Leveraging Technology to Prevent Catheter-Associated Urinary Tract Infections (CAUTI): Disrupting the Lifecycle of the Urinary Catheter

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CAUTIs: An Indicator of Quality & Safety

- 2008: CAUTI classified as a “never event”
- Mandatory Reporting to National Healthcare Safety Network (NHSN)
  - 2012: CAUTI rates in ICU settings required
  - 2015: CAUTI rates in ALL settings required
- CAUTI rates directly linked to reimbursement
- CMS bases penalties on NHSN CAUTI data

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Ongoing audits are important to assess process measures and compliance with interventions

Along with reducing catheter use, strategies and interventions to reduce CAUTIs **MUST** also focus on improving appropriate use of urine cultures

- Avoid “culture-first” approach
- Avoid “pan-culturing” for fever, especially in patients with an indwelling urinary catheter
Aim: Reduce CAUTIs by 15% over 12 months

Primary Drivers

- Reduce Inappropriate Catheter Use
- Ensure Appropriate Care & Maintenance
- Reduce Inappropriate Urine Cultures?
Measurement

Outcome Measures

- NHSN CAUTI Rate =
  - Number of CAUTI per 1,000 catheter-days

- Catheter Utilization Ratio =
  - Catheter-days per Patient-days
Cause-Effect Driver Diagram
Reducing Catheter-Associated Urinary Tract Infections

**Outcome**
- NHSN CAUTI Rate

**Primary Drivers**
- Reduce Inappropriate Catheter Use
  - Catheter Utilization Ratio
- Ensure Appropriate Care & Maintenance
- Reduce Inappropriate Urine Cultures?

**Aim:** Reduce CAUTIs by 15% over 12 months
Primary Prevention Strategy

Reduce Catheter Use

1. Catheter Placement
2. Catheter Care
3. Catheter Removal
4. Catheter Re-insertion

Meddings J, Saint S Clin Infect Dis. 2011;52:1291-1293
Cause-Effect Driver Diagram
Reducing Catheter-Associated Urinary Tract Infections

**Aim:** Reduce CAUTIs by 15% over 12 months

**Primary Drivers**
- Reduce Inappropriate Catheter Use
- Ensure Appropriate Care & Maintenance
- Reduce Inappropriate Urine Cultures?
- Catheter Utilization Ratio

**Secondary Drivers**
- Require physician order for catheter placement
- Use ONLY for approved indications
- Replace only when indicated
- Promptly remove when indication no longer exists

**Outcome**
- NHSN CAUTI Rate

**Drivers:**
1. Catheter Placement
2. Catheter Care
3. Catheter Re-insertion
4. Catheter Removal
Cause-Effect Driver Diagram
Reducing Catheter-Associated Urinary Tract Infections

Primary Drivers
- Reduce Catheter Use
  - Catheter Utilization Ratio

Secondary Drivers
- Require physician order for catheter placement
- Use ONLY for approved indications
- Promptly remove when indication no longer exists
- Replace only when necessary/indicated

Process Changes
- Alert physician when no order present
- Require physician to select an appropriate indication at order entry
- RN-Driven Catheter Removal Protocol
Clinical Decision Support Interventions:

Implementation of Prevention Strategies

Appropriate Indication for Placement Required in Order

- Acute urinary retention
- Accuracy of urinary output in critically ill
- Periop
- Open sacral/perianal wound with incontinence
- Prolonged immobilization
- Improved comfort for end of life care
- Other (see comments)

**Insert and/or Manage**

Routine, CONTINUOUS starting For: Remove Indwelling Foley Catheter

<table>
<thead>
<tr>
<th>Frequency:</th>
<th>CONTINUOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>For:</td>
<td></td>
</tr>
<tr>
<td>Starting:</td>
<td>4</td>
</tr>
<tr>
<td>Starting:</td>
<td>4</td>
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</table>

**Scheduled**

**Questions:**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indications for Foley:</td>
<td></td>
</tr>
<tr>
<td>2. Remove Indwelling Foley Catheter:</td>
<td>Per Nursing Urinary Catheter Removal Protocol When ordered</td>
</tr>
</tbody>
</table>

**Comments (F6):**

*Click to add text*

Reference Links:

