Reducing Rates of Catheter-Associated Urinary Tract Infection

One Magnet hospital implemented a nurse-managed approach.

Research suggests that the longer a Foley catheter remains in place, the higher the risk of infection becomes. Various guidelines have stated that the best practice is to limit the number of patients who receive a Foley catheter, and when one is used that it be removed when it's no longer medically indicated. But clearly, not all hospitals comply with those recommendations.

In 2007 Pennsylvania became the first state to order hospitals and nursing homes to report all health care–acquired infections to state authorities and to the Centers for Disease Control and Prevention (CDC), as a part of Prescription for Pennsylvania, the state’s sweeping health care reform plan. Of the nearly 14,000 health care–associated infections reported in Pennsylvania in the last six months of 2008, nearly a quarter were urinary tract infections—the most common—and 69% of those were associated with the use of catheters.

The fight against catheter-associated urinary tract infection (CAUTI) has been ongoing. It was a part of the Institute for Health Care Improvement’s 100,000 Lives Campaign in 2004 and its 5 Million Lives Campaign in 2006, each seeking to reduce the rates of preventable “medical harm” to hospitalized patients. And in October 2008 the Centers for Medicare and Medicaid Services stopped reimbursing hospitals for the treatment of eight preventable hospital-acquired conditions, including CAUTI. Recognizing the seriousness of CAUTI as a patient safety issue, Lancaster General Hospital, a 350-bed Magnet hospital in eastern Pennsylvania, where I work in performance improvement, took action. In 2006 the defining criteria for CAUTI at the National Healthcare Safety Network (NHSN) included both symptomatic infections and asymptomatic bacteriuria. We found a CAUTI rate in our critical care units of 7.9 per 1,000 Foley catheter days, compared with the NHSN national mean for critical care units of 3.1 to 7.5 per 1,000 Foley catheter days. No national benchmarks for hospital-wide CAUTI rates were available at the time; therefore, we compared our hospital-wide data over time, looking for internal trends. In response to these rates, the hospital assembled a team to assess the best practices for decreasing the incidence of CAUTI.

We knew that no single practice would eliminate CAUTI; we would have to take a multifaceted approach. We embarked on this process through “shared governance”—a framework whereby both nursing leaders and bedside nurses have autonomy, accountability, and decision-making authority in the workplace. (For more information on shared governance, see “Shared Governance Supports Evidence-Based Practice,” Cultivating Quality, November 2009.) And for quality improvement, the hospital used the Plan–Do–Study–Act model, in which a change in practice is first proposed, then tested and observed before being implemented; after implementation, the model requires ongoing assessment.

We began with education, and over a period of two years we identified and tested product enhancements. We then added a unique aspect, a “nurse-driven protocol” for Foley catheter removal, in which nurses documented daily the medical necessity of Foley catheters and were empowered to remove them when they were unnecessary.

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A THREE-PRONGED APPROACH

In 2006 Lancaster General’s hospital-wide Environmental
The role of biofilm in CAUTI. Many nurses were unaware of the increased risk of CAUTI for each day the catheter remains in place. Also, some believed that intermittent catheterization carried a greater risk of CAUTI than indwelling catheterization. But that isn’t the case, in part because of biofilm—a complex compound of proteins, electrolytes, and other organic matter that accrues on indwelling devices such as catheters. Bacteria and yeasts attach firmly to the biofilm and multiply rapidly; bacteria, partially protected by the biofilm, may become antibiotic resistant. A common example of a biofilm is tooth plaque, which forms from microbes normally present in the mouth. Unless removed by routine oral hygiene, plaque can lead to tooth decay and gum disease and in extreme cases progress to abscess formation, sepsis, and death. Similarly, a Foley catheter will develop a biofilm that colonizes the bladder with microbes, which can lead to bladder infection that, if left untreated, may lead to sepsis and death.

Proper collection of urine specimens is essential to the diagnosis and treatment of urinary tract infection. (Improper technique can also introduce microbes that cause an infection.) Determining the causative microbe is

Figure 1. StatLock Foley Stabilization Device with Intact Tamper-Evident Seal

Product improvements included the use of a closed Foley catheter system with a tamper-evident seal, a catheter securement device, and a collection port for direct transfer of urine specimens.
difficult when urine specimens are contaminated; without proper identification, inappropriate antibiotic prescribing can occur and lead to antibiotic resistance. Both the health care worker and the patient must adhere to proper specimen-collection techniques. Before collecting a specimen from a Foley catheter, the nurse should take an extra 15 to 20 seconds to “scrub the hub” of the collection port with alcohol and allow it to air dry. The use of a direct-transfer device, whereby the urine is transferred from the Foley catheter into the culture tube in only one step, also decreases the likelihood of contamination. The sample should be delivered to the laboratory promptly after collection.

