

Educational Module for Nurses in Long-term Care Facilities: Urinary Tract Infections & Asymptomatic Bacteriuria

In this module you will learn about urinary tract infections (UTIs), asymptomatic bacteriuria and antibiotic resistance among long-term care facility (LTCF) residents.

This module:

- Describes components of nursing assessment for UTI
- Outlines laboratory testing for UTI
- Defines and describes asymptomatic bacteriuria
- Discusses management of residents without signs/symptoms of UTI
- Lists indications for appropriate antibiotic use for UTI in LTCF residents



Pre-test

Urinary Tract Infections and Asymptomatic Bacteriuria in Long-term Care Facility Residents

1. Is the following statement true or false?
Asymptomatic bacteriuria is defined as a bacterial count of $\geq 10^5$ cfu/mL without clinical symptoms of UTI.
True False
2. Which of the following are risk factors for the development of asymptomatic bacteriuria in long-term care residents?
 - a. Increased age
 - b. Increased number of diagnoses
 - c. Decreased ability to perform activities of daily living
 - d. Indwelling urinary catheter
 - e. All of the above
3. Randomized trials have described the effect of antibiotic treatment for asymptomatic bacteriuria among LTCF residents. Which of the following effects have not been consistently shown in these studies?
 - a. No effect on morbidity and mortality
 - b. No effect of symptoms of chronic incontinence
 - c. Increase in the number of acute episodes of UTI
4. A thorough nursing assessment is an essential component of care for a resident with a possible urinary tract infection. Which of the following symptoms or conditions is not important when assessing a resident who may have a UTI?
 - a. Symptoms of dysuria (pain on urination) or urinary urgency/frequency
 - b. New onset or worsening of:
 - Delirium
 - Rigors (shaking chills)
 - Urinary incontinence
 - c. Tenderness in the suprapubic and costovertebral angle areas on palpation
 - d. Hematuria (blood in the urine)
 - e. None of the above (all symptoms and conditions listed are important findings in a nursing assessment)

Objectives

After completion of this module you will be able to:

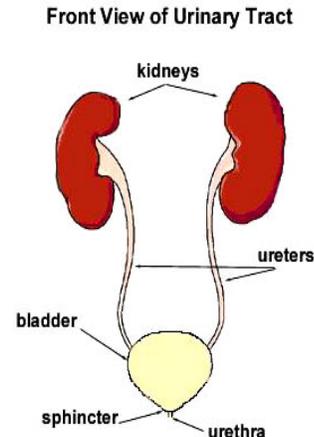
1. Define these terms:
 - a. Urinary tract infection (UTI)
 - b. Asymptomatic bacteriuria.
2. Describe risk factors for UTI and asymptomatic bacteriuria among LTCF residents.
3. Describe the components of a thorough nursing assessment for a resident with a possible UTI.
4. State the clinical indications for antibiotics to treat a UTI.

Urinary tract infection (presence of bacteria in the urine and clinical symptoms of an infection) is easily confused with asymptomatic bacteriuria (presence of bacteria in the urine without clinical symptoms of infection). This module will provide you with a thorough description of these two conditions and their management - especially the appropriate use of antibiotics.

Urinary tract infection (UTI)

A UTI is an infection in the bladder, kidney, or ureters that is characterized by bacteria in the urine (bacteriuria) and clinical symptoms (e.g. painful urination, fever, etc.). The presence of bacteria in the urine is determined by a urine culture.

Urine does not typically contain bacteria, yeast, or white blood cells (pus or pyuria) in younger, healthy people. However, bacteria and pus are frequently found in the urine of elderly and debilitated people as a function of several risk factors described below.



LTCF Resident Risk Factors for Developing a UTI

Not only are LTCF residents at increased risk for having bacteria in their urine, they are also at greater risk than healthy, younger people for developing clinical symptoms of UTI. Studies have shown a rate of 0.1 to 2.4 UTIs per 1000 resident-days among LTCF residents¹. For instance, in a 500-bed LTCF, about 2 residents per week would be diagnosed with a UTI.

