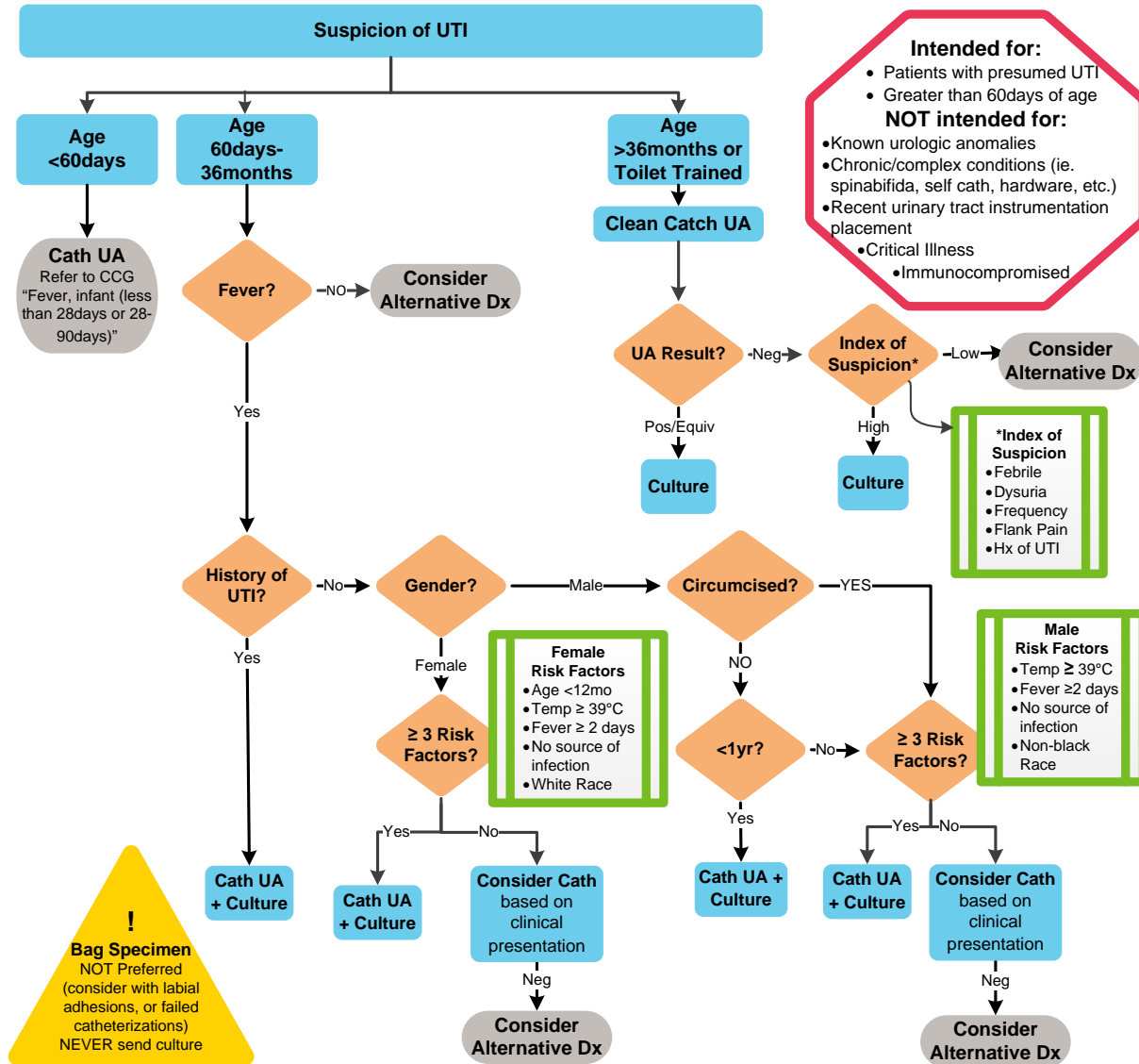


URINARY TRACT INFECTION (UTI)

ALGORITHM- UTI Testing



Intended for:

