Supplementary Online Content


eTable. Activities at Intervention and Comparison Sites

eAppendix. CAUTI Diagnostic Algorithm and Audit and Feedback Script
### eTable. Activities at Intervention and Comparison Sites

<table>
<thead>
<tr>
<th>Intervention Site</th>
<th>Comparison Site</th>
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<td><strong>Baseline (July 2010 to June 2011)</strong></td>
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| Infection control activities:  
VA national CAUTI kickoff call  
CAUTI surveillance in long-term and acute care  
Catheter insertion and maintenance training  
Purchased closed catheter systems | Infection control activities:  
VA national CAUTI kickoff call  
CAUTI surveillance in long-term and acute care  
Catheter insertion and maintenance training  
Purchased closed catheter systems |
| **Intervention (July 2011 to June 2012)** | |
| **Activity** | Delivered by or to | **Activity** | Delivered by or to |
| Penlight with study logo distribution | Research team to internal medicine residents and long-term care staff | CAUTI work group established by physician champion | NA |
| Internal medicine team–based audit and feedback | Research team to internal medicine residents | NA | NA |
| In-service workshops with long-term care personnel | Principal investigator to long-term care staff | NA | NA |
| Kicking CAUTI surveys | Research team to internal medicine residents and long-term care staff | NA | NA |
| **Quality Improvement Efforts Across Both Sites** | |
| Algorithm pocket card distribution | Research team to internal medicine residents and long-term care staff | Distribution of the Infectious Diseases Society of America CAUTI and ASB guidelines via email | Research team to internal medicine residents |
| Internal medicine grand rounds | Principal investigator to medical staff and residents | Internal medicine residents noon conference | Infection control physician director to internal medicine residents |
| Infection control activities:  
Developing catheter documentation template, reminders, and orders  
Monitoring and reporting of catheter insertion and maintenance | | Infection control activities:  
Introduced catheter documentation template  
Initiated catheter surveillance rounds |
| **Maintenance (July 2012 to June 2013)** | |
| **Activity** | Delivered by or to | **Activity** | Delivered by or to |
| Internal medicine grand rounds | Principal investigator to medical staff and residents | NA | NA |
| Internal medicine morning report case presentations | Principal investigator to medical residents and students | NA | NA |
| Internal medicine residents noon conference | Principal investigator to medical residents and students | NA | NA |
| Algorithm pocket card distribution | Research team to internal medicine residents and | NA | NA |

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<table>
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<tr>
<th>students</th>
<th>Kicking CAUTI surveys</th>
<th>Research team to internal medicine residents and long-term care staff</th>
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<th>Research team to internal medicine residents</th>
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**Infection control activities:**
- Education for high-rate units
- Activated catheter order sets
- Review of CAUTI compliance results with nurse managers

**Infection control activities:**
- Education about CAUTI prevention
- Developed order sets for catheter insertion and discontinuation
- Automated CAUTI surveillance tracking documentation initiated

Abbreviations: ASB, asymptomatic bacteriuria; CAUTI, catheter-associated urinary tract infection; NA, not applicable; VA, Veterans Affairs.
Decreasing CAUTI through correct diagnosis: Personalized case report

Dr. Barbara Trautner, Infectious Diseases
Catheter-Associated UTI (CAUTI) vs Asymptomatic Bacteriuria

(Patient with urinary catheter or catheter use within 48 hours)

Start

1. Does the patient have any of CAUTI symptoms?
   - Fever
   - Acute Hematuria
   - Delirium
   - Rigors
   - Flank Pain

   YES

   2. Does a non-UTI diagnosis likely account for the symptoms?
      - Pelvic Discomfort
      - Urgency
      - Frequency
      - Dysuria
      - Suprapubic Pain

   NO

   Do not send urine culture

   YES

   Work-up other cause

2a. Send urine culture

2b. Consider empiric antibiotics for CAUTI

2c. Review urine culture results

Continue on other side

2005 IDSA GUIDELINES FOR ABU
2009 IDSA GUIDELINES FOR CAUTI
2d. Review urine culture results

3. Were there more than 1000 organism/ml?
   - NO
   - YES

3.1a Base decision on symptoms prior to urine culture
   - NO
   - YES

3.1b Re-evaluate case

3.2 Stop empiric antibiotics given for CAUTI

4. Is patient currently on antibiotics for CAUTI?
   - NO
   - YES

5a. Are symptoms still present?
   - NO
   - YES

Add antibiotics to treat the organism(s) isolated for 7-14 days

5b. Are symptoms still present?
   - NO
   - YES

6a. Do antibiotics cover the organism isolated?
   - NO
   - YES

Stop antibiotics given for CAUTI

6b. Do antibiotics cover the organism isolated?
   - NO
   - YES

Continue antibiotics for 7 days

7. Original symptoms improving?
   - NO
   - YES

Change to appropriate antibiotics for 7-14 days

Re-evaluate with attention to upper urinary tract or obstruction

Continue antibiotics for 10-14 days
1. According to the guidelines, the first thing to do is to check whether the patient had any of the following symptoms: fever, acute hematuria, delirium, rigors, flank pain, pelvic discomfort, urgency, frequency, dysuria, or suprapubic pain.

