

DIAGNOSTIC STEWARDSHIP AND CAUTI MANAGEMENT

Emily Perry, PharmD

Antimicrobial Stewardship Pharmacist

Center for Collaboration and Advancement in Pharmacy

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Disclosure

- Support for all or part of these activities has been provided by the Department of Health and Human Services through the CDC Epidemiology and Laboratory Capacity program.

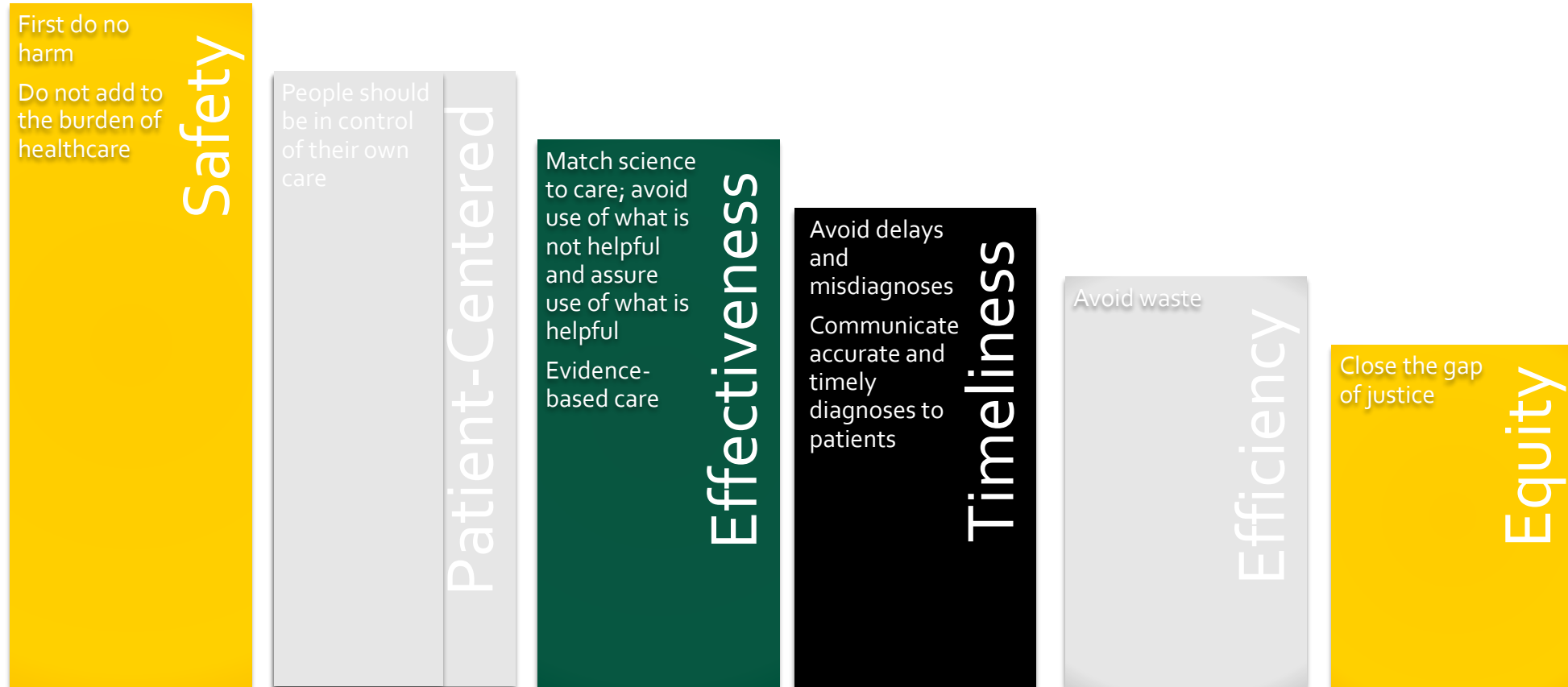
Objectives

- Analyze how diagnostic accuracy, antimicrobial stewardship, and healthcare quality outcomes are intricately connected, and explore strategies to minimize diagnostic errors and prevent patient harm.
- Develop skills to initiate and navigate challenging stewardship conversations with clinicians and staff using advocacy, inquiry, listening, and teaching techniques that foster collaboration and improve care decisions.
- Identify evidence-based criteria for diagnosing catheter-associated urinary tract infections (CAUTIs), differentiate between symptomatic and asymptomatic presentations, and apply best practices for treatment and prevention.

Why focus on diagnostic safety and stewardship?

To prevent harm!

Six Pillars of Healthcare Quality



Burden of Serious Harms from Diagnostic Error in the USA

- An estimated 795,000 Americans become permanently disabled or die annually across care settings because dangerous diseases are misdiagnosed.
- Just 15 diseases account for about half of all serious harms, so the problem may be more tractable than previously imagined.
- 5 of the 15 diseases are infectious diseases

ORIGINAL RESEARCH

Burden of serious harms from diagnostic error in the USA

David E Newman-Toker ^{1,2} Najlla Nassery,³ Adam C Schaffer,^{4,5} Chihwen Winnie Yu-Moe,⁵ Gwendolyn D Clemens,⁶ Zheyu Wang,^{6,7} Yuxin Zhu,^{1,6} Ali S. Saber Tehrani,¹ Mehdi Fanai,¹ Ahmed Hassoon,^{1,2} Dana Siegal^{8,9}

CDC Core Elements of Hospital Diagnostic Excellence Programs

Hospital Leadership Commitment and Accountability

- Commitment to the staff and board that improving diagnosis is a priority for the hospital and ensuring the entire organization is accountable for progress.
- Dedicating the necessary human, financial, technological, and information technology resources.

Multidisciplinary Expertise

- Creating inclusive and multidisciplinary diagnostic teams that include laboratory and radiology testing experts.

Patient, Family, and Caregiver Engagement

- Engaging patients, their families, and caregivers as partners in diagnostic excellence, including identifying effective ways to communicate diagnostic test results and other information.

Actions

- Improving diagnosis through 1) diagnostic stewardship, 2) strengthening systems and processes, and 3) identifying, monitoring, and learning from diagnostic safety events.
- Improving teamwork and coordination within the hospital and across the continuum of care.

Education

- Educating healthcare personnel, patients, and family/caregivers about diagnosis and testing.

Tracking and Reporting

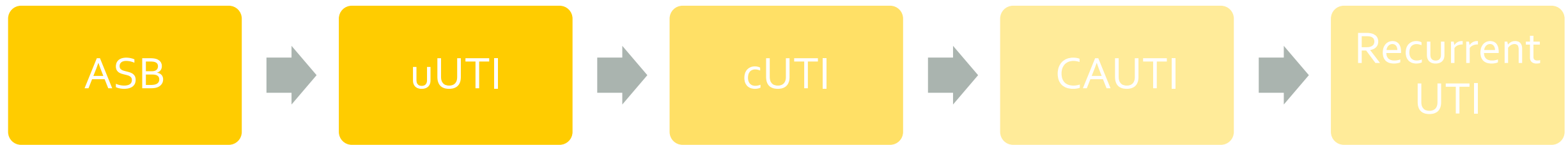
- Monitoring and reporting the activities of the diagnostic excellence program.

