Reducing Foley Catheter Device Days in an Intensive Care Unit
Using the Evidence to Change Practice

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The prolonged use of indwelling urinary catheters can lead to many complications, the most prevalent being urinary tract infections. These hospital-acquired infections can increase hospital costs, length of stay, and mortality rates. Evidence-based guidelines for the prevention of urinary tract infections are compared and discussed. Minimizing indwelling urinary catheter use is well-recognized in the literature to reduce the risk of these infections. To decrease the incidence of catheter-associated urinary tract infections, the staff of a 22-bed, mixed medical, surgical, and trauma intensive care unit focused on reducing the number of foley catheter device days. A multidisciplinary team was convened to create an evidence-based plan. Staff nurses were engaged in the development and implementation of the plan. Criteria-based foley catheter guidelines, a decision-making algorithm, and a daily checklist were implemented that led to a significant reduction in foley catheter device days and a decrease in catheter-associated urinary tract infections. Keywords: critical care, urinary catheter, urinary tract infections

Catheter-associated urinary tract infections (UTIs) are the most common hospital-acquired infection and can lead to increased length of stays, mortality rates, and ultimately higher hospital costs. The length of time foley catheters remain in situ is directly related to increases in UTIs. This article describes a step-by-step clinical quality initiative to reduce UTIs by reducing foley catheter device days in an intensive care unit (ICU). A multidisciplinary team was assembled, and staff was engaged to develop the plan. Criteria-based foley catheter guidelines, a decision-making algorithm, and an educational program were developed and implemented. The strategy resulted in a significant reduction in foley catheter device days and a decrease in catheter-associated UTIs. This project supported an evidence-based quality improvement approach to change clinical practice and improve patient outcomes.

Practice Problem: Incidence, Diagnosis, and Prevalence of Urinary Tract Infections
Approximately 30 million indwelling urinary catheters are used in the United States each

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year. This is estimated to be 15% to 25% of all hospitalized patients. Urinary tract infections are the most prevalent hospital-acquired infection and are directly associated with the use of indwelling urinary catheters, or foley catheters. The literature estimates that UTIs account for 40% of all hospital-acquired infections, and that 80% of these infections are secondary to a foley catheter. There are 2 routes that allow bacteria to enter into the catheterized patient. Intralumenal migration allows passage through the inside of the catheter tubing. Extralumenal migration allows passage in the space between the urethral mucosa and outside of the catheter tubing.

The National Nosocomial Infection Surveillance (NNIS) system is a national database developed by the Centers for Disease Control and Prevention (CDC) to benchmark infection rates of similar hospitals. The CDC classifies catheter-associated UTIs into 2 groups: symptomatic UTIs and asymptomatic bacteriuria (Table 1). The term catheter-associated means that the patient had a foley catheter at the time or within 7 days of the onset of the infection.

NNIS criteria define the incidence of catheter-associated UTI by dividing the number of UTIs by the number of foley catheter days and multiplying by 1000 (UTIs/1000 foley days). The NNIS benchmarks are published annually and are determined by calculating the pooled mean infection rates for similar participating critical care units. There are over 300 participating hospitals in the NNIS database. The pooled mean for medical/surgical ICUs in major teaching hospitals in 2004 was 3.9 UTIs/1000 foley days.

The complication of a UTI can increase a patient's hospital length of stay by 0.4 days for an asymptomatic UTI and 2.0 days for a symptomatic UTI. One recent cost analysis of UTIs estimated an additional expense ranging from $401 to $1,727 per UTI. Additional reported estimates have been as high as $3,803 per infection.

Other complications associated with the use of foley catheters include urethritis, urethral strictures, hematuria, bladder perforation, catheter obstruction, and urosepsis. Urosepsis is a life-threatening infectious complication, and its associated risk increases with prolonged indwelling urinary catheter usage. Urosepsis mortality rates are reported as high as 25% to 60%.