1. Algorithm for Removal of Indwelling Urinary Catheters (see page 2)
Reduce Catheter Use

Catheter Utilization Ratio

Primary Drivers

Secondary Drivers

Reduce Catheter Placement

Use ONLY for approved indications

Promptly remove when indication no longer exists

Replace only when necessary/indicated

Process Changes

Alert physician when no order present

Require physician to select an appropriate indication at order entry

RN-Driven Catheter Removal Protocol

Daily review of catheter necessity

Daily nursing documentation of the indication for continued use

Require physician order for catheter placement

The Ohio State University
Wexner Medical Center
Clinical Decision Support Interventions: Implementation of Prevention Strategies

- Automated RN-Directed Alerts/Reminders
- Daily Documentation of Indication for Continued Use
Interventions & Prevention Strategies

- Automated RN-Directed Alerts/Reminders
- Daily Documentation of Indication for Continued Use
- Accurate measurement of urinary output in the critically ill
- Aid healing of open sacral/perianal wound with incontinence
- Prolonged immobilization
- Improved comfort for end of life care
- Perioperative use

Daily Review of Necessity
Urine Output (mL)
Reduce Catheter Use

Primary Drivers

- Catheter Utilization Ratio

Secondary Drivers

- Require physician order for catheter placement
- Use ONLY for approved indications
- Promptly remove when indication no longer exists
- Replace only when necessary/indicated

Process Changes

- Alert physician when no order present
- Require physician to select an appropriate indication at order entry
- RN-Driven Catheter Removal Protocol
- Daily review of catheter necessity
- Daily nursing documentation of the indication for continued use
- Bladder Scanning Protocol After Catheter Removal
Avoid Catheter Replacement After Removal

Bladder Scanning Protocol After Catheter Removal

- Monitor patient for signs of urinary retention.
- Has patient voided within 6-8 hours post-Foley removal?
  - Yes: Does patient appear comfortable and deny need/urge to void?
    - Yes: Continue to monitor patient for spontaneous void, comfort, signs of urinary retention
    - No: Perform Bladder Scan
      - If Bladder Scan volume <400 ml., assess patient for discomfort; document bladder scan volume; assist patient with optimal voiding conditions; repeat bladder scan in 2 hours if no void
      - If Bladder Scan volume >400 ml. (or >250 PVR volume), notify MD/LIP; perform straight catheterization as ordered; document bladder scan volume and volume obtained from catheterization
  - No: Perform Bladder Scan
    - Refer to Chart A for Guideline
      - Continue to monitor patient for spontaneous void, comfort, signs of urinary retention
  - Notify MD/LIP
Cause-Effect Driver Diagram
Reducing Catheter-Associated Urinary Tract Infections

Primary Drivers

Reduce Catheter Use

Catheter Utilization Ratio

Secondary Drivers

Require physician order for catheter placement

% of catheters with an order

Use ONLY for approved indications

% of catheters with an appropriate indication

Promptly remove when indication no longer exists

% of catheters reviewed daily

Replace only when necessary/indicated

% of catheters w/appropriate indication for continued use

Process Changes

Alert physician when no order present

Require physician to select an appropriate indication at order entry

% of orders w/appropriate indication

RN-Driven Catheter Removal Protocol

% of catheters on Removal Protocol

Daily review of catheter necessity

% of catheters reviewed daily

Daily nursing documentation of the indication for continued use

% of catheters w/appropriate indication for continued use

Bladder Scanning Protocol After Catheter Removal

Catheter Utilization Ratio
So Were These Interventions Effective?

- Reduction in CAUTI Rates?
- Reduction in Catheter Utilization?
NHSN CAUTI Rate

\[ \text{NHSN CAUTI Rate} = \frac{\text{CAUTIs}}{\text{Catheter-Days}} \times 1000 \]

CAUTI Definition Change

Process Changes
Catheter Utilization Ratio

\[ \text{Catheter Utilization Ratio} = \frac{\text{Catheter-Days}}{\text{Patient-Days}} \]

CAUTI Definition Change

Process Changes

0.23
Why No Improvement in Outcome Measures?

A Focused Review of the Process Measures

- Audit of 100 consecutive patients w/ catheters in place
- 3 Hospitals within OSU Wexner Medical Center
  - University Hospital (UH)
  - James Cancer Hospital (James)
  - Ross Heart Hospital (Ross)
- Only non-ICU units
- Focused Review of Process Measures:
  - Do all catheters in place have orders in the EMR?
  - Appropriate indication per MD for catheter placement
  - Daily documentation of catheter necessity by RN
  - Appropriate indication per RN to continue catheter use
Catheter Order in EMR?