Urinary Tract Infection (UTI)

- Are the most common infection worldwide
- In the United States more than 10 million people affected annually
- At least 50% of adult women will have more than one UTI in their lifetime
- Associated with significant healthcare costs-est. annual cost exceeding \$4.8 billion in the U.S.

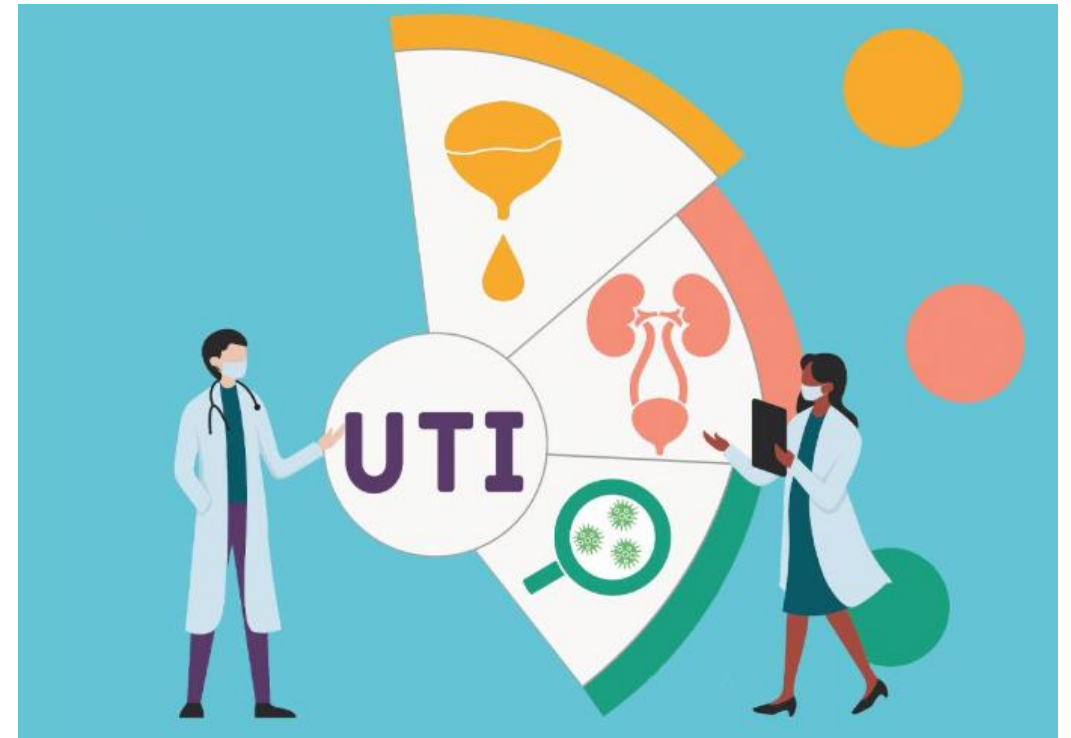


Spectrum of UTI's



Challenges in Diagnosis and Management

- Heterogeneity
 - Variation in clinical presentation
 - Etiology
 - Disease course
 - Patient characteristics (age, gender, comorbidities, etc.)
- Low adherence to guideline recommended treatment
- Overdiagnosis and antibiotic overprescribing



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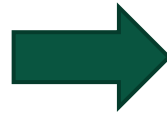
Challenges in Diagnosis and Management

OLD DEFINITION

Uncomplicated UTI: Acute cystitis in a healthy non-pregnant afebrile woman with no diabetes and no urologic abnormalities

Acute Pyelonephritis

Complicated UTI: everything else



NEW DEFINITION

Complicated UTI: Infection beyond the bladder

- Pyelonephritis
- CAUTI
- Febrile or Bacteremia from UTI
- Septic shock due to UTI

Uncomplicated UTI: infection confined to the bladder (women and men)

IDSA GUIDELINES

International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases

Kalpana Gupta,¹ Thomas M. Hooton,² Kurt G. Naber,³ Björn Wultz,¹⁰ Richard Colgan,² Loren G. Miller,⁴ Gregory J. Moran,⁵ Lindsay E. Nicolle,⁶ Raul Raz,¹¹ Anthony J. Schaeffer,⁸ and David E. Soper⁷

<https://www.idsociety.org/practice-guideline/complicated-urinary-tract-infections/>

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Symptoms of UTI's

Uncomplicated cystitis

- Urgency
- Frequency
- Dysuria
- Supra-pubic tenderness
- In postmenopausal women:
 - Abdominal pain
 - Back pain
 - Chills
 - Constipation

Pyelonephritis

- More severe, systemic presentation
- Suprapubic pain
- Costovertebral angle tenderness (Flank Pain)
- Fever
- Chills
- Elevated WBC count
- Nausea
- Vomiting

Catheter-associated

- New onset or worsening fever
- Rigors
- Altered mental status
- Malaise or lethargy with no other identified cause
- Flank pain
- Costovertebral angle tenderness
- Acute hematuria
- Pelvic discomfort

Challenges in Diagnosis and Management

Anorexia

Confusion

Decline in
functional
status

Falls

Non-specific symptoms DO
NOT automatically mean
resident has an infection!

Causes of non-specific symptoms

- Anorexia
 - Medical conditions: Cancer, depression, or dementia
 - Dental problems (tooth ache or poorly fitting dentures)
 - New medication started that changes the taste of food
 - Examples: ACE inhibitors (lisinopril), Statins (atorvastatin/lovastatin), Thyroid medication (levothyroxine), Diuretics (furosemide), metformin, antibiotics (ciprofloxacin/azithromycin), etc..
- Confusion
 - Dehydration
 - Electrolyte imbalance (low sodium or calcium)
 - Low or high blood sugar
 - New medication
 - Pain



Causes of non-specific symptoms

- Decline in functional status
 - Dehydration
 - Decreased physical activity
 - Pain
- Falls
 - Dehydration
 - New medication
 - Changes in blood pressure
 - Diabetes
 - Inner Ear problems



The Urinalysis



**FRIEND?
Or
FOE?**

- Complex test used for a variety of clinical purposes-can contribute to diagnostic uncertainty
- Good Negative Predictive Value
- Presence of pyuria-caution with interpretation. Highly prevalent in healthy pre-menopausal women
- In chronically ill populations-decreased discriminatory value

Asymptomatic Bacteriuria is COMMON

Population	Prevalence
Healthy premenopausal women	1–5%
Women 70–90 years old	11–16%
Female long-term care residents	25–50%
Male long-term care residents	15–50%
Females with diabetes	9–29%
Males with diabetes	1–11%
People receiving hemodialysis	25%
People with long-term indwelling urinary catheters	> 90%

Pyuria is COMMON in patients with ASB

Population With ASB	Prevalence of Pyuria
Young women	32%
Pregnant women	30–70%
Women with diabetes	70%
Elderly institutionalized patients	90%
Dialysis patients	90%
Patients with short-term catheters	30–75%
Patients with long-term catheters	50–100%

- Pyuria in patients with asymptomatic bacteriuria is not an indication for antibiotic therapy.
- Other causes of pyuria to consider: sexually transmitted infections and interstitial nephritis.