While many risk factors are not modifiable, you can still take several actions to reduce residents' risk of developing a UTI.

Factors that contribute to the high frequency of UTIs among LTCF residents include:

- Increased Age
 - Older people have weaker immune systems and are less able to fight infections.
 - **ACTION:** Increased responsibility for staff to protect residents (e.g., consistent adherence to hand hygiene, Standard Precautions)

- Chronic Disease
 - Chronic diseases such as diabetes, heart disease, and kidney disease lower a person's ability to fight infections.
 - **ACTION:** Increased responsibility for staff to protect residents (e.g., consistent adherence to hand hygiene, Standard Precautions)
 - Neurogenic bladder as a complication of degenerative neurological diseases (e.g., Alzheimer's, Parkinson's, and cerebrovascular diseases).
 - **ACTION:** Avoid unnecessary catheterization; when catheters are needed, follow protocols to provide appropriate catheter care
- Functional Impairment
 - Incomplete bladder emptying caused by decreased mobility or other functional impairment.
 - **ACTION:** Provide regular opportunities for resident to empty bladder
- Invasive Devices
 - Invasive devices such as urinary catheters allow bacteria and viruses to enter the body.
 - **ACTION:** Avoid unnecessary catheterization
 - Twisted urinary catheter tubing prevents urine flow into collection bag
 - **ACTION:** Ensure tubing is secured properly, without kinks or twists, with collection bag below bladder
 - **ACTION:** Follow protocols to provide appropriate catheter care

Other factors that promote bacterial growth in urine:

- Dehydration and poor fluid intake
 - **ACTION:** Offer fluids frequently (unless on fluid restriction)
- Prostatic hypertrophy in men (sometimes referred to as "BPH")
- Decreased estrogen in women
 - **ACTION:** Care givers should be aware of this increased risk among elderly residents

Recognition of UTI

The key factor in determining if a UTI requires treatment is the presence of symptoms and objective findings localized to the urinary system, as displayed in Figure 1 below. Urinalysis and urine culture can provide supportive evidence, but results are not helpful without associated clinical information.

Nursing Assessment

Nursing assessment plays an important role in providing accurate and objective criteria upon which an accurate diagnosis can be made by a clinician and appropriate treatment initiated. Nurses should assess the following:

- Nonverbal cues that may indicate pain
- Vital signs (temperature, blood pressure, respiratory rate, heart rate, oxygen saturation, most recent finger stick blood glucose values (if diabetic or otherwise indicated))
- Presence of catheter
 - Insertion date
 - Rationale
- Intake and output (note any change in trend or unusually high or low values)
- Any symptoms of dysuria (pain on urination) or urinary urgency/frequency
- New onset or worsening of:
 - Urinary incontinence
 - Rigors (shaking chills)
 - Delirium
- Tenderness in the suprapubic and costovertebral angle (or flank) areas on palpation
- Hematuria (blood in the urine)

Complete a thorough nursing assessment prior to contacting the provider.

*Consider requesting blood draw for a CBC if febrile, experiencing rigors

Other possible causes of urinary tract symptoms:

- Change in medication regimen or recent prn medication
 - Some medications can affect urine output, urge, or color, and cause other changes in alertness or body temperature
- Change in routine
 - New environments or stimuli may increase likelihood of delirium or confusion
- Change in diet
 - Some foods can affect appearance and odor of urine; some beverages can increase urine output

- Bowel patterns
 - Constipation can cause abdominal and/or back pain that can be mistaken for suprapubic or flank pain
- Diagnoses
 - Clinical course may explain resident behaviors (e.g., incontinence may be influenced by dementia, depression, diabetes, etc.)
 - Keep in mind that dementia and medications may mask or prevent recognition of clinical symptoms such as pain, urgency, or fever².

