URINARY TRACT INFECTIONS: Focus on CA-UTIs

William A. Rutala, Ph.D., M.P.H.
Director, Statewide Program for Infection Control and Epidemiology and Professor of Medicine, University of North Carolina at Chapel Hill, NC, USA
Former Director, Hospital Epidemiology, Occupational Health and Safety, UNC Hospitals, Chapel Hill, NC
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
Clostridium difficile infections and surgical site infections accounted for a greater percentage of our 2018 infections compared to 2017, while bloodstream infections and urinary tract infections accounted for a smaller percentage of our 2018 infections compared to 2017.
UNC Hospitals

CAUTI Rates since 2006 at UNC Hospitals

- New NMSN surveillance definition for CAUTI implemented (excludes yeast and <50% organisms)
- New NMSN surveillance definition for CAUTI implemented

CAUTI per 1000 Foley catheter days

- ICU
- Hospital-wide
CA-UTIs

Definitions

- CA infection refers to infection occurring in a person whose urinary tract (UT) is currently catheterized or has been catheterized within the previous 48h.
- UTI refers to significant bacteruria in a patient with symptoms or signs attributable to the UT.
- Asymptomatic bacteruria refers to significant bacteruria in a patient without symptoms or signs attributable to UT.
CATHETER-ASSOCIATED URINARY TRACT INFECTIONS (CA-UTI)

- Prevalence, Incidence
  - Most common site of HAI: Accounts for more than 30% of all reported HAIs by acute care hospitals
  - Estimated >560,000 healthcare-associated UTIs annually
  - 15-25% patients in hospitals have a urethral catheter
  - Most hospitalized patients are catheterized for only 2-4 days but many longer
  - Incidence of bacterurias associated with indwelling catheter is 3-8% per day

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
CATHETER-ASSOCIATED URINARY TRACT INFECTIONS (CA-UTI)

Impact

- About 15% of cases of nosocomial bacteremia are attributable to the UT
- Bacteruria is the most common source of gram-negative bacteremia among hospitalized patients
- Bacteremia complicates CA-bacteruria in 1-4% of cases
- Estimated 13,000 attributable deaths annually
- Leading cause of secondary BSI with ~10% mortality
- Excess length of stay: 2-4 days
- Increased cost: $0.4-0.5 billion per year nationally
URINARY CATHETER USE

- 15-25% of hospitalized patients
- 5-10% (75,000-150,000) of patients in extended care facilities
- Often placed for inappropriate purposes
- Physicians frequently unaware
  - In a recent survey of US hospitals:
    - >50% did not monitor which patients were catheterized
    - 75% did not monitor duration and/or discontinuation

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
PATHOGENESIS OF CA-UTI

- Source of microorganisms
  - Endogenous: meatal, rectal, vaginal colonization
  - Exogenous: via contaminated hands of HCP during catheter insertion or manipulation of the collecting system

CA-UTIs

- Introduction of bacteria into the bladder at the time of catheter insertion
- Extraluminal migration of bacteria or perianal bacteria into the bladder along the outer surface of the catheter
- Intraluminal retrograde migration of bacteria into the bladder from the drainage bag along the inner surface of the catheter following a catheter care violation
### SOURCE OF CA-UTI PATHOGENS

Table 2. Mechanisms of catheter-associated urinary tract infection, based on a prospective study of 1,497 newly catheterized patients who had 235 new-onset infections (16)

<table>
<thead>
<tr>
<th>Mechanism of CAUTI</th>
<th>Gram-positive cocci (n=44)</th>
<th>Yeasts (n=34)</th>
<th>Gram-negative bacilli (n=37)</th>
<th>Overall (n=115)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraluminal</td>
<td>79%</td>
<td>69%</td>
<td>54%</td>
<td>66%</td>
</tr>
<tr>
<td>Intraluminal</td>
<td>21%</td>
<td>31%</td>
<td>46%</td>
<td>34%</td>
</tr>
</tbody>
</table>

