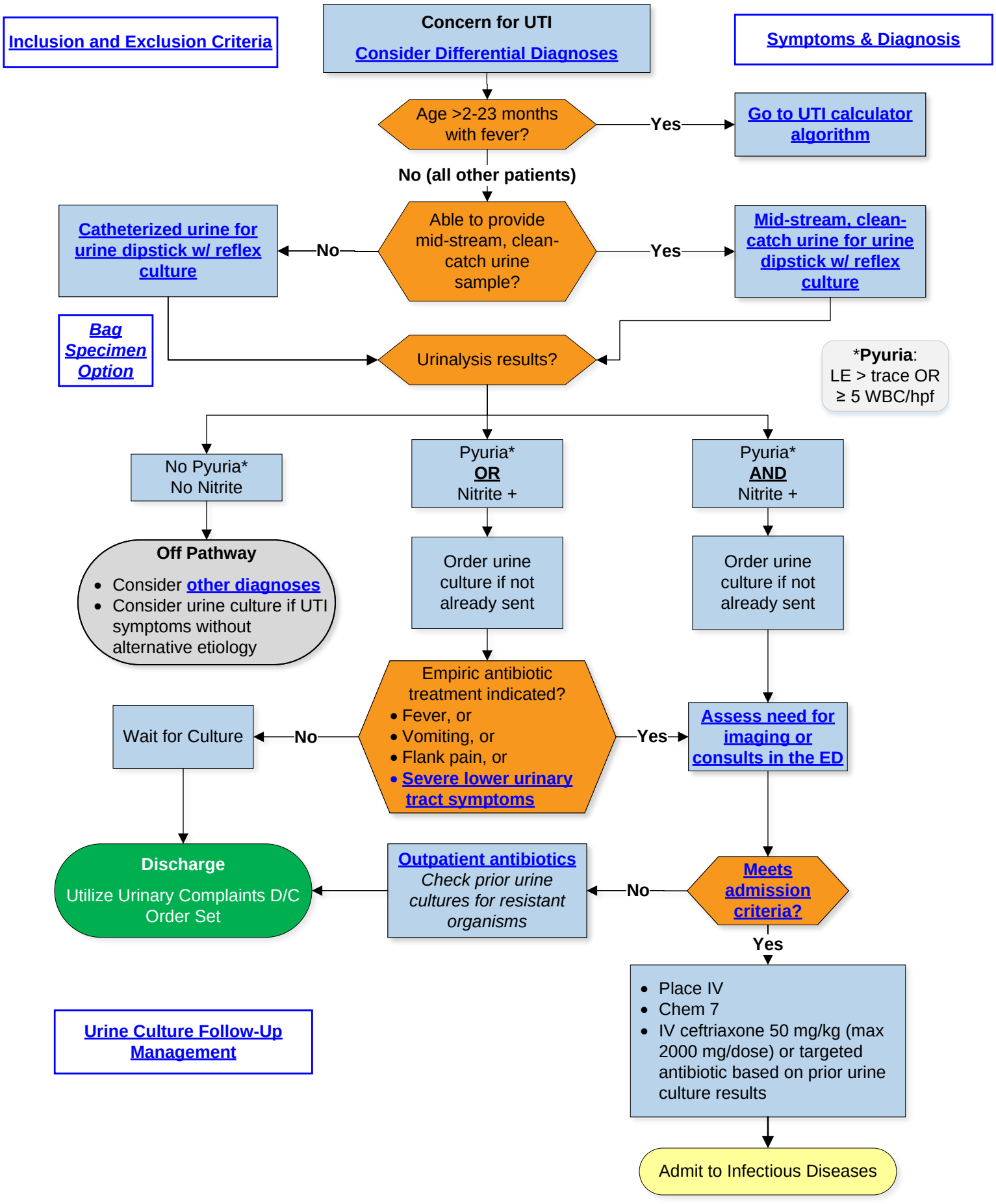
Urinary Tract Infection

Emergency Department/Urgent Care

Nationwide Children's — When your child needs a hospital, everything matters.

Center for Clinical Excellence



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[Inclusion and Exclusion Criteria]

[Symptoms & Diagnosis]

Concern for UTI in child age 2-23 months with fever

Enter clinical characteristics into **UTICalc**

Urine testing recommended?