Figure 1. Clinical symptoms of UTI^{3,4}

For residents **WITH**
indwelling urinary catheters:

- Fever $>100^{\circ}\text{F}$ ($>37.9^{\circ}\text{C}$) or 2.4°F (1.5°C) increase above baseline
- New costovertebral angle tenderness
- Rigors (shaking chills) with or without identified cause
- Delirium (new onset)
- Altered mental status
- Malaise
- Lethargy with no other identified cause
- Acute hematuria
- Pelvic discomfort

If recent catheter removal:

- Dysuria
- Urgent or frequent urination
- Suprapubic pain or tenderness

For residents **WITHOUT**
indwelling urinary catheters:

- Acute dysuria (painful urination)
or
- Fever $>100^{\circ}\text{F}$ ($>37.9^{\circ}\text{C}$) or 2.4°F (1.5°C) increase above baseline *and* at least one of the following:
 - New or worsening:
 - Suprapubic pain (pain over the bladder)
 - Urinary frequency or urgency
 - Urinary incontinence
 - Gross hematuria (blood in the urine)
 - Costovertebral angle (CVA) tenderness (flank pain)

Nursing assessments should be completed based on your facility's protocol. The assessment components listed here are intended to highlight the importance of a holistic approach to assessing a resident while also recognizing the localizing signs and symptoms that may be indicative of a UTI. If signs or symptoms outlined in Figure 1 are identified, these should be communicated to the nurse manager or clinician, who will determine potential next steps, including whether laboratory testing is required.

Laboratory testing for UTI

Most UTIs result from bacteria ascending the urethra. This means that they are present in the perineal/peri-anal areas, close to the urinary opening (urethra), where they can gain entry to the bladder. The most common organisms isolated from urine are:

- *Escherichia coli* (*E. coli*)
- *Klebsiella pneumoniae*
- *Proteus mirabilis*
- Enterococci
- Streptococci (Group B)
- *Candida*

When should a urinalysis or urine culture be performed?

Clinical symptoms of UTI should be present before requesting a urinalysis⁵.

The physician or nurse practitioner will utilize nursing assessment findings and laboratory results to determine if antibiotic treatment is needed.

If a urinalysis or urine culture is performed, despite a lack of clinical signs or symptoms of a UTI, antibiotics are not indicated - even if bacteria are present.

"Treat the resident, not the culture." (Adapted from presentation by Dr. Ayesha Rashid, St Paul Infectious Disease Associates, Minnesota Antimicrobial Stewardship Conference October 24, 2013.)

Appropriate urine specimen collection ensures accurate lab results

Appropriate urine specimen collection techniques are essential to the effective diagnosis and treatment of a UTI. Accurate lab results are only possible if the urine specimen is collected using appropriate techniques that prevent contamination of the specimen. This includes:

- Clean catch collection (if towelettes are used, wipe front to back (from the urinary opening toward the anus, never scrubbing back and forth); mid-stream urine should be collected, if possible)
- Bladder catheterization (from sterile port of indwelling catheter). If catheter has been in place for > 14 days, specimen will likely reflect the presence of catheter biofilm; results will be more meaningful if specimen is collected from newly placed catheter, if catheter is still indicated. Consider obtaining an order to change catheter prior to collecting specimen if previous catheter has been in place >14 days.
- Suprapubic aspiration

Collect a urine specimen prior to initiation of antibiotics in order to ensure an accurate test result. A urine culture may be negative if the specimen is collected after antibiotics have been started.

Urinalysis or urine culture should only be performed on residents with clinical signs or symptoms of a UTI. Urinalysis or urine culture should be done in order to:

- Confirm the presence and type of bacteria
- Guide antibiotic therapy by ensuring that antibiotic therapy matches the bacteria and antibiotic susceptibility testing results

If the urine culture is negative, discontinue empiric antibiotic therapy.

Other Laboratory Testing

Other laboratory tests can be used in conjunction with clinical symptoms to diagnose a UTI.