### Table 1: CDC Criteria for Diagnosis of Symptomatic Urinary Tract Infection and Unsymptomatic Bacteriuria

<table>
<thead>
<tr>
<th>I. Symptomatic UTI must meet at least one of the following criteria:</th>
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<tbody>
<tr>
<td>1. Positive urine culture with ( \geq 10^5 ) cfu/mL urine with 2 or less bacterial species and 1 of the following symptoms with no other recognized cause:</td>
</tr>
<tr>
<td>a. Fever (( &gt;38^\circ C ))</td>
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<tr>
<td>b. Frequency</td>
</tr>
<tr>
<td>c. Urgency</td>
</tr>
<tr>
<td>d. Dysuria or suprapubic pain at palpation</td>
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<tr>
<td>e. Positive urine culture</td>
</tr>
<tr>
<td>2. Two of the following symptoms with no other recognized cause: fever (( &gt;38^\circ C )), frequency, urgency, dysuria or suprapubic pain at palpation and one of the following findings:</td>
</tr>
<tr>
<td>a. Evidence of leukocyte-esterase and/or nitrate</td>
</tr>
<tr>
<td>b. Pyuria (( \geq 10 ) leukocytes/mm (^3 ) or ( \geq 3 ) leukocytes/high power field of uncentrifuged urine)</td>
</tr>
<tr>
<td>c. Microscopic evidence of pathogen in Gram-stain of uncentrifuged urine</td>
</tr>
<tr>
<td>d. Two urinary cultures with an identical uropathogen ( \geq 10^5 ) cfu/mL from correctly obtained specimens</td>
</tr>
<tr>
<td>e. Pure culture with ( \leq 10^5 ) cfu/mL after appropriate antibiotic treatment</td>
</tr>
<tr>
<td>f. Physician diagnosis of a UTI</td>
</tr>
<tr>
<td>g. Physician institutes appropriate therapy for a UTI</td>
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<tr>
<th>II. Asymptomatic bacteriuria must meet at least one of the following criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patient has an indwelling urinary catheter within 7 days before the culture and patient has a positive urine culture, that is ( \geq 10^5 ) cfu/mL with 2 or less bacterial species, and patient has no fever (( &gt;38^\circ C )), urgency, frequency, dysuria, or suprapubic tenderness.</td>
</tr>
<tr>
<td>2. Patient has not had an indwelling urinary catheter within 7 days before the first positive culture and patient has had at least 2 positive urine cultures, that is, ( \geq 10^5 ) cfu/mL with 2 or less bacterial species and patient has no fever (( &gt;38^\circ C )), urgency, frequency, dysuria, or suprapubic tenderness.</td>
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UTI, urinary tract infection.
Evidence-based Practice: Strategies to Decrease Urinary Tract Infections

Evidence-based guidelines for the care and maintenance of foley catheters are published by a number of different groups, including the CDC, Joanna Briggs’s Institute, and the Association of Practitioners in Infection Control (APIC). Whereas these national guidelines are very similar, there are some differences in their recommendations (Table 2). For example, the CDC recommends properly securing the catheter to the leg, but Joanna Briggs’s Best Practice document does not address this issue. The CDC also recommends sterile technique during insertion, but Joanna Briggs states that sterile technique does not reduce the risk of UTI.

In an effort to base nursing practice on the best supporting evidence at our institution, changes were implemented to decrease the incidence of catheter-associated UTIs. Product evaluation, practice issues, and education were integral to implementing change. There were several studies that supported the use of silver-alloy catheters for the reduction of catheter-associated UTIs and a meta-analysis of the research supported their use. Silver-alloy catheters were purchased and these catheters have become the standard of care in this facility. Studies have shown the benefit of a closed drainage system. Catheter kits were implemented to provide a closed system. To further ensure a closed system, a bladder scanner was purchased to scan the bladder and confirm whether a decrease in urine output is due to catheter blockage or reduced urine in the bladder. This minimizes unnecessary irrigation that would require a break in the closed system. Once these changes were initiated, securing devices were addressed. CDC guidelines strongly recommend the practice of properly securing the foley catheter to the leg. Foley catheter leg-securing devices were used to ensure an adequate securing system.

Education was the next focus. There is variance regarding care practices of foley catheters, and they are frequently not evidence-based. In one study, an estimated 53.1% of patients with a catheter-associated UTI had a “preventable mistake” in either the indications for or the management of the catheter. Education regarding the care and maintenance of foley catheters is recommended and has been shown to reduce catheter-associated UTIs. An educational program was developed by the ICU nurse educators in conjunction with the Infection Control Department. A foley catheter educational video tape was purchased and all ICU nurses viewed the tape and completed a posttest. The video tape was kept in the conference room where the nurses could view it at their convenience. All new hires were also required to view the tape.

