CAUTI Prevention Case Study

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Executive Summary

University of Missouri Health, a comprehensive academic medical center that includes MU Health Care, MU School of Medicine and its University Physicians practice plan, MU Sinclair School of Nursing, and MU School of Health Professions, has a mission to advance the health of all people, especially Missourians, through exceptional clinical service, which supports the academic and research mission of the University of Missouri.

MU Health recognizes that an electronic health record (EHR) is essential to our mission and we have had an EHR infrastructure since 1996. Consisting of five hospitals and more than 50 clinics staffed by more than 550 university physicians, MU Health Care has the only Level 1 trauma center in mid-Missouri. Our health system offers primary, secondary, and tertiary services to central Missourians in a 25-county service area with a population of 776,861.

The 2015 National Patient Safety Goal 07.06.01 is to “Implement evidence-based practices to prevent indwelling catheter-associated urinary tract infections (CAUTI).” The CAUTI team at MU Health Care has worked for the last two years to reduce CAUTIs and catheter utilization. Leadership support, focus on best practice with use of an EHR urinary catheter indication reminder, and a program which recognizes audit champions, as well as education and rewards, have contributed to a decrease in both CAUTI and catheter utilization. The CAUTI team motto is “if you don’t have a catheter in, you cannot get a CAUTI!”

The biggest change agent in this project to decrease CAUTI rates and catheter utilization as evidenced by the literature¹, is the EHR. When a physician places an order for a urinary catheter, we have created mandatory fields in the EHR that require him or her to consider and document a
specific reason why each patient should have a catheter. We also added a nursing task in the EHR to discontinue the catheter if it is no longer indicated to ensure connection of assessment to action.

Through these and other means, system-wide, CAUTI rates decreased from a rate of 6.0 in calendar year (CY) 2013 to 4.50 (CY 2014) per 10,000 patient days, a 25 percent reduction. Catheter utilization rates decreased from 33 percent (CY 2013) compared to 25 percent (CY 14), for a 24 percent reduction. Patient days were used to track CAUTI rates based on guidelines from the the Infectious Disease Society of America and Society for Hospital Epidemiology of America. This recommendation is based on the danger of success achievements being masked despite a total reduction in the number of CAUTI when using device days.

Local Problem

CAUTIs increase patient discomfort, increase antibiotic usage, contribute to antibiotic resistance, increase length of stay, and are a reportable health-care-acquired infection.

CAUTIs have been the most common hospital-acquired infection identified at MU Health Care, and this is consistent with literature. Historically, CAUTIs have been the most common primary site for secondary bloodstream infections at MU Health Care. In CY 2013, our system-wide catheter utilization rate was 33 percent, meaning one-third of all patients had a urinary catheter. In CY 2013, our CAUTI rate per 10,000 patient days was 6.0. Based on these numbers, we established a system-wide strategic goal of a 10 percent reduction in CAUTI. However, we lacked a systematic process to assess daily necessity of continuation of catheters. We did not have a standardized reminder for a nurse or a provider that a catheter was in place, or an expectation to assess for indications. Urinary catheters remained in place due to physicians’ lack of awareness and a lack of nursing pursuance of discontinuation. Catheters were accepted as a routine part of patient care, and discontinuation was not a high priority. These factors promoted an environment in which clinicians did not pay enough attention to the detrimental effects of unnecessary catheter utilization. Use of urinary catheters without patient indications increases the risk of CAUTI by three to seven percent for each additional day.

Importantly, the costs related to treating CAUTI and associated complications, such as testing, medication, and longer inpatient stays, are not reimbursed. Catheter-associated urinary tract infections also factor in the Centers for Medicare and Medicaid Services (CMS) value-based purchasing scores, which affect reimbursement. These infections are publically reported on the Hospital Compare Website.
This type of infection also is associated with high cost. According to Zimlichmann, et al., the cost of a CAUTI can range from $603-$1,189 with a mean of $896 based on 2012 dollars. Secondary bloodstream infections occur in up to 10 percent of CAUTI infections, and the average cost of a bloodstream infection is $45,814.

