicoureteral reflux. *(36-42)* – Weak recommendation, moderate quality evidence

**Evidence Lacking/Inconclusive**
- No evidence addressing whether the diagnostic accuracy of RUS is affected if taken within two days after UTI diagnosis versus several days after diagnosis.

**Recommendations Adopted/Adapted from National Guidelines**
- If a clinician assesses a febrile infant with no apparent source for the fever as not being so ill as to require immediate antimicrobial therapy, then the clinician should assess the likelihood of UTI. If the clinician determines the febrile infant to have a low likelihood of UTI, then clinical follow-up monitoring without testing is sufficient (evidence quality: A; strong recommendation).
  - If the clinician determines that the febrile infant is not in a low-risk group, then there are 2 choices.
    - Option 1 is to obtain a urine specimen through catheterization or SPA and perform a urinalysis.
    - Option 2 is to obtain a urine specimen through the most convenient means and perform a urinalysis. If the urinalysis results suggest a UTI (positive leukocyte esterase test results or nitrates or microscopic analysis results for leukocytes or bacteria), then a urine specimen should be obtained through catheterization or SPA and cultured; if urinalysis of fresh (less than 1 hour since void) urine yields negative leukocyte esterase and nitrates results, then it is reasonable to monitor the clinical course without initiating antimicrobial therapy, recognizing that a negative urinalysis does not rule out a UTI with certainty. *(7)*
  **Remarks:** This recommendation was adopted from the American Academy of Pediatrics - The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2-24 Months of Age guideline.
• To establish the diagnosis of UTI, clinicians should require both urinalysis results that suggest infection (pyuria and/or bacteriuria) and the presence of at least 50,000 colony-forming units (cfu) per milliliter of a uropathogen cultured from a urine specimen obtained through transurethral catheterization or SPA. (7)

Remarks: This recommendation was adopted from the American Academy of Pediatrics - The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2–24 Months of Age guideline. (7)

Febrile infants with UTIs should undergo renal and bladder ultrasonography (RBUS). Voiding cystourethrography (VCUG) should not be performed routinely after the first febrile UTI; VCUG is indicated if RBUS reveals hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy, as well as in other atypical or complex clinical circumstances. (7)

Remarks: This recommendation was adopted from the American Academy of Pediatrics - The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2–24 Months of Age guideline. VCUG may be indicated with recurrent UTIs when deemed appropriate by the practitioner. (7)

When initiating treatment, the clinician should base the choice of route of administration on practical considerations: initiating treatment orally or parenterally is equally efficacious. The clinician should base the choice of agent on local antimicrobial sensitivity patterns (if available) and should adjust the choice according to sensitivity testing of the isolated uropathogen (evidence quality: A; strong recommendation). The clinician should choose 7 to 14 days as the duration of antimicrobial therapy (evidence quality B; recommendation). (7)

Remarks: This recommendation was adopted from the American Academy of Pediatrics - The Diagnosis and Management of the Initial Urinary Tract Infection in Febrile Infants and Young Children 2–24 Months of Age guideline. A recent study in children with pyelonephritis aged 6 months and older found no difference in outcomes in those treated with shorter (6 to 9 days) vs longer (10 or more days) courses of antibiotics. (7,43)

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Condition-Specific Elements of Clinical Management

Urine Specimen for Urinalysis and Culture (7,11-16)
• Non-toilet trained children: transurethral catheterization
• Toilet trained children: midstream clean catch
• If an infant (29 days to 24 months of age) is assessed to have a fever without localizing signs and symptoms and not in need of immediate antibiotics, the clinician should determine risk status for UTI. (7)
• If the infant (29 days to 24 months of age) is assessed to be at low risk for UTI, follow-up without testing is adequate. (7)
• If the infant (29 days to 24 months of age) is assessed to NOT be low risk, proceed with either option below. (7)
  • Option 1 - Obtain a urine specimen through catheterization or SPA for culture and urinalysis.
  • Option 2 - Perform a urinalysis. If the urinalysis results suggest a UTI, then a urine specimen should be obtained through catheterization or SPA and cultured.

Hydration
• IV fluids if not taking oral fluids adequately.

Imaging Studies (1,7)

<table>
<thead>
<tr>
<th>Age</th>
<th>Imaging Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-24 months</td>
<td>Renal ultrasound (RUS)</td>
</tr>
<tr>
<td></td>
<td>If RUS is normal, a VCUG is not needed.</td>
</tr>
<tr>
<td>&gt;24 months</td>
<td>RUS at discretion of physician based on clinical findings</td>
</tr>
</tbody>
</table>

*VCUG may be performed as soon as fever is decreasing and culture-specific antibiotics are in use. There is no need to perform an additional urinalysis if the patient is on appropriate antibiotics.