**Correct:** “The decision not to send a urine culture was correct. The patient did not have any of these symptoms.”

**Incorrect:** “The decision to send a urine culture was incorrect. Per chart review, the patient did not have any of the symptoms of CAUTI. [CASE-SPECIFIC SYMPTOM, pyuria, and foul smelling urine] are not symptoms of CAUTI and should not prompt ordering a urine culture.

**Feedback:** “Screening for asymptomatic bacteriuria (ABU) is not recommended. Unless a patient has symptoms consistent with CAUTI, a urine culture should not be sent in the first place. If the patient does have symptoms that could indicate CAUTI, a urine culture should be sent and then you should next consider whether another diagnosis could account for the symptoms.”

**CAUTI-related treatment of the patient ceases here.**
1. According to the guidelines, the first thing to do is to check whether the patient had any of the following symptoms: fever, acute hematuria, delirium, rigors, flank pain, pelvic discomfort, urgency, frequency, dysuria, or suprapubic pain.

**Correct:** You decided YES, The patient had....... [SYMPTOMS], which are consistent with CAUTI by IDSA guidelines.

**Incorrect:** You decided YES, the patient had symptoms. However, the patient did not have symptoms of a CAUTI according to the IDSA guidelines.

**Next Step:** If the patient does have symptoms that could indicate CAUTI, then you should next consider whether another diagnosis could account for the symptoms. In this case the symptoms suggestive of CAUTI were [INSERT SYMPTOMS HERE].
2. Did a non-UTI diagnosis likely account for the symptoms?

Correct: “You made the correct decision to work up a non-UTI cause for the symptoms. It seems likely that a non-UTI diagnosis did account for the patient’s symptoms. The patient likely had [ALTERNATIVE DIAGNOSIS].

Incorrect: Although you treated the patient empirically for CAUTI without further workup, it seems likely that a non-UTI diagnosis accounted for the symptoms. This is because the patient also had [ALTERNATIVE DIAGNOSIS], which could account for the [CASE-SPECIFIC SYMPTOM].”

Feedback (regardless of whether resident made correct or incorrect decision): “It is likely that the patient’s symptoms could be explained by a non-UTI diagnosis, in this case [ALTERNATIVE DIAGNOSIS]. Further work-up of other possible causes for the patient’s symptoms was appropriate. This is because.......”

CAUTI-related treatment of the patient ceases here.

Were inappropriate antibiotics given? [YES/NO]
If YES: The patient did not have symptoms of CAUTI, or if another diagnosis likely accounted for the symptoms, antibiotics were not indicated. However, the patient received [ANTIBIOTIC] on [DATE]. Per IDSA guidelines, this treatment was unnecessary.
IF NO: Since the patient did not have symptoms CAUTI, or had another diagnosis to explain the symptoms, antibiotics were not indicated. You did not prescribe antibiotics, a decision that was consistent with IDSA guidelines.
2. Did a non-UTI diagnosis likely account for the symptoms?

**Correct:** You made the correct decision. It seems likely that the patient had CAUTI because there was not an alternative explanation for the symptoms.

**Incorrect:** You attributed the patient’s symptoms to CAUTI, but it seems more likely that a non-UTI diagnosis explained the symptoms, according to IDSA guidelines. Your treatment should stop here and a urine culture should not be sent.

**Feedback (regardless of whether resident made correct or incorrect decision):** The correct course of action to follow when the patient’s symptoms are caused by CAUTI is to begin empiric antibiotics for CAUTI while waiting for the urine culture results. The goal of treating CAUTI with antibiotics is to relieve symptoms.

**Feedback 2:** The goal of treating CAUTI with antibiotics is to relieve symptoms. Since the patient did not have symptoms specific to CAUTI, a urine culture and antibiotics were not necessary.

2a. Send urine culture.
2b. Consider empiric antibiotics for CAUTI.
2c. Wait for urine culture results.
2d. Urine culture results are available.

3. Did the patient’s urine culture grow > than 1000 organism/ml?

Correct: “The urine culture grew fewer than 1000 organisms/ml.

