APIC IMPLEMENTATION GUIDE

Guide to Preventing Catheter-Associated Urinary Tract Infections

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Guide to Preventing Catheter-Associated Urinary Tract Infections

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Section 1: Epidemiology and Pathogenesis of Catheter-Associated Urinary Tract Infections

Urinary tract infections are one of the five most common types of healthcare-associated infection (HAI), and along with other device-associated infections (e.g., central catheter-associated bloodstream infections and ventilator-associated pneumonia) account for 25.6 percent of all hospital HAIs.[1] Majority of healthcare-associated UTIs are caused by instrumentation of the urinary tract. Catheter-associated urinary tract infection (CAUTI) has been associated with increased morbidity, mortality, hospital cost, and length of stay.[2] Bacteriuria also leads to unnecessary antimicrobial use, and urinary drainage systems can be reservoirs for multidrug-resistant bacteria and a source of transmission to other patients.

Catheter Utilization and Prevalence

During hospitalization, from 12 to 16 percent of patients may receive short-term indwelling urinary catheters. The prevalence of urinary catheter use in residents in long-term care (LTC) facilities in the United States is estimated to be around 5 percent.[3] However, the overall prevalence of long-term indwelling urethral catheterization use is unknown. The daily risk of acquisition of urinary infection varies from 3 to 7 percent when an indwelling urinary catheter remains in place.[4] Although the mortality attributable to a single catheter episode is limited, the high frequency of catheter use in hospitalized patients creates a high cumulative burden of CAUTI. Urinary catheter use is also associated with other noninfectious outcomes, such as urethral stricture, mechanical trauma, and immobility.[5] Indeed, the indwelling urinary catheter hs been called a "one point restraint" that often limits a patient's mobility.[18] In 2002, an estimate of the annual incidence of HAIs and mortality based upon a survey of U.S. hospitals found that urinary tract infections made up the highest number of infections compared to other HAIs.[6] However, in a multistate point prevalence ssurvey of U.S. hospitals conducted by the CDC and using 2011 data, CAUIT ranked fourth among the most commonly reported HAIs.[1] Despite the fact that less than 5 percent of patients with bacteriuria develop secondary bacteremia, CAUTI is the leading cause of secondary hospital-associated bloodstream infections.[7] It is estimated that 12.9 percent of hospital-associated bacteremias are from a urinary source. In a study of blood stream infections manifesting in NH/SNF residents, 50 percent were related to UTI.[19]

In April 2013, the Centers for Disease Control and Prevention (CDC) released the National Healthcare Safety Network (NHSN) data summary report for 2011. The CAUTI pooled means for intensive care units (ICUs) ranged from 1.2 per 1,000 urinary catheter days in medical surgical ICUs to 4.1 in burn ICUs. Non-ICU rates ranged from 1.3 to 1.5 per 1,000 urinary catheter days in medical, surgical, or medical surgical units.[8] Although there has been modest improvement in CAUTI rates, progress has been much slower than other device-associated infections, such as central line-associated bloodstream infections (CLABSIs), where significant improvement has been made. An estimated 17 percent to 69 percent of CAUTI

may be preventable with implementation of evidence-based practices. This means that 380,000 infections and 9,000 deaths related to CAUTI per year could be prevented.[9]

Pathogenesis

The source of microorganisms causing CAUTI can be endogenous—typically via meatal, rectal, or vaginal colonization—or exogenous, such as via equipment or contaminated hands of healthcare personnel.

A urinary catheter provides a portal of entry into the urinary tract. Bacteria may ascend into the tract via the external or internal surface of the catheter. Characteristics of each method of ascension are identified below:[10] (Also see Figure 1.1.)

External (extraluminal) bacterial ascension

- Microorganisms colonize the external catheter surface, most often creating a biofilm.
- Bacteria tend to ascend early after catheter insertion. This suggests a lack of asepsis during initial insertion.
- Bacteria can also ascend one to three days after catheterization, usually due to capillary action.

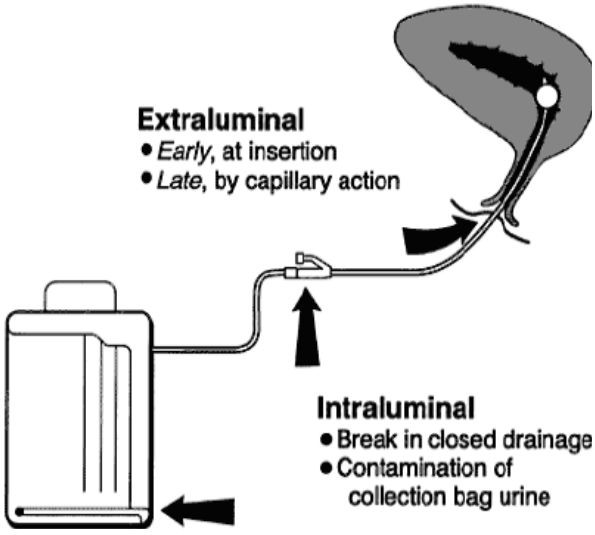
Internal (intraluminal) bacterial ascension

- Bacteria tend to be introduced when opening the otherwise closed urinary drainage system.
- Microbes ascend from the urine collection bag into the bladder via reflux.
- Biofilm formation occurs, and damage to bladder mucosa facilitates biofilm on this surface.

Multiple factors contribute to CAUTI. A fishbone diagram describing the cause and effect of these factors is shown in Figure 1.2.

The CDC reports that the most frequent pathogens associated with CAUTI in hospitals reporting to NHSN between 2006 and 2007 were *Escherichia coli* (21.4 percent) and *Candida* spp (21 percent), followed by *Enterococcus* spp (14.9 percent), *Pseudomonas aeruginosa* (10 percent), *Klebsiella pneumoniae* (7.7 percent), and *Enterobacter* spp (4.1 percent). A smaller proportion was caused by other gram-negative bacteria and *Staphylococcus* spp.[11]

Figure 1.1. Routes of Entry of Uropathogens to Catheterized Urinary Tract



Source: Catheter-associated Urinary Tract Infection (CAUTI) Toolkit. Available at: www.cdc.gov/HAI/pdfs/toolkits/CAUTItoolkit_3_10.pdf

The Role of Biofilm

Bacteria can establish colonization of a patient's bladder within three days of their introduction onto the inner or outer surface of urinary catheters. The introduction of bacteria with urinary catheter use is often associated with catheter-related biofilms. Biofilms are complex structures that include bacteria, host cells, and cellular by-products.[12] Biofilm formation within invasive medical devices is proposed as a primary mechanism in the development of certain diseases, as well as CAUTI. The biofilm life cycle illustrated in three steps: initial attachment events, the growth of complex biofilms, and detachment events by clumps of bacteria or by a 'swarming' phenomenon within the interior of bacterial clusters, resulting in so-called 'seeding dispersal.'

Biofilm plays a significant role in the pathogenesis CAUTI. The development of biofilms occurs when free-floating (planktonic) cells come into

contact with a surface and become irreversibly attached. Typically catheter surfaces are initally colonized with a thin film of bacteria. As the bacteria continue to produce matrix material (extra-cellular polymeric substances) they are able to develop thick, complex structures. This "slimey coating" may be clearly visible upon catheter removal on indwelling Foleys than have been in place for extended periods of time. See Figure 1.3.

Bacteria living in a biofilm can have significantly different properties from free-floating bacteria, as the dense extracellular matrix of biofilm and the outer layer of cells may protect the bacteria from antibiotics and normal host defense mechanisms of the white blood cells, such as phagocytosis.