- **No** → **Off Pathway**
  - Consider other diagnoses
  - F/u urine culture if sent
- **Yes**

Catheterized urine for urine dipstick w/ reflex culture

[*Bag Specimen Option*]

Enter urinalysis results into **UTICalc**

Empiric treatment recommended?

- **No** → **Off Pathway**
  - Consider other diagnoses
  - F/u urine culture if sent
- **Yes** → Order urine culture if not already sent

Assess need for imaging or consults in ED

Meets admission criteria?

- **No** → **Outpatient antibiotics**
  Check prior urine cultures for resistant organisms
  → **Discharge**
  Utilize Urinary Complaints D/C Order Set
- **Yes**
  - Place IV
  - Chem 7
  - IV ceftriaxone 50 mg/kg (max 2000 mg/dose) or targeted antibiotic based on prior urine culture results

Admit to Infectious Diseases

[Urine Culture Follow-Up Management]

Inclusion & Exclusion Criteria

Inclusion Criteria:

- Age > 60 days (2 months) and suspicion of UTI

Exclusion Criteria:

- Hemodynamic instability
- Need for ICU care
- Suspected infection other than UTI
- History of renal disease
- Anatomic or functional abnormalities of the urogenital tract
- Previous urologic surgery
- Presence of urinary catheters, stents, drains or other equipment
- Immunodeficiency
- Pregnancy

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Symptoms & Diagnosis

- The diagnosis of UTI requires 1) symptoms, 2) positive urinalysis, and 3) positive urine culture
  - Symptoms:

Pre-Verbal Children	Verbal Children
Fever (may be only symptom present) Poor feeding Vomiting Decreased urine output Lethargy Irritability Jaundice (unexplained)	Lower urinary tract symptoms: Dysuria Suprapubic or non-localized abdominal pain Urinary frequency Urgency Enuresis Hematuria Upper urinary tract symptoms: Fever Vomiting Flank pain

  - Positive urinalysis:
    - Pyuria: Leukocyte Esterase (LE) > trace or ≥5 WBC/hpf
      --OR--
    - Nitrite test positive
  - Positive urine culture: ≥50,000 CFU/mL of a single **uropathogen**
- Equivocal culture results (e.g. atypical organism, lower colony counts, or mixed organisms) must be considered on a case by case basis (see **Follow-up of Urine Culture Results)**
- The above symptoms and pyuria are not specific to UTI. It is important to consider **other diagnoses** that may present with non-specific symptoms and pyuria.

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Differential Diagnoses

Many conditions can mimic symptoms of UTI and cause abnormal urinalysis results. The following list is not exhaustive:

- Bladder & bowel dysfunction (including constipation)
- Irritant urethritis
- Vulvovaginitis
- Sexually transmitted infections
- Local trauma
- Viral cystitis
- Polyuria (e.g. diabetes)
- Nephrolithiasis
- Appendicitis (fever, pain, pyuria)
- Kawasaki Disease (fever, pyuria)

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Laboratory Testing

- If a UTI is suspected based on clinical signs/symptoms, collect a urine sample for **urinalysis**:
  - Mid-stream, clean-catch collection is acceptable for toilet-trained children who are able to provide an appropriate sample
  - For children who cannot provide a mid-stream, clean-catch urine sample, two options are appropriate:
    - Option 1: Collect a urine sample by catheterization
    - **Option 2: Collect a urine sample by bagged method**

Clean-catch method

- Literature does not support an advantage of urine microscopy over urine dipstick for diagnosing UTI

Test	Sensitivity	Specificity
LE	83%	78%
Nitrite	53%	98%
Microscopy, WBCs	73%	81%

- Urine **Gram stain** may be a helpful additional test, particularly in patients pre-treated with an antibiotic prior to collection of the urine sample. A result of at least 1 organism per high-power field is suggestive of ≥100,000 CFU/mL in culture (which may not grow due to antibiotic pre-treatment)
- Send the urine for **culture** if either of the following:
  - Pyuria: LE > trace or ≥5 WBC/hpf
  - Nitrite positive
- If hospitalization indicated, obtain a serum **Chem 7** to evaluate for acute kidney injury and/or electrolyte derangements
- Not routinely recommended:
  - Complete blood count, sedimentation rate, C-reactive protein, procalcitonin
  - Blood culture
  - Test of cure urine culture
  - *Note: Obtain CBC with differential and blood culture if the patient appears toxic or has hemodynamic instability*

