


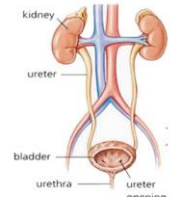



# Nurses Take Antibiotic Stewardship Action Initiative

## Urinary Tract Infection 101 For Nurses





Slide Title and Commentary	Slide Number and Image										
<p><b>Urinary Tract Infection 101 For Nurses</b></p> <p>SAY:</p> <p>This presentation will address best practices in the diagnosis of asymptomatic bacteriuria and urinary tract infections. This material was supported in part by a U.S. Centers for Disease Control and Prevention (CDC) contract to Johns Hopkins University.</p> <p><u>Disclaimer:</u> The conclusions in this presentation are those of the JHU authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.</p>	<p><b>Slide 1</b></p>  <p><b><u>Urinary Tract Infection 101</u></b> <b><u>For Nurses</u></b></p> <p><b>Nurses Take Antibiotic Stewardship Action Initiative</b></p> <p>This material was supported in part by a U.S. Centers for Disease Control and Prevention (CDC) contract to Johns Hopkins University.</p> <p>The Department of Antimicrobial Stewardship, The Johns Hopkins Hospital:</p> <ul style="list-style-type: none"> <li>• Valeria Fabre, MD</li> <li>• Sara E. Cosgrove, MD, MS</li> <li>• Ashley Pleiss, RN, BSN</li> </ul> <p>The Office of Antibiotic Stewardship, Centers for Disease Control and Prevention:</p> <ul style="list-style-type: none"> <li>• Arjun Srinivasan, MD</li> <li>• Lauri Hicks, DO</li> <li>• Melinda Neuhauser, PharmD</li> </ul>  <p><small>Disclaimer: The conclusions in this presentation are those of the JHU authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.</small></p> <p style="text-align: right;"><small>1</small></p>										
<p><b>Urinary Tract Infections</b></p> <p>SAY:</p> <p>Infections of the urinary tract can involve the upper urinary tract (kidneys) or the lower urinary tract (bladder).</p> <p>A urinary tract infection (UTI) requires <u>3</u> elements: 1) symptoms, 2) white cells in the urine (pyuria) and 3) significant growth of bacteria in the urine.</p> <p>Common symptoms of cystitis are dysuria, frequency, and urgency. Common symptoms of pyelonephritis are fever and unilateral flank pain. The kidneys are located in the upper posterior abdomen; thus, flank pain can be elicited by tapping on the back under the ribs. Note that back pain is common, particularly lower back pain which should not be confused with flank pain of pyelonephritis. Bilateral “flank” pain suggests musculoskeletal pain because bilateral pyelonephritis is extremely uncommon. Asking if the pain is new or different from baseline back pain may also be helpful.</p>	<p><b>Slide 2</b></p>  <p><b>Urinary Tract Infections</b></p> <p><b>Consists of an infection of:</b></p> <ul style="list-style-type: none"> <li>• Kidneys (Pyelonephritis, renal abscess)</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• Bladder (Cystitis)</li> </ul>  <p><u>To make a diagnosis of UTI, the following 3 elements are needed:</u></p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">Symptoms</td> <td style="text-align: center;">+</td> <td style="text-align: center;">White cells in the urine (except in neutropenic patients)</td> <td style="text-align: center;">+</td> <td style="text-align: center;">Positive urine culture (bacterial growth in urine culture)</td> </tr> <tr> <td style="text-align: center;">↓</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ol style="list-style-type: none"> <li>1. CYSTITIS: Dysuria, frequency, urgency</li> <li>2. PYELONEPHRITIS: Fever and flank pain</li> <li>3. CATHETER-ASSOCIATED UTI: Fever and suprapubic tenderness</li> </ol> </div>  <p style="text-align: right;"><small>2</small></p>	Symptoms	+	White cells in the urine (except in neutropenic patients)	+	Positive urine culture (bacterial growth in urine culture)	↓				
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↓											