Criteria for Symptomatic UTI

Without an Indwelling Urinary Catheter

SHEA/CDC (revised McGeer)	McGeer criteria 1991	Loeb criteria
Swelling or tenderness of the testes, epididymis or prostate or: Fever or leukocytosis and at least one of the following or In the absence of fever and leukocytosis at least two of the following:	Three of the following criteria:	Acute dysuria alone or: Fever ($>37.9^{\circ}\text{C}$ or 1.5°C increase in baseline) plus one of the following:
Acute costovertebral angle pain or tenderness	Fever $\geq 38^{\circ}\text{C}$ or chills	New or worsening urgency
Suprapubic pain	New or increased burning on urination, frequency, or urgency	Frequency
Gross hematuria	New flank or suprapubic pain or tenderness	Suprapubic pain
New or marked increase in incontinence	Change in character of urine	Gross hematuria
New or marked increase in urgency or frequency	Worsening of mental or functional status (includes new or increased incontinence)	Costovertebral angle tenderness
Plus positive urine culture		Urinary incontinence

Criteria for Symptomatic UTI

With an indwelling urinary catheter

SHEA/CDC (modified McGeer)	McGeer criteria 1991	Loeb criteria
One of the following criteria:	Two of the following criteria:	At least one of the following criteria:
Fever, rigors or new-onset hypotension	Fever $\geq 38^{\circ}\text{C}$ or chills	Fever (37.9°C or 1.5°C increase in baseline)
Acute change in mental status or acute functional decline and leukocytosis	New flank or suprapubic pain or tenderness	New costovertebral tenderness
New-onset suprapubic pain or costovertebral angle pain or tenderness	Change in character of urine	Rigors (shaking chills)
Purulent discharge from around the catheter or acute pain, swelling or tenderness of the testes, epididymis or prostate	Worsening of mental or functional status	New onset of delirium
PLUS positive urine culture		

Reminder:

- McGeer's criteria is to be used for surveillance NOT diagnosis
 - To meet criteria for definitive infection, more diagnostic information (e.g. positive laboratory tests) is often necessary
 - Surveillance criteria are not intended for informing antibiotic initiation because they depend on information that might not be available when that decision must be made.
 - If using for access antibiotic initiation appropriateness, measures of inappropriate prescribing might be artificially increased.
- Loeb's can be used for diagnosis

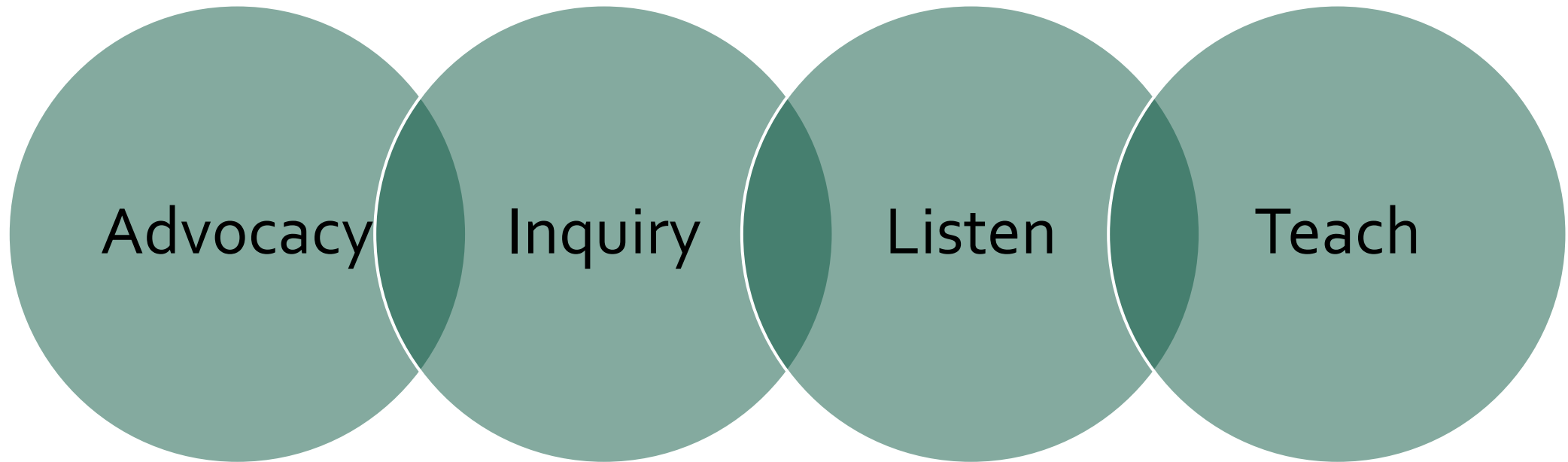
How do we educate providers on these criteria?

- Remember McGeer (surveillance) and Loeb's (diagnosis)
- Report and Use Surveillance Data
 - Plan for distribution of findings
 - Report to health care providers most able to impact patient care
 - Report in a manner to stimulate improvement
 - Use visual displays of data (charts, graphs, tables)
- Send yearly report of infections to local providers/urgent care/clinic
 - Include an statement about McGeer's criteria
 - Offer to present at physician/department meeting

What are qualities of a productive conversation?

- Antimicrobial stewardship requires initiating **hard conversations**
 - Especially when...
 - Values are not aligned
 - There is a difference in training and expertise
 - Habits are deeply rooted
- Non-confrontational and non-judgmental
- Direct and to-the-point (we're all busy)
- Focused teaching on the root of the problem

Fostering a Productive Conversation



Fostering a Productive Conversation



Advocacy

Draw attention to a perceived discrepancy
Stick to objective facts

“I noticed...”

“I saw...”

Case #1

- A 55 yo resident with an indwelling Foley catheter is noted to have cloudy and malodorous urine. No fever, leukocytosis or abdominal/flank pain is reported. A urinalysis and urine culture are ordered and empiric ceftriaxone is planned.

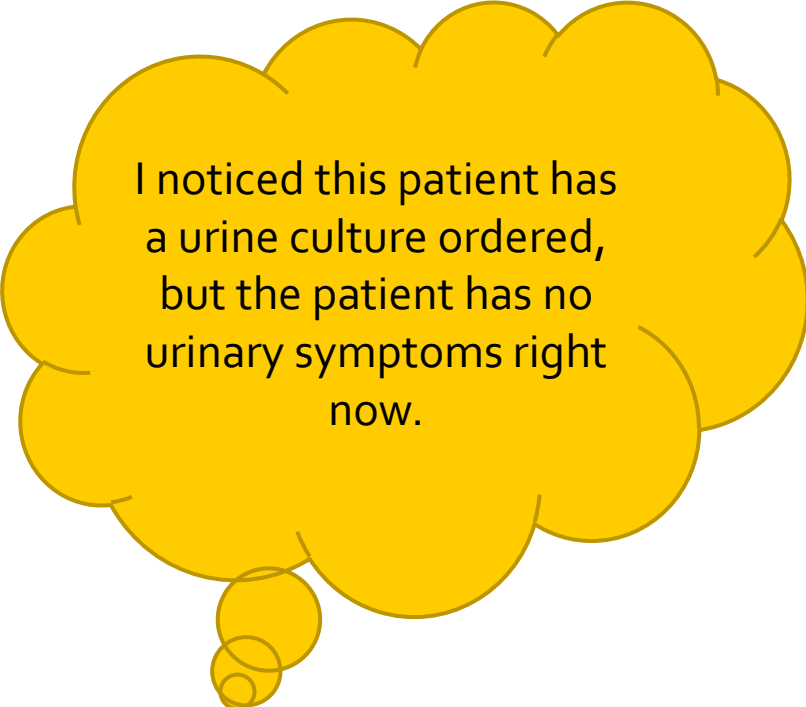
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New-onset suprapubic pain or costovertebral angle pain or tenderness	Change in character of urine	Rigors (shaking chills)
Purulent discharge from around the catheter or acute pain, swelling or tenderness of the testes, epididymis or prostate	Worsening of mental or functional status	New onset of delirium
PLUS positive urine culture		