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Urine Bag Specimen Option

Obtaining a urine sample via bag collection may be considered when:

- Antimicrobial therapy does not need to be immediately provided
- Shared decision-making with family determines this is the best option

If a bagged urine sample is positive for any of the following, a catheterized sample must be obtained:

- Leukocyte esterase
- Nitrite

Do not send a bagged urine specimen for culture

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Laboratory Testing

Outpatient Antibiotics

Empiric Antibiotic Therapy

Suspected Diagnosis	Age Range	Preferred Antibiotic[a]
Bacterial Cystitis	< 12 years	Cephalexin 25 mg/kg/dose BID x 3 days (max 500 mg/dose)
	≥ 12 years	Nitrofurantoin macrocrystal/monohydrate 100 mg BID x 3 days[b]
Pyelonephritis (including Febrile UTI)	< 12 years	Cephalexin 25 mg/kg/dose TID x 7 days (max 1000 mg/dose)[c]
	≥ 12 years	Cephalexin 1000 mg TID x 7 days[c]

a. Preferred empiric antibiotic choices are based on commonly recovered pathogens, antimicrobial susceptibility patterns at Nationwide Children's Hospital, and drug penetration into sites of infection
b. Cephalexin 500 mg BID x 3 days is an alternative therapy if nitrofurantoin is not an option
c. See cefdinir dosing in 'Culture-Directed Therapy' if cephalexin is not an option due to adherence concerns

Culture-Directed Therapy

Spectrum	Antibiotic	Dose	Frequency and Duration	
			Cystitis	Pyelonephritis
Most Preferred	Nitrofurantoin[a]	100 mg/dose (adult dose)	BID x 3 days	Do NOT Use
	Amoxicillin	20 mg/kg/dose (max 875 mg/dose)	BID x 3 days	TID x 7 days
	Cephalexin	25 mg/kg/dose	BID x 3 days (max 500 mg/dose)	TID x 7 days (max 1000 mg/dose)
	TMP/SMX	4 mg/kg/dose (max 160 mg/dose)	BID x 3 days	BID x 7 days
	Cefdinir	7 mg/kg/dose (max 300 mg/dose)	BID x 3 days	BID x 7 days
	Amoxicillin/ Clavulanate[b]	20 mg/kg/dose (max 875 mg/dose)[b]	BID x 3 days	TID x 7 days
Least Preferred	Ciprofloxacin	15 mg/kg/dose (max 750 mg/dose)	BID x 3 days	BID x 7 days

a. Macrocrystal/Monohydrate (age ≥12 years). Use for cystitis only; Nitrofurantoin should NOT be used for Pyelonephritis/Febrile UTI
b. Dose based on amoxicillin component. Use products with 7:1 ratio of amoxicillin to clavulanate below:
Suspension: 400 mg/57 mg/5 mL | Tablet: 875 mg/125 mg | Chewable tablet: 400 mg/57 mg

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Admission Criteria

Consider hospital admission if any of the following:

- Not clinically improving after 48 hours of appropriate antibiotic therapy
- Inability to tolerate PO/feeds
- Inability to tolerate enteral antibiotic
- Dehydration not improved with initial management in the ED
- Urgent renal/bladder ultrasound imaging that shows evidence of abscess or obstruction

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Follow-up of Urine Culture Results

Culture Situational Guidance

Negative (any of)

- No growth
- Growth <10K CFU/mL
- Distal urethral/perineal flora only

Was patient treated empirically?

- No → No change in management
- Yes → **Was patient receiving antibiotics when culture obtained?**
  - No → **Discontinue antibiotic:**
    - Call patient
    - Advise re-check if continued symptoms
    - Discontinue antibiotic in Epic
  - Yes → **Continue antibiotic**

Culture Situational Guidance

Equivocal (any of)

- Atypical pathogen ≥50K CFU/mL
- Pure growth 10K-49K CFU/mL
- Mixed growth >10K CFU/mL

Was patient treated empirically?