The NHSN defines a CAUTI as a urinary tract infection that occurs while the Foley catheter is in place or within 48 hours of its insertion. Nurses might assume, incorrectly, that the use of iodine swabs is adequate for perineal cleansing, but the antiseptic effect of iodine is diminished in the presence of blood and body proteins. If the catheter is contaminated during insertion, a new closed system must be obtained. Sterile catheter insertion in hospitals is not complicated, but it can be difficult because it requires attention to detail and a commitment to begin again when contamination occurs. Care of the Foley catheter is multifaceted, and our educational efforts focused on catheter securement, perineal cleansing, and the position of the catheter bag. The goal of securement is to stabilize and prevent tension on the Foley catheter, and we believe that minimizing inadvertent tugs on the catheter might diminish the disruption of biofilm. Washing removal. When taking a voided sample, proper technique is also essential. The first step is to cleanse the perineal area with soap and water. A clean-catch, mid-stream specimen from a female patient requires the separation of the labia, and a male patient must take care not to touch his penis to the inside of the collection cup. Sterile technique during catheter insertion and closed-system maintenance. The optimal Foley catheter system is a closed one, with an indicator verifying that it’s closed. Although more study is needed to determine whether sterile technique reduces rates of CAUTI, our hospital’s protocol requires that the nurse wash the patient’s perineal area with soap and water before opening the catheter-insertion kit. (The nurse must also perform hand hygiene before and after cleansing the perineal area, among other infection-control measures.)

Nurse-Directed Protocol for Removal of Foley Catheters at Lancaster General Hospital

Nurses at Lancaster General Hospital assess all patients with indwelling catheters daily using the following criteria (these are reasons to maintain a Foley catheter, not to insert one). The nurse removes the catheter unless one or more of the following criteria are met. For each day the patient has a catheter, the date and criteria for keeping it in place are documented in the electronic medical record.

A nurse keeps the Foley catheter in place if

- a urologist is on the case; the catheter cannot be removed without the urologist’s approval.
- a physician has ordered that the catheter not be removed (the medical reason to continue or criteria for removal should be documented).
- a physician has documented “medical necessity” within the last 24 hours.
- the patient is unresponsive or comatose.
- the patient is receiving palliative or hospice care.
- the patient has received IV sedation within the last 12 hours.
- the patient has received IV inotropic agents within the last 24 hours.
- there is an order for IV diuretics to be given every six or fewer hours.
- the patient is undergoing ultrafiltration.
- acute or worsening renal failure is evident (that is, there has been a creatinine level increase of 1 mg/dL or more above the admission or baseline level).
- surgery has been performed within the last 24 hours.
- a pressure ulcer might be soiled if the catheter is removed and the patient is incontinent.
the perineal area daily with soap and water removes mucus and fecal material that harbor bacteria. 

Editor’s note: a recent literature review by Wilson and colleagues shows that more study is needed to determine whether either catheter securement or perineal cleansing has a statistically significant effect on CAUTI rates. More frequent cleansing of the perineum may be warranted if, for example, fecal incontinence occurs. Also, the catheter-drainage bag must always be positioned lower than the bladder (to prevent the flow of urine from the bag back into the bladder) and never on the floor (where it can become contaminated). During transport, the drainage bag is often placed next to the patient on a stretcher, but it should be placed on the end of the stretcher frame, away from side rails that might be raised and lowered. Also, personnel transporting patients should be instructed in the positioning of the Foley catheter bag.

Prompt removal of Foley catheters. The Association for Professionals in Infection Control and Epidemiology guidelines on preventing CAUTI state that there is an overreliance on Foley catheters because of “complexities of care, increased acuity, and severity of illness and decreased staffing levels” and that there is a “high frequency of inappropriate and unjustified use of urinary catheters.” I have found that some hospitalized patients who are immobile or in pain prefer a Foley catheter and might not understand the benefits of “trips to the bathroom”—decreasing the risk of deep vein thrombosis, pulmonary embolism, pneumonia, and skin breakdown. The use of Foley catheters for the convenience of either nurses or patients must be discouraged.

Product enhancements included our use of a closed Foley catheter system, manufactured by Bard Medical Division, that has a tamper-evident seal—a plastic wrapper covering the connection site of the catheter and the catheter bag (not to be mistaken for the disposable packaging) that validates that a closed system has been maintained (see Figure 1).

We also tested the use of an improved catheter securement device. Our hospital uses the StatLock Foley Stabilization Device for catheter securement (see Figure 1). Leg-strap securement devices were eliminated from the available stock because tight straps might not be appropriate for patients at risk for deep vein thrombosis. We use the securement device on all catheterized patients, except for those with fragile skin or “third spacing” (that is, excess fluid in the interstitial space), for whom the use of a securement device may increase the risk of blister development.

In addition, we instituted the use of a direct-transfer device for urine-specimen collection.