Case #1: Advocacy

- 55 yo with Foley catheter
- Cloudy, malodorous urine
- No fever, leukocytosis or abdominal/flank pain
- UA/UC ordered
- Empiric ceftriaxone planned



I noticed this patient has a urine culture ordered, but the patient has no urinary symptoms right now.

Fostering a Productive Conversation



Inquiry

Probe this discrepancy with an open-ended question

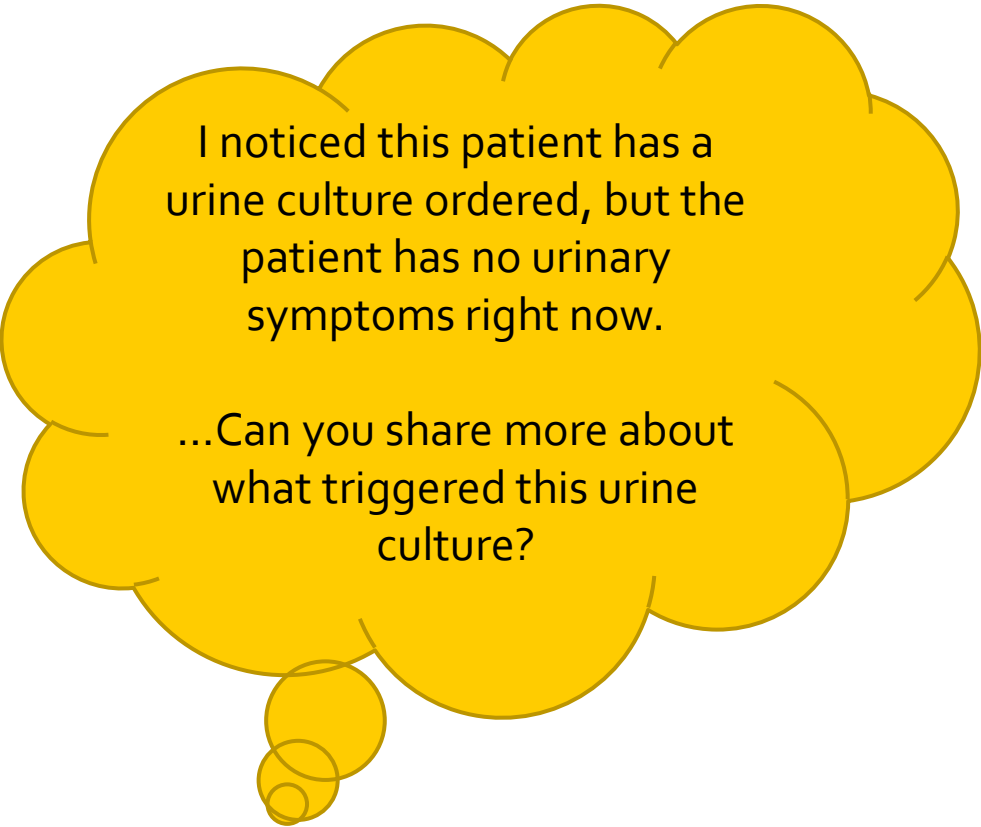
"Can you help me understand....?"

"Can you share more about...?"

"Can you teach me about....?"

Case #1: Inquiry

- 55 yo with Foley catheter
- Cloudy, malodorous urine
- No fever, leukocytosis or abdominal/flank pain
- UA/UC ordered
- Empiric ceftriaxone planned



I noticed this patient has a urine culture ordered, but the patient has no urinary symptoms right now.

...Can you share more about what triggered this urine culture?

Fostering a Productive Conversation

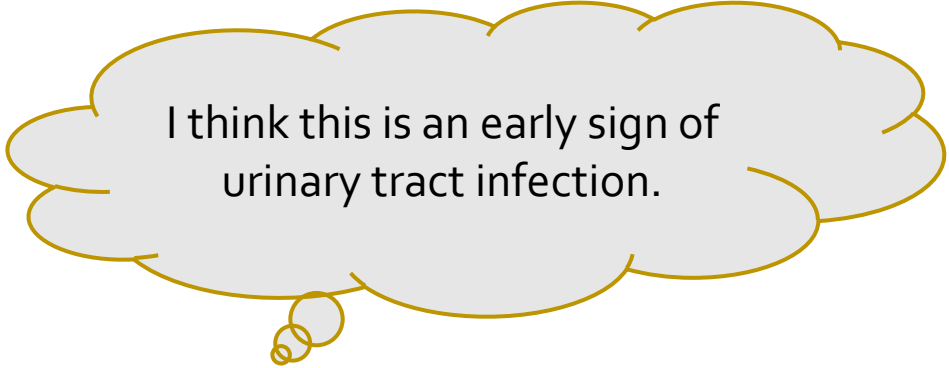


Listen

Understand what frameworks underlie
their assumption
Identify cognitive errors

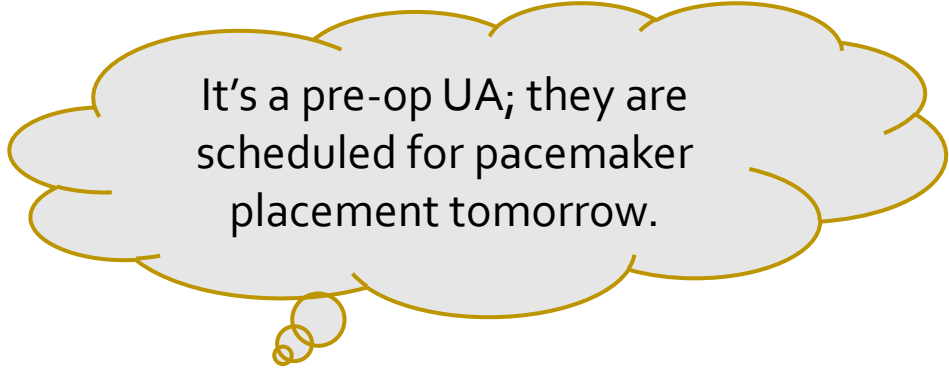
Case #1: Listen

- 55 yo with Foley catheter
- Cloudy, malodorous urine
- No fever, leukocytosis or abdominal/flank pain
- UA/UC ordered
- Empiric ceftriaxone planned



I think this is an early sign of urinary tract infection.