- Patients with presumed UTI
- Greater than 60days of age

NOT intended for:

- Known urologic anomalies
- Chronic/complex conditions (ie. spinabifida, self cath, hardware, etc.)
- Recent urinary tract instrumentation placement
- Critical Illness
- Immunocompromised

***Index of Suspicion**

- Febrile
- Dysuria
- Frequency
- Flank Pain
- Hx of UTI

Male Risk Factors

- Temp ≥ 39°C
- Fever ≥ 2 days
- No source of infection
- Non-black Race

!
Bag Specimen
 NOT Preferred
 (consider with labial adhesions, or failed catheterizations)
 NEVER send culture

Imaging Recommendations for patients >2months after 1st Febrile UTI

No imaging required

- o Prompt response to therapy (afebrile in 72 hrs)
- o Reliable outpatient follow up
- o Normal voiding pattern
- o No abdominal mass
- o Normal (≤5mm pelvic dilation) 3rd trimester (>28 week) prenatal ultrasound

Consider Renal Ultrasound:

- o At clinical discretion in patient under 2 years
- o Bowel/bladder dysfunction

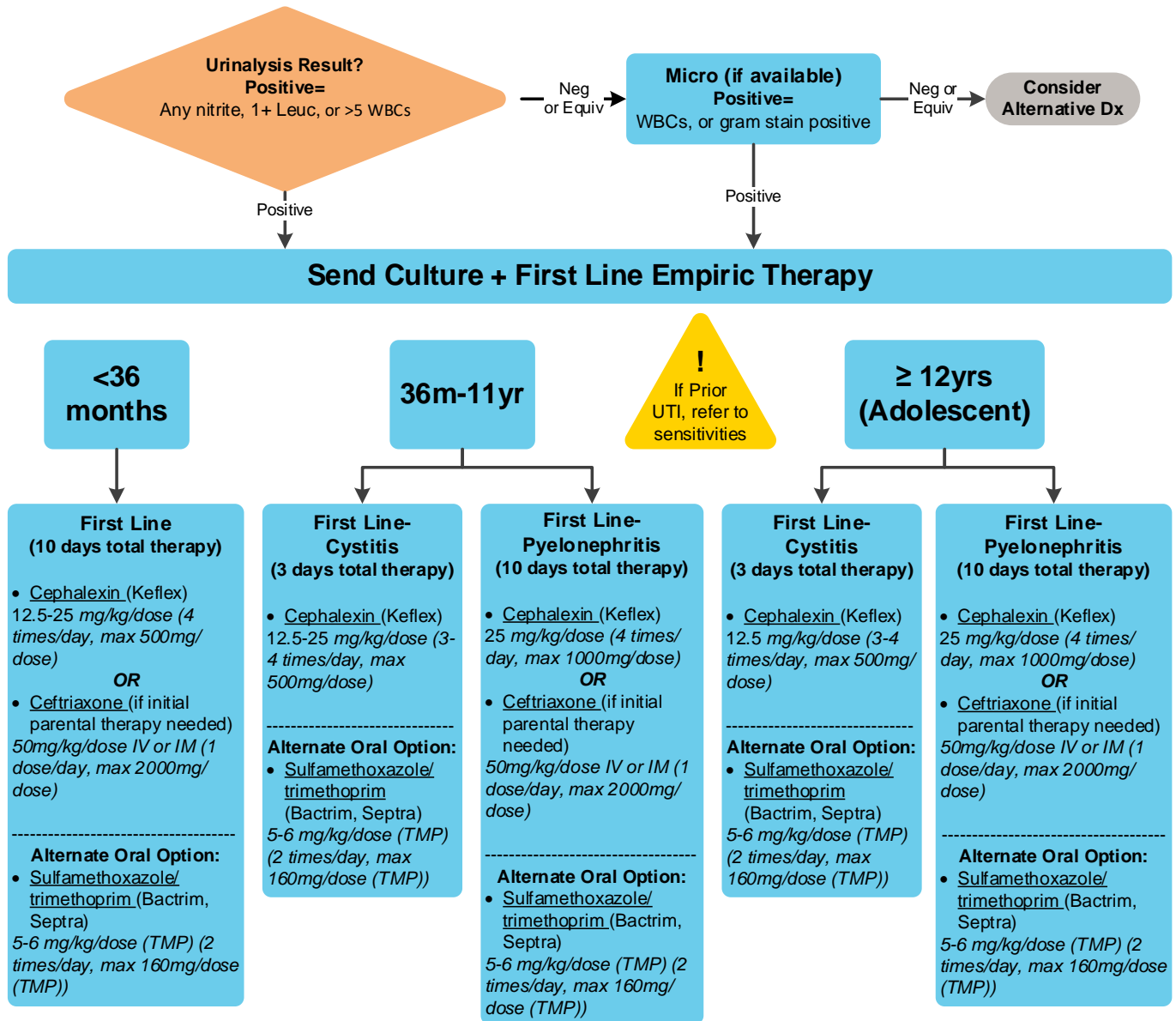
Renal Ultrasound recommended

- o Patient does not have adequate clinical response to appropriate treatment
- o Urosepsis/Severe infection associated with UTI
- o Recurrent UTIs
- o Unusual pathogens
- o Hypertension

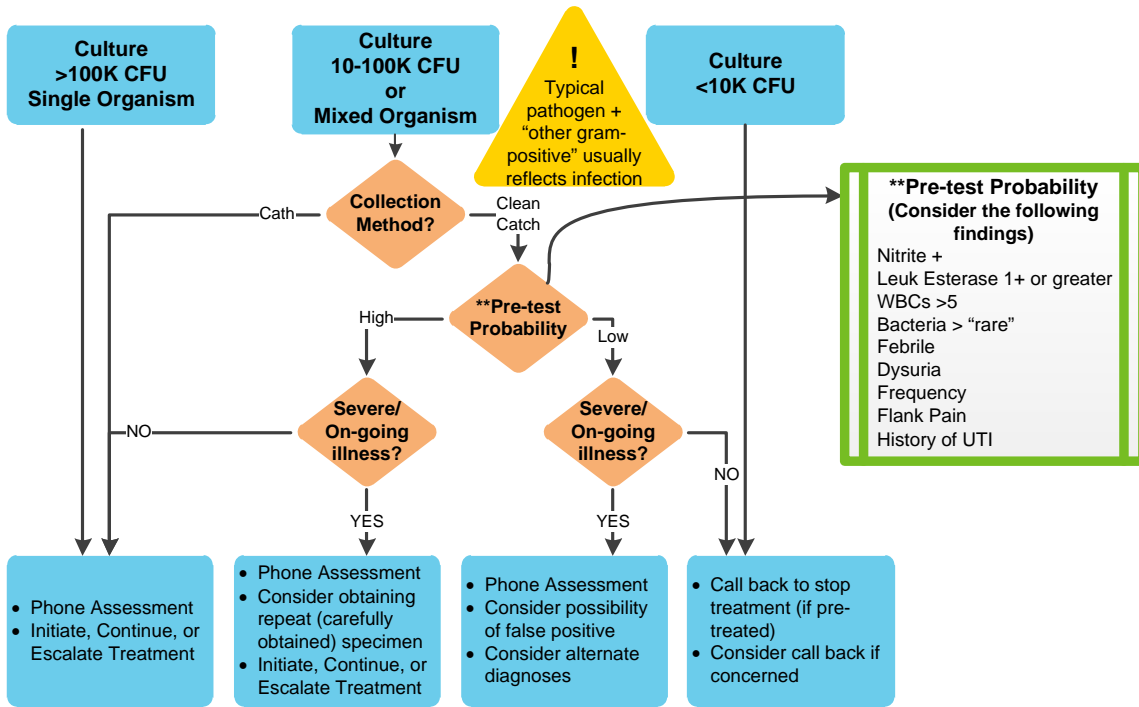
Strongly consider Voiding Cystourethrogram (VCUG)

- o Renal U/S reveals hydronephrosis, scars, or findings of high grade VUR or obstructive uropathy
- o Urosepsis/Severe infection associated with UTI (postpone until infection has cleared)
- o Recurrent UTIs (especially if family hx)

