

## Adult Urinary Tract Infection

*This Care Pathway is intended to provide guidance for Penn State Health and affiliated providers in the evaluation and treatment of Urinary Tract Infection in adult patients. The guidance provided in this document is based on evidence-based standards. This document provides an approach applicable for most patients; however, providers should use clinical judgement and adapt to individual patients and situations.*

### BACKGROUND

Urinary tract infections (UTI) are the second most common type of infection in the body, accounting for about 8.1 million visits to health care providers each year.<sup>(1)</sup> Women are especially prone with a lifetime risk of having a UTI greater than 50 percent. UTIs in men are not as common as in women but can be serious when they occur. A defined care pathway to share with primary care practices, skilled nursing facilities and home health care agencies supports appropriate and timely care for the patients.

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### GOALS

The goals for this care pathway for Urinary Tract Infection are

1. Improve the accuracy of clinical diagnosis of UTIs.
2. Improve outpatient clinic efficiency in caring for patients with UTIs.
3. Reduce inappropriate prescribing of antibiotics for asymptomatic bacteriuria.
4. Optimize antibiotic therapy for treatment of UTI while minimizing short and long term risks of antibiotic use.
5. Optimize testing and use of laboratory services for UTI.
6. Reduce Emergency Department Visits and Hospital Admissions related to bacteremia and UTI.

### OUTCOMES MEASUREMENT

In order to reach our goals for Urinary Tract Infection, Penn State Health Care Partners will measure

1. Appropriate antibiotic selection and duration in asymptomatic & uncomplicated UTIs.
2. Appropriate lab assessment in asymptomatic & uncomplicated UTIs.
3. Patients with multiple Emergency Department visits and/or Hospital Admissions related to UTI and bacteremia.

### CARE TEAM OPPORTUNITIES

**Care Manager:** Connect with patients who were hospitalized from a skilled nursing facility for a UTI to confirm and/or coordinate post-infection follow-up care

**Pharmacist:** Offer provider education for appropriate antibiotic stewardship

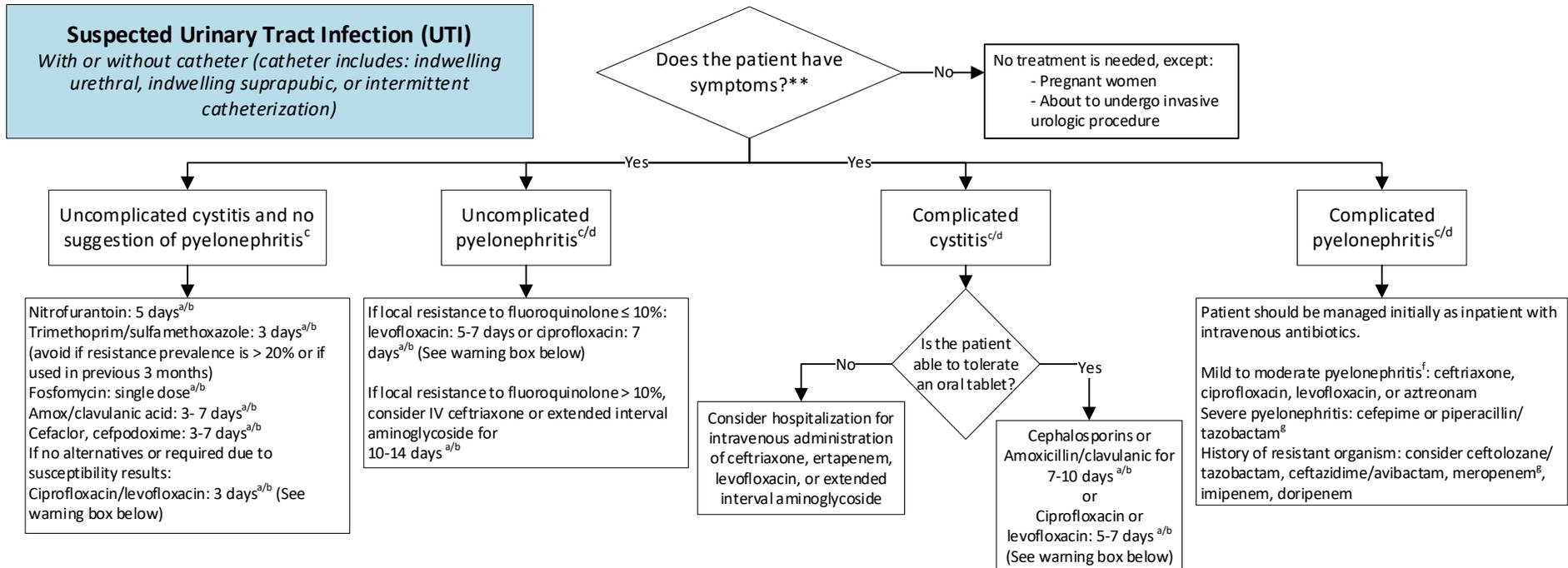
**Recommendations:** The following recommendations are based on the goals and measures listed above as well as general operational practices.