**Design and Implementation**

In August 2013, the Intensive Care Unit (ICU) oversight committee at MU Health Care decided that the ICU would implement the HOUDINI indications list on paper during morning rounds on each patient with a catheter (see Figure 2 on page 4). The HOUDINI is a list of indications that was developed by Trovillion et al. The paper version of this was implemented in ICUs with poor compliance. Executive leaders appointed a team to focus on CAUTI reduction, consisting of two clinical managers, a clinical educator, and an infection control practitioner to lead a quality improvement project within the organization’s Performance Improvement Leadership Development Program. This team analyzed many aspects of CAUTI causes as shown in the fishbone diagram below (Figure 1). The group focused on removal of the catheter since the risk increases each day a patient has a catheter. Individual utilization rates were high in most units compared to the National Healthcare Safety Network.

![Figure 1: Fishbone Diagram](image-url)
The team presented the HOUDINI indications list (Figure 2) to the interdisciplinary ICU oversight committee. Data was collected by survey to assess front-line staff knowledge of HOUDINI indications and to measure the likelihood that a given indicator would be selected for catheter continuation. The team analyzed records of 22 individual patients with CAUTI, finding 9 (41 percent) in whom catheter did not meet HOUDINI indications. Further, the importance of earlier removal was reinforced, with 20 (91 percent) infections identified after the catheter had been in place for 5 or more days.

We presented our findings to the ICU Oversight Committee as a key stakeholder group, as well as to multiple staff stakeholder and leadership groups. Intake and output was the selected HOUDINI indication 85.3 percent of the time, but only 54.3 percent of patients had received treatment for hemodynamic instability within the past 48 hours. Immobility was the selected indication 76.5 percent of the time (multiple indications could be selected), yet 92 percent of these patients could be rolled from side to side, allowing other interventions to safely manage patient voiding.

The Committee approved customization of the HOUDINI list to narrow these indications. We further defined the intake and output indication to apply to patients who had hemodynamic resuscitation in the last 48 hours, hyperosmolar therapy, intravenous diuretic therapy, and diabetes insipidus. Similarly, we further defined the immobility indication to apply to patients with unstable fracture, spine not clear, paraplegia, quadriplegia, respiratory or hemodynamic instability with turning; and ventilation and sedation. The team then presented the revised list of catheter indications to the Executive Committee of the Medical Staff, Nursing Practice Council, and Education Council for input and approval. We then modified the organization’s urinary management protocol.
With a focused effort on catheter removal, the team elected to create an electronic reminder in the EHR to improve compliance with the regular assessment of the indicated use of urinary catheters. The team worked with MU Health Care’s information technology (IT) nursing director to develop a draft workflow in the EHR and presented it to Nursing Informatics Council. With input from the council, the new workflow was approved and implemented in December 2013.

Next, the team designed a nursing EHR catheter indication intervention to reduce the utilization of urinary catheters through required daily assessment documentation. This approach has helped nurses and physicians take the initiative to discontinue catheters that are no longer indicated and to consider the indication prior to placement.
EHR Workflow

The following figures show the additions made in the nursing EHR to prompt discontinuation of the catheter. In the I-view genitourinary assessment section (Figure 3), “Voiding Per ... Foley” was already a choice a nurse could select when charting how the patient voids.

1. Nurse documents “Voiding Per Foley” by checking the box.

   ![Figure 3: Nursing Documentation](image)

   When a nurse selects “Voiding Per Foley” in the documentation, we created a “Urinary Cath Indications” box (Figure 4) so nurses and other clinicians could select a proper indication.

   ![Figure 4: Nursing Documentation](image)

2. The nurse selects as many indications that apply from the list.

3. If the nurse charts “None- Pursue Discontinuation”, the EHR creates a “Nursing Task” and displays it in the task list as “Notify Provider Houdini Criteria Not Met”.