ALGORITHM- UTI Empiric Therapy



ALGORITHM- UTI Culture Results



Second Line Therapy
 If resistant, phone follow-up is warranted. If patient is not improving, change to susceptible antimicrobial

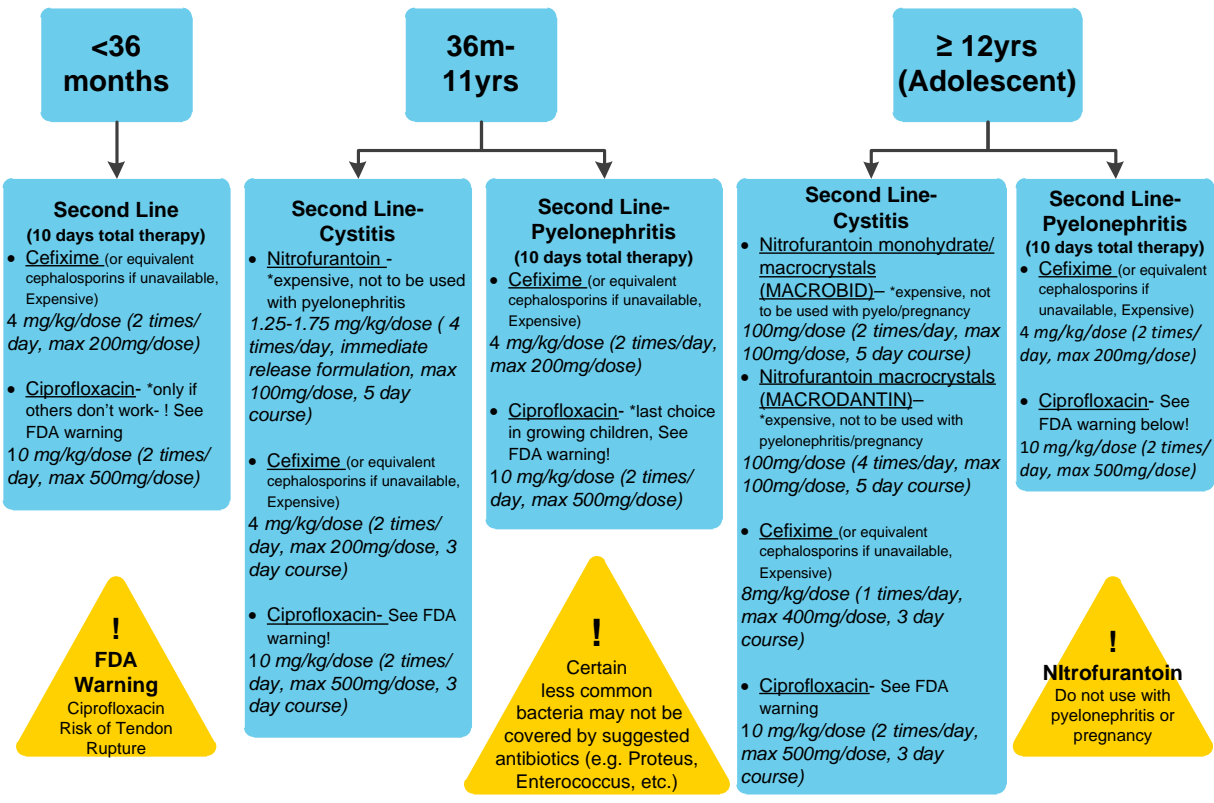


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TARGET POPULATION

Inclusion Criteria

- Patients with presumed or documented UTI
- Patients aged >60 days old

Exclusion Criteria

- Need for immediate critical care/toxicity
- Known urologic anomalies
- Chronic/Complex conditions (ex. Spinabifida, self-cath, hardware, etc.)
- Immunocompromised

BACKGROUND

- UTIs are the most common cause of serious bacterial illness in children
- Recurrent UTI is a known cause chronic kidney disease in children
- Inappropriate management may result in severe or invasive illness
- Knowledge of risk factors and appropriate testing and interpretation of the results in proper clinical context is necessary for accurate diagnosis and treatment of UTI