*aPercentages refer to organisms in which the mechanism of infection could be determined. For comparison of gram-positive cocci and yeasts vs. gram-negative bacilli, p = 0.007.
CAUTI = catheter-associated urinary tract infection.*

PATHOGENESIS OF CA-UTI

- Formation of biofilms by urinary pathogens common on surfaces of catheters and collecting systems
- Bacteria within biofilms resistant to antimicrobials and host defenses
- Some novel strategies in CA-UTI prevention have targeted biofilms

Figure 2. Scanning electron micrograph of an infected catheter showing dense and complex biofilm on the extraluminal surface. Urine culture at catheter removal yielded Candida albicans $10^4$ CFU/mL and C. glabrata $10^4$ CFU/mL (X 5000).
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
## HAI PATHOGENS, NHSN, 2011-2014

### Table 4. Distribution and Rank Order of Pathogens Frequently Reported to the National Healthcare Safety Network (NHSN), by Type of Healthcare-Associated Infection (HAI), 2011–2014

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Overall</th>
<th>CLABSI</th>
<th>CAUTI</th>
<th>VAP&lt;sup&gt;a&lt;/sup&gt;</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%) of pathogens</td>
<td>Rank&lt;sup&gt;b&lt;/sup&gt;</td>
<td>No. (%) of pathogens</td>
<td>Rank&lt;sup&gt;b&lt;/sup&gt;</td>
<td>No. (%) of pathogens</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>62,904 (15.4)</td>
<td>1</td>
<td>5,193 (5.4)</td>
<td>7</td>
<td>36,806 (23.9)</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>48,302 (11.8)</td>
<td>2</td>
<td>12,706 (13.2)</td>
<td>2</td>
<td>2,515 (1.6)</td>
</tr>
<tr>
<td>Klebsiella (pneumoniae/oxytoca)</td>
<td>31,498 (7.7)</td>
<td>3</td>
<td>8,062 (8.4)</td>
<td>4</td>
<td>15,471 (10.1)</td>
</tr>
<tr>
<td>Coagulase-negative staphylococci</td>
<td>31,361 (7.7)</td>
<td>4</td>
<td>15,794 (16.4)</td>
<td>1</td>
<td>3,696 (2.4)</td>
</tr>
<tr>
<td>Enterococcus faecalis&lt;sup&gt;d&lt;/sup&gt;</td>
<td>30,034 (7.4)</td>
<td>5</td>
<td>8,118 (8.4)</td>
<td>3</td>
<td>10,728 (7.0)</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>29,636 (7.3)</td>
<td>6</td>
<td>3,881 (4.0)</td>
<td>10</td>
<td>15,848 (10.3)</td>
</tr>
<tr>
<td>Candida albicans&lt;sup&gt;d&lt;/sup&gt;</td>
<td>27,231 (6.7)</td>
<td>7</td>
<td>5,761 (6.0)</td>
<td>6</td>
<td>17,926 (11.7)</td>
</tr>
<tr>
<td>Enterobacter spp&lt;sup&gt;c&lt;/sup&gt;</td>
<td>17,235 (4.2)</td>
<td>8</td>
<td>4,204 (4.4)</td>
<td>9</td>
<td>5,689 (3.7)</td>
</tr>
<tr>
<td>Enterococcus faecium&lt;sup&gt;d&lt;/sup&gt;</td>
<td>14,942 (3.7)</td>
<td>9</td>
<td>6,567 (6.8)</td>
<td>5</td>
<td>4,212 (2.7)</td>
</tr>
<tr>
<td>Other Enterococcus spp.&lt;sup&gt;d&lt;/sup&gt;</td>
<td>14,694 (3.6)</td>
<td>10</td>
<td>1,974 (2.0)</td>
<td>14</td>
<td>6,291 (4.1)</td>
</tr>
<tr>
<td>Proteus spp.&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11,249 (2.8)</td>
<td>11</td>
<td>820 (0.8)</td>
<td>17</td>
<td>6,108 (4.0)</td>
</tr>
<tr>
<td>Yeast NOS&lt;sup&gt;e&lt;/sup&gt;</td>
<td>10,811 (2.6)</td>
<td>12</td>
<td>763 (0.8)</td>
<td>18</td>
<td>9,443 (6.1)</td>
</tr>
<tr>
<td>Other Candida spp.&lt;sup&gt;d&lt;/sup&gt;</td>
<td>10,641 (2.6)</td>
<td>13</td>
<td>4,730 (4.9)</td>
<td>8</td>
<td>5,178 (3.4)</td>
</tr>
<tr>
<td>Candida glabrata&lt;sup&gt;d&lt;/sup&gt;</td>
<td>8,121 (2.0)</td>
<td>14</td>
<td>3,314 (3.4)</td>
<td>11</td>
<td>4,121 (2.7)</td>
</tr>
<tr>
<td>Bacteroides spp.</td>
<td>7,560 (1.9)</td>
<td>15</td>
<td>515 (0.5)</td>
<td>19</td>
<td>2 (&lt;0.1)</td>
</tr>
<tr>
<td>Other pathogen</td>
<td>51,932 (12.7)</td>
<td>14</td>
<td>14,130 (14.6)</td>
<td>19</td>
<td>9,771 (6.4)</td>
</tr>
<tr>
<td>Total</td>
<td>408,151 (100)</td>
<td></td>
<td>96,532 (100)</td>
<td></td>
<td>153,805 (100)</td>
</tr>
</tbody>
</table>