- Yes → **Organism(s) susceptible to prescribed antibiotic?**
  - No → Call patient to inquire about continued symptoms
  - Yes → Continue antibiotic
- No → Call patient to inquire about continued symptoms

Clinician's discretion:

- If symptoms resolved, do not treat
- Change antibiotic based on susceptibility results
- Repeat urinalysis and culture

Culture Situational Guidance

Positive

Pure growth of ≥50K CFU/mL typical uropathogen

Was patient treated empirically?

- Yes → Review susceptibility results and adjust antibiotic if necessary
- No → Call patient to inquire about continued symptoms

Clinician's discretion:

- If symptoms resolved, do not treat
- Initiate antibiotic based on susceptibility results

Typical Uropathogens	Comments
E. coli	~80% UTIs overall
Other enteric Gram-negative bacilli	Klebsiella, Proteus, Enterobacter, etc.
Enterococcus	more common among males with UTI
Staphylococcus saprophyticus	especially adolescents/adults
Pseudomonas	usually in complicated UTIs

Atypical Pathogens	Comments
Group B streptococcus	usually a contaminant, but uncommonly a uropathogen in young infants
Coagulase-negative staphylococcus	usually a contaminant, but uncommonly a uropathogen in young infants
Staphylococcus aureus	may be a contaminant, but consider bacteremic seeding of kidney (especially if flank pain)

Other bacteria may be true UTI pathogens occasionally, particularly in a symptomatic patient with pyuria whose urine culture yields pure growth ≥50,000 CFU/mL

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Symptoms and Diagnosis

Culture Situational Guidance

Preliminary result versus waiting for susceptibility results:

- If patient is not treated empirically and if all symptoms have resolved completely without treatment, no need to start antibiotic even if culture is positive
- If patient is overall well (no fever, vomiting or flank pain) it is appropriate to wait for susceptibility results prior to starting or changing the antibiotic
- If the patient does have fever, vomiting, or flank pain, it is preferable to start an antibiotic prior to susceptibility results
- If an antibiotic has been started and fever, vomiting, or flank pain occur/persist, the patient should follow-up with the primary care provider, the urgent care, or the emergency department.

Return to Urine Culture Follow-up

ED Imaging & Consult Recommendations

Indications for renal/bladder ultrasound to be completed in ED:
Goal: evaluate for abscess or obstruction

- Failure to improve after 48 hours of effective antibiotic therapy
- History of kidney stones
- Unusually severe presentation: hemodynamic instability or severe flank pain

Indications to Consult Urology and/or Nephrology from the ED
(ask specialist if unsure which service most appropriate)

- Imaging concerning for or a history of a structural or functional urinary tract anomaly or UTI complication:
  - Concern for obstruction
  - Vesicoureteral reflux
  - Posterior urethral valves
  - Ureterocele
  - Bladder and/or kidney stones
  - Solitary kidney
  - Duplex kidney, horseshoe kidney, or cross-fused ectopia
  - Kidney size discrepancy >1 cm
  - Renal cyst(s)
  - Renal/perinephric abscess
  - Renal scar or wedge-shaped areas of increased echogenicity
- Associated hypertension
- Acute kidney injury
- Chronic kidney disease

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Treatments Not Recommended

- Continuous antibiotic prophylaxis is not recommended after a 1st febrile UTI with a normal renal/bladder ultrasound
- Decisions regarding continuous antibiotic prophylaxis in patients with recurrent febrile UTIs or abnormal imaging should be made in consultation with Urology and/or Nephrology

Patient Handout on UTI Prevention

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Quality Measures

- Empiric treatment rate for patients who ultimately have a non-confirmatory culture
- Use of recommended 1st-line empiric antibiotics in outpatients
- Use of most narrow appropriate option for definitive treatment of inpatients
- Duration of treatment for bacterial cystitis and pyelonephritis
- Completion of recommended imaging studies
- ED order set utilization
- ED UTI pathway visualization

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Pathway Team & Process

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Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

For more information about our pathways and program please contact:
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Helping Hands

- Clean Catch Urine Collection
- Urinary Tract Infection (UTI): Prevention

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Laboratory Testing