Using Technology to Reduce Catheter-Associated Urinary Tract Infections

Abstract
Catheter-associated urinary tract infection, a common and potentially preventable complication of hospitalization, is the most frequent healthcare-associated infection in the United States. With approximately one in every five patients admitted to an acute care hospital receiving an indwelling catheter, urinary catheter use is common. Infection frequently occurs after placement of urinary catheters; each day of catheter use is associated with an approximately 5% increase in bacteriuria. Each episode of catheter-associated urinary tract infection costs at least $600; each episode of urinary tract-related bacteremia costs at least $2800. Because catheter-associated urinary tract infection is common, costly, and believed to be “reasonably preventable,” it was chosen by the Centers for Medicare and Medicaid Services (CMS) as one of the complications for which hospitals no longer receive additional payment.

To help prevent catheter-associated urinary tract infections, Texas Health Resources (Texas Health) developed guidelines and a best practice protocol that was approved by each of our 14 hospital’s Medical Executive Committees. Texas Health’s information system’s department used collaborative and social media tools to rapidly incorporate this best practice protocol within our EHR. The use of these tools enabled a team of 5 to quickly modify and test changes to 1,639 order sets, deploy this best practice to the entire organization within 3 weeks (go-live was December 3, 2011), and achieve wide-spread adoption of this best practice. Evidence of this project’s success is illustrated by the over 26% reduction in the length of catheter line days within 90 days of deployment.

By:
Texas Health Resources
Texas Health Innovative Technology Solutions
610 E. Lamar Blvd
Suite 300
Arlington, Texas 76011

Ellen Batch, RN, BSN, CCRN, CPHIMS  Sallie K. Moore
EHR Applications System Analyst III  Director, IS Strategy and Business Services
(682) 236-7355  (682) 236-6649
elenbatch@texashealth.org  salliemoore@texashealth.org

National Patient Safety Goal Alignment
• Use proven guidelines to prevent infections of the urinary tract that are caused by catheters.

Partnership for Patients
• Keep patients from getting injured or sicker. Area of focus: Preventing Catheter-Associated Urinary Tract Infections

Health Information Technology
• Electronic Health Record (EHR)
• Computerized Provider Order Entry (CPOE)
• Clinical Decision Support System (CDSS)

Meaningful Use Goals:
• Improve quality, safety, efficiency, and reduce health disparities
• Improve care coordination
Background Knowledge.

**Care Problem.** Catheter-associated urinary tract infection (CAUTI), a common and potentially preventable complication of hospitalization, is the most frequent healthcare-associated infection in the United States. With approximately one in every five patients admitted to an acute care hospital receiving an indwelling catheter, urinary catheter use is common. Infection frequently occurs after placement of urinary catheters; each day of catheter use is associated with an approximately 5% increase in bacteriuria. Each episode of catheter-associated urinary tract infection costs at least $600; each episode of urinary tract-related bacteremia costs at least $2800\textsuperscript{ii}. Because catheter-associated urinary tract infection is common, costly, and believed to be “reasonably preventable,” it was chosen by the Centers for Medicare and Medicaid Services (CMS) as one of the complications for which hospitals no longer receive additional payment.

**Organization.** Texas Health Resources (Texas Health) is one of the largest faith-based, nonprofit health care delivery systems in the United States. It includes 14 acute-care hospitals, one transitional care hospital and 3,800 licensed hospital beds that serve more than 6.2 million people living in 16 counties. Texas Health employs more than 21,500 staff and more than 5,500 physicians with staff privileges. Annually Texas Health has more than 1.3 million inpatient and outpatient visits including 24,573 deliveries and 557,785 emergency visits.

Local Problem.

Variation at the point of care may lead to preventable catheter-associated urinary tract infections. The adoption and incorporation of best practice protocols into the electronic health record (EHR), reduced the care variation among caregivers and facilities.