Incorrect: “The urine culture grew fewer than 1000 organisms/ml.

Feedback: “Fewer than 1000 organisms/ml on urine culture is not compatible with the diagnosis of CAUTI UNLESS the patient had already received antibiotics when this urine culture was collected.”
3.1 Was patient on antibiotics when urine culture sent?

Correct: “Since this patient was not on antibiotics when the urine culture was sent, the negative urine culture essentially rules out CAUTI.

Incorrect: “We do not believe the patient was on antibiotics when the urine culture was collected, so a negative urine culture would essentially rule out CAUTI.

Feedback: “A patient with a negative urine culture by IDSA guidelines does not have CAUTI, unless the urine was collected while the patient was on antibiotics. Your next step is to re-evaluate the case and to stop the empiric antibiotics given for CAUTI.”

3.1c. Re-evaluate case.
3.1d. Stop empiric antibiotics given for CAUTI.

CAUTI-related treatment of the patient ceases here.
3.1 Was patient on antibiotics when urine culture sent?

**Correct:** “This patient was on antibiotics when the urine culture was collected.

**Incorrect:** “Although this patient was on antibiotics when the urine culture was collected, it is not clear if your team was aware of this situation.

**Feedback:** “Urine cultures collected when the patient is already on antibiotics are not reliable means to rule in or rule out CAUTI. In this situation, your decision about whether the patient has a CAUTI will need to be based on the patient’s symptoms.”

**Should we add** “Information about the antibiotics used can be found here in the pharmacy records (show provider) on in Theradoc.”

3.1a. Base decision on symptoms prior to urine culture.

*CAUTI-related treatment of the patient ceases here.*
3. Did the patient’s urine culture grow > than 1000 organism/ml?

**Correct:** “The urine culture grew >1000 organisms/ml, which is consistent with CAUTI.

**Incorrect:** “The urine culture grew > 1000 organisms/ml, but it is not clear from our chart review if your team thought the patient had a positive urine culture.

**Feedback:** “Greater than 1000 organisms/ml on urine culture is compatible with the diagnosis of CAUTI.”
4. Is the patient receiving antibiotics for CAUTI?

Correct: “This patient was not receiving antibiotics for CAUTI when the urine culture results became available.”

Incorrect: “Based on our review of the chart, you may have thought the patient was already receiving antibiotics for CAUTI but this patient was not.” “This is because.....OPTIONAL and use only if explanation readily apparent.”

Feedback: “When a patient who is suspected of CAUTI proves to have bacteriuria on the urine culture, your next step is to determine whether the patient’s symptoms are still present.”
5a. Were symptoms still present? [if the patient was *NOT* receiving antibiotics for CAUTI]

**Correct:** Since the patient’s symptoms were no longer present when you got the urine culture results back, there was no need to start antibiotics for CAUTI. Your decision to withhold antibiotics to treat the urinary flora was consistent with the IDSA guidelines.

**Incorrect:** Since the patient’s symptoms were no longer present when the urine culture results came back, there was no need to start antibiotics for CAUTI. Your decision to start antibiotics to treat the urinary flora was not consistent with the IDSA guidelines.

**Feedback:** “If the symptoms that prompted the initial urine culture have resolved without treatment of the organisms in the urine (or if the patient never had symptoms of CAUTI in the first place), there is no need to begin antibiotics when the urine culture results come back. When you see a positive urine culture result, the best course of action is to reassess the patient and ask whether the patient still has symptoms consistent with untreated CAUTI. If not, guidelines recommend leaving the organisms in the urine alone.

*CAUTI-related treatment of the patient ceases here.*
5a. Were symptoms still present? [if the patient was NOT receiving antibiotics for CAUTI]

**Correct:** “This patient still had [SYMPTOMS] which are consistent with CAUTI, and the patient was not yet receiving antibiotics to treat the urinary organisms

**Incorrect:** “We believe that the patient still had [SYMPTOMS] which are consistent with CAUTI. Since the patient was not receiving antibiotics to treat the organisms in the urine, this patient had an untreated CAUTI.

**Feedback:** “Because the patient’s symptoms were still present and the patient was not receiving antibiotics for CAUTI, the IDSA guidelines recommend adding antibiotics to cover the organism(s) isolated for 7 to 14 days. The purpose of treating CAUTI is to relieve the patient’s symptoms.

**CAUTI-related treatment of the patient ceases here.**
4. Is the patient receiving antibiotics for CAUTI?

Correct: “This patient was already on empiric antibiotics for CAUTI.

Incorrect: “It is not clear from our review of the chart that you believed the patient was already receiving empiric antibiotics for CAUTI. You may have made this decision because…….”