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<p>Common symptoms of catheter-associated urinary tract infection, or CAUTI, are fever and suprapubic tenderness. In addition, a severe CAUTI can lead to pyelonephritis, in which case patients will then have symptoms of pyelonephritis.</p> <p>Whenever possible, use the term that best localizes the UTI, since the antibiotic choices and duration differ if the infection is in the kidneys (pyelonephritis) or the bladder (cystitis).</p>	
<p><b>What Does It Mean To Have Bacteria In The Urine Without Urinary Symptoms?</b></p> <p>SAY:</p> <p>Asymptomatic bacteriuria is defined as the isolation of significant colony counts of bacteria in the urine from a person <i>without</i> symptoms of a urinary tract infection.</p> <p>Guidelines recommend screening for and treating ASB in <u>two specific situations</u>—pregnant women and individuals about to undergo a urologic procedure in which mucosal bleeding is expected.</p> <p>Asymptomatic bacteriuria in early pregnancy confers a 20-30-fold increased risk for the development of pyelonephritis during the pregnancy compared to women without bacteriuria. It is also associated with pre-term labor and low birth weight.</p> <p>ASB has been associated with urosepsis in patients undergoing urologic procedures involving mucosal bleeding. Of note, the term “urologic procedure” does not include placement or removal of a urinary catheter.</p>	<p><b>Slide 3</b></p>  <p><b>What Does It Mean To Have Bacteria In The Urine Without Urinary Symptoms?</b></p> <ul style="list-style-type: none"><li>• This is called <b>asymptomatic bacteriuria (ASB)</b> and is defined as isolation of significant growth of bacteria* in the urine of a person <b>WITHOUT</b> symptoms of UTI</li><li>• There are only <b>TWO</b> situations in which searching for ASB is recommended:<ul style="list-style-type: none"><li>• <b>Pregnant women</b></li><li>• <b>Patients undergoing a traumatic urologic procedure where mucosal bleeding is expected</b> (e.g., transrectal prostate biopsy)</li></ul></li></ul> <p>*Significant bacterial growth is defined as:</p> <ul style="list-style-type: none"><li>• No catheter present: <math>\geq 100,000</math> (<math>10^5</math>) CFU/mL of a urinary pathogen</li><li>• Catheter present: <math>\geq 1,000</math> (<math>10^3</math>) CFU/mL of a urinary pathogen</li></ul>  <p>3</p>

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### What Does It Mean To Have White Cells In The Urine?

SAY:

Pyuria or the presence of white blood cells in the urine can be detected through urinalysis by measuring leukocyte esterase or by direct microscopic visualization of white cells in the urine.

The presence of pyuria is not enough to diagnose a UTI and is not an indication for antibiotic therapy. If you have a patient with pyuria without typical symptoms of UTI, you should consider whether the patient might have another cause of pyuria. There are many reasons why a patient may have white cells in the urine. A common reason in hospitalized patients is the presence of a urinary catheter causing irritation of the bladder wall.

### Slide 4



### What Does It Mean To Have White Cells In The Urine?



- White cells in the urine, or **pyuria**, is defined as:
  - ≥ 10 white cells/mm<sup>3</sup>
  - ≥ 3 white cells/HPF of unspun urine
  - Positive leukocyte esterase

- White cells may be present in the urine due to non-infectious causes
  - Examples of non-infectious cases of pyuria

- Presence of urinary catheter
- Recent urologic procedure
- NSAIDs (e.g., ibuprofen)
- Steroids
- Proton pump inhibitors
- Antibiotics (e.g., vancomycin, penicillin)
- Pelvic irradiation due to cancer
- Urinary tract stones
- Renal-vein thrombosis
- Interstitial cystitis/nephritis
- Systemic lupus erythematosus

**Pyuria with or without bacteriuria is NOT an indication for a urine culture or antibiotic therapy if the patient is ASYMPTOMATIC (exceptions already discussed)**



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### Asymptomatic Bacteriuria And Pyuria Are Common In Certain Patient Populations

SAY:

Asymptomatic bacteriuria is common in certain patient populations. The majority of patients on dialysis and with long-term indwelling catheters have ASB. Many elderly women and long-term care residents have ASB (30-50%). ASB can also be found in up to 10% of patients with short-term urinary catheters and approximately 3% of pre-menopausal women.

Remember, ASB alone, in the absence of symptoms of UTI should not be treated with antibiotics.

### Slide 5



### Asymptomatic Bacteriuria And Pyuria Are Common In Certain Patient Populations

- Patients with very high prevalence of ASB and pyuria (≥ 90%):**
  - Dialysis patients
  - Patients with long-term indwelling catheters
- Patients with moderate (30-50%) prevalence of ASB and high (90%) prevalence of pyuria:**
  - Elderly women
  - Long-term care residents
- Patients with lower (< 10%) prevalence of ASB and moderate (30-50%) prevalence of pyuria:**
  - Short-term catheters (in place for < 30 days)
  - Pre-menopausal women