There are different levels of awareness among entities, in monitoring infection rates related to urinary catheters and documentation of catheter insertion and removal times. Upon implementation of the protocol and education, there is increased awareness among clinicians and increasing documentation compliance.

Intended Improvement.

**Specific Aim.** Improving patient safety and quality by utilizing health information technology to drive consistent practices at the point of care throughout the enterprise in order to prevent catheter-associated urinary tract infections is our specific aim.

**Who, What, Why.** Chief Quality Officers (CQO) were engaged to work with each hospital’s Medical Executive Committee (MEC) so that best practice protocols would be approved and adopted. Once this was accomplished and working with our performance improvement team, Texas Health information system’s department used collaborative and social media tools to rapidly develop and test this best practice protocol so that it could be quickly incorporated within our EHR.

The use of these tools enabled a team of 5 to quickly modify and test changes to 1,639 order sets and deploy this best practice to the entire organization within 3 weeks (go-live was December 3, 2011). These tools were also used to communicate and educate clinicians to help gain acceptance of these changes.

Evidence of this project’s success is illustrated by the over 26% reduction in the length of catheter line days after 90 days of deployment.
Planning the intervention

Texas Health created system clinical guidelines and a best practice protocol that established criteria for urinary catheter removal by the nurse within 48 hours post placement, if no physician order is placed. These guidelines were based on the 2008 CDC Guidelines to Prevent Urinary Tract Infections and recommendations cited in the NQF #25 Safe Practices for Better Health Care.

This clinical guideline and protocol was piloted at 1 hospital. The pilot tested the protocol and care documentation, which was done on paper. During this pilot, feedback was obtained from physicians and nurses so that the guidelines and protocol could be refined. Once this was accomplished and a decrease in catheter line days was realized, adoption of these guidelines and protocol were expanded system-wide.

This was accomplished by engaging each hospital’s CQO and Chief Nursing Officers (CNO). Each CQO solicited support and approve of these guidelines and protocol by their MEC. Each CNO ensured the protocols were implemented at the point of care. Each of the Texas Health’s 14 hospital’s MECs approved this protocol over a 9 month period. The final hospital MEC approved in November of 2011.

Once the best practice protocol was approved, Texas Health dedicated resources from information systems, clinical decision support, performance improvement and clinical staff to explore a practical solution to reduce point of care variations through innovative use of the EHR.

Integration of Best Practice Protocol into the EHR. Leveraging existing functionality of the EHR, the approved protocol was incorporated into our clinician workflow. From order entry, we automated the presentation of both “Insertion” and “Discontinue per protocol” orders. These two orders are grouped/linked together. By linking them together, order entry is facilitated so with one action two orders can be placed 1. to insert a catheter then 2. discontinue catheter per protocol based on approved criteria. This modification helps minimize the use of pop-up reminders and alerts that disrupt clinician’s ordering workflow - preventing alert fatigue in the early phase of implementation. Easy access to the protocol and catheter removal indications are made available through order entry and order acknowledgement (see image Protocol Guidance Incorporated into Order Workflow).

Incorporating this new protocol into the EHR required major changes to order entry activities and order set content. It also required changes to flowsheet documentation to support periodic assessment by nursing to determine whether a catheter can be removed based on approved criteria. The flowsheet screen provides easy access to the protocol as reference and guidance for the clinician while the catheter is in place (see image Additional Protocol Guidance Incorporated into Workflow).

Incorporating these guidelines into our EHR required major revisions to orderable items and order sets. To facilitate the management of this effort, collaboration tools were used by the project team. Social media tools were used to help rapidly deploy this effort throughout the organization. As a result, 1,639 order sets were modified, tested then deployed within one month.

