Objectives

- Understand burden of UTI and ASB in nursing facilities (NFs)
- Identify and describe how the culture of culturing in NFs leads to overdiagnosis of UTI
- Identify contributors and utilize approaches to reduce diagnostic error in NFs.
- Describe safety culture and consider its contribution to clinical outcomes in NFs.
- Utilize strategies such as decision support and team communication to improve urine culture practices
Disclosures

- No financial conflicts
- Infectious Diseases Society of America
- Colorado Hospital Association

Case Presentation

Mr. M is an 85 yo LTC resident with bipolar disorder and dementia. He has a chronic suprapubic catheter.

CC: Fall with facial laceration. Urine with clumps of material in the drainage tube and smells bad.

U/A: 50 wbc/hpf and many bacteria
Comprise 3 of the top 5 reasons for readmission to hospital from NF: UTI, pneumonia, sepsis (Ouslander, 2011)
Regulatory focus on infections in NFs

- Current requirement
  - Infection control program
  - Most common FTAG nationally last year:
    1st 441 Infection Prevention and Control programs (37%)

- Proposed (2015) Updated Conditions of Participation for LTC
  - Addition of antimicrobial stewardship program.

UTI in NFs

Each year UTIs account for:
- 30-40% of all infections
  - affecting 3-5% of residents
    (Mylotte, ICHE 2005)
- 30% of 30-d readmits
- $673 million-$2 billion
- Up to 50% of bloodstream infections
How does one get a UTI?

Sterile Bladder → Asymptomatic Bacteriuria → UTI

- Host factors: Bladder function, Manipulation, Catheter insertion, Sexual Activity
- Bacterial factors
- Urination
- Host response
- Bacterial adaptation

Foxman, ID Clinics North America, 2014

Asymptomatic Bacteriuria (ASB) in NFs

- **23-50% of residents have ASB** (Nicolle, ICHE 2000)

- Screening for and treatment of ASB has no impact on mortality, development of UTI, or incontinence
  - High level of evidence – 5 RCTs, 31-75% of subjects with cognitive impairment

→ USPSTF and IDSA recommend against treatment for ASB (Exceptions: pregnancy, urologic surgery)
What does this patient have?

A. Asymptomatic Bacteriuria
B. Cystitis (UTI)
C. Pyelonephritis
D. CAUTI
E. Urosepsis
Diagnostic Criteria

(Stone, Infect Control Hosp Epidemiol, 2012)

Symptom Criteria

UTI or CAUTI diagnosis

Culture Criteria

Localizing symptoms of UTI

YES – URINARY TRACT SYMPTOMS

- CVA pain or tenderness
- Suprapubic Pain
- Gross Hematuria
- New or marked increase in incontinence, urgency, frequency
- Purulent discharge from catheter or inflammation of the GU organs

UTI is rare in the absence of lower urinary tract symptoms

NO – URINE APPEARANCE

- Foul-smelling urine
- Change in urine color
- Cloudy urine
- Urinary sediment
How useful are other common symptoms?

<table>
<thead>
<tr>
<th>Symptom</th>
<th>High Likelihood of Bacterial infection</th>
<th>High Likelihood of UTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional decline</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Weakness, falls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteration in Mental Status</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fever/rigors</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Modified definition in elders more sensitive for detecting infection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These are all non-specific findings

Delirium and Bacteriuria

- Some episodes are self-limited and short-lived
  - 432 hospitalized older patients; 64 cases of delirium; 69% resolved in 1 day

- Antibiotic treatment of ASB does not lead to better delirium outcomes

- Dementia patients with suspected UTI have no improvement in mortality when treated with antibiotics. (JAGS, 2015)
Fever and Bacteriuria

- Simultaneous occurrence is common

- 8-10% = positive predictive value of bacteriuria for identifying a urinary source of fever

How useful are urine tests in NF residents?