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<p><b>Treatment of ASB: Why Not?</b></p> <p>SAY:</p> <p>Randomized controlled trials have been performed in many populations to assess whether there is any benefit to treating ASB. Treatment did not decrease the risk of subsequent UTIs in healthy women, diabetic women, patients with long term indwelling urinary catheters, older women in the community, elderly nursing home residents, or renal transplant patients. Treatment did not prevent subsequent joint infection in patients undergoing orthopedic surgery.</p> <p>Treatment of ASB is associated with adverse events related to antibiotics, such as <i>C. difficile</i> infection, renal failure, and development of resistant organisms causing future UTIs. Treatment of ASB in healthy women may increase the risk of a subsequent symptomatic UTI, which suggests a protective effect of these urinary bacteria.</p>	<p><b>Slide 6</b></p>  <p><b>Treatment Of ASB: Why Not?</b></p> <ul style="list-style-type: none"> <li>• Treatment of asymptomatic bacteriuria is not recommended in most patients (exceptions mentioned earlier) because of the potential harm associated with antibiotics and the lack of clinical benefit.</li> <li>• Some studies have shown an increase in UTIs when asymptomatic bacteriuria was treated, suggesting a protective effect of these urinary bacteria.</li> <li>• Adverse events associated with antibiotic use may occur in 1/5 of patients receiving antibiotics.             <ul style="list-style-type: none"> <li>• e.g., renal failure, <i>C. difficile</i> colitis, cardiac arrhythmias, inflammation/rupture of tendons, anemia, liver inflammation</li> </ul> </li> </ul>  <p>6</p>
<p><b>Special Populations</b></p> <p>SAY:</p> <p>Bacteriuria and delirium are both common in the elderly; thus, it can be difficult to know clinically if there is a causal relationship between these two conditions. While a UTI diagnosed based on the traditional symptoms reviewed earlier may also be associated with delirium, there is no evidence that delirium, falls, or confusion are symptoms of a UTI in the absence of development of symptoms related to the urinary tract such as dysuria or systemic signs of infection.</p> <p>Current guidelines on asymptomatic bacteriuria recommend that in the absence of local genitourinary symptoms or systemic signs of infection, older patients with bacteriuria experiencing delirium or falls should be managed with assessment for other causes, such as dehydration, and careful observation rather than antibiotic therapy. It is important to remember that if a patient has symptoms suggestive of a systemic infection, such as fever and hypotension, antibiotic initiation should be considered, regardless of the presence of symptoms related to the urinary tract.</p>	<p><b>Slide 7</b></p>  <p><b>Special Populations</b></p> <ul style="list-style-type: none"> <li>• <b>Elderly patients</b> <ul style="list-style-type: none"> <li>• Bacteriuria and delirium are <b>independently common</b> in elderly patients.</li> <li>• Delirium or fall <b>should not prompt a urine culture</b> if there are no local genitourinary symptoms (e.g., suprapubic pain) or other signs of infection (e.g., fever or hemodynamic instability).</li> </ul> </li> <li>• <b>Spinal cord injury patients</b> <ul style="list-style-type: none"> <li>• Clinical signs and symptoms of a UTI may differ from persons with normal sensation (presenting symptoms may include increased spasticity, leaking around the catheter, malaise).</li> </ul> </li> <li>• <b>Both of these patient groups are at a higher risk of inappropriate antibiotic treatment as their urine is frequently cultured for non-specific symptoms.</b></li> </ul>  <p>7</p>

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<p>Similarly, current guidelines in the US and Europe recommend against screening patients with spinal cord injury for ASB. Patients with neurogenic bladder may have urinary symptoms that might be compatible with UTI and therefore pose a challenge to clinicians. In these patients, a UTI may manifest as increased spasticity, leaking around the catheter, malaise, back pain, fever. In these patients, a new change in clinical status and no other explanation may prompt a urine culture.</p>	
<p><b>The Color Does <i>NOT</i> Tell</b></p> <p>SAY:</p> <p>Urine discoloration can be caused by many reasons. For example, dark urine is usually seen in patients with decreased fluid intake or dehydration. Medications can turn the urine orange or green. Certain vitamins will cause a bright yellow discoloration. Isolated change in color of urine (“dark”, “cloudy”) is not an indication for urine culture if patient reports no symptoms.</p>	<p><b>Slide 8</b></p>  <p><b>The Color Does <i>NOT</i> Tell</b></p> <ul style="list-style-type: none"><li>• Many non-infectious causes may alter the appearance of the urine.<ul style="list-style-type: none"><li><b>Pale yellow/clear:</b> good hydration</li><li><b>Bright yellow:</b> B vitamins</li><li><b>Red:</b> blood, beets, blackberries</li><li><b>Orange:</b> dehydration, carrots, rifampin</li><li><b>Green:</b> phenol drugs, antidepressants, dyes in food, bile</li><li><b>Brown:</b> anti-psychotics, laxatives, muscle relaxants, muscle injury</li><li><b>Purple:</b> porphyria</li></ul></li><li>• Isolated urine color changes (“dark”, “murky”, “cloudy”) do not correlate well with UTI and should not prompt urine cultures in the absence of other signs and symptoms of infection.</li></ul>
<p><b>The Smell Does <i>NOT</i>, Either!</b></p> <p>SAY:</p> <p>A strong urine smell is usually secondary to ammonia production. There are many reasons for odorous urine, including non-infectious causes such as food (the most prominent being asparagus), vitamins, and medical conditions such as uncontrolled diabetes. Therefore, urine odor should not be used as a reason to send a urine culture in a patient without urinary symptoms.</p> <p>Studies have investigated whether certain urine smells correlate with UTIs, and have found that when providers send urine cultures based on smell, they mislabeled patients with odorous urine as</p>	<p><b>Slide 9</b></p>