These tests include:

- Microscopic urinalysis
 - Identifies the presence of pyuria (more than minimal white cells in the urine)
- Dipstick test
 - Rapid, inexpensive, and requires little technical expertise.
 - Tests for leukocyte esterase or nitrites.
 - Leukocyte esterase test: Detects esterases released from degraded white blood cells and indicates the presence of significant pyuria.
 - Nitrite reduction test detects nitrites produced by Enterobacteriaceae, a group of Gram-negative bacteria found in the urinary tract.
 - A negative leukocyte esterase (absence of pyuria) strongly suggests that a UTI is not present.
 - A positive leukocyte esterase test alone does not prove that the individual has a UTI. Clinical symptoms must be present in order to make the diagnosis of UTI.

Interpreting urine culture results

A positive urine culture is defined as $\geq 10^5$ (100,000) colony forming units (cfu)/mL⁶. This value may be lower and still considered a positive urine culture in residents with conditions such as renal failure.

- **ACTION:** Notify prescriber regardless of colony count. Be sure to indicate whether specific pathogens are identified or if results state "mixed culture," as this may indicate contamination or colonization.

Multiple organisms are frequently identified in a single urine specimen. Up to 25% of people with a UTI have more than one organism present in the urine. For this reason, the identification of more than one microorganism in a urine specimen with an appropriate number of colony forming units does not necessarily mean the specimen was contaminated.

Antibiotic susceptibility testing indicates which antibiotics can kill a specific organism and should be used to guide appropriate prescribing of antibiotics. The prescribed antibiotic should be changed if susceptibility testing indicates that this drug is not effective against the bacteria that are present.

- **ACTION:** Notify prescriber of antibiotic currently prescribed (if any) and whether the pathogen is susceptible to this medication. Ensure that the prescriber is made aware of how susceptibilities align with currently prescribed medication.

Treating urinary tract infections

The overarching goal of UTI treatment is to optimize the use of antibiotics by prescribing antibiotics only when clinically indicated. The Society for Healthcare Epidemiology in America (SHEA) has published criteria to help guide the initiation of antibiotics to treat UTI in residents of LTCF (Table 1).

NOTE: The criteria are different for LTCF residents who have an indwelling catheter from those LTCF residents who do not have an indwelling urinary catheter.

Table 1: Criteria for Initiation of Antibiotics for Urinary Tract Infection in Long-Term Care Residents⁴

Catheterized Resident (Foley or suprapubic)	Non-catheterized Resident
<p>Presence of at least one of the following symptoms:</p> <ul style="list-style-type: none"> • Fever: >37.9°C or 100°F; or 1.5°C or 2.4°F increase above baseline • New costovertebral angle (CVA) tenderness • Rigors (shaking chills) • New onset of delirium 	<ul style="list-style-type: none"> • Acute dysuria (pain with urination) Note: Dysuria alone is an indication to start antibiotics without any other symptoms <p>OR</p> <ul style="list-style-type: none"> • Fever: >37.9°C or 100°F; or 1.5°C or 2.4°F increase above baseline PLUS at least one of the following symptoms: <ul style="list-style-type: none"> • New or worsening: <ul style="list-style-type: none"> ○ Urgency ○ Frequency ○ Suprapubic pain ○ Gross hematuria (blood in urine) ○ Costovertebral angle (CVA) tenderness ○ Urinary incontinence

Residents who are intermittently catheterized (either with an indwelling catheter or condom catheter) are at lower risk of developing UTIs than residents who have an indwelling catheter. For this reason, the criteria for non-catheterized residents should be used for these residents when determining when to prescribe antibiotics. While providers are responsible for making UTI treatment decisions, nursing assessment and actions can promote informed provider decision making.

Post-treatment testing

Post-treatment urine cultures are not recommended unless the resident continues to have symptoms or develops new symptoms of UTI.

- **ACTION:** Continue to assess for symptoms following completion of medication course. If no symptoms are present (or no change from baseline), a repeat culture is not indicated.

"Treat the resident, not the culture."
(Adapted from presentation by Dr. Ayesha Rashid, St Paul Infectious
Disease Associates,
Minnesota Antimicrobial Stewardship Conference October 24, 2013.)