Collaboration tools. Like other adopters of the EHR, this IDN faces challenges with managing customized components such as order sets. Rather than using spreadsheets, which can create version control issues as multiple concurrent users can update, we customized Sharepoint - a collaboration tool used to facilitate workflow and manage components of the EHR. Sharepoint can be accessed and updated by multiple users real-time. One useful customization was a search tool (see image Sharepoint Customizations). By using this tool, our EHR Clinical Decision Support team was able to quickly identify the 1,639 order sets impacted by the new catheter protocol from within the 3,000+ existing order sets.

The identified order sets were prioritized and arranged according to their Utilization rates from the past 6 months, and was assigned to each team member/builder. The Builder Workspace, (see image Builder Workspace using Collaboration Tools), is another customized build utility we created in Sharepoint. It helps the builder see all the assigned Order sets. As each order set is selected, the corresponding sections within the Order set, that needs the modifications, are exclusively presented. This allows the builder to
efficiently modify the appropriate section of the Order set and can quickly document once completed. The Order set automatically drops down to the bottom of the list as the builder completes each task. The status of the order set was automatically updated within the Team Lead’s dashboard to monitor the progress of the build.

Other collaboration tools such as Office Communication Server (OCS) and Live Meeting were used to streamline the development and testing processes. The use of these tools enabled a more diverse customer base to participate in the development and testing of this protocol within the EHR. It removed barriers traditionally imposed by the geography. Rather than requiring clinicians to spend hours traveling to a central location to provide input and/or test, these tools were used to share information. That way efforts were focused on achieving the end goal rather than spending time traveling between locations.

When deploying this best practice, Texas Health delivered training to clinicians via our web-based learning management system, My Talent. This enabled clinicians to quickly complete training immediately before implementation (see image My Talent – Web-based Learning Management System).

**Social Media Tools.** Texas Health uses Yammer, a social media tool, to bring the power of social networking inside our enterprise in a private and secure environment. This tool enabled our IT team to quickly share ideas and updates. Most importantly, it enabled the team to inform caregivers of the initiative, disseminate accurate information quickly and effectively (see image - Yammer Announcement of Urethral Catheter Protocol), as well as solicit feedback (see image - Feedback from physicians using social media).

**Outcomes: Nature of setting and improvement intervention.**

Engaged Chief Quality Officers and entity champion leadership were crucial to success. Our CQOs were able to successfully work with each MEC to gain acceptance and approval of the best practice protocol. Both physician and nursing leaders as well as end users were actively engaged in the development process, providing feedback and input into the design of this best practice protocol into the EHR.

Education on the importance of early catheter removal and the assessment criteria was critical and achieved through the active support of our nursing leaders. Conducting nursing assessments of the need for continued urinary catheter at each shift using MEC developed criteria for removal is another outcome as a result of this effort.

**Outcomes: Changes in processes of care and patient outcomes associated with the intervention.** Use of the best practice protocol has increased since it went into production within the EHR on December 3, 2011. As of March 11th approximately 90 days after implementation, usage is now averages 29% (see image - Urethral Catheter Protocol Usage by Month below). As of May 2012, the average protocol utilization has gone up to 31.83%. The first 2 months of implementation showed that 93-94% of the protocol were entered via Order sets (see image – Order Set utilization).

Most importantly, the average number of catheter line days has decreased as well. When the best practice protocol is used, the average catheter line day is 1.88 days. When it’s not used, the average catheter line day is 1.41 days, as of May 2012. (Refer to image - Average Line Days trend over time (June-11 to May-12). This is a significant reduction in catheter line days (see Line Days Statistics).

The pilot entity showed an improvement of their CAUTI rates from 1.6 per 1000 foley days in 2011 to 1.07 per 1000 foley days by the end of the 1st Quarter of 2012.

As of March 2012, the expected number of CAUTI’s was 15.374 as calculated based on NHSN average times the entity’s number of foley days for each type of ICU. Texas Health observed 10.
To date, the expected number of CAUTIs (YTD) is 47.44. Texas Health observed 37 CAUTIs with the Standardized Infection Ratio (SIR) of 0.78.