%MRSA by site: CLABSI, 50.7% (2014); VAP, 42.4% (2012); SSI, 42.6% (2014); CAUTI, 52.0% (2014)

CA-UTI: PATHOGENS
NHSN, 2006-2007

## HAI Pathogens, NHSH, 2011-2014

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>36,806 (23.9)</td>
</tr>
<tr>
<td>Candida albicans</td>
<td>17,926 (11.7)</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>15,848 (10.3)</td>
</tr>
<tr>
<td>K. pneumoniae/oxytoca</td>
<td>15,471 (10.1)</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>10,728 (7.0)</td>
</tr>
<tr>
<td>Yeast</td>
<td>9,443 (6.1)</td>
</tr>
<tr>
<td>Other Enterococcus spp</td>
<td>6,291 (4.1)</td>
</tr>
<tr>
<td>Proteus spp</td>
<td>6,108 (4.0)</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>5,680 (3.7)</td>
</tr>
</tbody>
</table>

Top Ten Pathogens Causing Healthcare Associated Urinary Tract Infections, 2017

- *Escherichia coli*
**Pathogen Distribution for CAUTIs in Adult/Pediatric ICUs & Wards, and Adult/Pediatric Medical, Surgical and Medical/Surgical Wards, 2017**

- **E. coli** (35%)
- **Enterococcus** (17%)
- **Klebsiella** (15%)
- **Pseudomonas** (11%)
- **Other - Gram Negative Bacteria** (9%)
- **Enterobacter** (5%)
- **Staphylococcus coagulase negative** (4%)
- **Missing** (2%)
- **Staphylococcus aureus** (2%)
- **Other - Gram Positive Bacteria** (1%)
- **Candida & other yeasts** (0%)

**How to Understand Figure 11:**
- **E. coli** (35%) and **Enterococcus** (17%) were the most commonly identified pathogens among reported CAUTI infections in 2017.
- **Candida** species and other yeasts are considered excluded organisms and cannot be used to meet the UTI definition.
# Healthcare-Associated UTIs, UNCHC, 2006-2009