Preventing UTIs in LTCF residents

Asymptomatic bacteriuria is very common among LTCF residents and does not need to be treated with antibiotics. While many of the factors that increase a LTCF resident's likelihood of developing a UTI cannot be changed (other than avoiding long-term catheterization), it is important to focus on infection prevention. Infection prevention measures include:

- Use Standard Precautions when caring for all residents
 - Wear gloves when there is potential for having contact with body fluids, secretions or excretions (including contact with urine, and genital mucous membranes)
 - Wear gowns when there is potential for your clothing to become contaminated by splashing or contact with body fluids, secretions or excretions, regardless of the resident's multidrug resistant organism (MDRO) status.
 - Always clean your hands 1) before touching a resident; 2) before putting on gloves; 3) before a clean/aseptic procedure; 4) after body fluid exposure; 5) after removing gloves; 6) after touching a resident; 7) after touching resident surroundings
- Implement a plan to increase hydration in residents at high risk for UTI
 - Check resident's care plan to assure that the resident is not on a fluid restriction
- Use indwelling urinary catheters only when medically indicated (e.g., clinically significant urinary retention, comfort for terminally ill resident with urinary incontinence, etc.)
- Prevent fecal soiling by offering regular opportunities for toileting; assess for soiling regularly in incontinent residents
- Encourage frequent bladder emptying by offering assistance with / providing toileting opportunities
- Ensure proper perineal and catheter care is provided
 - Wipe front-to-back (from urethra to anus) to prevent contamination of urethra with fecal flora
- Do not collect urine for urinalysis or culture in absence of symptoms consistent with urinary tract infection unless instructed by provider

Asymptomatic bacteriuria

Asymptomatic bacteriuria is defined as a bacterial count of $\geq 10^5$ cfu/mL of urine without clinical symptoms of UTI.

Asymptomatic bacteriuria and UTI among LTCF residents

Asymptomatic bacteriuria is very common and considered a benign condition among LTCF residents. It occurs as a result of increased age, decreased mobility and/or decreased bladder emptying. Routine screening for bacteriuria among LTCF residents is not recommended⁷.

It is believed that as many as 15 - 40% of men and 25 - 50% of women in LTCFs who do not have indwelling urinary catheters have bacteria in their urine (bacteriuria). Nearly 100% of LTCF residents with an indwelling urinary catheter have bacteria in their urine⁸. *Ninety-eight percent of LTCF residents with bacteriuria do not have clinical symptoms.*

Table 2. Prevalence of Asymptomatic Bacteriuria⁹

Group	Prevalence
Pre-menopausal women	1 - 5%
Post-menopausal women	2.8 - 8.6%
Pregnant women	1.9 - 9.5%
Elderly females in LTCF	25 - 50%
Elderly males in LTCF	15 - 40%
Short-term catheter	9 - 23%
Chronic indwelling catheter	100%

Risk factors for asymptomatic bacteriuria among LTCF residents include:

- Indwelling catheter
- Increased age
- Increased number of diagnoses
- Increased number of medications
- Decreased ability to perform independent activities of daily living
- Decreased mental status
- Decreased independent mobility
- Decreased overall health status (self-rated)

Management of asymptomatic bacteriuria

Randomized trials^{10,11,12} that have described the effect of antibiotic treatment for asymptomatic bacteriuria among LTCF residents have consistently shown:

- No effect on:
 - Morbidity and mortality
 - Symptoms of chronic incontinence
 - Future acute episodes of UTI
- Negative effect on LTCF residents:
 - Increased drug side effects
 - Increased future isolation of resistant organisms
 - Antibiotics may not be as effective against future infections, when they are truly indicated
 - Increased cost of medication and healthcare
 - Increased risk of acquiring *Clostridium difficile* infection

Bacteriuria without clinical symptoms of a UTI should not be treated with antibiotics².

"You cannot make an asymptomatic resident better."
(Adapted from presentation by Dr. Ayesha Rashid, St Paul Infectious Disease Associates, Minnesota Antimicrobial Stewardship Conference October 24, 2013.)