Microorganisms may contain or produce toxins and other substances that increase their ability to invade a host, produce damage within the host, or survive on or in host tissue. Characteristics of the specific infecting microorganism, particularly related to virulence as well as the ability to adhere to a foreign object, such as a urinary catheter, play a role in the presentation of infection.[13]

Antibiotic Stewardship

By definition, antimicrobial stewardship refers to coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy, and route of administration.[14] As highlighted in the CDC's campaign to prevent antimicrobial resistance, a program for antimicrobial stewardship in any healthcare setting (acute and LTC) has the potential for positive impact on all HAIs. The development of biofilms, colonization, asymptomatic bacteriuria, and

Figure 1.2. Factors Contributing to CAUTI

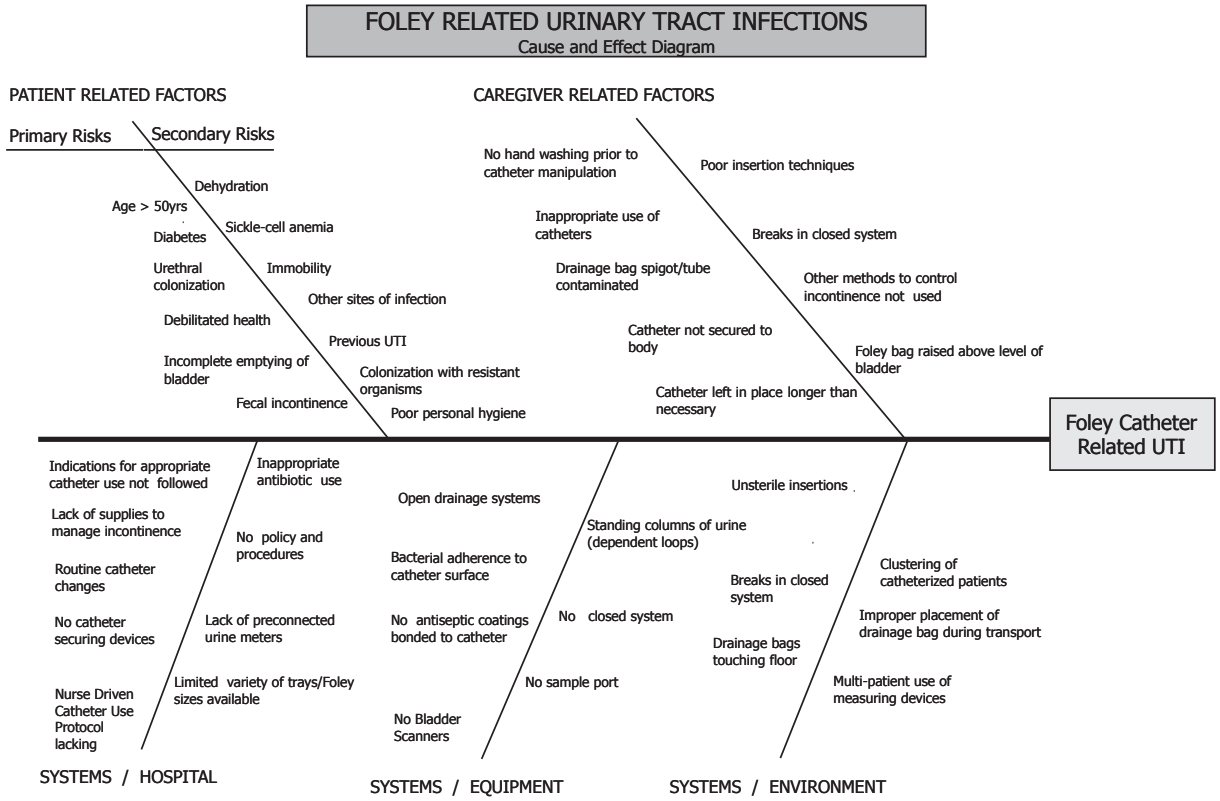
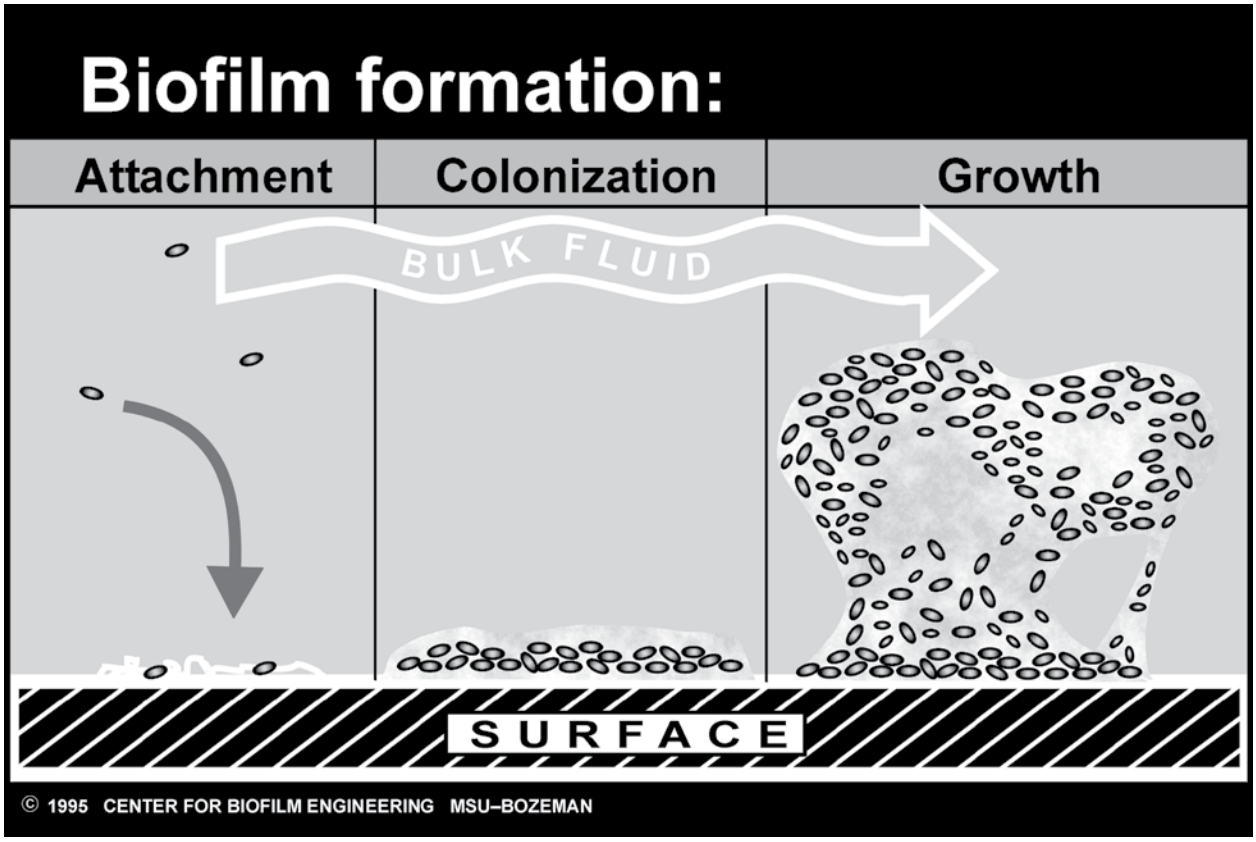


Figure 1.3



Source: Montana State University Center for Biofilm Engineering, P Dirckx. Used with permission.

symptomatic urinary tract infections are common to urinary catheter use.[15] Antimicrobial stewardship can play a role in minimizing the potential adverse outcomes of these occurrences. Inappropriate choice and utilization of antimicrobials has well-documented effects on patients and residents and can lead to development of multidrug resistance in a healthcare setting. Preparing a facility or unit-based antibiogram can demonstrate the changes in antimicrobial resistance that develop over time and can be used to track and monitor changes. The Association for Professionals in Infection Control (APIC) and the Society for Healthcare Epidemiology of America (SHEA) collaborated to outline the roles of healthcare epidemiologists and infection preventionists (IPs) in antimicrobial stewardship programs, and their report was published in the *American Journal of Infection Control* in March of 2012.[16] IPs can play an important role in antimicrobial stewardship through several strategies, which include identification of multiply drug resistant organisms, compliance with hand hygiene, and standard and transmission-based precautions. By using surveillance data to develop a comprehensive risk assessment, IPs can educate care providers on appropriate and judicious use of antimicrobials and implementation of strategies aimed at the prevention of HAIs. Clearly, the prevention of CAUTI through evidence-based strategies focused on early removal and appropriate indications for insertion can have a major impact on these efforts.