- A. Providers/care teams to review their patient list of patients with multiple Emergency Department visits and/or Hospital Admissions related to bacteremia and UTI to determine adjustments to treatment plan and/or addition of care management services.
- B. Practices implement process, to assess, diagnose, and treat patients with potential UTI
- C. Providers/Care teams have processes in place to eliminate treatment for asymptomatic bacteriuria (unless indicated for patients with pregnancy, urologic procedures, or nephrostomy tubes)
- D. Practices to develop workflows to address culture results with a resistant organism or drug-bug mismatch.
- E. Practices use standard EMR tools for patient education and follow-up.
- F. Health systems work to make local service area's antibiograms available to providers as electronic resources.

(1) Schappert SM, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2006. National health statistics reports; no 8. Hyattsville, MD: National Center for Health Statistics; 2008



### Clinical Pathway



**Ciprofloxacin and levofloxacin** now carry a black box warning that these drugs **should NOT be a first choice for uncomplicated cystitis.**

- Duration of therapy in catheter associated urinary tract infection (CA-UTI):
- 7 days in patients with prompt resolution of symptoms
  - 10-14 days in patients with delayed response
  - 5-day regimen with levofloxacin may be considered for non-severely ill patients
  - 3-day regimen may be considered in women ≤65 years old with CA-UTI without upper urinary tract symptoms after an indwelling catheter has been removed

a Antibiotic selection should be individualized and based on patient’s allergy, adherence history, pattern of resistance, cost, and side effects  
 b See specific dose on pages 3-5  
 c Urine culture may not be needed for uncomplicated UTI. Should always obtain urinalysis and urine culture for complicated UTI, recent treatment, frequent recurrent urinary symptoms, past resistant organism, or possible pyelonephritis.  
 d Complicated UTI (localized to either the lower or upper tract) with associated underlying conditions (such as poorly controlled diabetes, pregnancy, hospital-acquired infection, acute or chronic kidney injury, presence of indwelling catheter, stent, nephrostomy tube, or urinary diversion, functional or anatomic abnormality of urinary tract, renal transplantation, or other immunocompromising condition) increases the risk of failing therapy  
 f Broader therapy with one of the agents listed for severe pyelonephritis may be warranted if there is suspicion for infection with a resistant organism  
 g If Pseudomonas aeruginosa is suspected, higher doses of piperacillin/tazobactam (4.5 gram IV every 6 hours with traditional infusion or 4.5 gram IV every 8 hours with extended infusion) or meropenem (1 gram every 8 hours) can be used in normal kidney function

\*\* Symptoms: dysuria, frequency, urgency, suprapubic or flank pain, nausea/vomiting, T> 38°C, new onset/worsening incontinence, lethargy, confusion, or change in mental status.