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>CA-UTI (N=1218)</th>
<th>UTI (N=459)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td>23.6%</td>
<td>29.0%</td>
</tr>
<tr>
<td><em>Enterococcus</em> spp.</td>
<td>15.4%</td>
<td>16.3%</td>
</tr>
<tr>
<td><em>Candida</em> spp.</td>
<td>14.9%</td>
<td>6.1%</td>
</tr>
<tr>
<td><em>P. aeruginosa</em></td>
<td>9.2%</td>
<td>7.2%</td>
</tr>
<tr>
<td><em>Klebsiella</em> spp.</td>
<td>9.1%</td>
<td>12.6%</td>
</tr>
<tr>
<td><em>Proteus</em> spp.</td>
<td>6.2%</td>
<td>4.1%</td>
</tr>
<tr>
<td><em>Enterobacter</em> spp.</td>
<td>4.7%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Coag neg staph</td>
<td>2.9%</td>
<td>4.6%</td>
</tr>
<tr>
<td><em>Torulopsis glabrata</em></td>
<td>2.1%</td>
<td>0.7%</td>
</tr>
<tr>
<td><em>Acinetobacter</em></td>
<td>1.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td><em>S. aureus</em></td>
<td>1.6%</td>
<td>2.4%</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td>1.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td><em>Citrobacter</em> spp.</td>
<td>1.2%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Other</td>
<td>6.0%</td>
<td>8.9%</td>
</tr>
</tbody>
</table>
## CA-UTI: NHSN, 2006-2008

<table>
<thead>
<tr>
<th>Unit</th>
<th>Infection Rate (pooled mean)</th>
<th>Infection Rate (10% - 90%)</th>
<th>Urinary Cath Utilization Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burn ICU</td>
<td>7.4</td>
<td>2.6, 12.3</td>
<td>0.61</td>
</tr>
<tr>
<td>Medical cardiac ICU</td>
<td>4.8</td>
<td>0.0 – 9.4</td>
<td>0.56</td>
</tr>
<tr>
<td>Medical, major teaching ICU</td>
<td>4.7</td>
<td>1.0 – 8.9</td>
<td>0.72</td>
</tr>
<tr>
<td>Neurology ICU</td>
<td>7.4</td>
<td>NA</td>
<td>0.77</td>
</tr>
<tr>
<td>Neurosurgical ICU</td>
<td>6.9</td>
<td>1.6 – 10.8</td>
<td>0.76</td>
</tr>
<tr>
<td>Pediatric medical ICU</td>
<td>4.0</td>
<td>NA</td>
<td>0.21</td>
</tr>
<tr>
<td>Pediatric, med/surg ICU</td>
<td>4.2</td>
<td>0.0 – 7.2</td>
<td>0.29</td>
</tr>
<tr>
<td>Surgical ICU</td>
<td>4.3</td>
<td>0.7 – 9.1</td>
<td>0.81</td>
</tr>
<tr>
<td>Cardiothoracic ICU</td>
<td>3.6</td>
<td>0.7 – 7.0</td>
<td>0.77</td>
</tr>
<tr>
<td>Trauma ICU</td>
<td>5.4</td>
<td>0.2 – 8.1</td>
<td>0.89</td>
</tr>
<tr>
<td>Medicine floor</td>
<td>6.7</td>
<td>1.2 – 14.4</td>
<td>0.20</td>
</tr>
<tr>
<td>Surgical floor</td>
<td>6.5</td>
<td>0.0 – 11.8</td>
<td>0.26</td>
</tr>
</tbody>
</table>