The accumulated results of these initiatives decreased the incidence of catheter-associated UTIs by approximately 50% from 1999 to 2003. According to the NNIS, these rates raised our unit to the top 50th percentile (this means that 50% of the hospitals reporting had rates higher). Even though this was an acceptable improvement, further reductions in UTI incidence were desired. Recommendations in the literature stress the importance of decreasing the unnecessary use of indwelling foley catheters. Duration of catheterization has shown to be the major independent risk factor for catheter-associated UTIs and there is some evidence that earlier removal of urinary catheters is associated with a shorter length of stay.

The ratio of foley catheter days to patient days is part of the required data submitted to the NNIS; these data are collected and calculated monthly. The NNIS comparative benchmark was approximately 82% to 84% (foley catheter device days/patient days) and the monthly average for this ICU was 92% to 100%. Previous attempts to decrease foley catheter days through education, charge nurse surveillance, and the use of a daily goals sheet in our ICU were unsuccessful. In an effort to decrease foley catheter-related complications (UTIs and urosepsis), our 22-bed, medical, surgical, and trauma ICU focused on reducing the number of foley catheter device days in the critical care setting.

Team Development to Change Practice

A multidisciplinary team is imperative to the success of any quality improvement or evidence-based change in practice. The multifaceted complexity of a critically ill patient requires that all members caring for that patient envision the same goals. All disciplines that may be affected by these practice changes must be consulted in the development phase, so there is less resistance in the implementation.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Centers for Disease Control and Prevention’s and Association of Practitioners in Infection Control’s Guidelines*</th>
<th>Joanna Briggs’ Guidelines*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>Only trained professionals/personnel, trained family members, trained patients should handle the catheter (Category I); Regular periodic inservices (Category II); Effective hand washing before and after handling (Category I).</td>
<td>No Level I or II evidence-supported education; however, there were 3 studies that indicated that continuous reinforcement through education may reduce UTIs (Level III).</td>
</tr>
<tr>
<td>Catheter use</td>
<td>Use only when necessary (Category I); Consider other catheters such as condom catheters, suprapubic, and intermittent when appropriate (Category III); No specific recommendation as to the material used for catheter design.</td>
<td>One study suggests intermittent catheterization of postop patients may reduce UTI, but further studies needed to support this (Level II); Silver impregnated catheters may reduce UTI in certain patients, but further research needed and cost effectiveness is unclear (Level I).</td>
</tr>
<tr>
<td>Catheter insertion</td>
<td>Aseptic technique/sterile equipment (Category I); Smallest bore catheter possible (Category II); Proper securement (Category I).</td>
<td>Aseptic technique does not reduce UTI (Level II); No recommendation of catheter bore; No recommendation for securement.</td>
</tr>
<tr>
<td>Closed sterile drainage</td>
<td>Sterile, continuously closed drainage system (Category I); If break in aseptic technique or disconnection, the catheter should be changed (Category III).</td>
<td>Sterile, continuously closed drainage system recommended, but cost should be considered (Level I).</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Intermittent irrigation should be avoided unless obstruction (Category II); Use aseptic technique to irrigate (Category I); If frequent irrigation is needed, change catheter (Category II).</td>
<td>Based on insufficient evidence, no recommendation of irrigation could be given.</td>
</tr>
<tr>
<td>Specimen collection</td>
<td>Collect small volumes from port using aseptic technique (Category I); Collect larger volumes from drainage bag using aseptic technique (Category I).</td>
<td>No discussion.</td>
</tr>
<tr>
<td>Spatial separation</td>
<td>Infected and uninfected patients should not share the same room (Category III).</td>
<td>No recommendation given.</td>
</tr>
<tr>
<td>Urinary flow</td>
<td>Unobstructed flow should be maintained *No kinks in tubing *Empty regularly with separate container (be sure spigot does not touch sides on non-sterile container) *Keep drainage bags below bladder at all times (Category I)</td>
<td>No discussion</td>
</tr>
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(continues)
phase. A critical care nurse and infection control nurse were chosen as project leads by the chief nursing officer, ICU manager, and infection control manager, and the organization’s Six Sigma Department was consulted to guide the project. Intensive care unit nurses, critical care physicians, nephrologists, urologists, infectious disease physicians, the ICU nurse manager, and representatives from the Infection Control Department were consulted to develop criteria for foley catheter use in this patient population.