Admission Criteria
• Unable to tolerate oral fluids (requires IV fluids for hydration)
• Failed outpatient therapy (requires IV antibiotics)

Inpatient Discharge Criteria
• A decreasing trend in daily maximal temperatures combined with physician discretion
• On culture-specific antibiotics

Tolerating oral intake
• Patient/Caregiver discharge teaching completed on:
  - Discharge care
  - Signs and symptoms of concern
  - Risk of recurrence
  - Proper perineal care
  - Documentation of scheduled PCP follow-up

Parent Teaching
• Teach parents to recognize symptoms of UTI
• Clearly explain the course of necessary testing and treatment
• Explain strategies to prevent future recurrence (e.g., adequate hydration, frequent voiding, perineal hygiene, completion of antibiotic course)
• Pediatrician follow-up

Consults/Referrals
• Refer to urology if surgical intervention is being considered and/or if child has VUR.
• Refer to nephrology if child has VUR and associated renal insufficiency, hypertension, abnormal serum chemistries, or renal scarring.

Measures
Structure
• Location of radiologic studies (inpatient or outpatient setting)

Process
• Utilization of the order set(s)
• Frequency of completed radiologic studies
• Time frame to complete radiologic studies

Outcome
• Use of prophylactic antibiotics with documented reflux
• EC visit within 14 days and reason for visit
• Documented use of prophylactic antibiotics
• Length of stay
• Organisms and their resistance patterns
• Rate of positive/negative RUS, radionuclide cystogram, and VCU
**Antibiotic Therapy**

Consider insurance/Medicaid formulary restrictions.

### Empirical Oral Therapy - Outpatient

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cefixime</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants and children ≤45 kg</td>
<td>4 mg/kg/dose PO every 12 h (MAX: 200 mg/DOSE)</td>
<td>Yes</td>
</tr>
<tr>
<td>Children &gt;45 kg and adolescents</td>
<td>400 mg PO every 24 h</td>
<td></td>
</tr>
<tr>
<td><strong>Cefdinir</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children ≥6 months to 12 years</td>
<td>7 mg/kg/dose PO every 12 h (MAX: 300 mg/DOSE)</td>
<td>Yes</td>
</tr>
<tr>
<td>Adolescents</td>
<td>600 mg PO every 24 h</td>
<td></td>
</tr>
</tbody>
</table>

If available, cefixime is the preferred oral antibiotic for the empiric treatment of UTI since it has better pharmacokinetic properties than cefdinir (e.g. urine penetration, and half-life).

### Empirical Parenteral Therapy (IV/IM) - Emergency Center or Inpatient

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CefTRIAXone</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants and children ≥2 months and adolescents</td>
<td>50 mg/kg/dose IV every 24 h (MAX: 2 grams/DAY)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
| NOTE: Not for use in patients receiving Y-site administration of calcium-containing IV fluids with a single lumen or single IV site  
^Use cefTAZidime as an alternative |

**CefTAZidime**  
^Use cefTRIAXone as an alternative

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants, children, and adolescents</td>
<td>50 mg/kg/dose IV every 8 h (MAX: 6 grams/DAY)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Directed Oral Therapy (Based on Lab Results)

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cefixime</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants and children ≤45 kg</td>
<td>4 mg/kg/dose PO every 12 h (MAX: 200 mg/DOSE)</td>
<td>Yes</td>
</tr>
<tr>
<td>Children &gt;45 kg and adolescents</td>
<td>400 mg PO every 24 h</td>
<td></td>
</tr>
<tr>
<td><strong>Cefdinir</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children ≥6 months to 12 years</td>
<td>7 mg/kg/dose PO every 12 h (MAX: 300 mg/DOSE)</td>
<td>Yes</td>
</tr>
<tr>
<td>Adolescents</td>
<td>600 mg PO every 24 h</td>
<td></td>
</tr>
<tr>
<td>If available, cefixime is the preferred oral antibiotic for the empiric treatment of UTI since it concentrates better in the urine compared to cefdinir.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Amoxicillin**

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants and children &lt;40 kg</td>
<td>13 mg/kg/dose PO every 8 h (MAX: 500 mg/dose)</td>
<td>Yes</td>
</tr>
<tr>
<td>Children and adolescents ≥40 kg</td>
<td>500 mg PO every 8 h</td>
<td></td>
</tr>
</tbody>
</table>

**Trimethoprim and Sulfamethoxazole (TMP/SMX)**

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children and adolescents</td>
<td>4 mg TMP/kg/dose PO every 12 h (MAX: 160 mg TMP/dose)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Directed Parenteral Therapy (IV) - Inpatient (Based on Micro Results)

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CeFAZolin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants and children</td>
<td>33 mg/kg/dose IV every 8 h</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**CefTRIAXone**  
^Use cefTAZidime as an alternative