# HEALTHCARE-ASSOCIATED UTIs, UNCHC, 2006-2009


<table>
<thead>
<tr>
<th>Ward Type</th>
<th>CA-UTI Number</th>
<th>CA-UTI Rate*</th>
<th>UTI Number</th>
<th>UTI Rate^</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine ICU</td>
<td>133</td>
<td>3.75</td>
<td>6</td>
<td>0.16</td>
</tr>
<tr>
<td>Medicine Step Down</td>
<td>27</td>
<td>2.65</td>
<td>7</td>
<td>0.42</td>
</tr>
<tr>
<td>Medicine Ward</td>
<td>101</td>
<td>3.35</td>
<td>77</td>
<td>0.43</td>
</tr>
<tr>
<td>Surgery ICU</td>
<td>300</td>
<td>4.81</td>
<td>9</td>
<td>0.13</td>
</tr>
<tr>
<td>Surgery Step Down</td>
<td>31</td>
<td>2.90</td>
<td>3</td>
<td>0.30</td>
</tr>
<tr>
<td>Surgery Ward</td>
<td>358</td>
<td>4.59</td>
<td>108</td>
<td>0.42</td>
</tr>
<tr>
<td>Pediatric ICU</td>
<td>50</td>
<td>4.52</td>
<td>77</td>
<td>0.92</td>
</tr>
<tr>
<td>Pediatric Ward</td>
<td>25</td>
<td>4.83</td>
<td>38</td>
<td>0.32</td>
</tr>
<tr>
<td>Rehabilitation Ward</td>
<td>43</td>
<td>10.12</td>
<td>60</td>
<td>1.68</td>
</tr>
<tr>
<td>Psychiatric Ward</td>
<td></td>
<td></td>
<td>26</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1068</strong></td>
<td><strong>4.32</strong></td>
<td><strong>411</strong></td>
<td><strong>0.48</strong></td>
</tr>
</tbody>
</table>

* Per 1,000 day catheterized  
^ Per 1,000 days hospitalized
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
RISK FACTORS FOR CA-UTI

- Indwelling catheterization
- Not receiving systemic antimicrobial therapy
- Female sex
- Positive urethral meatal culture results
- Microbial colonization of the drainage bag
- Catheter insertion outside the OR
- Catheter care violations
- Older age
- Diabetes mellitus
- Rapidly fatal underlying illness
- Elevated serum creatinine at the time of catheterization
## RISK FACTORS FOR CA-UTI

Table 3. Risk factors for catheter-associated urinary tract infection, based on prospective studies and use of multivariable statistical modeling (27-30)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Relative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged catheterization &gt;6 days</td>
<td>5.1-6.8</td>
</tr>
<tr>
<td>Female gender</td>
<td>2.5-3.7</td>
</tr>
<tr>
<td>Catheter insertion outside operating room</td>
<td>2.0-5.3</td>
</tr>
<tr>
<td>Urology service</td>
<td>2.0-4.0</td>
</tr>
<tr>
<td>Other active sites of infection</td>
<td>2.3-2.4</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.2-2.3</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>2.4</td>
</tr>
<tr>
<td>Azotemia (creatinine &gt;2.0 mg/dL)</td>
<td>2.1-2.6</td>
</tr>
<tr>
<td>Ureteral stent</td>
<td>2.5</td>
</tr>
<tr>
<td>Monitoring of urine output</td>
<td>2.0</td>
</tr>
<tr>
<td>Drainage tube below level of bladder and above collection bag</td>
<td>1.9</td>
</tr>
<tr>
<td>Antimicrobial-drug therapy</td>
<td>0.1-0.4</td>
</tr>
</tbody>
</table>

EVIDENCE-BASED RISK FACTORS FOR CA-UTI

Symptomatic UTI
- Prolonged catheterization*
- Female gender^
- Older age^
- Impaired immunity^

Bacteriuria
- Disconnection of drainage system*
- Lower professional training of inserter*
- Placement of catheter outside of OR^
- Incontinence^
- Diabetes
- Meatal colonization
- Renal dysfunction
- Orthopaedic/neurology services

* Main modifiable risk factors
^ Also inform recommendations
ANTIBACTERIAL HOST DEFENSES
IN THE URINARY TRACT

Urine (osmolality, pH, organic acids)
Urine flow and micturition
Urinary tract mucosa (bactericidal activity, cytokines)
Urinary inhibitors of bacterial adherence
  Tamm-Horsfall protein
  Bladder mucopolysaccharide
  Low-molecular-weight oligosaccharides
  Secretory immunoglobulin A (SIgA)
  Lactoferrin
Inflammatory response
  Polymorphonuclear neutrophils (PMNs)
  Cytokines
Immune system
  Humoral immunity
  Cell-mediated immunity
Miscellaneous
  Prostatic secretions
CA-UTI DEFINITIONS