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The system displays these nursing tasks (Figure 5) so nurses know which tasks they need to complete.

**Figure 5: Nursing Tasks**

<table>
<thead>
<tr>
<th>Task Status</th>
<th>Schedule/Date and Time</th>
<th>Task Description</th>
<th>Order Details</th>
<th>Frequency</th>
<th>Charted By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overdue</td>
<td>05/06/2015 09:11</td>
<td>Complete Nursing Admission History Adult</td>
<td>05/06/19 11:12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pending</td>
<td>05/06/2015 15:06</td>
<td>Provider Notified Houdini Criteria Not Met</td>
<td>Ordered secondary to admission transfer to inpa...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The system attaches the description, “Provider Notified Houdini Criteria Not Met”, to the task, which also promotes completion.

4. Next, the nurse notifies the provider that the HOUDINI indications are not met (Figure 6). The nurse selects the “Yes” or “No” box to discontinue, and documents the discontinue date. If the provider requests that a Foley catheter be left in place, the nurse can document the reason in the “Reason Foley to be Continued” box.

**Figure 6: Provider Notification**
Value Derived

Building on the team’s motto, “If you do not have a catheter in, you cannot get a CAUTI”, the mandatory EHR requirements helped MU Health Care achieve a lower utilization rate. After this intervention, ICUs achieved a 13.3 percent decrease in utilization. Inpatient, non-ICU units achieved even greater success, decreasing utilization by 33.3 percent.

These decreases occurred because we required clinicians to document in the EHR why a patient needed a catheter. The EHR provided a comprehensive approach to document appropriate indications for catheters, replacing the failed paper and verbal methods.

Figure 7 (below, left) displays catheter utilization with six months of pre-intervention data and 16 months of post-intervention data. The trend line shows the steady decline in catheter utilization. Figure 8 (below, right) shows the CAUTI infection rate per 10,000 patient days for the same time period.

System-wide, CAUTI rates\(^2\) dropped from a rate of 6.0 in CY 2013 to 4.50 in CY 2014 per 10,000 patient days, which translates into a 25 percent reduction. Catheter utilization rates decreased by 24 percent from 33 percent in CY 2013, compared to 25 percent in CY 2014.

The graph below (Figure 9) displays the variation in July 2014. There is just one data point above the second sigma demonstrating random cause variation.
EHR additional utilizations

The EHR displays data documented by nurses through a patient access list (PAL) (Figure 10), which clinicians look at daily for surveillance. This patient surveillance includes catheter day counts, indications, discontinuation dates, and bladder scan amounts (each line represents one patient’s data). This data comes directly from the nursing documentation in the genitourinary assessment section of the EHR.
We used the PAL to identify staff members who discontinued unnecessary catheters twice a week. In all, we recognized 250 staff members between January-May 2014, rewarding them with vouchers that could be redeemed for cash and other prizes.

Training began in 2013 and continued through 2014. We developed education materials related to the customized HOUDINI, skin care for incontinent patients, and CAUTI rates and utilization, which we circulated from September through December 2013.

Later, in February 2014, we individually trained all new nurses on the modified HOUDINI protocol. Also in early 2014, all nursing staff members who take care of patients with urinary catheters completed a mandatory computer-based training module, which reinforced the modified HOUDINI, care of catheters, alternatives to catheters, and the system’s goal to reduce CAUTI. Later in 2014, we required each nurse to do an online module, which simulated a urinary catheter insertion and discussed appropriate indications for use.

In addition, in May, 2014, we started a system-wide CAUTI team, which continues to meet monthly to review CAUTI cases, monitor audits, and review the CAUTI and utilization data. Team members disseminate information to the multi-professional team within their clinical areas. Infection and utilization rate data and trends are presented monthly at each unit quality improvement meetings, system-wide infection control committee meetings, and ICU oversight committee meetings. The CAUTI team completed a study on the audits to identify most common indications chosen for catheter retention. The top indication was urinary retention. This data is being used to direct our focus on bladder scan as a means of identifying urinary retention after catheter removal. Each month, the CAUTI team selects a new unit to receive a travelling banner award (Figure 11) (each staff member on the unit receives a voucher for a free cookie). We have circulated this banner from winning unit to winning unit for the last 13 months.