Framework error: Foul smelling urine $\neq$ UTI



It's a pre-op UA; they are scheduled for pacemaker placement tomorrow.

Framework error: Non-urologic surgery does not require screening/treatment of ASB

Fostering a Productive Conversation



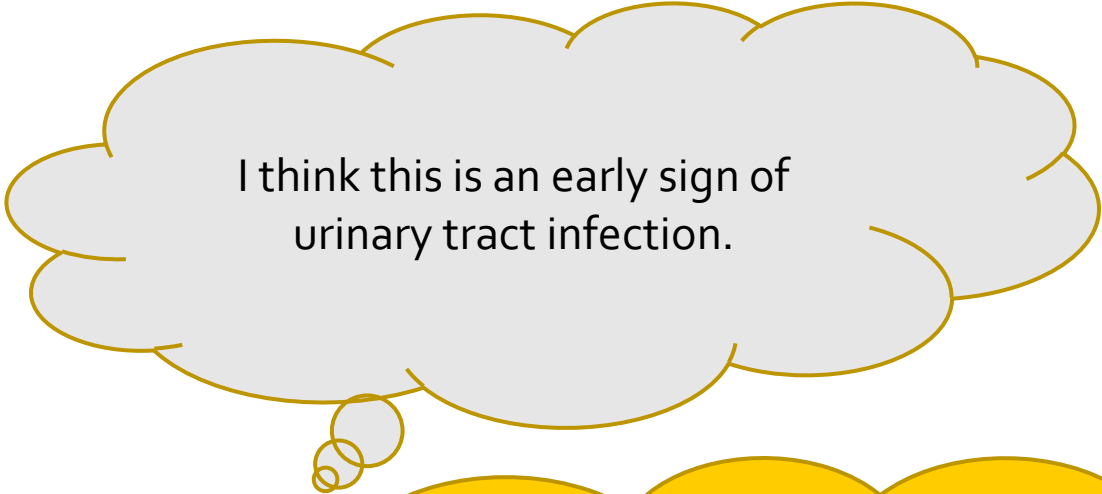
Teach

Address the framework error

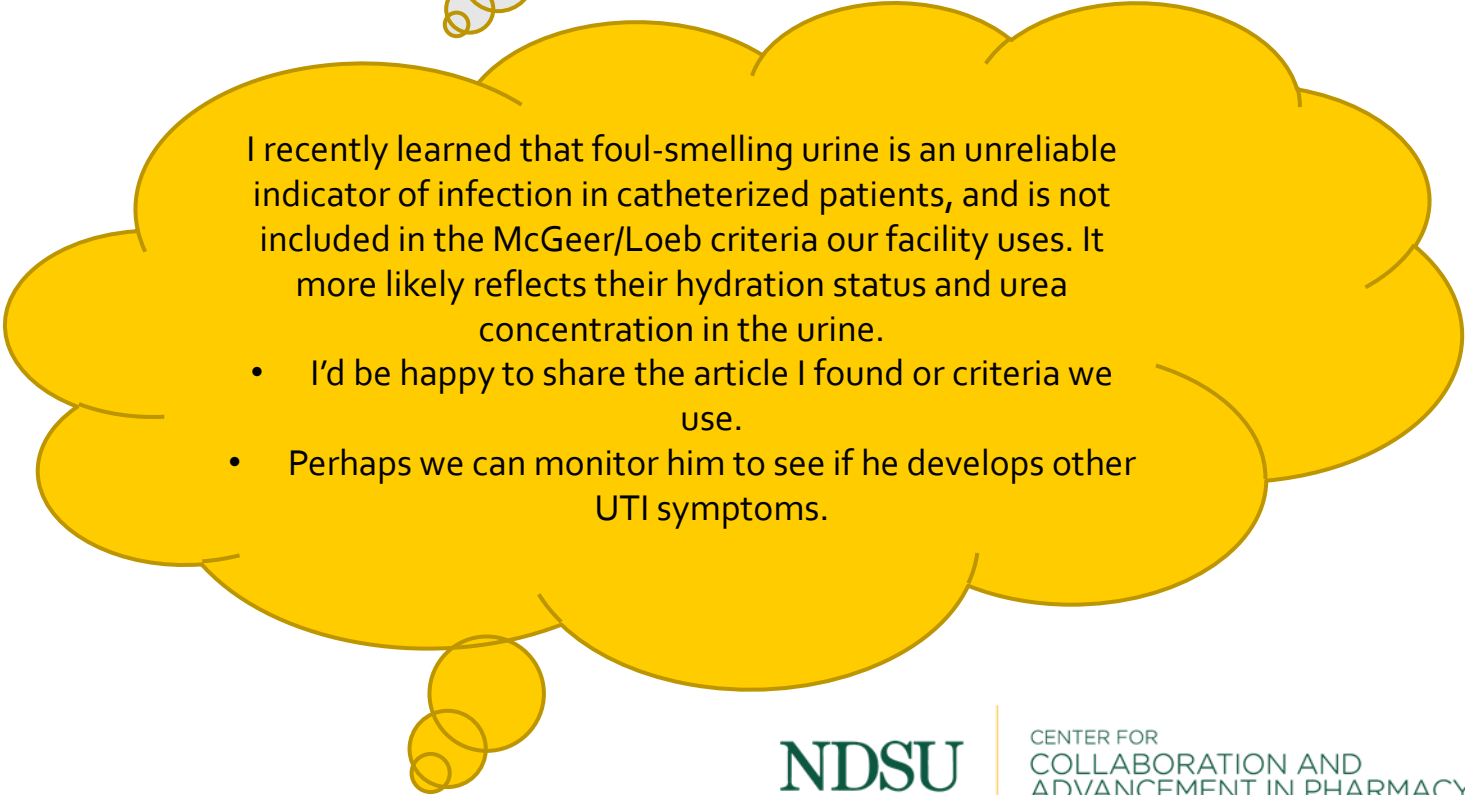
Share recommendations

Case #1: Teach

- 55 yo with Foley catheter
- Cloudy, malodorous urine
- No fever, leukocytosis or abdominal/flank pain
- UA/UC ordered
- Empiric ceftriaxone planned



I think this is an early sign of urinary tract infection.



I recently learned that foul-smelling urine is an unreliable indicator of infection in catheterized patients, and is not included in the McGeer/Loeb criteria our facility uses. It more likely reflects their hydration status and urea concentration in the urine.

- I'd be happy to share the article I found or criteria we use.
- Perhaps we can monitor him to see if he develops other UTI symptoms.