**Barriers & Challenges.**

1) Texas Health hospitals are geographically dispersed throughout the Dallas-Fort Worth area. Communications is always been a challenge. All project participants from key stakeholders to telecommuting project team members and clinicians had to be in constant communications to make this project successful.

2) Clinician Buy-in – As the protocol was introduced to the Medical Executive Committees (MEC) of each hospital for approval, there were some pushbacks from the physicians and questions regarding the criteria for catheter removal and associated workflow. Adjustments were made in the workflow and how the protocol will be implemented and utilized were modified to reach a consensus and approval. The initial design based on the paper pilot had to be changed in order to accommodate all MEC feedbacks.

3) Inspite of rigorous testing, there were system limitations that were met during implementation which resulted to the vendor making some enhancements and changes to the code. This code enhancement is available for use by any of their customers.

**Sustainability.** – Continuous data collection and reporting of Foley line days and CAUTI rates require dedicated staff to monitor, track and trend this project. The collaboration between entity Infection Control staff, PI and the Clinical Decision Support team, both process and patient outcomes are monitored and evaluated. This enables us to identify any further opportunities for improvement concerning clinician workflow, and periodically evaluate the effectiveness of the CDS interventions (i.e. alerts, order sets, reference links, etc) in place. This will help us identify need for further CDS build.

Social Media and the collaborative technologies utilized in this project are useful to any type of project. Crowd sourcing end user and clinician feedback within a social media platform provides valuable information to the success of the project. The customized Builder tools, are efficient means to rapidly identify Order sets needing updates, modifications or remediation. A sample utilization of these builder tools is addressing FDA updates that require immediate removal or replacement of drugs pulled out of market for safety reasons.

**Summary.**

With planning, support and open communication (supported by social media and collaborative tools) and leveraging an EHR, it is possible to advance a standardized MEC approved standing/delegated order across all hospitals within a large integrated healthcare delivery system, like Texas Health - even with a voluntary medical staff. Critical success factors include:

- Gaining strong commitment and support from senior leadership (QI, CQO, CNIO, CMIO) during the approval process and throughout the project
- Early involvement of end users to obtain buy-in and early identification of process and workflow gaps.
- Early and frequent communication to end users.
- On-demand training provided immediately before implementation.
Using social media and collaboration tools greatly facilitated the development, testing, and adoption of best practices throughout a large organization. It enabled users who are located remotely to be engaged and have input into the development, testing and implementation process. By using these tools to actively engaging physicians and nurses early in the development, support was gained and champions created to encourage adoption and usage.

As a result, usage of the best practice keeps increasing; the average catheter line days keep decreasing; and Texas Health patients benefit.

**Conclusion**

In 90 days post implementation, Texas Health has achieved 26% reduction in catheter line days and averages 29% usage of best practice protocols. This is just the beginning. This best practice will be continually monitored at both the hospital- and system-level. Based on trending, Texas Health will embark on phase two. This will include making additional refinements to increase clinical adoption and compliance. It may also include additional clinical decision support tools such as clinical alerts/reminders and on-going training and support in the clinical setting.

**Protocol Guidance Incorporated into Order Workflow**
Additional Protocol Guidance Incorporated into Nursing Flowsheet
SharePoint Customizations

Builder Workspace using Collaboration Tools
Order Set Build Status Tracker

My Talent – Web-based Learning Management System
Yammer Announcement of Urethral Catheter Protocol

**IDN Staff**

**ANNOUNCEMENT:** (Just a friendly reminder from the Clinical Decision Support Team)

New tools to support the Urethral Catheter Management and Removal Protocol approved by the MECs across IDN, will be released this Saturday, Dec 3rd. It is based on a system-wide Quality initiative to better track the use of and reduce the number of hospital acquired infections (HAIs) from urethral catheters.

A new Smartgroup panel will replace the single order, “Insert Foley” in the Order workflow.