Probability of UTI based on Number of Risk Factors

# Risk Factors	Males		Females
	Uncircumcised	Circumcised	
0	2.1%	0.2%	3.3%
1	4.1%	0.5%	5.1%
2	7.9%	1.0%	6.5%
3	14.7%	1.9%	11.4%
4	25.9%	3.7%	33.0%
5	--	--	45.0%

<p>Male Risk Factors</p> <ul style="list-style-type: none"> • Temp $\geq 39^{\circ}\text{C}$ • Fever ≥ 2 days • No source of infection • Non-black Race 	<p>Female Risk Factors</p> <ul style="list-style-type: none"> • Age <12mo • Temp $\geq 39^{\circ}\text{C}$ • Fever ≥ 2 days • No source of infection • White Race
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

INITIAL EVALUATION

Signs and Symptoms¹

Age group		Symptoms and signs Most common ———> Least common		
Infants younger than 3 months		Fever Vomiting Lethargy Irritability	Poor feeding Failure to thrive	Abdominal pain Jaundice Haematuria Offensive urine
Infants and children, 3 months or older	Preverbal	Fever	Abdominal pain Loin tenderness Vomiting Poor feeding	Lethargy Irritability Haematuria Offensive urine Failure to thrive
	Verbal	Frequency Dysuria	Dysfunctional voiding Changes to continence Abdominal pain Loin tenderness	Fever Malaise Vomiting Haematuria Offensive urine Cloudy urine

CLINICAL MANAGEMENT

Consider Urology Consult

- Urologic anomalies
- Recurrent UTI unresponsive to routine preventative measures
- Any questions or concerns regarding imaging, management, or prophylaxis

LABORATORY STUDIES | IMAGING

Laboratory Studies

Urinalysis (UA)

- Dipstick^{2, 3} or Standard

Table 2. Urinalysis Methods

	Dipstick	Microscopic
Mechanism	Dipstick	Centrifuge, No Gram stain
Pyuria	Leukocyte esterase: suggestive of UTI but not diagnostic	Equal to or greater than 5 WBC/HPF
Bacteriuria	Nitrite: highly specific but negative test not reliable *concentrated/first morning void specimens might make it more likely to observe nitrites when infection is present	Any bacteria\HPF (but correlates poorly with Gram stain and culture)
Sensitivity	Moderate- 88%, but not specific	Low - less than 81 %

Urine Culture (UC)

- Gold standard for diagnosis of UTI
- Most definitive result is >100,000 cfu of a single uropathogen
- CHCO lab does not report colony counts above or below 50,000 (only 10,000 or 100,000)
- However, multiple organisms and lower colony counts can reflect true UTI, particularly if:
 - The culture comes from a catheter specimen
 - There is high pre-test probability of UTI based on clinical history and urinalysis results (particularly if urine was nitrite positive)
 - One organism is a typical/common pathogen, e.g. *E.coli* and second organism is “other gram positive”
 - The patient has urinary tract anomalies
- Organisms considered contaminants (See [Table 5. Microorganisms Associated with UTI](#))
- Voided specimens can lead to false positive urine cultures. This is particularly true when there is low pre-test probability. When illness is severe or higher risk (e.g. in infancy), or an alternate diagnosis is more likely, a catheter specimen will lead to more reliable final culture results unless the urine is known to be nitrite positive.
- Test of cure/repeat urine cultures are not needed if responsive to therapy ^{4,5}

Table 4. Microorganisms Associated with UTI at Children’s Hospital Colorado

Frequency of organisms in urine culture by collection method at CHCO June 1, 2013 and May 31, 2015. Note frequency of “other gram positive” in cultures with multiple organisms. The vast majority of these cultures from catheter specimens also contain a typical uropathogen. Thus a typical pathogen (e.g. *E. coli*) plus “other gram positive” should be considered a positive culture for the pathogen, rather than a contaminated/unreliable specimen.