Case #1: Teach

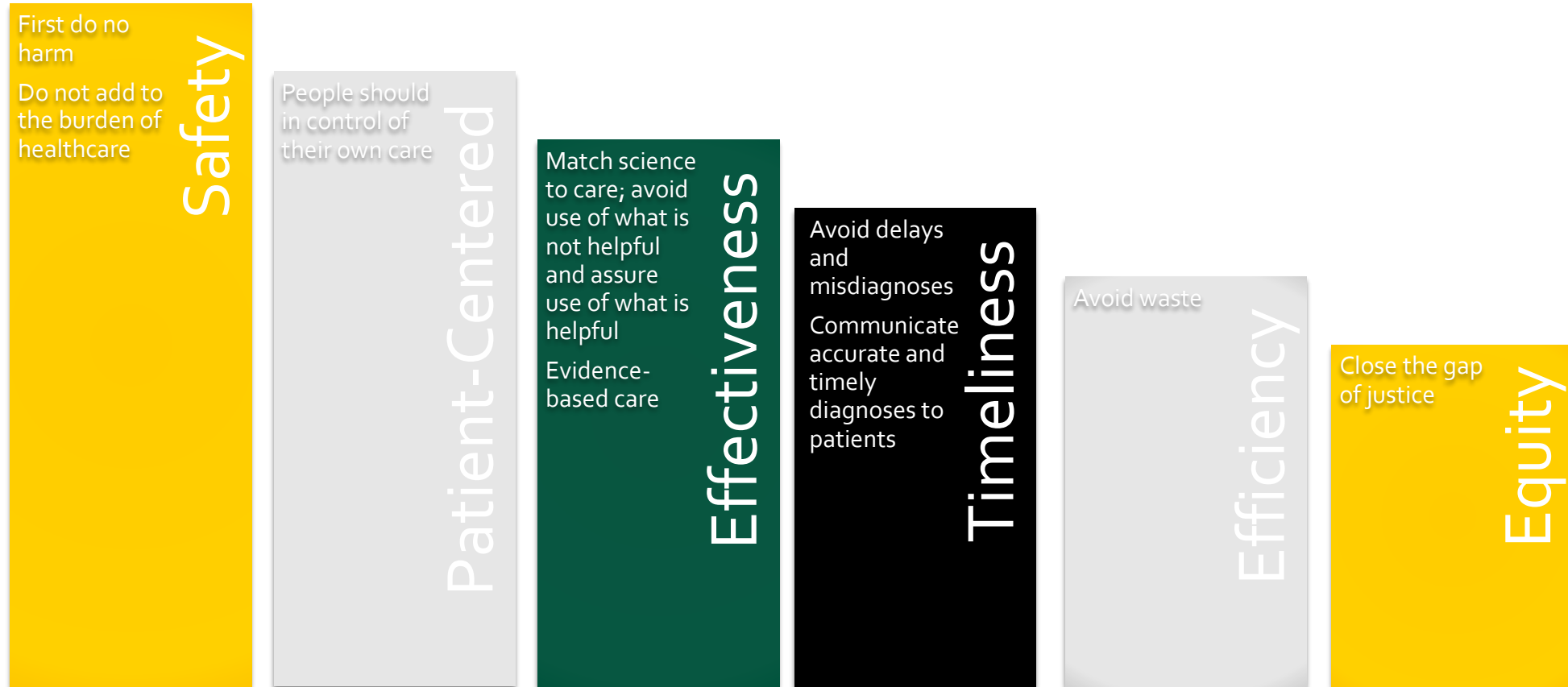
- 55 yo with Foley catheter
- Cloudy, malodorous urine
- No fever, leukocytosis or abdominal/flank pain
- UA/UC ordered
- Empiric ceftriaxone planned

It's a pre-op UA; they are scheduled for a pacemaker tomorrow.

Oh, I didn't realize pacemaker placement was planned. The IDSA guidelines recommend pre-operative urine cultures to screen for ASB only for urologic surgeries.

- I'd be happy to send you a link to the guidelines
- Even if this urine culture is positive, it would not need to be treated.

Six Pillars of Healthcare Quality



CAUTI's

- What is a catheter-associated urinary tract infection?
 - UTI occurring in an individual whose urinary bladder is catheterized or has been catheterized within the past 48 hours.
 - Most common nosocomial infection (~1 million cases per year in the U.S.)
 - Most common cause of secondary bloodstream infections
- Who is at risk?
 - Older persons
 - Female gender
 - Diabetics
 - Prolonged catheterization time
 - Catheter insertion outside of the operating room

CAUTI's

- What causes them?
 - Gram-negative, gram-positive bacteria, and fungi
 - In ND, *E.coli* and *Pseudomonas aeruginosa* are the top two bacteria identified via data from NHSN
 - Other bacteria: *Enterococcus* spp, *Klebsiella pneumoniae*, *Candida* spp, *Staphylococcus aureus*, *Proteus mirabilis*, and Group B *Streptococcus*
- How do we prevent?
 - Minimize the use of indwelling catheters
 - Use shortest duration possible
 - Stewardship point: Assess daily and consider removal
 - Aseptic insertion technique (Including hand hygiene)
 - Proper placement of tubing and drainage bag
 - Timely emptying of drainage bag
 - Have a monitoring system (duration of use)

Diagnostic Stewardship of CAUTI's

- Only obtain urine samples when person has symptoms!
- Avoid contaminated samples
 - When obtaining a sample:
 - Perform hand hygiene
 - Obtain sample PRIOR to starting antibiotics
 - Replace catheter prior to obtaining urine sample
 - Do NOT obtain a culture from urine drainage bag (high risk of contamination)
 - Ensure proper storage of specimen
 - If there is any delay to the lab make sure to refrigerate sample

CAUTI Treatment

- How do we treat them?
 - Depends on cultures and susceptibilities
 - Candida infection
 - Fluconazole 200-400mg for 2 weeks
 - Call ID provider if Glabrata, Auris, or Krusei
- Duration
 - 7 days but may be as short as 5 days with a fluoroquinolone
 - May be extended to 10-14 days if response to therapy is delayed

Table 1.1: Potential Empiric Antibiotics for cUTI^A prior to using the four-step approach to choose among these options

Four-Step Approach to choose among these antibiotics: Assess (1) severity of illness, (2) risk factors for resistance, (3) patient-specific considerations, and (4) if septic, consider the antibiogram. See discussion below for details of the four steps.

Condition of the Patient	Preferred	Alternative
Sepsis with or without shock**	Third or fourth generation cephalosporins,* carbapenems,# piperacillin-tazobactam, fluoroquinolones&	Novel beta lactam-beta lactamase inhibitors,+ cefiderocol, plazomicin, or older aminoglycosides%
Without sepsis, IV route of therapy	Third or fourth generation cephalosporins,* piperacillin-tazobactam, or fluoroquinolones&	Carbapenems,# newer agents (novel beta lactams-beta lactamase inhibitors,+ cefiderocol, plazomicin), or older aminoglycosides%
Without sepsis, oral route of therapy	Fluoroquinolones& or trimethoprim-sulfamethoxazole	Amoxicillin-clavulanate or oral cephalosporins (see Table 3.1)

^ADifficult-to-treat resistant pathogens may require use of drugs not listed here (e.g., colistin); refer to IDSA Antimicrobial Resistance guidance.

^{**}Sepsis is life-threatening organ dysfunction related to infection, identified by SOFA score of 2 or higher. Screening tools such as qSOFA or SIRS may be useful for presumptive identification. In sepsis with shock, in step 4 choose an antibiotic for which the susceptibilities of the most relevant organisms are at least 90%. In sepsis without shock, in step 4 choose an antibiotic for which the susceptibilities of the most relevant organisms are at least 80%.