**Doses of oral antibiotics commonly used in treating UTI**

<b>Drug Name</b>	<b>Estimated CrCl (mL/min)</b>	<b>Recommended Dose</b>
Amoxicillin/clavulanic acid	CrCl ≥ 30 CrCl 10-30 CrCl < 10 ESRD on HD	875 mg BID 250-500 mg BID 250-500 mg daily 250-500 mg daily (give after HD on the day of HD)
Cefaclor	Mild-moderate	250-500 mg Q8H
Cefpodoxime	CrCl ≥ 30 CrCl < 30 ESRD on HD	100 mg BID 100 mg daily 100 mg three times per week following HD
Ciprofloxacin (see black box warning on page 2)	CrCl ≥ 30 CrCl < 30	250-500 mg BID 250-500 mg daily
Fosfomycin	-	3 gram in 3-4 oz. of water as single dose
Levofloxacin (see black box warning on page 2)	CrCl ≥ 50  If dose is 250 mg daily, - CrCl 20-49 - CrCl 10-19  If dose is 750 mg daily: - CrCl 20-49 - CrCl 10-19	Uncomplicated cystitis and no suggestion of pyelonephritis 250 mg daily for 3 days  Complicated cystitis, acute uncomplicated pyelonephritis 250 mg daily for 10 days <b>OR</b> 750 mg daily for 5 days  250 mg daily 250 mg Q48H  750 mg Q48H 750 mg once, followed by 500 mg Q48H
Nitrofurantoin	CrCl ≥ 60  CrCl < 60	100 mg BID (for Macrobid®) <b>OR</b> 50-100 mg Q6H (for Macrochantin®) Not recommended, but could consider use if CrCl > 30 ml/min
Trimethoprim/ Sulfamethoxazole	CrCl > 30 CrCl 15-30 CrCl < 15	160 mg/800 mg (Bactrim DS tab) Q12H 50% of recommended dose Not recommended



**Doses of intravenous antibiotics used in treating UTI (patients with complicated cystitis who are unable to tolerate oral agents and complicated pyelonephritis)**

Drug Name	Estimated CrCl (mL/min)	Recommended Dose
Aztreonam	CrCl ≥30 CrCl 10-30 CrCl < 10  IHD (assumption of 3 times/week complete hemodialysis)  Peritoneal dialysis  Continuous renal replacement therapy (CRRT)	1 gram IV Q8H to Q12H 50% of usual dose at the usual interval 25% of usual dose at the usual interval  Loading dose of 500 mg, 1 gram, or 2 gram followed by 25% of initial dose at usual interval – or – alternatively may administer 500 mg IV Q12H  Administer as CrCl < 10 ml/min  CVVH: loading of 2 gram ONCE, followed by 1 -2 gram IV Q12H CVVHD/CVVHDF: loading of 2 gram ONCE, followed by either 1 gram Q8H or 2 gram Q12H
Cefepime	CrCl > 60 CrCl 30-60 CrCl 11-29 CrCl < 11  IHD (assumption of 3 times/week complete hemodialysis)  Peritoneal dialysis  Continuous renal replacement therapy (CRRT)	2 gram IV Q12H 2 gram IV Q24H 1 gram IV Q24H 500 mg IV Q24H  Initial 1 gram on day 1. Maintenance: 500 mg to 1 gram IV Q24H or 1-2 gram IV Q48-72H or 2 gram three times weekly after dialysis  Administer normal recommended dose every 48 hours  CVVH: loading of 2 gram ONCE, followed by 1 -2 gram IV Q12H CVVHD/CVVHDF: loading of 2 gram ONCE, followed by either 1 gram Q8H or 2 gram Q12H
Ceftazidime/avibactam	CrCl >50 CrCl 31-50 CrCl 16-30 CrCl 6-15 CrCl ≤ 5 ESRD on IHD	2.5 gram IV Q8H 1.25 gram IV Q8H 0.94 gram IV Q12H 0.94 gram IV Q24H 0.94 gram IV Q48H Administer based upon patient’s estimated renal function (i.e. CrCl 6-15 ml/min or CrCl ≤ 5 ml/min)
Ceftolozane/tazobactam	CrCl > 50 CrCl 30-50 CrCl 15-29 CrCl < 15, not on dialysis ESRD on IHD	1.5 gram IV Q8H 750 mg IV Q8H 375 mg IV Q8H There is no dosage adjustment provided in the manufacturer’s labeling 750 mg IV ONCE, followed by 150 mg IV Q8H
Ceftriaxone	-	1 gram IV Q24H
Ciprofloxacin (see black box warning on page 2)	CrCl ≥30 CrCl < 30	400 mg IV Q12H 400 mg IV Q24H
Doripenem	CrCl > 50 CrCl 30-50 CrCl 11-29 ESRD on IHD  Peritoneal dialysis  Continuous renal replacement therapy (CRRT)	500 mg IV Q8H 250 mg IV Q8H 250 mg IV Q12H 250 mg IV Q24H If treating <i>Pseudomonas aeruginosa</i> , administer 500 mg IV Q12H on day 1, followed by 500 mg IV Q24H  There is no dosage adjustment provided in the manufacturer’s labeling  CVVHD: 1000 mg IV Q8H CVVHDF: 250 mg IV Q12H
Ertapenem	CrCl > 30 CrCl ≤ 30 and ESRD CAPD	1 gram IV Q24H 500 mg IV Q24H 500 mg IV Q24H