Organism	Catheter		Clean Catch	
	1 organism (% total)	% present in isolates with multiple organisms	1 organism (% total)	% present in isolates with multiple organisms
<i>Escherichia coli</i>	570 (66.28)	14.3%	814 (48.74)	3.1%
Other gram-positive	86 (10.00)	76.2%	592 (35.45)	92.3%
Other gram-negative rods	63 (7.33)	2.4%	75 (4.49)	1.9%
Other gram-negative enteric	42 (4.88)	2.4%	35 (2.10)	0.8%
<i>Enterococcus</i>	42 (4.88)	4.2%	20 (1.20)	0.2%
<i>Proteus</i>	22 (2.56)	0.6%	39 (2.34)	0.4%
<i>Staphylococcus</i>	19 (2.21)	0.00%	60 (3.59)	1.3%
<i>Streptococcus</i>	13 (1.51)	0.00%	31 (1.86)	0.00%
Other	3 (0.35)	0.00%	4 (0.24)	0.00%

Table 5. *Microorganisms Associated with UTI*

Gram-negative Organisms	Gram-positive Organisms	Fungal	Other organisms considered contaminants
<i>Escherichia coli</i> (most common, more than 80% first UTI)	<i>Enterococci</i>	<i>Candida</i> (usually in premature infants)	"Other Gram Positives" <i>Lactobacillus</i>
<i>Klebsiella</i> (next most common organism)	<i>Staphylococcus saprophyticus</i> (& others)		<i>Corynebacteria</i>
<i>Proteus</i>	<i>Staphylococcus aureus</i>		<i>Micrococcus</i> species
<i>Pseudomonas</i> (less than 2%)	Group B <i>streptococci</i>		<i>Diphtheroids</i>
<i>Enterobacter</i> (less than 2%)			<i>Bacillus</i>

Additional laboratory studies to consider based on clinical presentation

- Serum chemistries
 - BMP if concerns for renal involvement
- CBC, ESR, CRP are not routinely indicated
- Blood culture is not routinely indicated unless concern for bacteremia

Imaging

Imaging studies for identifying structure

- Renal Ultrasound²⁶
 - Non-invasive study dependent on examiner skill
 - Demonstrates anatomy of bladder, ureters, kidneys including renal size, and obstruction
 - No evaluation of renal function
 - Not adequate for assessment VUR
- CT Scan/ MRI
 - With IV contrast, useful in evaluation of renal parenchyma (both active infection and renal scarring). There is limited value in split renal function.
 - Useful in perinephric pathology
 - Useful in defining the degree and level of obstruction

- CT poses the potential risk associated with ionizing radiation and risk from contrast on the kidneys
- MRI often requires sedation in young children

Imaging studies for identifying VUR ²⁷

- Voiding cystourethrogram (VCUG)
 - Optimal initial study to demonstrate anatomy of lower tract disease (e.g. valves), and evaluate and grade VUR (postpone until infection has resolved).

Imaging studies for identifying scarring

- CT, MRI, or DMSA (only if indicated by urology)- should only be ordered in consultation with urology

THERAPEUTICS

Antibiotics

- See algorithm for recommendations
- Please note... Amoxicillin/clavulanate (Augmentin) and Amoxicillin are not recommended antibiotics for UTI treatment based on CHCO sensitivity data.
- If Cefixime is unavailable, alternative options would be cefpodoxime, cefuroxime, cefprozil, etc.

Analgesics

- Acetaminophen for comfort
- Ibuprofen or other NSAIDS should be used with caution if concern for renal injury
- Phenazopyridine for symptoms of dysuria for patients 6 years and older age. Educate families on urine discoloration when taking this drug.

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Antimicrobial Stewardship Committee – March 2017
 Clinical Care Guideline and Measures Review Committee – March 20, 2017
 Pharmacy & Therapeutics Committee – April 6, 2017

MANUAL/DEPARTMENT	Clinical Care Guidelines/Quality
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APPROVED BY	 Lalit Bajaj, MD, MPH Medical Director, Clinical Effectiveness

REVIEW | REVISION SCHEDULE

Scheduled for full review on April 6, 2021

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