^{*}Third and fourth generation IV cephalosporins include: ceftriaxone, ceftazidime, cefotaxime, and cefepime. (see **Table 2.1 & 3.1**, Dosing of IV and oral antibiotics for cUTI).

[&]The fluoroquinolones approved for UTI currently include ciprofloxacin and levofloxacin.

[#]The carbapenems currently include imipenem-cilastatin, doripenem, meropenem, and ertapenem.

⁺The novel beta lactam-beta lactamase inhibitors currently include ceftolozane-tazobactam, ceftazidime-avibactam, meropenem-vaborbactam, and imipenem-cilastatin-relebactam.

[%]Older aminoglycosides include gentamicin, amikacin, and tobramycin.

This table was created in 2025; new drugs approved after this date may also be appropriate choices.

Please note that nitrofurantoin and oral fosfomycin are generally not appropriate choices for cUTI because they may not achieve adequate levels in renal parenchyma and blood.

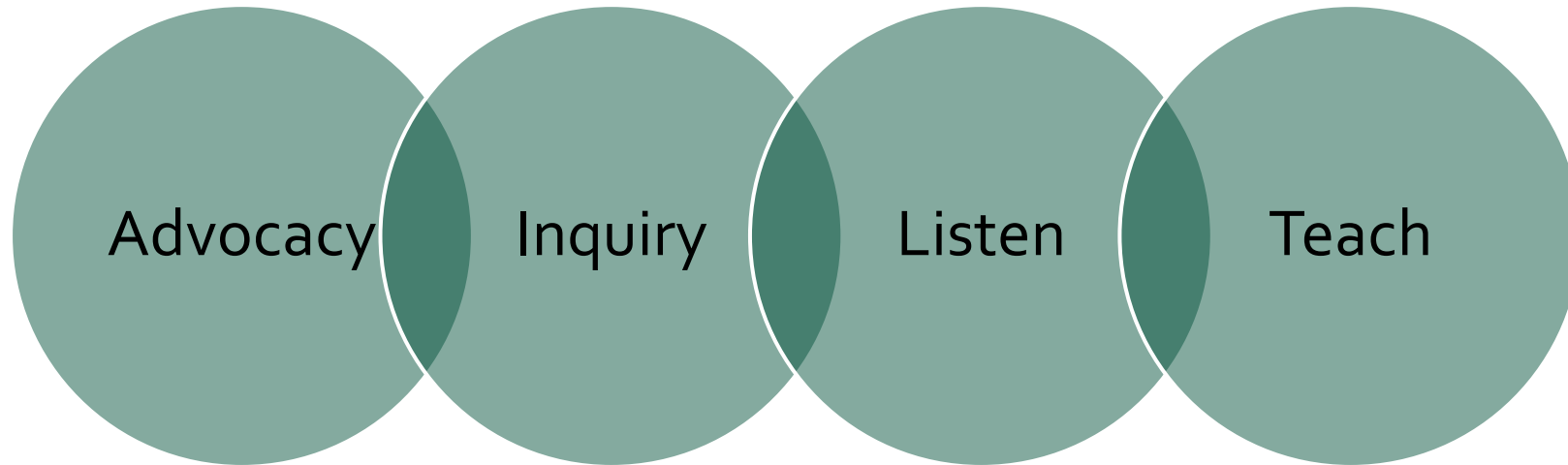
CAUTI Prevention: Don't waste your time on these...

- Avoid using for prevention of recurrent UTI
 - D-Mannose
 - Despite an encouraging initial small industry-sponsored study, a large multicenter, RCT published last year in JAMA Internal Medicine demonstrated NO BENEFIT for prevention of recurrent UTI (in a mostly post-menopausal population).
 - Vitamin C Monotherapy
 - Evidence very poor/mixed, biologically implausible and there is a risk of nephrolithiasis and GERD
 - Probiotics
 - Encouraging studies for VAGINAL (applied to the vagina) probiotics, but commercial/prescription formulations are not available yet. It is implausible that oral probiotics would be effective, and a Cochrane review concludes that there is no significant benefit compared with placebo or no treatment. Careful of oral supplements that claim to be “vaginal probiotics” or “support vaginal health”.

CAUTI Prevention: What is useful? Evidence-based, non-antibiotic prevention

- **“High dose” water**-40-50% reduction dilutes and clears bacteriuria
 - May be limited by incontinence
 - Should start working quickly
- **Vaginal estrogen**-50% reduction-increases blood flow, restores microbiome
 - Likely needs a few months for efficacy
 - Benefits symptoms of genitourinary syndrome of menopause and (perhaps) overactive bladder in addition to UTI
 - Safe for (almost) all patients
- **Methenamine Hippurate**-50% reduction-inhibits bacterial growth
 - Should start working quickly
 - Occasional GI side effects
 - Can use down to eGFR of 30. May consider dose reduction below that
- **Cranberry** (controversial) ~25% reduction-may decrease bacterial binding
 - Efficacy is variable
 - Can be expensive
 - Certainty of benefit is low

Fostering a Productive Conversation



Not only works on providers, but can be used to train staff members as well!

Case 2: Diagnostic stewardship with staff

- A 92 yo resident was noted to have altered mental status on Friday night. There was no record of fever, leukocytosis, abdominal pain, or dysuria. The staff on duty reached out to the on call physician who ordered a UA, which was notable only for + squamous cells and 2+ bacteria. Antibiotic were then ordered.

Case #2: Advocacy-Inquiry

- 92 yo presented with altered mental status
- No fever, leukocytosis, dysuria, elevated WBC, or abdominal/flank pain
- UA 2+ bacteria and 2+ squames
- Antibiotics ordered

What should we say to the staff who called the on-call provider?

- A. The resident had altered mental status that is not a reason to call the provider.
- B. I noticed this patient was started on antibiotics for a contaminated urine sample. Did you call the provider to discontinue them?
- C. I noticed this resident's only symptom was confusion. Can you share more with me about how the decision was made to call the provider?

Case #2: Advocacy-Inquiry

- 92 yo presented with altered mental status
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What should we say to the staff who called the on-call provider?

A. The resident had altered mental status that is not a reason to call the provider.

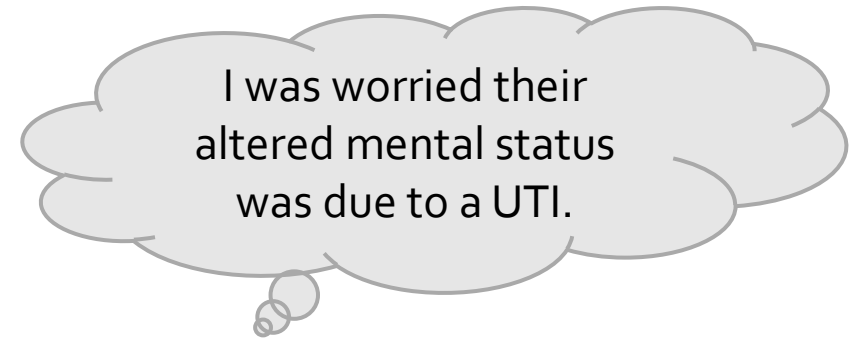
B. I noticed this patient was started on antibiotics for a contaminated urine sample. Did you call the provider to discontinue them?