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having UTIs when these patients did not have a UTI and missed cases of UTI in the setting of non-odorous urine.



### The Smell Does *NOT*, Either!

- Strong urine smell is thought to be secondary to ammonia production.
- Reasons for odorous urine:
  - Uncontrolled diabetes
  - Diet (e.g., asparagus)
  - Vitamins
  - Concentrated urine (dehydration)
- Urine odor (including foul smell) is not an accurate predictor of UTIs.
- Smell of urine is often a misleading symptom of UTIs and results in error.



**Common Reasons For Inappropriate Culture/Decision To Treat ASB**

SAY:

Remember, there are many inappropriate reasons for which urine cultures are sent or antibiotic therapy may be initiated. These include previously mentioned reasons such as changes in the color or smell of urine, the presence of bacteria or white blood cells in the urine, or neurocognitive changes. Other inappropriate indications include screening upon admission, a history of previous UTIs, test of cure, or treatment of leukocytosis in the absence of current urinary symptoms.

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**Common Reasons For Inappropriate Culture/Decision To Treat ASB**

- Pyuria
- Foul smelling urine
- Dark urine
- Sediment in urine
- Prior UTI diagnosis
- Test of cure
- Resistant organisms in urine
- Vague malaise/weakness
- Fall
- Admission or transfer to a new unit/hospital
- Leukocytosis (increased white blood cell count in blood)



**Treatment**







SAY:

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<p>If treatment for a UTI is indicated, whenever possible oral medications are preferred over intravenous options due to the complications associated with IV access such as phlebitis, bacteremia, and thrombosis.</p> <p>Treatment duration depends on the antibiotic, but in general, treatment for cystitis is 3-7 days and treatment for pyelonephritis is 5-14 days. Catheter removal may be sufficient to resolve CAUTIs, but antibiotics may be necessary.</p> <p>If an alternate diagnosis arises that explains a patient’s clinical condition after antibiotics have been started for a UTI, the UTI treatment should be discontinued.</p>	<div style="display: flex; justify-content: space-between; align-items: center;">  <div style="text-align: center;"> <h3>Treatment</h3>  </div> </div> <ul style="list-style-type: none"> <li>• If a patient is able to take oral medications, oral options are preferred for cystitis and recommended for pyelonephritis once the patient has improved (to avoid complications of intravenous access such as phlebitis, bacteremia, and thrombosis).</li> <li>• Duration:             <ul style="list-style-type: none"> <li>○ Cystitis: 3-7 days depending on antibiotics</li> <li>○ Pyelonephritis: 5-14 days depending on antibiotics</li> <li>○ CAUTI: Remove catheter (this alone may resolve the infection). Duration depends on location and severity of illness (3-14 days).</li> <li>○ Longer courses for cases with urinary obstruction</li> </ul> </li> <li>• If an antibiotic was started for a suspected UTI and subsequently an alternative diagnosis is identified, antibiotics should be stopped.</li> </ul> <div style="text-align: right;">  <p>11</p> </div>
<h3>Urine Culture Collection DON'Ts</h3> <p>SAY:</p> <p>When collecting urine for culture, <u>never</u> collect it from the drainage bag. Bacteria often grow at these sites, and are not indicative of a UTI. This can lead to false positive cultures and inappropriate antibiotic treatment.</p>	<h3>Slide 12</h3> <div style="display: flex; justify-content: space-between; align-items: center;">  <div style="text-align: center;"> <h3>Urine Culture Collection DON'Ts</h3> </div> </div> <p><b>Indwelling catheter urine:</b></p> <ul style="list-style-type: none"> <li>• Do not collect urine from the drainage bag because growth of bacteria outside the catheter may have occurred at this site.</li> <li>• Urine catheter tip cultures are not acceptable.</li> </ul> <div style="display: flex; justify-content: center; align-items: center;">  </div> <div style="text-align: right;">  <p>12</p> </div>
<h3>Urine Collection DO's</h3> <p>SAY:</p>	<h3>Slide 13</h3>