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Section 2: National CAUTI Prevention Initiatives

Given the incidence of CAUTI across the continuum of care as well as supportive literature to suggest that CAUTI may be the most preventable HAI, it is no surprise that several federal initiatives aimed at reducing CAUTI have evolved. Attributable costs associated with CAUTI range from $758 to $1,006.[18] Although the individual cost per case is lower than other HAIs, the cumulative cost of these infections given their prevalence, places a substantial financial burden on the healthcare community.

Federal Initiatives

HHS Action Plan

The Action Plan developed by the U.S. Department of Health and Human Services (HHS) came in response to a 2008 Government Accountability Office report that highlighted the fact that multiple HHS programs collect data on HAIs.[1] However, the scope of information and lack of integration across the multiple databases, as well as a lack of high level prioritization of CDC-recommended practices has hindered implementation. This prompted the establishment of the HHS Steering Committee for the Prevention of Healthcare-Associated Infections in July of 2008.[2] The Steering Committee, along with experts and program officials across HHS, developed the *HHS Action Plan to Prevent Healthcare-Associated Infections.* The plan provides an initial roadmap for HAI prevention. The objectives included the following:

- Establish national goals for reducing HAIs.
- Include short- and long-term benchmarks.
- Outline opportunities for collaboration with external stakeholders.
- Coordinate and leverage HHS resources to accelerate and maximize impact.

This roadmap projected five-year targeted priorities for HAI reduction.[3] One of the targeted areas for reduction was CAUTI. In April 2013, HHS released an update to the plan, emphasizing the importance of HAI prevention across the continuum of care and highlighting current gaps in knowledge and practice:

- Basic and/or Laboratory Science
  - Facilitate research to enhance our understanding of factors leading to the development of CAUTI and the optimal modes of prevention, diagnosis, and therapy. A logical area for attention is biofilms.
  - Identify methods to differentiate bladder colonization from CAUTI in patients with catheters.
- Epidemiology
  - Explore the epidemiology of CAUTI and asymptomatic bacteriuria, including incidence, outcomes, and relative contributions to the use of antimicrobials.
  - Identify methods to improve the surveillance of CAUTI, including determining the accuracy of surveillance definitions in select populations (e.g., elderly patients) and developing methods for electronic capture of CAUTI.
  - Study the epidemiology of antimicrobial resistance in uropathogens, considering the role of different urinary catheter systems as reservoirs for resistant bacteria and the presence of resistance to antimicrobial/antiseptic coatings.

  - Quantify the unnecessary use of urinary catheters and its consequences (trauma, encrustation).

Additionally, phase 3 of this action plan focuses on preventing HAIs in long-term care setting. It extends earlier efforts that focused on acute-care hospitals (Phase 1), ambulatory surgical centers and end-stage renal disease facilities (Phase 2), and influenza vaccination of healthcare personnel (Phase 2). A major focus of the LTC chapter is prevention of CAUTI. Although LTC facilities have made significant progress in reducing urinary catheter device days, CAUTI is the most commonly reported and treated infection in nursing homes and skilled nursing facilities. It is also a leading cause of 30-day hospital readmissions from those facilities.

Clearly, prevention of CAUTI has become a national priority with a measurable improvement target described in the HHS National Action Plan. The 2013 National Prevention Target was a 25 percent reduction in CAUTI in ICU and ward-located patients or a 0.75 standardized infection ratio (SIR). However, ongoing measurements indicate that CAUTI prevention initatives are not currently on track to meet this target.HHS is currently considering the next phase of the HAI Action Plan and proposed targets for 2020. Due to the many challenges of reducing and/or eliminating CAUTI, IPs should expect that it will remain a national priority among the prevention goals.

Partnership for Patients

In April 2011, the Obama administration launched a public/private initiative called Partnership for Patients. This partnership involves hospitals, consumers, employers, unions, and health plans, among others, all working together in an effort to improve patient safety.[4] The goal of this is to make healthcare safer, more reliable, and less costly by doing the following:

- Preventing harm. Reducing preventable complications of care by 40 percent of 2010 rates by the end of 2013.
- Decrease preventable complications during a transition of care from one care setting to another by 20 percent by the end of 2013.

Twenty-six state, regional, national, or hospital system organizations received $218 million to become Hospital Engagement Networks (HENs). As HENs, these organizations help identify solutions already working to reduce healthcare-associated conditions and work to spread them to other hospitals and healthcare providers. They lead learning collaboratives and provide technical assistance for hospitals as well as develop mechanisms for monitoring hospitals' progress toward providing safer care for their patients.

The Partnership for Patients has identified the prevention of CAUTI as one of the 10 focused hospital-associated conditions to be reduced by 40 percent by 2013, representing a very ambitious and aggressive focus on HAI reduction. Case Study 1 describes the success achieved by an acute-care community hospital's participation in the VMS Partnership for Patients program.

Case Study 1: Partnership for Patients

An increased incidence of catheter-associated urinary tract infections (CAUTI) at a Louisiana community hospital triggered a prompt response from the facility's Infection Prevention department. CAUTI are associated with higher morbidity and mortality rates and may affect a hospital's reimbursement because it is a process measure in Value-Based Purchasing. This infection accounted for nearly 40 percent of the facility's hospital-acquired infections (HAIs).

To resolve the issue, a CAUTI Reduction Team was established in the summer of 2012 as part of the facility's participation in the Centers for Medicare & Medicaid Services Partnership for Patients Campaign. The team, comprised of a nursing representative from each major patient-care area and an infection prevention nurse, achieved a dramatic reduction in the number of CAUTI within two months and sustained that decrease throughout the next year.

A major challenge of the CAUTI Reduction Team was to bring CAUTI awareness to the forefront of nurses' minds, despite all their other tasks and responsibilities. Here, Implementation Science proved useful. This action-oriented model uses "The Four Es"—Engage, Educate, Execute, and Evaluate—to create an operational framework that integrates research and evidence into practice—also known as implementation science.[19]

Engage: Nurses were successfully engaged by forming a crew of high performers who are well respected by their peers to act as role models in delivering excellent care. Once members of the team consistently exhibited exemplary professional practice relating to CAUTI prevention, their peers followed suit. To facilitate a sustained, meaningful change, the CAUTI Reduction Team members continue to serve as resources and role models for other staff. Furthermore, staff exhibited ownership of CAUTI preventative efforts and the outcomes thereof. Combining model professional practice with ownership and accountability for the process facilitated nursing engagement.