Frequently asked questions about UTI and asymptomatic bacteriuria

Do vague behavioral changes indicate an UTI?

There are many myths about what symptoms indicate a UTI. While the following symptoms warrant evaluation, they do not correlate with the presence of clinical symptoms of UTI:

- Chronic incontinence (during sleep or when awake, when coughing or sneezing)
- Anorexia
- Difficulty falling asleep or staying asleep
- Fatigue
- Malaise
- Weakness

Does the presence of pyuria (pus in the urine) indicate a symptomatic UTI?

No, the presence of pyuria alone does not mean that the person has a symptomatic UTI or bacteria in the urine. Because pyuria is considered an immune response, the presence of pyuria indicates a response to the bacteria. However, pyuria is neither sensitive nor specific to the diagnosis of a UTI. If a resident has bacteria in their urine, they will almost always have pyuria. Pyuria without clinical symptoms should not be treated with antibiotics.

Does foul-smelling urine indicate a UTI?

- Foul-smelling or cloudy urine has historically been used by nurses and other health care providers as an indicator of a UTI. However, malodorous urine can be caused by several factors, including dehydration¹³, diet, medication, or the presence of specific bacteria¹⁴. Using urine odor to identify bacteriuria resulted in error in 1/3 of cases in one published study¹⁵. Foul-smelling urine without clinical symptoms of a UTI does not indicate the presence of a UTI¹⁶.

Are antibiotics needed to treat a UTI?

Symptomatic urinary tract infections should be treated with antibiotics. Persons with positive laboratory findings without clinical symptoms (asymptomatic bacteriuria) generally should not be treated with antibiotics.

Does it matter if asymptomatic bacteriuria is treated with antibiotics?

Yes! Antibiotics should only be prescribed for bacterial infections. Inappropriate antibiotic use contributes to antibiotic resistance. Infections caused by antibiotic-resistant organisms can be more severe, require more powerful and toxic antibiotics, and can lead to secondary infections, longer hospital stays, and increased healthcare costs. Additionally, antibiotics can cause adverse reactions and side effects; some of these can be severe. Adverse effects caused by antibiotics include:

- Allergic reactions
- Disruption of normal bowel flora (bacteria that are normally present in the intestines)
 - Antibiotics kill normal bowel flora, leaving space for disease-causing bacteria such as *Clostridium difficile* to multiply. See *Clostridium difficile* module
 - Diarrhea
- Increased rates of re-infection with resistant organisms
- Adverse drug interactions
- Rashes
- Yeast infections (antibiotics alter normal flora, allowing *Candida albicans*, a common yeast, to over-grow and cause an infection.)

Bacteriuria without clinical symptoms of a UTI should not be treated with antibiotics.

Treatment of asymptomatic bacteriuria will not:

- Decrease chronic symptoms
- Decrease the risk of future acute UTI episodes
- Decrease persistent bacteriuria
- Decrease mortality

Prescribing antibiotics when they are not needed - such as for asymptomatic bacteriuria - CAN:

- Increase the chance of the resident experiencing an adverse drug reaction
- Increase the chance that the resident will develop antibiotic-resistant organisms that may cause an infection
- Increase healthcare costs

Due to the potential of adverse drug reactions or development of antibiotic-resistant super-infections, inappropriate antibiotic prescribing can result in increased mortality.

Should prophylactic antibiotics be given to prevent a UTI in patients with asymptomatic bacteriuria?

Antibiotics should not be given to prevent a clinical UTI in LTCF residents. There are only two situations where antibiotics should be given as a prophylactic measure against a UTI: 1) prior to a urologic procedure for which mucosal bleeding is anticipated and 2) during pregnancy⁹.

Are silver-coated catheters helpful in preventing UTI?

Silver-coated catheters may delay the onset of bacteriuria by up to two days by preventing the growth of organisms on the catheter tubing that form a biofilm. These catheters are likely beneficial to people who have a catheter placed for only a short duration. However, they are not helpful for people who have a chronic, indwelling catheter.