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For patients with urinary catheters, the following process should be followed for collecting urine for culture:

1. Clean the catheter with an alcohol pad.
2. Loop the tubing below the collection site to isolate urine in the tube.
3. Use a sterile needle to puncture the tubing, or use a sterile syringe to aspirate urine from the collection valve.
4. Aspirate the urine directly from the tube or valve.
5. Transfer the tubing to a sterile specimen container or transport media.

For patients with long-term indwelling catheters, urine should be collected after replacement of the catheter. For patients with short-term indwelling catheters, urine should be taken after the catheter is removed or replaced.

For patients without catheters, instruct them to wash their hands and clean the urogenital area with a sterile towelette. They should then void initially into the toilet before catching the remaining urine in the cup with one continuous stream. They should then immediately close and return the container.

### When To Order A UA Versus A UA With A Urine Culture?

SAY:




A urinalysis (or UA) can be used to identify the presence of protein, casts, white cells and other components in the urine. If a UTI is suspected based on clinical symptoms, a UA should be ordered with either a reflex to culture or a separate urine culture order.

A UA with reflex sample will be cultured if there is pyuria, nitrite, or leukocyte esterase. Ordering a UA with reflex may help reduce unnecessary cultures; however, results must be interpreted with caution as a UA with reflex may be positive in patients without a UTI, especially in the patient populations we discussed ASB and asymptomatic pyuria.



### Urine Collection DO's

#### Indwelling catheter urine:

1. Clean the catheter with an alcohol pad. 
2. Use a sterile needle and syringe to puncture the tubing or use the urine vacutainer. 
3. Aspirate the urine directly from the tubing. 
4. Transfer the urine to a sterile specimen container or appropriate transport media.

#### Midstream urine (instructions to patients):

1. Wash hands.
2. Clean area with towelette.
3. Void ~20 mL into toilet and catch portion of the remaining urine in cup without stopping the stream.



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### When To Order A UA Versus A UA With A Urine Culture?

- If a UTI is suspected based on signs and symptoms of UTI (not a fall, not fatigue) either a UA with reflex or a UA plus a urine culture can be ordered
- If a UA with reflex is ordered, the clinical laboratory will set the urine culture if predefined criteria are met (usually based on pyuria, nitrite [comes from some urinary bacteria], or leukocyte esterase [comes from white cells])





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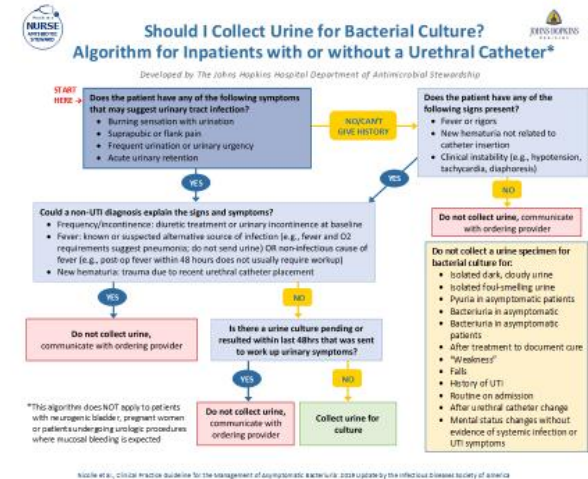
### Should I Collect Urine for Bacterial Culture? Algorithm for Inpatients with or without a Urethral Catheter\*

SAY:

This algorithm details when it is and is not appropriate to collect a urine culture, as well as common inappropriate indications. Use this algorithm to evaluate if an ordered culture is truly indicated, and to consult with the ordering provider if it is not. Do not apply this algorithm to pregnant women and patients undergoing traumatic urologic procedures expected to cause mucosal bleeding. Since patients with neurogenic bladders have atypical symptoms, we do not recommend applying this algorithm to this patient population without further modifications. The role of screening for ASB during the early post-kidney transplant period is not completely understood and we do not recommend applying this algorithm to this patient population without involving renal transplant surgeons and renal transplant ID experts.

### References

### Slide 15



### Slide 16



### References

Slide 3

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