Feedback: “When a patient who is already receiving empiric treatment for CAUTI proves to have bacteriuria on the urine culture, your next step is to determine whether the patient’s symptoms are still present.”
5b. Were symptoms still present despite the patient receiving antibiotics for CAUTI? [if the patient WAS receiving antibiotics for CAUTI]

**Correct:** If the patient is receiving antibiotics when the urine culture results become available, the correct next step is to determine whether the symptoms of CAUTI are still present. In this case it appears that you correctly determined that symptoms were no longer present.

**Incorrect:** “If the patient is receiving antibiotics when the urine culture results become available, the next step is to determine whether the symptoms of CAUTI are still present. In this case, it appears that you may have felt symptoms of CAUTI were still present or may have missed this re-assessment step.
6a. Did antibiotics cover the organism isolated? [if symptoms were no longer present and the patient had received antibiotics for CAUTI]

**Correct:** “Stopping antibiotics was correct here because the antibiotics prescribed did not cover the isolated organism.”

**Incorrect:** “Although the antibiotics did not cover the organism found in the urine culture, we are not sure whether this mismatch was apparent to the team. You cannot assume that the antibiotics given were responsible for the improvement in symptoms of CAUTI because the antibiotics did not cover the organism isolated.

**Feedback:** “Since the antibiotics did not cover the organism isolated from the urine, it would have been appropriate to stop the empiric therapy for CAUTI when you got the urine culture results. If the symptoms of CAUTI resolved despite an inappropriate initial choice of antibiotics, it is unlikely that the patient had a CAUTI. Of course, if you now believed your patient had a different infection that responded to the antibiotics, you may have a non-CAUTI related reason to continue these antibiotics.”

**CAUTI-related treatment of the patient ceases here.**
6a. Did antibiotics cover the organism isolated? [if symptoms were no longer present and the patient had received antibiotics for CAUTI]

**Correct:** “If the patient’s symptoms consistent with CAUTI have resolved while the patient is on antibiotics, it is appropriate to consider whether the antibiotics were responsible for the improvement. In this case you correctly identified that the antibiotics did cover the organisms isolated, and the patient was improving.

**Incorrect:** Even though the patient’s symptoms consistent with CAUTI resolved while the patient was on antibiotics, you still need to consider whether the antibiotics were responsible for the improvement. You may not have been aware that the antibiotics did cover the organism isolated in the urine.

**Feedback:** When the patient improves while on empiric antibiotics for CAUTI, you use the urine culture results to determine whether antibiotics were possibly responsible for the improvement. If the organism was susceptible to the antibiotics used, and the symptoms resolved rapidly, 7 days is the recommended duration of therapy for CAUTI.

**CAUTI-related treatment of the patient ceases here.**
5b. Were symptoms still present despite the patient receiving antibiotics for CAUTI? [if the patient WAS receiving antibiotics for CAUTI]

Correct: “If the patient is receiving antibiotics when the urine culture results come back, it is appropriate to assess whether the patient still has symptoms consistent with CAUTI. In this case the patient still had [SYMPTOMS].

Incorrect: If the patient is receiving antibiotics when the urine culture results come back, you should re-assess whether the patient has symptoms consistent with CAUTI. In this case it appears that you may have missed the symptoms that were still present, [SYMPTOMS].
6b. Did antibiotics cover the organism isolated? [if symptoms were still present and the patient had received antibiotics for CAUTI]

**Correct:** “You appear to have correctly identified that the antibiotics prescribed did not cover the organism(s) found in the urine culture.”

**Incorrect:** “Although the antibiotics did not cover the organism found in the urine culture, we are not sure whether this mismatch was apparent to the team.

**Feedback:** “Since the antibiotics did not cover the organism isolated from the urine, it would have been appropriate to change the therapy for CAUTI when you got the urine culture results.”

*CAUTI-related treatment of the patient ceases here.*
6b. Did antibiotics cover the organism isolated? [if symptoms were still present and the patient had received antibiotics for CAUTI]

**Correct:** “In this case, you correctly identified that the empiric antibiotics prescribed for CAUTI do cover the organisms that grew on urine culture.

**Incorrect:** In this case the antibiotics prescribed empirically for CAUTI do cover the organisms that grew in the urine culture. We are not sure if this situation was apparent to the team, as the [INSERT REASON HERE, LIKELY THAT ANTIBIOTICS WERE CHANGED].

**Feedback:** It is appropriate to use the urine culture results to determine whether the empiric antibiotics prescribed cover the urinary organisms. If the antibiotics do cover the organisms isolated but symptoms are still present, you next consider whether the patient is improving.
7. Original symptoms improving?