C. **ADVOCACY:** I noticed this resident's only symptom was confusion.

INQUIRY: Can you share more with me about how the decision was made to call the provider?

Case #2: Listen-Teach

- 92 yo presented with altered mental status
- No fever, leukocytosis, dysuria, elevated WBC, or abdominal/flank pain
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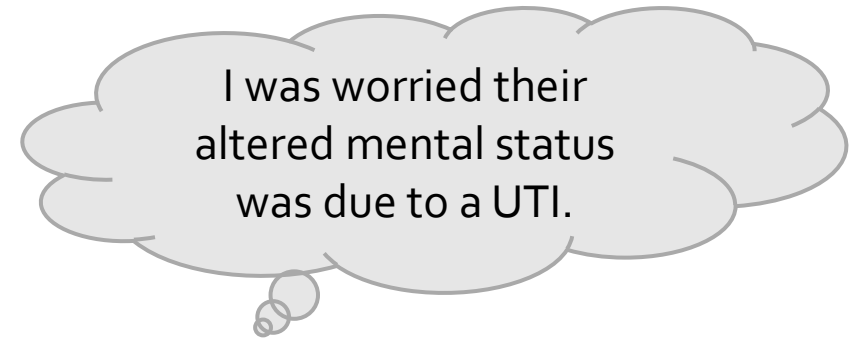


What is the framework error?

- A. Misunderstanding of what represents a UTI symptom
- B. Misunderstanding of when to call a physician
- C. Misunderstanding of how to read a UA

Case #2: Listen-Teach

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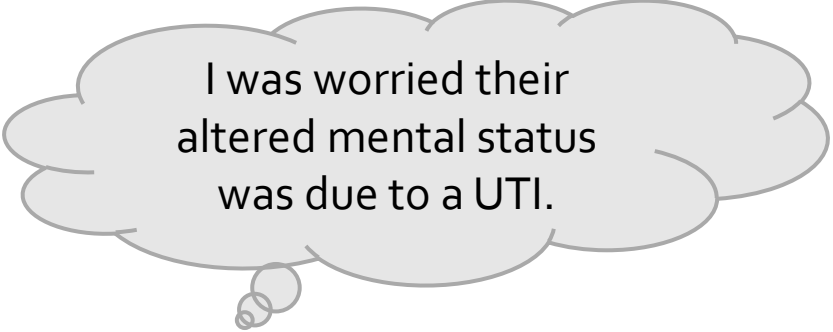


What is the framework error?

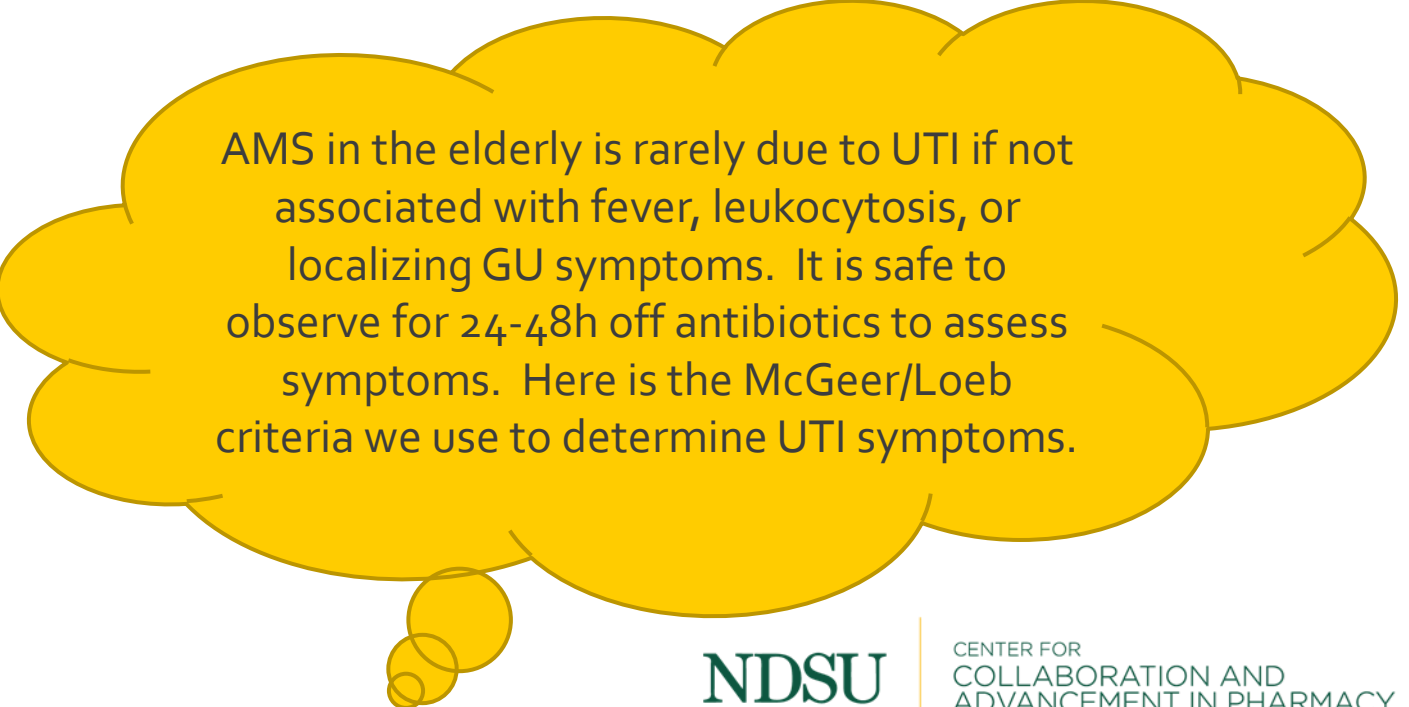
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Case #2: Listen-Teach

- 92 yo presented with altered mental status
- No fever, leukocytosis, dysuria, elevated WBC, or abdominal/flank pain
- UA 2+ bacteria and 2+ squames
- Antibiotics ordered



I was worried their altered mental status was due to a UTI.



AMS in the elderly is rarely due to UTI if not associated with fever, leukocytosis, or localizing GU symptoms. It is safe to observe for 24-48h off antibiotics to assess symptoms. Here is the McGeer/Loeb criteria we use to determine UTI symptoms.

What are the qualities of a production conversation?

- Non-confrontational and non-judgmental
- Direct and to-the-point (we're all busy)
- Focused teaching on the root of the problem

BUT...What if the conversations isn't "going-well"? How can we use this awareness?

What are the qualities of a production conversation?

- Non-confrontational and non-judgmental
- Direct and to-the-point (we're all busy)
- Focused teaching on the root of the problem

Reconsider

- Is this conversation with the right clinician?
- Should this conversation be over the phone or in person?
- Do I need more information to understand the issue?

Summary

- Diagnostic stewardship is important to prevent misdiagnosis and inappropriate treatment
- CAUTI's happen but important to know the signs, when and how to obtain a urine sample, and prevention is key
- The Advocacy, Inquiry, Listen, Teach method is excellent to use for stewardship conversations with providers and staff.



QUESTIONS?

Emily Perry, PharmD
Emily.Perry@ndsu.edu

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