- Urine culture is neither sensitive nor specific for UTI
  - 30+% of asymptomatic residents
  - 100% of catheterized residents

- UA and culture are only useful if negative.
  - No LE and no nitrite has 88-100% neg pred value;
    (Juthani Mehta, JAGS, 2007; Sundvall, BMC Geriatr, 2009)
Pyuria has a positive predictive value of 32%

Bacteriuria is nearly universal; its positive predictive value is 10%

Cloudy or malodorous urine is not useful

<table>
<thead>
<tr>
<th>Symptom(s)</th>
<th>Positive Urinalysis</th>
<th>Positive Culture</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic Bacteriuria (ASB)</td>
<td>✓</td>
<td>✓</td>
<td>Dysuria, frequency, urgency</td>
</tr>
<tr>
<td>Cystitis</td>
<td>✓</td>
<td>✓</td>
<td>Fever, flank pain, nausea</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>✓</td>
<td>✓</td>
<td>Fever, Suprapubic or flank pain</td>
</tr>
<tr>
<td>CAUTI</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Poor adherence to diagnostic criteria

- Original McGeer and Loeb criteria
  - Mean 10% adherence to criterial (range 0-39%) in 12 NHs in NC (Olsho, JAMDA, 2013)

→ Implications for treatment:
  - 40-75% of patients not meeting the criteria still got antibiotics (D’Agata, JAGS, 2013; Rotjanapan Archives Int Med 2011.)

The Culture of Culturing
Case: Question 2

What should be done next?

- a. Urinalysis
- b. Urine culture
- c. Urinalysis and antibiotics
- d. Urine culture and antibiotics
- e. Nothing

The Culture of Culturing

Common practice of sending a urinalysis and urine culture every time a frail older patient has a change in condition, regardless of the likelihood of a UTI.
Top 3 Harms of the Culture of Culturing

1. Overinflated UTI/CAUTI rates
2. Inappropriate antimicrobial use
   1. MDROs
   2. C difficile
3. Diagnostic Error

3. Culture rates affect surveillance CAUTI rates...

...without a change in clinical CAUTI

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Patients with urine cultures done (%)</th>
<th>Prevalence of bacteria (%)</th>
<th>Prevalence of fever &gt; 38°C at onset (%)</th>
<th>Estimated number of NSH-CAUTIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>30</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>18</td>
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<td>30</td>
<td>30</td>
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<td>27</td>
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<td>4</td>
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<td>20</td>
<td>6</td>
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<tr>
<td>5</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>60</td>
<td>20</td>
<td>36</td>
</tr>
</tbody>
</table>

Assume 1,000 patients with urinary catheters
Scenario 4: 1000 X 0.3 X 0.1 X 0.2 = 6
Scenario 6: 1000 X 0.3 X 0.6 X 0.2 = 36

Number of surveillance CAUTIs Depend on Frequency of Cultures and Prevalence of Fever

2. Inappropriate Abx Use

Collateral damage (Wikipedia)

Damage to things that are incidental to the intended target.

Stewardship use: The ecologic adverse effects of antimicrobial therapy; i.e. the potential for emergence of antimicrobial resistance
C difficile in NFs

- 2/3 healthcare associated C diff infections are in patients aged >=65
- 1/9 die within 30 days, about ½ of those are directly attributed to C diff. (Lessa, et. al., NEJM, 2015)
- >100,000 C diff infections in NHs each year.

1. Diagnostic Error

The Diagnostic Process

IOM Report on Diagnostic Error, Sept 2015

FIGURE The committee’s conceptual model of the diagnostic process.
Heuristics and Biases

- Heuristics = shortcuts in thinking; allow quick decisions about complex problems by following instinctive rules of thumb
  - Mental models = disease models reflecting common symptoms associated with diseases

- Biases = systematic errors that predispose one's thinking in favor of a certain viewpoint over other viewpoints

Incorrect mental models

- Vague, non-urinary symptoms are commonly signs of urinary infection; particularly in the dementia patient (Trautner, BMC Med Inform Decision Making, 2013)

Why is Mr. M falling?
It must be those UTIs again.
Incorrect mental model #2

- The bladder and urine are sterile; therefore, an abnormal u/a or culture must indicate infection
  (Trautner, BMC Med Inform Decision Making, 2013)

Mr. M has 50 wbc/hpf and many bacteria...I can’t ignore that “positive” result.

Incorrect mental model #3

- The risk of withholding antibiotics is greater than the risk of delivering antibiotics
  (Trautner, BMC Med Inform Decision Making, 2013)

I’m not sure it’s a UTI, but let’s treat him just in case.
Search satisfying

Are you guilty of this?

*The Scapegoat*
by William Holman Hunt (1827-1910)
How to address cognitive bias

Systems interventions:
- Slowing down strategies
- Group decision making
- Metacognition, mindfulness
- Structured data acquisition
- Affective debiasing
- More information
- Skepticism

The 2-step approach: Question 1

Does this patient have any localizing UTI symptoms?

NO

Do not send urine studies
Work up other cause
Reassess

YES

Go to Question 2
The 2-step approach: Question 2

Can a non-UTI diagnosis account for these symptoms?