- UTI that occurs in a patient who has had an indwelling urethral catheter in place within the 48-hour period before the onset of the UTI
- Does not include in and out catheters or urinary catheters that are not placed in the urethra (e.g., suprapubic catheter)
- Do not include patients with asymptomatic bacteriuria
COMPLICATIONS OF SHORT-TERM CATHETERIZATION

- Less than 25% of hospitalized patients with CA-bacteriuria develop UTI symptoms
- ~15% of cases of nosocomial bacteremia are attributable to the urinary tract
- Bacteriuria is the most common source of Gram negative bacteremia among hospitalized patients
- However, bacteremia complicates CA-bacteriuria in only <1% to 4% of cases
- The mortality of nosocomial bacteremic UTI is ~13%, but <1% of hospital deaths are due to bacteremic UTI

LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
CA-UTI Prevention-IHI

- Avoid unnecessary catheters
- Insert urinary catheters using aseptic technique
- Maintain urinary catheters based on recommended guidelines
- Review urinary catheters necessity daily and remove promptly when not needed
CA-UTI Prevention-IHI

- Avoid unnecessary urinary catheters
  - Explicit criteria for appropriate insertion should be in place and verification that criteria are met prior to insertion
  - Indications
    - Preoperative use for selected surgical patients
    - Urine output monitoring in critically ill patients
    - Management of acute urinary retention and urinary obstruction
    - Assistance in pressure ulcer healing for incontinent patients
    - As an exception, at patient request to improve comfort or for comfort during end-of-life care
  - Strategies: require verification that criteria are meet; build criteria for catheter insertion into order entry systems and require documentation of need at time of order; review cases of insertion that do not meet criteria
CA-UTI Prevention-IHI

- Insert urinary catheters using aseptic technique
  - Use appropriate hand hygiene
  - Insert catheter using aseptic technique and sterile equipment (gloves, drape, sponges, antiseptic solution for cleaning urethral meatus, sterile lubricant gel)
  - Use as small a catheter as possible consistent with proper drainage
  - Strategies: checklist for indications for catheter use and insertion; kits; education and training of staff; competency assessment
CA-UTI Prevention-IHI

- Maintain catheters based on recommended guidelines
  - Maintain sterile, continuously closed drainage system
  - Keep catheter properly secured to prevent movement and urethral traction
  - Keep collection bag below the level of the bladder
  - Maintain unobstructed urine flow
  - Empty collection bag regularly

- Strategies: verify and document five items at least once per shift; avoid irrigating catheters; disconnecting the catheter from the drainage bag; and replacing catheters routinely
CA-UTI Prevention-IHI

- Review urinary catheter necessity daily and remove promptly (duration of catheterization is the most important risk factor for development of infection)
  - Daily review of catheter necessity is recommended
- Strategies: automatic stop orders; daily reminders by nurses to physicians; alerts in computerized ordering systems; daily assessment at the start of every shift with the requirement to contact physician if criteria are not met
CA-UTI Prevention-IHI

- Forming the Team
- Champions
- Setting Aims
  - Decrease the rate of CA-UTI by 5% within one year by achieving high levels of performance in the preventive measures
- Assess where we stand presently
CA-UTI Prevention-IHI

- Process Measures
  - Unnecessary urinary catheters (inserted without appropriate indication documented at the time of insertion)
  - Number of patient records or forms with documentation of aseptic technique
  - Urinary catheters maintained according to recommended practices (sterile, closed drainage; bag below bladder, etc)
  - Unnecessary urinary catheter days (number of days with no documentation of indication for continued necessity)
CA-UTI Prevention-IHI
Questions

- Do we require verification that catheter indications are met
- Do we conduct a daily review of catheter necessity
- Are we measuring unnecessary catheters
- Is there a process in place for daily review of inserted catheters
- Are we using an insertion checklist
- Do we follow daily maintenance procedures
- Are all supplies for compliance with appropriate insertion available at point of care
- Do we teach core principles of prevention of CA-UTI
- Where are urinary catheters used most frequently
- What is our CA-UTI rate
Table 1. Modified HICPAC Categorization Scheme* for Recommendations