Educate: The CAUTI team carried out a massive educational agenda to ensure everyone was aware of the CAUTI prevention initiative. Team members attended every nursing unit's staff meeting to promote CAUTI awareness. This initial step was followed by another round of meetings to explain the newly approved nurse-driven protocols. When opportunities for improvement are identified, specific patient case studies are presented during staff meetings and/or staff huddles on the unit. Key CAUTI prevention strategies have been incorporated into nursing orientation for new hires and are reinforced during annual competency evaluations. Posters displaying CAUTI prevention measures are rotated throughout departments to allow individuals to learn at their own pace.

Execute: The team investigated evidence-based interventions. A Foley catheter securement device, a nurse-driven Foley catheter removal protocol, and a post-catheter removal protocol were implemented. These protocols grant the nurse autonomy to remove a Foley catheter, depending on specific criteria outlined in the protocol. Additionally, the nurse can perform one straight catheterization if the patient has not voided within the determined time frame outlined in the protocol.

The team utilized the quality improvement methodology of Rapid-Cycle Change to guide implementation of the two nurse-driven Foley catheter protocols. This methodology uses the traditional Plan-Do-Study-Act (PDSA) cycle to facilitate rapid improvement through small scale test interventions. If the intervention provided favorable results, then the change was applied to a larger population.

Directly applying the PDSA cycle, the two nurse-driven Foley catheter protocols were first introduced to the hospital's three surgery units. Within a month, those units' device days decreased significantly. The next month it was rolled out to the remaining seven nursing units.

Evaluate: The team chose infection rates as an outcome measure because the CDC provides standardized, scientifically rigorous definitions. Each month, department managers share data on infection rates and device days. Surgical Care Improvement Project statistics and Partnership for Patients comparative data also are evaluated to determine progress and are shared monthly with the team and other administrators. Concurrent audits on the use of nurse-driven protocols are completed, random audits determine if protocols are being used appropriately and feedback is given to staff. Future team goals relate to continuously evaluating current processes, as well as validating that staff is inserting catheters aseptically.

Since the team was established, the facility has seen a 74 percent decrease in the incidence of CAUTIs compared to the prior year. Implementing effective evidenced-based interventions and using Implementation Science were crucial in achieving the team's mission to reduce this prevalent hospital-acquired infection.

Additional Information:

North Oaks Medical Center is a 330-bed acute care community hospital located in Tangipahoa parish, which is between New Orleans and Baton Rouge. The infection prevention department consists of two full-time RNs, the department director, a surveillance nurse, and a secretary. The department director is certified in infection control, and the surveillance nurse is preparing to take the certification exam. The infection prevention team is supported by two infectious disease physicians.

Contributed by: Brooke Buras, RN, BSN, Infection Prevention Nurse, North Oaks Medical Center

CDC HICPAC

The Healthcare Infection Control Practices Advisory Committee (HICPAC) is a federal advisory committee made up of 14 external infection control experts who provide advice and guidance to the CDC and the HHS secretary regarding the practice of healthcare infection control, strategies for surveillance and prevention, and control of HAIs in U.S. healthcare facilities. The committee has liaison representatives from professional organizations and other federal agencies—including APIC, the Society for Healthcare Epidemiology of America, the Association of periOperative Registered Nurses, the Centers for Medicare & Medicaid Services (CMS), the Food and Drug Administration (FDA), and such other nonvoting liaison representatives as the secretary deems necessary to effectively carry out the functions of the committee.[5]

The 14 members include the chair and co-chair. Members are recommended by the CDC and appointed by the HHS secretary from experts in the fields of infectious diseases, healthcare-associated infections, nursing, surgery, epidemiology, public health, health outcomes, and related areas of expertise. In 2009, HICPAC released the *Guideline for Prevention of Catheter-Associated Urinary Tract Infections*. This guideline updated and expanded the original CDC guideline published in 1981.[6]

Although CDC guidelines have long been considered the gold standard in infection prevention strategies, the science is constantly evolving. It is important that infection preventionists and others responsible for implementing evidence-based recommendations pay close attention to peer review publications, particularly where well-developed, randomized control studies have provided new or emerging evidence.

CAUTI in the SHEA/IDSA Compendium

In 2014 the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Disease Society of America (IDSA) released the first update to their 2008 *A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals*. The first update addressed CAUTI. The compendium, including the 2014 updates, is the product of a collaborative effort led by SHEA and IDSA with support from the American Hospital Association (AHA), the Association for Professionals in Infection Control and Epidemiology (APIC), and The Joint Commission with major contributions from representatives of a number of organizations and societies with content expertise.

According to SHEA and IDSA, the *Compendium* synthesizes best evidence for the prevention of surgical site infections, central line-associated bloodstream infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, Clostridium difficile, and MRSA. It also highlights basic HAI prevention strategies plus advanced approaches for outbreak management and other special circumstances and recommends performance and accountability measures for infection prevention practices.

Learn More About the Compendium Updates

For more information about the SHEA/IDSA *Compendium*, be sure to read *Maintaining the Momentum of Change: The Role of the 2014 Updates to the Compendium in Preventing Healthcare-Associated Infections*

Edward Septimus, MD; Deborah S. Yokoe, MD, MPH; Robert A. Weinstein, MD; Trish M. Perl, MD, MSc; Lisa L. Maragakis, MD, MPH; Sean M. Berenholtz, MD, MHS

Source: *Infection Control and Hospital Epidemiology*, Vol. 35, No. 5 (May 2014), pp. 460-463

The *Compendium* does not reflect a complete systematic review of the literature and is not intended to replace previously published guidelines such as those released by the CDC. Instead the goal of the *Compendium* is to provide acute care hospitals with a summary of practical, concise guidance based primarily on existing authoritative guidance documents.[22]

The CAUTI update is available as an open access publication at the SHEA website: www.shea-online.org/PriorityTopics/CompendiumofStrategiestoPreventHAIs.aspx

AHRQ CAUTI CUSP

The Agency for Healthcare Research and Quality (AHRQ) (formerly known as the Agency for Health Care Policy and Research) is one of 12 agencies within the HHS. The purpose of the agency is to enhance the quality, appropriateness, and effectiveness of healthcare services, and access to such services through the establishment of a broad base of scientific research and through the promotion of improvements in clinical practice and delivery of healthcare services.[7] As part of the National Action Plan, the AHRQ has funded a nationwide effort to promote the use of the Comprehensive Unit-based Safety Program (CUSP) to prevent CAUTI in U.S. hospitals. This project combines the implementation of general socio-adaptive approaches to improve care in a particular unit or hospital coupled with evidence-based interventions focusing on the technical aspects of CAUTI prevention.[8]

CUSP is a five-step program designed to change a unit's workplace culture to bring about significant safety improvement through empowering staff to assume responsibility for safety in their environment. This is achieved through education, awareness, access to organization resources, and a toolkit of interventions.

The CAUTI-CUSP initiative, applied lessons and experience from CLABSI prevention collaborative that was piloted in Michigan, which resulted in a

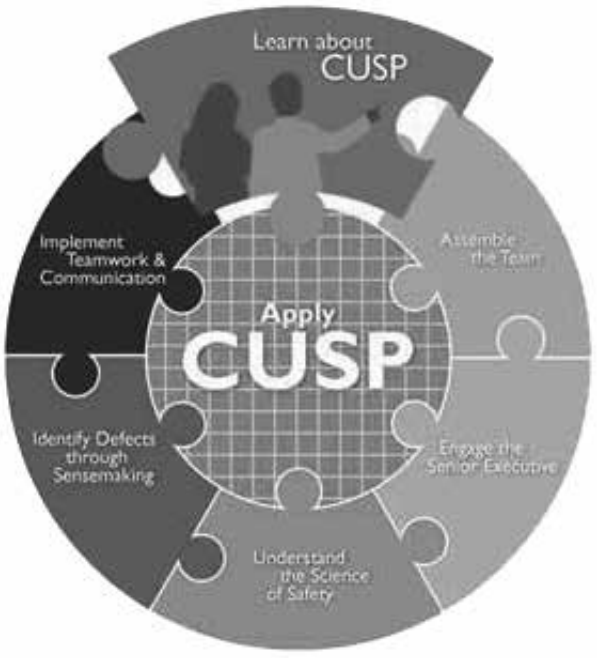
66 percent decrease in CLABSI rates over the first 18 months and a sustained reduction in CLABSI over 3 years.[20] The goals of the national On the CUSP: Stop CAUTI project are to accomplish the following:

1. Reduce mean CAUTI rates in participating clinical units by 25 percent over 18 months.
2. Improve patient safety by disseminating the CUSP model and tools as evidenced by improved teamwork and communication.
3. Promote the coordination of state-based efforts to eliminate HAIs.