A thorough review of the literature regarding indications for the use of foley catheters in the critical care setting and other patient populations was conducted. After reviewing the literature with various nurses and physicians, criteria for appropriate foley catheter use were determined (Table 3). These ICU nurses and physicians were doubtful that many patients in this population could tolerate the removal of foley catheters. They were convinced that all the ICU patients would meet these indications for appropriate catheter use. The team leaders agreed that the results of this project may confirm these beliefs, but they persisted. The foley catheter criteria were approved by the ICU Committee and the Infection Control Committee and presented at other appropriate meetings, such as the medical and surgical business meetings and the ICU shared governance meeting. It was important to ensure that the goals were communicated throughout the organization to reduce resistance during the pilot phase.

### Determining the Baseline for Foley Catheter Device Days

In the early stages of the project, the measurement unit of foley catheter device days was defined. A device day began when a patient was admitted to the ICU with an indwelling foley catheter intact or one was inserted in the ICU. A device day ended when the foley catheter was discontinued in the ICU or the patient was discharged from the ICU with the foley catheter intact. After conducting a sample size calculation, it was determined that 123 patient charts were needed for preintervention data. A randomized, convenience sample of 124 patient charts was gathered by the medical record department. Exclusion criteria included patients who had expired in the ICU and patients with no foley catheter. A fishbone diagram (Figure 1) was developed by nursing staff during small, informal brainstorming sessions to determine possible causes of prolonged catheterization in the ICU. Data were collected to determine baseline foley catheter device days and to determine possible causal factors of prolonged catheterization.
The data collection tool was created (Table 4) and evaluated by the team leaders to ensure that the measurement system was accurate. There were several problems encountered. The two data collectors (the team leaders) were gathering the data from two different sources which added some variation to the data when compared. The infection control nurse was documenting the date and time of admission into the ICU with the foley catheter by using the hospital computer system and the critical care nurse was using the ICU flowsheet. This caused variation in the data that could affect results. After this was identified, consistency was established.

There was also some variation when calculating the length-of-stay and device day measures. In order to obtain accuracy and consistency the data collection tool was created in excel and formulas were used to provide accurate calculations. It is crucial that the accuracy of the data collection tool be determined and the process of data collection be defined by comparing and evaluating data collected on a small pilot sample, in this case, 10 patient charts.

After adequacy of the measurement system was determined, the charts were reviewed retrospectively through a manual data extraction process by the team leaders. The preintervention mean foley catheter device days was determined to be 4.72, with a standard deviation (SD) of 7.67 (n = 124). Foley catheter device day were similar to the average ICU length of stay in our unit, indicating that the majority of the patients had the continued use of the catheter for most of the ICU stay.

The next step was to analyze the multiple factors that could contribute to the prolonged use of foley catheters. During the baseline chart review, data was collected to determine: age of patient, physician service, delayed catheter removal after a written physician’s order to discontinue, and length of time the patient met the criteria for the foley catheter (according to the criteria developed by this unit). A regression analysis found that 71.9% ($P < .05$) (n = 124) of the process variation was due to the fact that the catheters were not being removed once criteria for removal was met. This was the only significant factor shown to contribute to prolonged foley catheterization and became the focus of our efforts to further reduce the incidence of UTIs.

### Engaging the Staff to Brainstorm Solutions

Signs were posted in the ICU conference room to invite staff to be a part of the solution to decrease UTIs by participating in brainstorming sessions during several ICU luncheons. Staff continued to be doubtful that many of the catheters in the ICU patients could be removed and they were concerned about the effects it may have on their practice. Some of their concerns were patient focused, such as the potential increase in decubiti and the inability to accurately determine intake and output; some were staff focused, such as the resistance to change the current standard of practice in the ICU; and some were process focused, such as the inability to physically manage patients without catheters due to the current challenges that their workload requires and the complexity of patient assignments.