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category IA</td>
<td>A strong recommendation supported by high to moderate quality† evidence</td>
</tr>
<tr>
<td></td>
<td>suggesting net clinical benefits or harms</td>
</tr>
<tr>
<td>Category IB</td>
<td>A strong recommendation supported by low quality evidence suggesting net</td>
</tr>
<tr>
<td></td>
<td>clinical benefits or harms or an accepted practice (e.g., aseptic technique)</td>
</tr>
<tr>
<td></td>
<td>supported by low to very low quality evidence</td>
</tr>
<tr>
<td>Category IC</td>
<td>A strong recommendation required by state or federal regulation.</td>
</tr>
<tr>
<td>Category II</td>
<td>A weak recommendation supported by any quality evidence suggesting a trade</td>
</tr>
<tr>
<td></td>
<td>off between clinical benefits and harms</td>
</tr>
<tr>
<td>No recommendation/ unresolved issue</td>
<td>Unresolved issue for which there is low to very low quality evidence with uncertain trade offs between benefits and harms</td>
</tr>
</tbody>
</table>

Table 1. Strength of Recommendation and Quality of Evidence

<table>
<thead>
<tr>
<th>Category/grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of recommendation</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Good evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>B</td>
<td>Moderate evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>C</td>
<td>Poor evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>Quality of evidence</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Evidence from &gt;1 properly randomized, controlled trial.</td>
</tr>
<tr>
<td>II</td>
<td>Evidence from &gt;1 well-designed clinical trial, without randomization; from</td>
</tr>
<tr>
<td></td>
<td>cohort or case-controlled analytic studies (preferably from &gt;1 center);</td>
</tr>
<tr>
<td></td>
<td>from multiple time-series; or from dramatic results from uncontrolled</td>
</tr>
<tr>
<td></td>
<td>experiments.</td>
</tr>
<tr>
<td>III</td>
<td>Evidence from opinions of respected authorities, based on clinical</td>
</tr>
<tr>
<td></td>
<td>experience, descriptive studies, or reports of expert committees.</td>
</tr>
</tbody>
</table>
PREVENTION

● Appropriate catheter use
  - Insert urinary catheters only for appropriate indications and leave in place only as long as needed (IB)
  - Avoid urinary catheters in patients for management of incontinence (IB)
  - Use urinary catheters in operative patients only as necessary, rather than routinely (IB)
  - For operative patients who require a catheter, remove it as rapidly as possible, preferably within 24 hours (IB)

PREVENTION:
APPROPRIATE INDICATIONS FOR A CATHETER

- Patient has acute urinary retention or bladder obstruction
- Need for accurate measurement of urinary output in critically ill patients
- Perioperative use for selected surgical patients
  - Urological surgery or other surgery on contiguous structures of GU tract
  - Anticipated prolonged duration of surgery (remove in PACU)
  - Patient anticipated to receive large volume infusions or diuretics during surgery
  - Need for intraoperative monitoring of urinary output
- To assist in healing of open sacral or perineal wounds in incontinent patients

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
## PREVENTION: APPROPRIATE INDICATIONS FOR A CATHETER


<table>
<thead>
<tr>
<th>Indication</th>
<th>Comment(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinically significant urinary retention</td>
<td>Temporary relief or longer-term drainage if medical therapy is not effective and surgical correction is not indicated.</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>For comfort in a terminally ill patient; if less invasive measures (e.g., behavioral and pharmacological interventions or incontinence pads) fail and external collecting devices are not an acceptable alternative.</td>
</tr>
<tr>
<td>Accurate urine output monitoring required</td>
<td>Frequent or urgent monitoring needed, such as with critically ill patients.</td>
</tr>
<tr>
<td>Patient unable or unwilling to collect urine</td>
<td>During prolonged surgical procedures with general or spinal anesthesia; selected urological and gynecological procedures in the perioperative period.</td>
</tr>
</tbody>
</table>
ALTERNATIVES TO INDWELLING URETHRAL CATHETERIZATION IN SELECTED PATIENTS