This work is now spreading across the United States. This national program seeks to leverage the expertise of different stakeholder groups and organizations for the unified goals of reducing urinary catheter-related harm.[9]

*Details on Patient Safety, CUSP Methodology, Toolkits and other resources are provided in Section 5.

Figure 2.1. CUSP Implement Model



Case Study 2: CAUTI CUSP at the University Medical Center of Southern Nevada

Ashley Komacsar, BSN, RN, was still in orientation at her new job in the surgical intensive care unit and neuroscience care unit (SICU/NSCU) at University Medical Center of Southern Nevada (UMC) when her interim manager suggested she attend a presentation about catheter-associated urinary tract infections (CAUTIs). "I figured it was a conference learning session—I didn't realize it was getting on board for an 18-month commitment," Komacsar said with a laugh.

Komacsar eventually became the team leader for UMC's *On the CUSP: Stop CAUTI* program, under the direction of Clinical Manager Marlon "Jon" Medina, RN, BSN. In a hospital that faces particular infection control challenges, Komacsar and Medina came to welcome the solutions that comprehensive unit-based safety program (CUSP) offered.

Located in Las Vegas, the 564-bed UMC is the only level-one trauma center in Nevada and frequently receives transfer patients from Arizona, California, and Utah. It's also a nonprofit operated by Clark County and thus serves a diverse population that includes the transient and indigent. Finally, UMC is a teaching hospital for University of Nevada medical students.

Both Medina and Komacsar believe staff buy-in was key to the success of their CUSP program. "In another unit with a very high CAUTI rate that was supposed to be involved in the program, they had a fractious team member and it didn't work out," Komacsar said.

But in Komacsar's and Medina's SICU/NSCU unit, the charge nurses took the lead in helping other nurses get on board. The executive champion, UMC Chief Financial Officer Stephanie Merrill, brought in the hospital administration and the physician champion, Matthew Schreiber, MD, who was key in communicating the value of the program to residents.

"It was so important to find people who were going to be invested and committed in the program, and to not just make them do it," Komacsar said. Added Medina: "It was particularly important to get buy-in from the charge nurses, especially the ones on the night shift, because they collect the data." Medina helped accomplish this by juggling the census and staff ratio to clear time for CUSP team members to participate in monthly meetings, national content calls, and state coaching calls.

There were 10 people on UMC's CUSP team: Medina and Komacsar, Schreiber, an infection preventionist, four charge nurses, and two staff nurses. They relied on the CUSP toolkit to help organize and define team members' roles.

Komacsar said CUSP helped them recognize how much indwelling urinary catheter use can increase CAUTIs, so the team focused on reducing Foley catheter use and on proper insertion when the catheters were deemed necessary. They began by reviewing current catheter and physician order sets, and established care bundles for the nurses to follow. "We also refined rules like 'Every ICU patient needs a Foley,'" Komacsar said.

The CUSP team then conducted a hospital-wide Foley training session. The future goal is to do these two-hour sessions quarterly, over a three-day period, to help ensure all staff can participate. "We don't have yearly competencies, so this makes sure our skills are up to par," Komacsar said.

The CUSP team also created a PowerPoint presentation on Foley use that is mandatory for all medical staff and placed Foley Decision Trees in every patient room, listing the insert date, catheter indications, and maintenance. For staff, the team created CUSP information boards, along with printed CAUTI alerts, listing the date and reason for the incident.

The CUSP team also reinforced the use of catheter alternatives. They educated staff on the proper application technique for condom catheters, and conducted a pilot program with a female urinal. "We female nurses realized we didn't even know how to use it, so we made it a CUSP team project to figure it out," Komacsar said. "Then we did a 220-employee in-service on it for the other floors. The nurses appreciated us teaching them, and as a result of that education other units ordered female urinals."

While UMC's CAUTI rates have actually risen since the CUSP program began, (from 4.16 in 2012 to 9.08 in the first three quarters of 2013), Foley-device utilization has decreased from 73 percent of patient days to 62 percent during that same time frame. "As the [Foley usage] numbers decrease, the infection rate increases because there is less of a sample size. This phenomenon is seen nationwide in this project as we use less Foley catheters," Medina said.

Overall, Medina and Komacsar view their CUSP program as a success. "We want to use the CUSP methodology on other projects because it makes a program comprehensive," Komacsar said. "It brings in everyone and bridges departments from the executives to the staff nurses. It uses the hospital system to its advantage."

From Prevention Strategist, Spring 2014; vol. 7, number 1.

Table 2.1. Reportable HAIs

HAI Events	Facility	Reporting Start Date
CLABSI	Acute-Care Hospital ICUs	Jan 2011
CAUTI	Acute-Care Hospital ICUs (except NICUs)	Jan 2012
SSIs	Colon Surgeries and Abdominal Hysterectomies in Acute Care Hospitals	Jan 2012
Dialysis Events	End-Stage Renal Disease Facilities	Jan 2012
CLABSI	Long-Term Care Hospitals	Oct 2012
CLABSI	Cancer Hospitals	Oct 2012
CAUTI	Long-Term Care Hospitals	Oct 2012
CAUTI	Inpatient Rehab Facilities	Oct 2012
CAUTI	Cancer Hospitals	Oct 2012
MRSA Bacteremia LabID Events	Acute-Care Hospitals	Jan 2013
***C. Difficile* LabID Events**	Acute-Care Hospitals	Jan 2013
HCP Influenza Vaccination	Acute-Care Hospitals	Jan 2013
HCP Influenza Vaccination	Long-Term Care Hospitals	Oct 2013
SSIs	Colon Surgeries and Abdominal Hysterectomies in Cancer Hospitals	Jan 2014
HCP Influenza Vaccination	Ambulatory Surgical Centers	Oct 2014
HCP Influenza Vaccination	Hospital Outpatient Departments	Oct 2014
HCP Influenza Vaccination	Inpatient Rehab Facilities	Oct 2014
CLABSI	Acute Care hospital medical, surgical and medical/surgical units	Jan 2015
CAUTI	Acute Care hospital medical, surgical and medical/surgical units	Jan 2015
MRSA Bacteremia LabID Events	Long-Term Care Hospitals	Jan 2015
***C. Difficile* LabID Events**	Long-Term Care Hospitals	Jan 2015

Centers for Medicare & Medicaid and Reimbursement

New attention to HAIs has underscored the need for comprehensive and systematic surveillance and prevention programs that are tied to public reporting and reimbursement. See Table 2.1. The CMS has increased scrutiny of practices and implemented financial incentives for the prevention of HAIs. Media and public attention to HAIs has also increased, as many HAIs, once seen as an unfortunate consequence of receiving healthcare, are now considered largely preventable.[10]