Finally, for the last 18 months, we have trained all new graduate nurses about urinary catheter care and usage. And each month, we also assess current staff members for urinary catheter care and usage at bi-monthly skills fairs.
Additionally, we added the HOUDINI list of indications as a required field in physician orders for placement or maintenance of a Foley catheter (Figure 12).

**Lessons Learned**

The success of these interventions hinged on administrative support, communication, and stakeholder engagement. MU Health Care leaders made catheter-associated urinary tract infection reduction a system-wide strategic goal, and we used resources to emphasize the initiative. A multi-disciplinary performance improvement team was chartered, leading to multi-layered interventions ranging from mandatory education to modification of tasks, orders and workflows within the EHR. Communication to and engagement of a wide variety of stakeholders prior to and throughout implementation also contributed to our success. When best practices were determined, the original team transitioned to a system-wide team focused on spread. This team continues to ensure CAUTI reduction and decreased catheter utilization remained a top priority through evidence-based practices and discovery.
EHR intervention required multiple revisions based on input from the Nursing Informatics Council. Since urinary catheter discontinuation was not a part of the existing culture, there were many levels of communication and education required to change our organization’s mindset about catheter usage. An attempt to use a paper-based reminder system for urinary catheter indication was not successful. In contrast, the mandatory EHR fields created a system of accountability, which, in turn, helped us change attitudes and our culture of catheter usage. Through this process, we also realized there were multiple ways a physician could order a urinary catheter through the EHR. The IT nursing director helped our team discern which orders were necessary in the EHR and which could be deleted, working through existing, physician-led IT governance structures. Thus, we streamlined this physician workflow.

In addition, the CAUTI Prevention leadership team anticipated and structured monitoring for unintended consequences of urinary catheter removal, including skin breakdown and urinary retention. Skin breakdown risk was addressed proactively with education to prevent incontinence-associated dermatitis embedded in the CAUTI Prevention computer-based training and annual skills competency fair required for all staff nurses. Through the unit champion audits, urinary retention was identified, corresponding with high frequency of the HOUDINI indicator for continuing catheterization. The team approached this as a new improvement opportunity using similar methods, developing a protocol embedded in existing nursing workflow for a bladder scan EHR task created when a catheter is discontinued. Because this is done in a standard fashion, high post-void residual bladder volume is identified early and treated appropriately.

Financial considerations

In 2013, we had a total of 49 CAUTIs in which five resulted in an associated secondary bloodstream infection, with estimated unreimbursed treatment costs of $272,974.

<table>
<thead>
<tr>
<th>Infections</th>
<th>Cost per Infection</th>
<th>2013 Cost of Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAUTI</td>
<td>49</td>
<td>$896</td>
</tr>
<tr>
<td>Secondary Bloodstream Infection</td>
<td>5</td>
<td>$45,814</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>$45,814</strong></td>
</tr>
</tbody>
</table>

In 2014, with a 16 percent decrease in CAUTI infections and a 20 percent decrease in secondary bloodstream infections, MU Health Care saw a 19 percent decrease in costs associated with CAUTI. The decrease in CAUTI and secondary bloodstream infection occurrences in calendar year 2014 decreased MU Health Care’s cost to treat hospital acquired infections by $52,982. Low CAUTI rates
played a major role in preventing payment reduction associated with the CMS Hospital Acquired Condition program.

While the team used the existing EHR as the primary point of intervention, there were no software or hardware costs associated with these changes. Staff hours invested were numerous and unmeasured, but MU Health Care did not add any additional staff positions to complete the project.

**References**

2. CAUTI rates are calculated as number of infections/patient days *10,000
3. Catheter utilization is calculated as number of Foley days/patient days.