The team leaders promoted problem-solving techniques by working through these issues.
and allowing the nurses to discuss their concerns through continued brainstorming solutions. There were suggestions to have the charge nurses, physicians, and/or residents conduct surveillance for catheter removal but that was rejected by the nursing staff. The nurses insisted that they have control of surveillance for catheter removal and requested a decision-making algorithm to help guide their practice. It was decided to implement nurse-driven surveillance of criteria-based foley catheter guidelines through the use of a criteria-based foley catheter checklist and a foley catheter decision-making algorithm. The checklist was created by the nursing staff (Figure 2) and the algorithm was created by the team leaders with input from the multidisciplinary team (Figure 3). The nurses also suggested that an educational program be developed and implemented. The educational program included complications related to prolonged catheterization and guidelines for appropriate foley catheter use. The plans for education and project implementation were presented for approval at the ICU and Infection Control Committee meetings. Institutional Review Board (IRB) approval was obtained.

An educational binder was created and utilized to educate ICU staff including nurses, residents, and physicians. The education was

![Fishbone Diagram](image)

**Figure 1**: Fishbone diagram depicting possible causal factors for prolonged foley catheter device days.

**Table 4: Foley Catheter Data Collection Tool**

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Medical record number</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Service</td>
</tr>
<tr>
<td>Date/time of intensive care unit (ICU) admission</td>
</tr>
<tr>
<td>Date/time of ICU discharge</td>
</tr>
<tr>
<td>ICU length of stay (calculated from 2 prior variables)</td>
</tr>
<tr>
<td>Presence of foley on admission</td>
</tr>
<tr>
<td>Date/time patient came to ICU with a foley or when foley inserted in the ICU</td>
</tr>
<tr>
<td>Date/time of foley catheter removal or patient transferred with foley in place</td>
</tr>
<tr>
<td>Foley catheter device days</td>
</tr>
<tr>
<td>Date/time patient met criteria for catheter removal</td>
</tr>
<tr>
<td>Number of device days criteria met</td>
</tr>
</tbody>
</table>
provided by the team leaders during multiple one-to-one in services for all shifts over a 2-week period. These in services were conveniently located at the nurse’s station on a daily informal basis. A log was kept to ensure that all staff completed the inservice. The education included risks associated with prolonged catheterization such as UTIs, urosepsis, and mortality rates associated with urosepsis. It also described appropriate indications for foley catheter use in the ICU through the use of the criteria-based foley catheter guidelines, and explained how to use the foley catheter decision-making algorithm which was placed in the bedside binders for easy referral.

The pilot was implemented upon completion of the staff education. A daily checklist for every ICU patient with a foley catheter was completed by the nurses. The checklist functioned as a trigger to determine the necessity of the catheter. If a patient did not fit the criteria the nurse would contact the physician to recommend catheter removal. The charge nurse was responsible for distribution and collection of the daily checklist.

**Results and Patient Outcomes**

After implementation of the pilot, a convenience sample of 83 charts were reviewed in the same manner as the preintervention study. The
postintervention mean foley catheter device days were 2.98, with a SD of 3.17 (n = 83). This was a decrease from preintervention foley catheter device days of 4.72, with a SD of 7.67 (n = 124).

A two-sample t-test was conducted on the pre- and postintervention means and a test for equal variance was completed for the pre- and postintervention standard deviations. The data showed a statistically significant decrease

**Patients Without a Foley Catheter**

1. Assess patient and consider the following every 2 hours or more frequently as needed.
   • Check for incontinence or offer bedpan.
   • Assess for bladder distention.
   • Turn and reposition and assess skin.
   • Use a protective moisture barrier.

2. If no voiding after 6 hours, utilize the bladder scanner to evaluate amount of urine in bladder:
   • If greater than 300 mL or patient complains of discomfort and/or bladder distension on palpation, call physician for straight catheter order X1.
   • If less than 300 mL, reevaluate every 2 to 3 hours.

3. If unable to void a second time, call MD for an order to insert a foley catheter.

4. Call physician if no voiding after 12 hours.

5. Consider twice a day or daily intermittent catheterization for patients with low urine output rather than a foley catheter.