Infections associated with devices have received close attention as a result of their escalating use and increased evidence of preventability when evidence-based guidelines are implemented. In a 2009 report issued by Scott et al., CAUTI continued to be the most prevalent device-related infection. The annual cost per case has been estimated to be between $789 and $1,003, and the cumulative burden of these infections was estimated at an annual cost to the nation's healthcare system of from $390 to $450 million based upon the consumer price index.[11]

The passage of the Deficit Reduction Act of 2005 required the HHS secretary to select at least two conditions that (a) are high cost, high volume, or both; (b) result in the assignment of a case to a diagnostic related group that has a higher payment when present as a secondary diagnosis and could

have reasonably been prevented through the application of evidence-based guidelines. The Fiscal Year 2008 Inpatient Prospective Payment System (IPPS) was published by the CMS in August 2007. Of the hospital-acquired conditions (HACs) originally selected, three are related to infections not considered present on admission: CAUTI, vascular catheter-associated infection, and mediastinitis after coronary artery by-pass graft surgery. Identification of HACs is based upon coding of claims for reimbursement of care involving hospital-acquired conditions and does not necessarily match criteria that infection preventionists use in surveillance of HAIs. Subsequent analysis of frequency of claims using the code for CAUTI found it was almost never used.[21]

In 2010, Congress incorporated HAI prevention into the Affordable Care Act. The CMS has elected to implement the requirement by including national public reporting of HAIs, as part of the Hospital Inpatient Quality Reporting Program (IQR), beginning with ICU CLABSIs in 2011 and ICU CAUTI (except NICU) in January 2012 followed by CAUTI reporting in long-term acute hospitals and inpatient rehab units in October 2012 (see Table 2.1 for complete list of reportable HAIs). Unlike the HACs, reporting of CAUTI information in the IQR Program requires facilities to apply NHSN definitions and report infections through the NHSN network.[12] CMS has continued to expand the scope of surveillance in the IQR program by adding CAUTI in non-ICU locations beginning in January 2015.[23] In addition, the original HACs, including CAUTI, were added to the value-based purchasing incentive program as a process measure beginning in FY 2013.

APIC, as well as other professional societies, has expressed growing concern over the confusion regarding two separate reporting measures using separate HAI definitions and criteria. In the 2013 Inpatient Prospective Payment Systems (IPPS) final rule, CAUTI will be removed from the hospital-acquired conditions beginning 2014 for fiscal year 2015. This change ensures that clearly defined, risk adjusted data will be utilized for public reporting and eventual pay for performance measures.

National Quality Forum

The National Quality Forum (NQF) is a nonprofit organization based in Washington, DC, that is dedicated to improving the quality of healthcare in the United States. To that end, the NQF embodies a three-part mission:

- to set goals for performance improvement,
- to endorse standards for measuring and reporting on performance, and
- to promote educational and outreach programs.

NQF members include purchasers, physicians, nurses, hospitals, certification bodies and fellow quality improvement organizations. Generally, the CMS seeks to include measures that are NQF endorsed in its proposed IPPS rulemaking.[13]

Accrediting Agencies

In 2008, the CMS enacted a new law requiring that any accrediting body seeking deeming status must apply to the CMS. The four major accrediting bodies are The Joint Commission (TJC), Det Norske Veritas Healthcare (DNV), and Healthcare Facilities Accreditation Program (HFAP), and the Accreditation Association for Ambulatory Healthcare (AAAHC). These accrediting organizations vary in the types of institutions for which they hold "deemed status."

The Conditions of Participation (COPs) (or for some nonhospital Medicare providers the Conditions for Coverage (CfC)) [e.g., ambulatory surgery centers] are the federal health and safety requirements that hospitals and other providers must meet to participate in the Medicare and Medicaid programs. The COPs are intended to ensure that high-quality care is provided to all patients. Compliance with the COPs is determined by State Survey Agencies (SAs) or Accreditation Organizations. The SAs survey hospitals to assess compliance with the

COPs. Hospitals are deemed to have met the requirements in the COPs if they are accredited by national accreditation programs approved by CMS. All Medicare- and Medicaid-participating hospitals are required to be in compliance with CMS COPs regardless of their accreditation status. The COPS require that the hospital infection control program specifically address the reduction of HAIs through the implementation of evidence-based practices. Consistent with these standards for reduction of HAIs is an emphasis on reduction of CAUTI.[14]

DNV Healthcare is a worldwide company initially focused on risk management. In the United States, DNV integrates ISO 9001 quality compliance with the CMS COPs. Infection-prevention standards, which include program management and standard operating procedures, are all part of the DNV accreditation process. An organizational risk assessment that includes CAUTI reduction is part of the accreditation process. [15] The DNV Managing Infection Risk Standard was developed to provide a modern, comprehensive and practical framework to help organizations improve their management of infection risk. It adopts a structure based upon 18 elements addressing all areas associated with the design, operation and management of healthcare facilities. The standard is compatible with the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC) and other national guidelines to allow better integration and ease of implementation.

HFAP standards also include nationally recognized standards and evidence-based best practices for patient safety and infection prevention. Originally created in 1945 to conduct an objective review of services provided by osteopathic hospitals, HFAP has become a recognized accreditor for **all** hospitals. HFAP has maintained its deeming authority continuously since the inception of CMS in 1965 and meets or exceeds the standards required by CMS.

The Accreditation Association for Ambulatory Health Care Inc. holds "deemed status" from CMS to survey ambulatory surgery centers (ASCs) for Medicare. However urinary catheter use in ASCs is limited both in frequency and duration, making it less urgent issue for patients in these settings where prevention targets focus on the identification and reduction in surgical site infections.

TJC focuses on infection prevention through its specific elements of performance as well as its National Patient Safety Goals (NPSGs), which include targeted interventions to reduce patient harm. One particular area identified as high risk for harm is HAIs. NPSGs specific to prevention of HAIs address, hand hygiene, prevention of surgical site infections (SSIs), prevention of CLABSI, MDROprevention, and CAUTI. The NPSG 07.06.01 specific to CAUTI requires implementation of evidence-based practices to prevent CAUTI.[16]

NPSG 7.06.01 Elements of Performance include the following**:**

- Limiting use and duration to situations necessary for patient care
- Using aseptic techniques for site preparation, equipment, and supplies

Manage indwelling urinary catheters according to established evidence-based guidelines that addresses the following:

- Securing catheters for unobstructed urine flow and drainage
- Maintaining the sterility of the urine collection system
- Replacing the urine collection system when required
- Collecting urine samples

Monitor:

- Select measures using evidence based guidelines
- Monitor compliance with evidence based guidelines
- Evaluate effectivenss of prevention efforts

Survey Process

The tracer methodology is widely used in various accrediting survey processes. The tracer methodology provides a means to analyze an organization's system of providing care, treatment and services by using actual patients as a framework for the review. Tracers engage staff who provide care, observe handoffs and transitions, review critical environmental issues, and evaluate employee knowledge and performance.[17]

Example:
Mrs. X is a patient on your high-volume medical unit. She has a urinary catheter in place and has developed a CAUTI, caused by vancomycin-resistant *Enterococcus* (VRE), which is healthcare-associated.

Possible questions from the surveyor:

- When was the catheter inserted?
- Where was the catheter inserted?
- What were the indications for insertion?
- What is this unit doing to prevent CAUTI?
- Have you received education regarding insertion and maintenance of CAUTI?
- What is your CAUTI incidence on this unit?

Documentation review:

- Is the insertion documented?
- Is there ongoing assessment of the need for the catheter?
- What criteria are utilized for continuing catherization?
- Is there documentation that the patient has received education relative to the VRE?

Observations:

- Is the catheter bag below the level of the bladder?
- Is the catheter secured and flow uninterrupted?
- Did the nurse practice appropriate hand hygiene?