Continued

Drug Name	Estimated CrCl (mL/min)	Recommended Dose
Imipenem	CrCl ≥ 90 CrCl ≥ 60 to < 90 CrCl ≥ 30 to < 60 CrCl ≥ 15 to < 30 CrCl < 15  ESRD on IHD (assumption of 3 times/week complete hemodialysis)  Continuous renal replacement therapy (CRRT)	500 mg IV Q6H 400 mg IV Q6H 300 mg IV Q6H 200 mg IV Q6H Do not administer imipenem unless hemodialysis is instituted within 48 hours  Use the recommendation for patients with CrCl ≥ 15 to < 30; administer dose after dialysis session and at intervals timed from the end of that dialysis session – OR – 250 to 500 mg IV Q12H  CVVH: 1 gram ONCE, followed by either 250 mg IV Q6H – OR – 500 mg IV Q8H CVVHD: 1 gram ONCE, followed by either 250 mg IV Q6H – OR – 500 mg IV Q6-8H CVVHDF: 1 gram ONCE, followed by either 250 mg IV Q6H – OR – 500 mg IV Q6H
Levofloxacin (see black box warning on page 2)	CrCl ≥ 50 CrCl 20-49 CrCl 10-19	750 mg IV Q24H 750 mg IV Q48H 750 mg IV ONCE, followed by 500 mg IV Q48H
Meropenem <sup>Δ</sup>	CrCl > 50 CrCl 26-50 CrCl 10-25 CrCl < 10  IHD (assumption of 3 times/week complete hemodialysis)  Continuous renal replacement therapy (CRRT)	500 mg IV Q6H Administer recommended dose based on indication every 12 hours Administer one-half recommended dose based on indication every 12 hours Administer one-half recommended dose based on indication every 24 hours  500 mg IV Q24H  CVVH: 1 gram ONCE, followed by either 500 mg IV Q8H – OR – 1 gram IV Q8H to 12H CVVHD/CVVHDF: 1 gram ONCE, followed by either 500 mg IV Q6 to 8H – OR – 1 gram IV Q8 to 12H
Piperacillin/tazobactam (traditional intermittent infusion dosing with infusion time over 30 minutes)	CrCl > 40 CrCl 20-40 CrCl < 20  ESRD on HD (assumption of 3 times/week complete hemodialysis)  Continuous renal replacement therapy (CRRT)	3.375 gram IV Q6H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 4.5 gram IV Q6H) 2.25 gram IV Q6H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 3.375 gram IV Q6H) 2.25 gram IV Q8H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 2.25 gram IV Q6H)  2.25 gram IV Q12H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 2.25 gram IV Q8H)  CVVH: 2.25 to 3.375 gram IV Q6 to Q8H CVVHD: 2.25 to 3.375 gram IV Q6H CVVHDF: 3.375 gram IV Q6H
Piperacillin/tazobactam (extended infusion dosing with infusion time over 4 hours)	CrCl > 40 CrCl 20-40  CrCl < 20 Peritoneal dialysis  ESRD on HD (assumption of 3 times/week complete hemodialysis)  Continuous renal replacement therapy (CRRT)	3.375 gram IV Q8H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 4.5 gram IV Q8H) 3.375 gram IV Q8H (if treating <i>Pseudomonas aeruginosa</i> , the dose is 4.5 gram IV Q8H)  3.375 gram IV every 12 hours 3.375 gram IV every 12 hours  Not applicable  CVVHDF: 3.375 gram IV every 8 hours (In select cases, more intensive piperacillin/tazobactam may be warranted, such as critically ill patients with severe or deep-seated infections, infections due to <i>Pseudomonas aeruginosa</i> , enhanced drug clearance, or cystic fibrosis. Consider using 4.5 gram every 8 hours infused over 4 hours)



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