The silver-alloy Foley catheter was the most recent new product we used. The value of silver technology in Foley catheters has received mixed reviews. But some studies have shown a decline in the risk of infection with silver-alloy catheters, and our facility found that use of a silver-alloy catheter was an important part of our quality improvement project.

A nurse-driven protocol for catheter removal. In our hospital, as in most hospitals, Foley catheter removal has required a physician’s order. But because
not all physicians know which of their hospitalized patients has a Foley catheter in place, a reminder system may help to decrease the incidence of CAUTI. Reminder systems may require action on the part of either a physician or a nurse.

Our hospital’s leadership gave nurses the authority to remove Foley catheters through the use of a protocol of specific criteria defining medical necessity; criteria were refined so as to be measurable rather than subjective (see Nurse-Directed Protocol for Removal of Foley Catheters at Lancaster General Hospital). In accordance with Pennsylvania law, which requires daily assessment and documentation of medical necessity in catheterized patients, our nurses assess all catheterized patients daily, using these specific criteria, and document their findings. If the nurse identifies no medical necessity, she or he removes the Foley catheter.

The “small tests of change” theory was used in the development and evaluation of the nurse-driven protocol. Staff from nine nursing units assisted. Initially, team members tested the protocol only on patients assigned to them. Based on their feedback, wording and definitions were refined to enhance the protocol, which was then tested by several nurse colleagues from their respective units and again revised. This period of refinement helped team members to conduct a successful two-month pilot test of the protocol, which included the nine nursing units involved in developing the tool, or roughly half of the hospital’s nursing units. During the pilot test, no Foley catheters were removed without a physician’s order. Instead, the nurse and the physician discussed the protocol and the plans for its full use. Additional physician education occurred at staff meetings and in office mailings. After the pilot test, the protocol was implemented hospital wide.

RESULTS
Analysis of hospital-wide data show no statistically significant difference between fiscal year 2007 (March through June 2007) and fiscal year 2008 (July 2007 through June 2008) ($P = 1$). But when comparing fiscal year 2008 with fiscal year 2009 (July 2008 through June 2009), there was a statistically significant reduction in the CAUTI rate of 1.23 per 1,000 Foley catheter days (95% confidence interval [CI], 0.6 – 1.87; $P = 0.001$). And when comparing fiscal year 2007 with fiscal year 2009, there was a statistically significant reduction in the CAUTI rate of 1.72 per 1,000 Foley catheter days (95% CI, 0.68 – 2.77; $P < 0.001$). (See Figures 2 and 3.) These calculations were based on the Bonferroni method using the two-sample Poisson Test.

BENEFITS AND LIMITATIONS
The CDC's Healthcare Infection Control Practices Advisory Committee produced guidelines for prevention of CAUTI in 2009 that supported a nurse-driven protocol for catheter removal with a “strong recommendation supported by low quality evidence.” Such a protocol should be one effort among many in a hospital’s quest to decrease its CAUTI rates.

The nurse-driven protocol gave new responsibilities to our bedside nurses, some of whom were initially hesitant to take it on. We addressed hesitation with education and support; we noted no adverse outcomes or inappropriate catheter removal, and now this protocol is our standard. Any nurse who’s uncomfortable or unsure about whether a catheter should be removed can discuss it with the physician during rounds. It’s then the physician’s responsibility to document why it should be maintained for one more day. Otherwise, the nurse removes the Foley catheter per hospital policy. Our experience

![Figure 3. Lancaster General Hospital’s Catheter-Associated Urinary Tract Infection Rates, Fiscal Years 2007, 2008, and 2009](image-url)
has shown that such a protocol has the most impact when used in concert with education and the best products available.

**Limitations.** The measurement outcome for the initiatives was the reportable CAUTI rate as defined by the NHSN. Since Pennsylvania’s mandate that its hospitals conduct hospital-wide surveillance and report all CAUTI cases, the use of CAUTI rates as an outcome measure didn’t increase the infection-control staff’s workload, require patient consent, or present unusual ethical dilemmas. Each initiative built upon the others, and this cumulative effect prohibited us from separating out the effect of each intervention.

The NHSN reporting definition changed on January 1, 2009, to include only symptomatic CAUTI, excluding asymptomatic bacteriuria. Lancaster General had an internal electronic database to retrospectively calculate symptomatic CAUTI rates from March 2007. Prior data are unavailable. Currently, data are collected under the newer reporting guidelines; thus, data compiled before March 2007 cannot be compared with current data.

**Relation to other evidence.** On January 12 of this year, when Pennsylvania released its first report on health care–associated infections, Lancaster General Hospital had a lower rate of CAUTI for the last six months of 2008 than almost all other hospitals in the state, according to its adjusted standardized infection ratio.1 We credit the combination of all the initiatives outlined in this article as the driving force behind the comparatively lower CAUTI rate we achieved. ▼

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**REFERENCES**