- Consider an external catheter in cooperative male patients without urinary retention or bladder outlet obstruction (II)
- Consider intermittent catheterization in spinal cord injury patients (II)
- Consider intermittent catheterization in children with myelomeningocele and neurogenic bladder (II)
- Intermittent catheterization is preferable to an indwelling urethral or suprapubic catheter in patients with bladder or emptying dysfunction (II)
PREVENTION

- Use Standard Precautions during manipulation of the catheter or collection system (IB)
- Changing indwelling catheters or drainage bags at routine, fixed intervals is not recommended. Change based on clinical indications such as infection, obstruction or whether the system is compromised (II)
- Do not clean the periurethral area with antiseptics to prevent CAUTI while the catheter is in place (IB)
- Unless obstruction is anticipated, bladder irrigation is not recommended (II)

PREVENTION

● Urinary catheter insertion
  ■ Perform hand hygiene before and after insertion (IB)
  ■ Insert catheters using aseptic technique and sterile equipment (IB)
    ● Use sterile gloves, drape, sponges, an appropriate antiseptic for periurethral cleaning, and a single-use packet of lubricant jelly for insertion
    ● Routine use of antiseptic lubricants is not necessary
  ■ Properly secure indwelling catheters after insertion (IB)
  ■ If intermittent catheterization is used, perform it at regular intervals (IB)

● Catheter maintenance
  ■ Following aseptic insertion, maintain a closed drainage system (IB)
  ■ Maintain unobstructed urine flow (IB)

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
PREVENTION

- Screening for and treatment of CA-ASB are not recommended to reduce subsequent CA-bacteriuria or CA-UTI in patients with short or long term indwelling urethral catheters.
- Screening for and treatment of CA-ASB are not recommended to reduce subsequent CA-bacteriuria or CA-UTI in patients with neurogenic bladders managed with intermittent catheterization.
- Screening for and treatment of CA-ASB are not recommended to reduce subsequent CA-bacteriuria or CA-UTI in other patients, except in pregnant women and patients who undergo urologic procedures for which visible mucosal bleeding is anticipated.

PREVENTION

- Routine instillation of antiseptic or antimicrobial solutions into the urinary drainage bags is not recommended (II)
- Further research is needed on the effect of antimicrobial/antiseptic-impregnated catheters in reducing the risk of symptomatic UTI (no recommendation)
- Further research is needed on the benefit of spatial separation of patients with urinary catheters (no recommendation)
PREVENTION

Quality Improvement Programs

- Assure utilization of catheters
- Remove catheters when no longer needed
- Education and performance feedback regarding appropriate use, hand hygiene, and catheter care
- Algorithms for perioperative management (removal, urinary retention)
SUMMARY OF PREVENTION MEASURES

CORE MEASURES
- Insert catheters only for appropriate indications
- Leave catheters in place only as long as needed
- Only properly trained persons insert and maintain catheters
- Maintain a closed drainage system
- Maintain unobstructed urine flow
- Hand hygiene and standard (or appropriate isolation precautions)

SUPPLEMENTAL MEASURES
- Alternatives to indwelling urinary catheterization
- Portable ultrasound devices to reduce unnecessary catheterizations
- Antimicrobial/antiseptic impregnated catheters

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
STRATEGIES NOT RECOMMENDED FOR CA-UTI PREVENTION

- Complex urinary drainage systems (e.g., antiseptic-releasing cartridges in drain port)
- Changing catheters or drainage bags at routine, fixed intervals (clinical indications include infection, obstruction, or compromise of closed system)
- Routine antimicrobial prophylaxis
- Cleaning of periurethral area with antiseptics while catheter is in place (use routine hygiene)
- Irrigation of bladder with antimicrobials
- Instillation of antiseptic or antimicrobial solutions into drainage bags
- Routine screening for asymptomatic bacteriuria

Adapted from CDC: http://www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf
LECTURE TOPICS

- Prevalence
- Pathogenesis
- Etiology of UTIs
- Risk factors
- Prevention
REFERENCES