**Figure 3:** Decision-making algorithm to use for determining the appropriate use of a foley catheter. Reprinted with permission from the Morristown Memorial Hospital Intensive Care Unit, Morristown, NJ. D/C, discontinue.
in the means ($P = 0.38$; $t$-value = $-2.10$; $df = 176$; $n = 83$). There was a 59% reduction in the pre- and postintervention standard deviation, but the test for equal variance did not prove a statistically significant difference. However, the improvement has a practical clinical significance that should be considered. Another important clinical consideration was that at preintervention, only 6% of the foley catheters were removed before the patient was transferred out of the ICU, but at postintervention, 20% of the foley catheters were removed prior to transfer out of the ICU. When a patient leaves the ICU without the foley catheter, chances are the foley catheter will not be reinserted on the general patient care unit, and it is likely that hospital-wide, catheter-associated UTIs have also been affected.

In the control phase of the project, a random sample of 30 patient charts was reviewed monthly to ensure that the improvement was sustained. This phase continued for 1 year postintervention. The monthly control data revealed intermittent months that the improvement was sustained and some months that the improvement was not. Every month, the team leader would post the results with either a congratulatory note for a job well done or a reminder that the criteria needs to be followed and the guidelines enforced. Catheter-associated UTI rates were also posted in the same manner.

One year postintervention, the catheter-associated UTI rates in this unit decreased by 33% and the device-day to patient-day ratio decreased from an average of 96% to an average of 86%, with a decrease of 408 foley catheter device days. There was some concern that lowering the device days may superficially inflate the UTI rate because it would lower the denominator (the NNIS calculates UTI rates by calculating UTIs/1000 foley days). A decrease in device days could potentially make each UTI account for a higher NNIS rate. We were aware of the potential for this to occur, but felt that the benefits of removing catheters outweighed the risks of potentially inflating infection rate percentages. It is also important to note that the improvement achieved is even more impressive with this observation considered.

**Implications of This Project**

Although a large percentage of the patients met the criteria for continued foley catheter use, there was a subcategory that, prior to intervention, had a continued use of the foley catheter when it was not warranted. Both physicians and nurses have an increased awareness of what constitutes appropriate indications for foley catheters and the importance of removing them when they are no longer medically indicated. Similar results have been obtained by other studies. One study implemented a written protocol for automatic foley catheter removal by nursing staff in 3 intensive care units. In another study, a nurse placed a daily reminder in the chart to remove the foley catheter after 5 days.

In addition to the nurse-driven, criteria-based foley catheter guidelines, a line has been added to the ICU Admission Order Set for this unit. The additional line asks the “reason” for the foley catheter, so that physicians will question the necessity of the catheter before writing the order. There is an evidence-based initiative underway to extend this project to the general medical/surgical patient care units and to formulate hospital-wide, evidence-based guidelines for foley catheter indications and care. At present, this organization has no written policy for the care and indications for foley catheters. Nursing practice is guided by CDC guidelines and Lippincott Procedure Manual guidelines, which recommends and refers to hospital-specific guidelines. The nursing care in this organization is governed by a Shared Governance Model. This project has been presented to the Shared Governance Practice Council and the Advanced Practice Nurse Committee, and the development of a hospital-wide foley catheter initiative is in the beginning stages.

**Conclusions**

The implementation of a set of evidence-based practice guidelines for foley catheter use and

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**Box 1: PATIENT RESPONSE TO FOLEY REMOVAL**

Nurse: “While assessing my patient at 0730, I realized she did not meet the criteria for the foley catheter so I initiated a call to the physician to recommend catheter removal. I discontinued the catheter by 0830 and the patient couldn’t thank me enough. She was diagnosed with congestive heart failure and was capable of using a bathroom and/or a bedpan and couldn’t understand the necessity of the catheter. The patient said, ‘The catheter was very uncomfortable and it was a tremendous relief to have it removed.’ She was very grateful.”

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care resulted in a reduction in UTIs and Foley catheter device days in a 22-bed, medical/surgical ICU. The development of a set of criteria and an algorithm for appropriate Foley catheter use, as well as staff education, were found to be effective strategies to changing practice and improving patient outcomes.

Acknowledgments
Special thanks to the following individuals for assistance with this project: Atlantic Health System Six Sigma Department, especially Lou Gorgia, Mark Jannone, Fran Schuster, RN, BSN, CCRN, CPHQ; Chief Nursing Officer Trish O’Keefe, RN, MSN, CNA; John Salaki, MD; Erwin Oei, MD; Louis DiFazio, MD; Rebecca Griffith, MD; Tony Forrester RN, PhD; and especially the nursing staff in the ICU.

References