Do cranberry juice and other cranberry products prevent UTI?

There are no clear data to indicate that cranberry juice prevents UTI, but if not otherwise contraindicated, there is no reason not to give cranberry juice to residents.

Post-test

Urinary Tract Infections and Asymptomatic Bacteriuria in Long-term Care Residents

1. Is the following statement true or false? **Answer: True**
Asymptomatic bacteriuria is defined as a bacterial count of $\geq 10^5$ cfu/mL without clinical symptoms of UTI.
True **False**
2. Which of the following are risk factors for the development of asymptomatic bacteriuria in long-term care residents? **Answer: e**
 - a. Increased age
 - b. Increased number of diagnoses
 - c. Decreased ability to perform activities of daily living
 - d. Indwelling urinary catheter
 - e. **All of the above**
3. Randomized trials have described the effect of antibiotic treatment for asymptomatic bacteriuria among LTCF residents. Which of the following effects have not been consistently shown in these studies? **Answer: c**
 - a. No effect on morbidity and mortality
 - b. No effect of symptoms of chronic incontinence
 - c. **Increase in the number of acute episodes of UTI**
4. A thorough nursing assessment is an essential component of care for a resident with a possible urinary tract infection. Which of the following symptoms or conditions is not important when assessing a resident who may have a UTI?
Answer: e
 - a. Symptoms of dysuria (pain on urination) or urinary urgency/frequency
 - b. New onset or worsening of:
 - Delirium
 - Rigors (shaking chills)
 - Urinary incontinence
 - c. Tenderness in the suprapubic and costovertebral angle areas on palpation
 - d. Hematuria (blood in the urine)
 - e. **None of the above** (all symptoms and conditions listed are important findings in a nursing assessment)

Glossary

Antibiotic resistance - The ability of a microorganism to withstand the effects of an antibiotic and not be killed by the antibiotic.

Asymptomatic bacteriuria - Presence of bacteria in urine in absence of clinical signs or symptoms of UTI

Bacteremia - Bacteria in the blood

Bacteria - Bacteria (singular: bacterium) are a major group of living microscopic organisms. Bacteria are the most abundant of all organisms. They are ubiquitous in soil, water, and as symbionts of other organisms. Many pathogens, disease-causing organisms, are bacteria.

Biofilm - A layered culture of microorganisms that grow on a surface that they have created themselves by secreting polysaccharides and glycoproteins. Antibiotics generally cannot penetrate a biofilm.

Colonization - Bacteria are present without causing disease

Costovertebral angle (CVA) tenderness - Pain near the ribs and thoracic vertebrae

Cystitis - Infection of the urinary tract that is limited to the bladder, usually involving only the mucosal surface. This is the infection that most people think of when they say "UTI. A more common term would be "bladder infection".

Delirium - An altered state of consciousness, consisting of confusion, distractibility, and disorientation.

Dysuria - Difficulty or pain with urination

Hematuria - Blood in the urine

Infection - The entry and multiplication of microorganisms in the tissues of the host that produce injurious effects. Infection generally implies that the person has clinical signs or symptoms.

Pyelonephritis - Infection of the kidney usually resulting from travel of the infection from the bladder to the ureter and then to the kidney. This infection is commonly referred to as a kidney infection.

Pyuria - Presence of white blood cells in the urine

Rigors - Shaking chills

Suprapubic pain - Pain in the midline (suprapubic) region

Urinary incontinence - Involuntary excretion of urine from one's body. It is often temporary, and almost always results from an underlying medical condition.

Urinary tract infection (UTI) - An infection of the urinary tract (bladder, kidney, ureters, urethra) that is characterized by bacteriuria and clinical symptoms.

Urosepsis - Sepsis occurs when bacteria enter the blood stream and lead to a widespread (systemic) inflammatory response - urosepsis means the infection has stemmed from an infection of the urinary tract.

Virus - A virus is a submicroscopic parasitic particle that infects cells in biological organisms. Viruses are obligate intracellular parasites that lack the cellular machinery for self-reproduction.

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