Record Review:

- May request competency and in-service records for this individual

Other Issues:

- May review where supplies are stored
- If catheter was inserted in other area, such as emergency department (ED), may visit area
- May ask to review catheter insertion and maintenance policy and standard

Example developed and provided with permission by Linda Greene, RN, MPS, CIC, Highland Hospital, Rochester, NY

The tracer methodology has now been adopted by the CMS and tested in facility surveys. An example of a CAUTI tracer tool developed by the CMS is shown in Figure 2.2. Survey tools, including tracers, undergo periodic updates. Check with the state survey agency for the most current forms applicable in any specific state.

Figure 2.2. A Urinary Catheter Tracer

Elements to be assessed		Manner of Assessment Code (check all that apply) & Surveyor Notes			Manner of Assessment Code (check all that apply) & Surveyor Notes	
Urinary catheters are inserted, accessed, and maintained in a manner consistent with hospital infection control policies and procedures to maximize the prevention of infection and communicable disease including the following:						
Insertion:						
4. A.1 The hospital has guidelines for appropriate indications for urinary catheters.	☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
No citation						
4. A.2 Hand hygiene performed before and after insertion.	☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
4. A.3 Catheter placed using aseptic technique and sterile equipment.	☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
4. A.4 Catheter secured properly after insertion.	☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
If no to 4.A.2 through 4.A.4, cite at 42 CFR 482.42(a)(1) (Tag A-0749)						
4. A.5 Catheter insertion and indication documented.	☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		☐ Yes ☐ No ☐ N/A	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	
If no, cite at 42 CFR 482.24(c)(2)(vi) (Tag A-0467)						

Interview = 1 Observation = 2 Infection Control Document Review = 3 Medical Record Review = 4 Other Document Review = 5

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Section 3: CAUTI Risk Assessment

The risk assessment is a thoughtful, systematic process of assessing potential negative outcomes in the environment. The CAUTI risk assessment is part of the overall infection prevention risk assessment.[1] An example of surveys of professionals in a large integrated network to assess status of CAUTI prevention program has been described in published literature.

The following steps outline tips for conducting a CAUTI risk assessment and may be helpful for organizations:

Step 1: Assess whether an effective organizational program exists.
Questions may include any of the following:

- Are there policies or guidelines that define criteria for insertion of a urinary catheter?
- Has the organization established criteria for when a catheter should be discontinued?
- Is there a process to identify inappropriate usage or duration of urinary catheters?
- Is there a program or are there guidelines to identify and remove catheters that are no longer necessary, e.g., physician reminders, automatic stop orders or nurse-driven protocols?
- Are there policies or guidelines for use of a portable ultrasound bladder scanner for post-void residual prior to insertion of a catheter for urinary retention?
- Are there mechanisms to educate care providers about use and care of urinary catheters?
- Are functional alternatives to indwelling catherization available?
- Overall Assessment: Is there an effective organizational program in place?

Step 2: Assess population at risk.
The primary at-risk population can be determined by identifying areas of high urinary catheter usage. These areas include critical care areas, medical and surgical units, nursing homes, etc.

It is also important to assess the intensity of device use, either organizationally or by high-risk area. Studies to determine the frequency of device use can be readily performed in each high-risk or problem-prone setting. These studies would include assessment for appropriate use of the catheter and patient care practices as defined by the facility's nursing and/or infection prevention and control policies.

When data concerning device use days are not readily available, a point prevalence study is useful to determine opportunities to enhance compliance with facility "best practice" policies, and/or to identify areas where specific targeted interventions are needed. To perform this type of study, staff members from the various care units could be recruited to perform and tally the required observations. This would provide the added benefit of rapid feedback of findings to participating units.

It is important to note that this type of study is only a "snapshot in time" and may not be representative of the actual practices and actions on all units all of the time. However, observational studies of this type can be readily performed as needed, and they can provide baseline data to complete the risk assessment, monitor trends in care practices, and identify outliers per unit, shift, or service.

The point prevalence survey questions may include any of the following as appropriate to facility policy or protocols:

- Is there a Foley catheter in use?
- Where was the foley inserted?
- What type of Foley catheter is in use (e.g., three-way catheter, temperature-sensing catheter, Coude catheter, impregnated vs. nonimpregnated with an antimicrobial, etc.)?
- Is this the type of catheter normally used in this facility?
- Is a closed system being maintained? Is tamper-resistant seal intact?
- Is the Foley inserted using a tray where preconnectionss are in place between the catheter and the bag?
- Is the Foley secured to the patient's body to prevent urethral tension?
- How is it secured (e.g., tape, securement device, etc.)?
- Is the bag below the level of the patient's bladder?
- Is the tubing from the catheter to the bag free of dependent loops? Would a picture be helpful for new infection preventionists?
- Is the tubing secured to the bed or chair to prevent pulling on the entire system?
- Is the bag hanging free without touching the floor?
- Does the patient have an individual urine output measuring device marked with his or her name and room number?

The denominator for this monitor is the number of patients who have urinary catheters during the surveillance period on the unit or in the population being monitored.

Consider obtaining catheter usage data from facility's Materials Management Department in order to identify high-volume usage areas.

- Assess baseline outcome data. Organizations may elect to collect and assess baseline outcome data either facilitywide or by high-risk area.

Step 3: Assess baseline outcome data.
Baseline data can be collected utilizing the surveillance methods described in Section 4 of this guide. If these options are not feasible, there are a few other options for establishing baseline outcome data for comparison purposes:

- Examine facility- or setting-specific CAUTI caused by epidemiologically important pathogens based on other HAI surveillance data or experience. Consider crude uropathogen analysis of urines obtained > 48 hours after admission. (Note: NSHN critata state day rather than greater 48 hours.)
- Assess location, frequency, and prevalence of MDROs or other epidemiologically significant organisms associated with UTIs. This information may be obtained by working with your facility's Microbiology Department or through the usage of electronic data systems.
- Use NHSN definitions of bloodstream infections, which meet criteria as being attributable or secondary to CAUTI. Determine frequency and overall impact of these infections.

Step 4: Determine financial impact.
Several methods exist to identify the financial impact of these infections:

Method 1:
Obtain a list of patients who met one of the UTI codes and the 999.64 catheter-association code in which the UTI was coded "not present on admission." Identify direct revenue loss. (Refer to text on value-based purchasing in Section 2.) However, this method is used very infrequently so yield may be artificially low.[3]

Method 2:
Utilize published data to estimate financial impact, based on average frequency and cost of UTIs. In 2005, Stone and colleagues published a review of the current literature addressing the

economic ramifications of adverse events, such as HAIs.[2] They examined more than 150 studies conducted from 2001 to 2004 that looked at the simple cost of infections or performed a cost analysis of interventions.[4]

Method 3:
Calculate actual excess costs of infections and excess length of stay. Resources, such as APIC's HAI Cost Calculator Tool, are available and can generate tables and graphs that can help describe the impact of a urinary tract infection in your own organization.

The HAI Cost Calculator Tool is included as part of APIC's *Dispelling the Myths: The True Cost of Healthcare-Associated Infections,* available at www.apic.org/store.

Type of Risk Assessment

The risk assessment may be either qualitative, quantitative, or a combination of both. The risk assessment should drive the infection prevention plan and help establish goals. The qualitative risk assessment uses an approach that assesses the risk based upon written descriptions. One example of a qualitative risk assessment is described in Table 3.1.

Alternate Risk Assessment

A quantitative RA uses scores, usually stratified in a defined and systematic way, to integrate the many types of risks that can potentially contribute to infection. An example of this RA model is shown in Figure 3.1.