- James: 86%
- Ross: 85%
- UH: 91%
- Total: 88%
Inappropriate Indication Entered by Provider

- James: 35%
- Ross: 42%
- UH: 38%
- Total: 38%
Inappropriate Indications
Selected by Providers

- Accuracy of urinary output in critically ill: 41%
- Prolonged immobilization: 23%
- Periop: 9%
- AUR or BOO: 15%
- Other: 12%
Daily Review of Catheter Necessity

Indication for Continued Use
Documented by Nurse

James: 83%
Ross: 93%
UH: 95%
Total: 91%
Inappropriate Indication Entered by Nurse

- James: 63%
- Ross: 84%
- UH: 76%
- Total: 75%
Inappropriate Indications
Selected by Nurses

- Accuracy of urinary output in critically ill: 71%
- Prolonged immobilization: 12%
- Periop: 7%
- Other: 3%
- AUR or BOO: 7%

Selected by Nurses
Our CAUTIs…

Analysis of CAUTIs over 6 months (n = 42 CAUTIs)
Appropriate Indication For Catheter Placement?

No
38%
(16/42)

Yes
62%
(26/42)
Appropriate Indication Selected by Nurse on Day of CAUTI?

- Yes: 54% (22/41)
- No: 46% (19/41)
Conclusions of Audit

- “Accurate measurement of urinary output in the critically ill”
  - Intended to mean HOURLY monitoring in ICU pts
- Nonspecific wording likely resulted in inappropriate selection of this indication & unnecessary catheter use.
- Ongoing audits are useful to assess actual compliance with interventions followed by re-education to further optimize urinary catheter utilization.
Aim: Reduce CAUTIs by 15% over 12 months

Outcome

Primary Drivers

- Reduce Inappropriate Catheter Use
- Ensure Appropriate Care & Maintenance
- Reduce Inappropriate Urine Cultures?
Background on CAUTIs
CDC/NHSN Defines CAUTI by Non-Specific Criteria

1. Catheter in place > 2 days
2. Bacteriuria / Positive Urine Culture (>100,000 CFU/mL)
3. Signs or Symptoms compatible with UTI (at least one):
   - Suprapubic tenderness
   - Costovertebral angle pain/tenderness
   - Fever > 100.4°F ( > 38.0°C)

   - 79.7% of ALL CAUTIs; > 95% of CAUTIs in ICU

   Surveillance definition: depends heavily on presence of fever

But is CA-Bacteriuria really the cause of the fever?
Attributing Fever to CA-Bacteriuria?

- **IDSA Guideline CAUTI Definition:**
  - Fever is a compatible sign or symptom of CAUTI only if it is new onset or worsening **AND cannot be attributable to another cause/source**

- **NHSN CAUTI Definition:**
  - All fevers are attributed to the urinary tract as long as other criteria for CAUTI are met.
CAUTI Reduction Initiative: Quality Assessment

OBJECTIVES:

- Further investigate gap between surveillance and clinical definitions of CAUTI
- Better understand the value of urine cultures in the evaluation of a new fever
Methods

- All CAUTIs identified using the NHSN definition over a 6-month period were reviewed (n = 42)

- Data Recorded:
  - Indication for urine culture
  - Source of specimen (e.g. old vs new catheter)
  - Cause of fever (if present)
  - Bloodstream infections attributable to CAUTI
  - Treatment with antibiotics
Indication for Urine Culture

- Fever: 74%
- Confusion: 2%
- Leukocytosis: 2%
- Cloudy urine: 2%
- Hypotension: 2%
- "ICU delirium": 5%
- SIRS w/o fever: 2%
Source of Culture Specimen

- New Catheter: 10%
- Clean Catch: 2%
- Straight Cath: 2%
- Old Catheter (≥ 3 days): 86%
Alternative Infection to Explain Fever

- Yes: 68% (n=13)
- No: 32% (n=7)

Alternative Infection (n=21)

<table>
<thead>
<tr>
<th>Infection</th>
<th>Percentage</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Pneumonia alone</td>
<td>48% (n=10)</td>
<td></td>
</tr>
<tr>
<td>Bacteremia alone</td>
<td>14% (n=3)</td>
<td></td>
</tr>
<tr>
<td>Wound Infection alone</td>
<td>5% (n=1)</td>
<td></td>
</tr>
<tr>
<td>Pneumonia &amp; Bacteremia</td>
<td>19% (n=4)</td>
<td></td>
</tr>
<tr>
<td>Pneumonia &amp; Wound Infection</td>
<td>10% (n=2)</td>
<td></td>
</tr>
<tr>
<td>Bacteremia &amp; Wound Infection</td>
<td>5% (n=1)</td>
<td></td>
</tr>
</tbody>
</table>
Alternative Non-Infectious Cause to Explain Fever