**STOp_Sheet:***

**Urethral_Catheter_Removal_Workflow_Philosophy**

Uploaded to All Network Files

View Conversation

**Return to search results for “urethral”**

**IDN Physician**

It was brought to my attention that one cannot simply write a “discontinue Foley” order anymore. The closest order that Dr. Richwine and I could find is “discontinue urethral catheter 48 hr post placement (foley)”. One could select “now” if you select this order but it had caused some confusion. Is there any way to bring back the old “discontinue Foley” order? # weekendmedicine # foley

December 4, 2011 at 11:13am from Android - Reply - Like - ...More

**IDN Staff**

**ORDERS TEAM UPDATE:** The “Discontinue urethral catheter” order is now found in the physician's preference list. This order should also pull up when you type in “Discontinue Foley”, “Foley,” or “discontinue”...

Please let us know if you are still having any issues related to any urethral catheter (Foley) orders in Care Connect. Thank you, Dr. @IDN Doc for your feedback.

December 4, 2011 at 3:30pm - Reply - Like - More

**IDN CQO:** Thanks for the rapid fix!

IDN CQO, MD, FACS
Protocol usage increases over time (Dec-11 to May-12)

Protocol Order:

“DISCONTINUE URETHRAL CATHETER WITHIN 48HRS POST PLACEMENT PER PROTOCOL”

Karan Garg, CDSIQ, May 2012

Urethral Catheter Protocol
Order set utilization

- 93.5% of the Protocols, ordered came from an order set.
Average Line Days trend over time (June-11 to May-12)

Care Connect tools implemented on Dec 3rd 2011

Ongoing MEC approvals across different entities
### Line Days Statistics

<table>
<thead>
<tr>
<th></th>
<th>Average Line Days (n)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Protocol</td>
<td>Without Protocol</td>
<td></td>
</tr>
<tr>
<td>Dec-11</td>
<td>1.41 (656)</td>
<td>1.84 (1857)</td>
<td></td>
</tr>
<tr>
<td>Jan-12</td>
<td>1.28 (740)</td>
<td>1.80 (1330)</td>
<td></td>
</tr>
<tr>
<td>Feb-12</td>
<td>1.33 (594)</td>
<td>1.75 (2271)</td>
<td></td>
</tr>
<tr>
<td>March-12</td>
<td>1.22 (1218)</td>
<td>1.67 (2395)</td>
<td></td>
</tr>
<tr>
<td>April-12</td>
<td>1.42 (1484)</td>
<td>2.22 (2457)</td>
<td></td>
</tr>
<tr>
<td>May-12</td>
<td>1.41 (1602)</td>
<td>1.88 (2632)</td>
<td></td>
</tr>
</tbody>
</table>

#### t-Test: Two-Sample Assuming Equal Variances

<table>
<thead>
<tr>
<th></th>
<th>without protocol</th>
<th>with protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.83</td>
<td>1.35</td>
</tr>
<tr>
<td>Variance</td>
<td>10.04508138</td>
<td>3.217797762</td>
</tr>
<tr>
<td>Observations</td>
<td>12820</td>
<td>6290</td>
</tr>
<tr>
<td>Pooled Variance</td>
<td>7.796106443</td>
<td></td>
</tr>
<tr>
<td>Hypothesized Mean Diff.</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>19116</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>11.17581619</td>
<td></td>
</tr>
<tr>
<td>P(T ≤ t) one-tail</td>
<td>3.29157E-29</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.644933343</td>
<td></td>
</tr>
<tr>
<td>P(T ≤ t) two-tail</td>
<td>6.58314E-29</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.960088091</td>
<td></td>
</tr>
</tbody>
</table>

Significance Level \( \alpha = 0.001 \)

Since \( P < \alpha \), implies that the 2 samples have different means, rejects the null hypothesis that the 2 samples have the same means with a 99.9% confidence level.

---