**Correct:** If the patient still has symptoms of CAUTI while on effective antibiotics to treat the urinary organisms, the next decision step is whether the patient’s symptoms are improving. In this case, you correctly identified that the patient’s symptoms were not improving.

**Incorrect:** If the patient still has symptoms of CAUTI while on effective antibiotics to treat the urinary organisms, the next step is to determine whether the patient’s symptoms are improving. We are not sure that you were aware that the patient was NOT improving at this point because [EXPLANATION].

**Feedback:** If the patient’s symptoms of CAUTI are not improving despite being on appropriate antibiotics for several days, the recommended action is to evaluate for an upper urinary tract problem, especially one that could cause urinary obstruction.

**CAUTI-related treatment of the patient ceases here.**
7. Original symptoms improving?

**Correct:** In this case, you correctly identified that the patient’s symptoms were improving although still present.

**Incorrect:** If the patient still has symptoms of CAUTI while on effective antibiotics to treat the urinary organisms, the next step is to determine whether the patient’s symptoms are improving. We are not sure that you felt the patient was improving at this point, because [INSERT EXPLANATION HERE, LIKELY THAT ANTIBIOTICS WERE STOPPED EARLY].

**Feedback:** Patients who are improving on appropriate antibiotics but who still have symptoms several days after starting therapy probably need a longer course of treatment. Guidelines experts recommend continuing antibiotics for 10-14 days in such patients.

**CAUTI-related treatment of the patient ceases here.**
Thank you again for your time! The Kicking CAUTI Campaign team hopes this feedback will be helpful to you when you encounter possible CAUTI cases in the future.

Here is a link to the IDSA guidelines:

http://cid.oxfordjournals.org/content/50/5/625.full
Audit and Feedback Script

- By telephone:
- This is [NAME OF RESEARCH ASSISTANT] from Dr. Trautner’s Kicking CAUTI Campaign. This campaign helps physicians learn to manage urinary-catheter associated bacteriuria according to the Infectious Diseases Society of America guidelines. I would like to visit your team about a case of bacteriuria that was recently on Team [letter]. I checked with the chief resident and he approves this process. The visit should take 30 minutes or less. Is this afternoon a good time? If not, tomorrow afternoon? To thank you for your time, we will give you a stethoscope light or a Sanford Guide to Antibiotics.

- Introducing yourself and the process to the provider:
- Our team has prepared a visual aide for this case that I would like to go over with you step-by-step. This feedback is based on the IDSA guidelines for effective management of CAUTI. (You can keep your copy of the form when we are finished.)
- [Show Slide 1] This is your personalized case report.
- [GIVE RESIDENT ALGORITHM WITH HIGHLIGHTS]
- [Show Slide 2]
- The case for discussion is [PATIENT NAME and MR#] on [HOSPITAL WARD]. The urine culture for this case was sent to the lab on [DATE] and the results showed a positive culture for [ORGANISM]. Based on our chart review and the IDSA guidelines, our suggestion is that this patient [DID/DID NOT] need a urine culture based on the (lack of symptoms related to the urinary tract) or symptoms this patient had of [LIST SYMPTOM(S)]. In our judgment this patient [HAD ABU RATHER THAN CAUTI/HAD CAUTI RATHER THAN ABU]. This patient [DID/DID NOT] receive antibiotics for [HIS/HER] bacteriuria. Antibiotics [WERE/WERE NOT] indicated for this type of bacteriuria. (Omit if management was appropriate--However, we may have not seen some information that you used in making your decision, and we respect your clinical judgment.

- Please follow along with me as I review the decisions you made while treating this patient’s bacteriuria. If you have any questions about the graphical feedback format while I go over it with you please feel free to ask them. [Answer any questions the participant might have, or let them know you’ll pass the question on to Dr. Trautner]
- Let’s begin at Start. The first diamond asks whether the patient shows symptoms. You selected [YES/NO].
- Conclusion:
- We are not going to review the second page of the algorithm in detail, but just so you know what information is there, page 2 is focused on antibiotic choice and treatment duration. You may find this useful for other patients.
- Thank you for your time and attention. Do you have any questions about the feedback we provided you with or treatment of CAUTI in-general?
- [IF RESIDENT HAS QUESTIONS WRITE THEM DOWN AND INFORM THE RESIDENT YOU WILL RELAY THEM TO DR. TRAUTNER WHO WILL ANSWER THEM PERSONALLY.]
- Do you have a copy of our CAUTI diagnostic algorithm? [PROVIDERS WHO DO NOT HAVE A COPY OF THE ALGORITHM ARE GIVEN ONE.]