YES → Work up other cause
Reassess

NO →
Send urine culture
Consider Empiric antibiotics
Review urine culture results

2-step approach implementation

![Graph showing urine cultures per 1000 bed days over time with baseline, intervention, and maintenance phases. The graph indicates a reduction in ASB over treatment from 1.6 to 0.6 to 0.4 across different study years.]
Use of algorithm in CHA Acute Care Collaborative

- 32 Colorado Hospitals
- 2 diseases (UTI and SSTI)
- Evidence based guidance
- Collaborative approach
- Baseline data collection 2014
- Post intervention data collection 2015-16.

Case: Question 3

What do we really mean by “do nothing”?
1. Do not send urine culture
2. Withhold antibiotics
3. Fall assessment
4. Change the catheter
5. Hydrate
6. All of the above
Safety Culture

What is safety culture?

1. the values shared among organization members about what is important
2. the beliefs about how things operate in the organization
3. the interaction of #1 and #2 with work-unit and organizational structures and systems

⇒ Together, these produce behavioral norms in the organization that promote safety
Safety Culture and HAI Prevention

"The patient in the next bed is highly infectious. Thank God for these curtains."

Paradigm Shift 1998-2006

An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

Peter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.
Domains of safety culture in NFs

- High Reliability
  - Teamwork
    - Compliance with procedures
    - Staffing
    - Training and skills
    - Handoffs
  - Organizational Learning
    - Feedback and communication about incidents
    - Communication openness
    - Organizational learning

- Just Culture
  - Non-punitive response to mistakes

- Leadership
  - Management support of resident safety
  - Supervisor expectations and actions promoting resident safety

- Overall
  - Overall perceptions of resident safety
  - Overall rating

Predictors of safety culture in NFs

- Organizational Factors (Castle, Handler et al. 2007; Thomas et al. 2012)
  - Nonprofit and independent ownership
  - Smaller size
  - Higher quality
  - More Medicare residents

- Individual Factors (Wisniewski et al. 2007, Wagner, Capezuti and Rice 2009; Scott-Cawiezell et al. 2006)
  - Not in direct care roles (i.e., CNAs, LPNs).
  - Longer tenure in facility
  - More work hours per week
TeamSTEPPS = teamwork training program from AHRQ and DOD; adapted for LTC

SBAR = a framework for team members to effectively communicate information to one another

Situation—What is going on with the resident?
Background—What is the clinical background or context?
Assessment—What do I think the problem is?
Recommendation—What would I recommend?
Case: SBAR with incorrect mental model

- **Situation**—What is happening?
  Mr. M had another fall today

- **Background**—What is the background?
  Mr. M. is our patient with a suprapubic catheter and multiple MDRO UTIs.

- **Assessment**—What do I think the problem is?
  He could have another UTI

- **Recommendation**—What would I recommend?
  Do you want me to send a UA and Culture?

Case: SBAR with corrected mental model

- **Situation**—What is happening?
  Mr. M had another fall today

- **Background**—What is the background?
  Mr. M. is our patient with bipolar d/o, dementia, and a suprapubic catheter. He was started on Aricept last week. He does have a history of MDRO UTI.

- **Assessment**—What do I think the problem is?
  On my assessment, Mr. M has no symptoms referable to his urinary tract or catheter. He is non-tender on exam.

- **Recommendation**—What would I recommend?
  I recommend we hydrate him, put him on the monitoring protocol, and review his fall risk factors. I do not recommend urine testing at this time.
Culture Change

Conceptual Model: Stewardship Opportunities for ASB/UTI

- Change in Patient
- (Over) Diagnosis of UTI
- Selection of Empiric Therapy
- Tailoring of Therapy
- Completion of Therapy
Methods: Diagnostic Criteria for UTI or CAUTI (Stone, Infect Control Hosp Epidemiol, 2012)

- **Confirmed**: Meeting diagnostic criteria for UTI or CAUTI (per Stone, *ICHE* 2012)
- **Unconfirmed**: Not meeting diagnostic criteria or unable to determine

Summary (114 episodes, 6 NFs)

- 49% of patients had only no symptoms on only constitutional symptoms (falls, confusion, etc.)
- 74% of UTI episodes unconfirmed
- 64% of episodes initially treated with quinolone or tmp-smx; 12% bug-drug mismatches
- Only 11% of empiric antibiotics were tailored in response to culture results
- 27% of episodes had > 7 days of antibiotics
Part 2: Stakeholder Engagement