<table>
<thead>
<tr>
<th>Age &amp; Weight Parameters</th>
<th>Dose and Frequency</th>
<th>TCH Formulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants and children ≥2 months and adolescents</td>
<td>50 mg/kg/dose IV every 24 h (MAX: 2 grams/DAY)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
| NOTE: Not for use in patients receiving Y-site administration of calcium-containing IV fluids with a single lumen or single IV site  
^Use cefTAZidime as an alternative |
<table>
<thead>
<tr>
<th>Medication</th>
<th>Patient Group</th>
<th>Dosage</th>
<th>Maximum</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>CefTAZidime</td>
<td>Infants, children, and adolescents</td>
<td>50 mg/kg/dose IV every 8 h (MAX: 6 grams/DAY)</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><em>Use cefTRIAXone as an alternative</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampicillin</td>
<td>Infants and children</td>
<td>25-50 mg/kg/dose IV every 6 h (MAX: 100 mg/kg/dose not to exceed 2 grams/dose or 12 grams/DAY)</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Infants and children</td>
<td>2.5 mg/kg/dose IV every 8 h (MAX: 3 mg/kg/dose not to exceed 120 mg/dose)</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Conventional Dosing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extended-Interval Dosing (Weight Directed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infants and children</td>
<td>7.5 mg/kg/dose IV every 24 h</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Clinical Algorithm for Children with First Febrile Urinary Tract Infection (UTI)

**Inclusion Criteria**
- Afebrile
- Conditions in which immunity may be compromised (transplant recipient or chronic renal insufficiency/kidney disease)
- Known major genitourinary anomalies
- Toxic-appearing
- Sepsis with shock or meningitis
- PICU or NICU 3/4 admission
- Extended-spectrum beta-lactamase (ESBL) producing bacteria
- Other severe comorbid conditions

**Exclusion Criteria**
- Unable to tolerate oral fluids (requires IV fluids for hydration)
- Failed outpatient therapy (requires IV antibiotics)

**Admission Criteria**
- Unstable newborns
- Febrile and/or toxic-appearing
- Risk of sepsis
- Renal insufficiency
- Compromised perfusion with altered mental status
- Kidney transplant recipient or chronic kidney disease
- Surgical intervention is being considered

**OFF algorithm**
- Search for alternate source of infection and follow up appropriately
- Admit; consider observation status
- Continue antimicrobial therapy
- Follow culture and adjust therapy based on antimicrobial susceptibility results to choose the most appropriate, narrow spectrum agent
- NOTE: Antibiotics should be discontinued if the culture is negative and the child has NOT been treated with antibiotics prior to obtaining the urine culture.

**Notes**
- VCUG may be performed as soon as fever is decreasing and culture-specific antibiotics are in use. There is no need to perform an additional urinalysis if the patient is on antibiotics.
- PCP to follow up VCUG results for VUR
- Refer to urology if child has VUR and/or surgical intervention is being considered
- Refer to nephrology if child has VUR and associated renal insufficiency, hypertension, abnormal serum chemistries, or renal scarring
- PCP to follow up VCUG results for VUR
- Meets discharge criteria

**Discharge Criteria**
- Tolerating oral intake
- PCP to follow up VCUG results for VUR
- Discharge home on appropriate antibiotics

**Abbreviations:**
- UA - urinalysis
- LE - leukocyte esterase
- IV - intravenous
- RUS - renal ultrasound
- VCUG - voiding cystourethrogram

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Texas Children’s Hospital
References


3. Cincinnati Children's Hospital Medical Center, Health Policy and Clinical Effectiveness Program. (2006). Evidence-based care guideline for children 12 years of age or less with first urinary tract infection.


Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing Internal and External Guidelines
   - Cincinnati Children’s First Urinary Tract Infection in Children ≤12 Years; American Academy of Pediatrics’ Urinary Tract Infection: The Diagnosis and Management of Initial UTI in Febrile Infants and Children 2 to 24 Months; 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; National Institute of Health and Clinical Excellence Urinary Tract Infection in Children
3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane Collaboration, CINAHL, Google
4. Critically Analyze the Evidence
   - 13 meta-analyses, 3 randomized controlled trials, and 39 nonrandomized studies
5. Summarize the Evidence
   - Materials used in the development of the guideline, evidence summary, and order sets are maintained in a UTI evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the AGREE II criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence in support of or against specific interventions and identifies where evidence is lacking/inconclusive. The following categories describe how research findings provide support for treatment interventions.

“Evidence Supports” provides evidence to support an intervention.
“Evidence Against” provides evidence against an intervention.
“Evidence Lacking/Inconclusive” indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn from the evidence.

The GRADE criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

<table>
<thead>
<tr>
<th>Quality</th>
<th>Type of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td>Moderate</td>
<td>Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td>Low</td>
<td>Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence</td>
</tr>
<tr>
<td>Very Low</td>
<td>Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence</td>
</tr>
</tbody>
</table>

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis/management of first febrile UTI in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children’s Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient’s family, to make the ultimate judgment regarding care.

Version History

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2008</td>
<td>Originally completed</td>
</tr>
<tr>
<td>Jan 2012</td>
<td>Updated</td>
</tr>
<tr>
<td>Dec 2015</td>
<td>Updated</td>
</tr>
<tr>
<td>Aug 2017</td>
<td>Added a note indicating preference of ceftriaxone over cefotaxime for children ≤6 months of age</td>
</tr>
<tr>
<td>Jan 2019</td>
<td>Updated</td>
</tr>
<tr>
<td>August 2021</td>
<td>Adopted AAP recommendations for imaging, specimen collection, antibiotic duration and diagnosis for UTI</td>
</tr>
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