- Yes: 39%
- No: 61%
Any Alternative Cause to Explain Fever

Yes 94%

No 6%
### Other Data from Analysis

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated for UTI <strong>WITHOUT</strong> Alternative Cause of Fever</td>
<td>50%</td>
<td>(1/2)</td>
</tr>
<tr>
<td>Treated for UTI <strong>WITH</strong> Alternative Cause of Fever</td>
<td>86%</td>
<td>(25/29)</td>
</tr>
<tr>
<td>% Bacteremia with Same Organism</td>
<td>5%</td>
<td>(2/42)</td>
</tr>
</tbody>
</table>
Other Data from Analysis

<table>
<thead>
<tr>
<th>Treated for UTI WITHOUT Alternative Cause of Fever</th>
<th>50% (1/2)</th>
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<td>5% (2/42)</td>
</tr>
</tbody>
</table>

- Suggests a very high rate of overtreatment and unnecessary use of antibiotics
- Likely represent asymptomatic bacteriuria (i.e. colonization) rather than true infection
Study Conclusions

- Obtaining urine cultures due to fever explained by another source falsely increases CAUTI rates
- Also results in inappropriate antibiotic use

# CAUTIs Based on # Urine Cultures (n=1,000 pts)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Prevalence of Bacteriuria</th>
<th>% of Urine Cultures Obtained</th>
<th>Prevalence of Fever &gt;38°C</th>
<th>Number of Symptomatic NHSN CAUTIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario1</td>
<td>30%</td>
<td>60%</td>
<td>20%</td>
<td>36</td>
</tr>
<tr>
<td>Scenario2</td>
<td>30%</td>
<td>30%</td>
<td>20%</td>
<td>18</td>
</tr>
<tr>
<td>Scenario3</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
<td>6</td>
</tr>
</tbody>
</table>

Increasing number of urine cultures leads to overestimating CAUTI rate
How to Reduce Unnecessary Urine Cultures

1. Provide education on the appropriate indications for obtaining urine cultures
2. Have periodic audits on urine culture use by unit
3. Avoid automatic triggers or screening cultures without appropriate indications
4. Avoid PAN culturing
Cause-Effect Driver Diagram
Reducing Catheter-Associated Urinary Tract Infections

Primary Drivers
- Reduce Inappropriate Urine Cultures
  - Urine culture orders per 1000 patient-days
  - Asymptomatic bacteriuria treated per 1000 patient-days

Secondary Drivers
- Require physician order for urine culture
- Restrict urine cultures to and urinalyses to appropriate indications - Avoid Pan-Culturing
- Ensure proper collection of urine specimen - Change old catheters (<48h) BEFORE collecting urine
- % of orders obtained as part of a “pan-culture”
- % of orders w/appropriate indication
- % of old catheters not changed prior to specimen collection

Process Changes
- Limit "verbal orders" entered by RN
- % of orders entered by nursing
- Provide education on appropriate indications for urine culture
- Require physician to select an appropriate indication for culture at time of order entry
- % of orders w/appropriate indication
- Require documentation of days catheter has been in place when culture obtained
- Average duration of catheter at time of specimen collection

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WEXNER MEDICAL CENTER
Recommendations & Plan Moving Forward

1. Update CAUTI Prevention Guideline –

   Change the wording of indications and expand indications list to improve compliance, clarity and simplify future measurements/audits

2. Re-Education Bundle –

   RNs, NPs, MDs need clarification & education on appropriate & inappropriate indications for catheter use and urine cultures
3. Change our “Culture of Culturing”
   - Avoid “culture-first” approach
   - Avoid “pan-culturing” for fever
   - There MUST be an appropriate indication when ordering a urine culture or UA w/reflex to culture
     - Orders in EMR are being revised to require an appropriate indication
       - Proposed indication list is based on published guidelines
Conclusions

- Ongoing audits are important to assess process measures and compliance with interventions
- Along with reducing catheter use, strategies and interventions to reduce CAUTIs **MUST** also focus on improving appropriate use of urine cultures
  - Avoid “culture-first” approach
  - Avoid “pan-culturing” for fever, especially in patients with an indwelling urinary catheter
Acknowledgments

- Susan Moffatt-Bruce, MD, PhD
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