- Understand workflow for diagnosing UTI
- Understand barriers and facilitators of use of decision support
- Understand use of mobile applications and smartphone technology in NFs

→ Focus groups of providers and frontline staff (n=24)

Focus group themes (prelim)

- Workflow
  - Problems/Disjointedness
  - Improvement
- Guidelines
  - Knowledge at time of assessment/culture
  - Attitudes about and adaptability to guidelines at time of assessment/culture
- Technology acceptance
  - External barriers and facilitators
  - Perceived usefulness
  - Perceived ease of use
  - Social norms/acceptability
Excerpt:

Knowledge/acceptability of guideline at time of assessment:

*Because if you’re going to use it [McGeer criteria] as an educational tool, in my mind, that’s the first thing. The nurses, “shouldn’t we get a UA? Shouldn’t we get a UA?” Well, no. Doesn’t meet criteria.*

Workflow (AKA Value Stream Map)

1. Identify change in condition (CNA/RN)
2. Call/fax to provider (RN)
3. Test and/or treat empirically (provider)
4. Monitor (CNA/RN)
5. Review results at 72 hrs (RN/provider)
6. Tailor treatment (provider)
UTiDecide

- Mobile application
  - Texas 2 step
  - SBAR communication script
  - Prescribing guidance

UTiDecide

This application is designed to help you decide if a resident has a UTI or not, using evidence-based guidelines. Disclaimer: This is intended as a guide for decision-making and should not replace sound clinical judgment.

What would you like to do?

- Assess a resident with a change in condition
- Treat a resident with a positive urine culture
The findings of changes in resident (falls), by themselves, are not specific for or typical of a UTI.

Evidence-based recommendation, based on your responses to previous questions:

1. Continue close observation.
2. Consider alternative diagnoses such as dehydration or medication side effect.
3. There is no indication to send urine culture or urinalysis at this time.

Would you like a sample SBAR to help you organize your communication with the provider?

Yes  No

This is a sample SBAR based on your previous responses:

Hi _[provider title/name]_, this is _[your name]_ from _[facility name]_.  
The situation is that I am calling about _[patient's name]_ who has changes in resident (falls).

The background is that the patient is _[age]_ years old, residing here for _[duration]_. She/he has _[comorbidities]_.

My assessment is that although she/he has changes in resident (falls), this is not a specific symptom of a UTI (based on my review of Uri Decide).

My recommendation is that we watch him/her today, consider hydration or medication review, and check in with you if anything changes.

Next
Workflow (AKA Value Stream Map)

- Texas 2 Step
- Identify change in condition (CNA/RN)
- Scripted communication
- Call/fax to provider (RN)
- Prescribing guidance
- Test and/or treat empirically (provider)
- Monitor (CNA/RN)
- Review results at 72 hrs (RN/provider)
- Prescribing guidance
- Tailor treatment (provider)

Human factors design

- Needs assessment
- Development by research team
- Feedback/validation from end users
- Usability testing
- Effectiveness
QI project Cortez, CO

- CG Health: 8 NHs in rural CO, 500+ beds admitting to one rural access hospital
- Collaborators:
  - Colorado Hospital Association
  - Mark Meyer, PharmD
- Pre/post design
- Urine tests ordered, antibiotic days, usability data

NF Course

U/A: 50 wbc/hpf and many bacteria.

Rx’d Imipenem x 14 d for h/o MDRO klebsiella.

UCx: 2 resistant GNRs

Day 9: Fall with facial laceration. Presents to ED with similar u/a; Admit to ACE for UTI and continued imipenim
ACE Course

1. Stopped imipenem
2. Changed catheter
3. Noted HR = 50; EKG sinus bradycardia
4. Med rec: donepezil started 14 days ago; d/c’d
5. PT eval: rx Walker
6. 24 hr obs; D/C to NF

Consequences of the Culture

1. 10 days of exposure to imipenem in patient colonized with MDRO
2. Missed symptomatic bradycardia as a side effect of a new medication
3. Falsely inflated UTI rate
Overdiagnosis of UTI is
- related to prevalence of ASB and is due to a culture of culturing
- Can be understood in the context of the diagnostic error framework
- Safety culture approaches (teamwork communication) may be helpful
- Clinical decision support, communication tools might address important aspects of this problem in NFs
- Stay tuned!

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CHA
Teri Hulett
Tim Jenkins
HRET
Lona Mody
Thank you for your attention!

"Your infection may be antibiotic-resistant, but let's see how it responds to intensive litigation."