Table 3.1. Example of Qualitiative Risk Assessment

Areas/ Topic	Current Status	Goals	Identified Gap	Actions	Priority
CAUTI	7 actual infections vs. 3.7 expected (NHSN)	Reduce CAUTI rates by 30 percent Improve adherence to discontinuing postoperative catheters within 48 hours	No standard order sets or pathways for discontinuing Foley catheters in surgical patients No nurse-driven protocols for removal No standard orders for appropriate insertion protocols	Incorporate discontinuing catheters post-op into standard order sets and pathways Develop nurse-driven protocols and vet with stakeholders Report incidence to units as soon as possible Use learning from defects or other tools to analyze issues	HIGH (rates have increased since the previous year) Now a CMS-reported measure in ICU, Rehab, and LTACH

Source: Adapted from the *APIC/JCR Infection Prevention and Control Workbook,* 2nd Ed

Figure 3.1. Quantitive RA Model

Program Elements	Risk Criteria							Risk Score	Mitigation Criteria		Mitigated Score	Target Objective/ Prioritization
	High Volume	New Initiative / Guideline	Continued Initiative/ Guideline	Required by Law	Morbidity / Mortality	Financial Risk	Institutional Risk		Program in Place	Objective Met or Program Effective		
Numerical Weight	Yes=3 N/A or No=0	Yes=13 No=0	Yes=5 No=0	Yes=15 No=0	N/A=0 Low=1 Med=3 High=5	N/A=0 Low=1 Med=3 High=5	N/A=0 Low=1 Med=3 High=5	Sum of Risk Criteria	Yes=3 No=0	Yes=15 No=0	Risk - Mitigation	Y=Yes N=No C=Consider
Device Related Infections												
CLABSI												
UTI												
VAP												

Source: Used with permission by Connie Steed, MSN, RN, CIC, Greenville Hospital System University Medical Center, Greenville, SC

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Section 4: Definitions, Surveillance, and Reporting

Clinical and Surveillance Definitions

Surveillance includes ascertainment of HAIs with the use of standardized definitions, aggregation of the data, analysis of the data, and feedback to key stakeholders. In addition to CMS reporting requirements, the NHSN definitions perform a crucial function by allowing hospitals to compare their data to aggregate data from other hospitals. However, the accuracy of this comparison requires a high degree of validity and reliability in applying the definitions. Current uses of NHSN beyond internal quality improvement require that hospitals and payers have confidence in the data reported. Infection preventionists and others responsible for data collection and analysis must also understand the difference between surveillance and clinical definitions.[1]

Surveillance definitions establish uniform criteria to be used to report a disease or to better ensure usefulness in aggregating and analyzing ***population-based data***. These types of definitions should not be used as the sole criteria for establishing clinical diagnoses or for determining the standard of care necessary for a particular patient.

Clinical definitions are ***specific to a patient*** and can manifest progressively during an illness. The use of additional clinical, epidemiological, and lab data may enable a provider to diagnose a disease even when the formal surveillance definition may not be met. Failure to meet the surveillance criteria of the formal case definition should never impede or override clinical judgment during the diagnosis, management, or treatment of patients.

NHSN Definitions

Surveillance definitions have been repeatedly revised in order to enhance their reliability, validity, and reproducibility as new knowledge and experience is gained. It is important, however, to remember that these definitions were primarily intended for internal performance improvement activities and eventually have progressed to facilitate inter-hospital comparisons, improve infection prevention and quality improvement efforts, and provide information for prevention research, mandatory public reporting, and public health surveillance. Inter-hospital comparisons of infection rates, however, are valid only if the methods of surveillance are uniform and reliable across institutions.[2]

The NHSN definitions for CAUTI in acute care have undergone considerable revisions. See Figure 4.1. The charts below reflect current definitions as published in July 2013. NHSN is in the process of making additional revisions based upon user feedback and input from subject matter experts. The anticipated time frame for the revised definitions is unknown, but expectations are that it may not occur until 2015. Users should check the NHSN website to ensure that they have the most current definitions.[3]

NHSN reporting in LTC facilities is currently available for certified skilled nursing facilities/ nursing homes and intermediate/chronic care facilities for the developmentally disabled. Surveillance definitions specific to LTC are summarized in Table 4.1.

If a resident is transferred from an acute-care facility and develops signs/symptoms of a UTI within the first 2 calendar days of admission (where date of admission = day 1) to the LTC facility, it would be considered present at the time of transfer to the LTC facility. An event present at the time of transfer should be reported back to the transferring facility and not reported to NHSN as an LTC facitility UTI event. Only UTI events presenting > 2 calendar days after admission (where date of admission= day 1) are considered facility onset events.[4] See Figures 4.2, 4.3, and 4.4.

Figure 4.1. Urinary Tract Infection Criteria

Criterion	Urinary Tract Infection (UTI)
	Symptomatic UTI (SUTI) Must meet at least 1 of the following criteria:
1a	Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1, and catheter was in place on the date of event *and* at least 1 of the following signs or symptoms: fever (>38°C); suprapubic tenderness*; costovertebral angle pain or tenderness* *and* a positive urine culture of $\geq 10^5$ colony-forming units (CFU)/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. ----------OR---------- Patient had an indwelling urinary catheter in place for >2 calendar days and had it removed the day of or the day before the date of event *and* at least 1 of the following signs or symptoms: fever (>38°C); urgency*; frequency*; dysuria*; suprapubic tenderness*; costovertebral angle pain or tenderness* *and* a positive urine culture of $\geq 10^5$ colony-forming units (CFU)/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause
1b	Patient did <u>not</u> have an indwelling urinary catheter that had been in place for >2 calendar days and in place at the time of or the day before the date of event *and* has at least 1 of the following signs or symptoms: fever (>38°C) in a patient that is ≤65 years of age; urgency*; frequency*; dysuria*; suprapubic tenderness*; costovertebral angle pain or tenderness* *and* a positive urine culture of $\geq 10^5$ CFU/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause

Criterion	Urinary Tract Infection (UTI)
2a	Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1, and catheter was in place on the date of event. *and* at least 1 of the following signs or symptoms: fever (>38°C); suprapubic tenderness*; costovertebral angle pain or tenderness* *and* at least 1 of the following findings: a. positive dipstick for leukocyte esterase and/or nitrite b. pyuria (urine specimen with ≥10 white blood cells [WBC]/mm3 of unspun urine or >5 WBC/high power field of spun urine) c. microorganisms seen on Gram's stain of unspun urine *and* a positive urine culture of ≥103 and <105 CFU/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. ----------OR---------- Patient with an indwelling urinary catheter in place for > 2 calendar days and had it removed the day of or the day before the date of event *and* at least 1 of the following signs or symptoms: fever (>38°C); urgency*; frequency*; dysuria*; suprapubic tenderness*; costovertebral angle pain or tenderness* *and* at least 1 of the following findings: a. positive dipstick for leukocyte esterase and/or nitrite b. pyuria (urine specimen with ≥10 WBC/mm3 of unspun urine or >5 WBC/high power field of spun urine c. microorganisms seen on Gram's stain of unspun urine *and* a positive urine culture of $\geq 10^3$ and $<10^5$ CFU/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause
2b	Patient did <u>not</u> have an indwelling urinary catheter that had been in place for >2 calendar days and in place at the time of, or the day before the date of event *and* has at least 1 of the following signs or symptoms: fever (>38°C) in a patient that is ≤65 years of age; urgency*; frequency*; dysuria*; suprapubic tenderness*; costovertebral angle pain or tenderness* *and* at least 1 of the following findings: a. positive dipstick for leukocyte esterase and/or nitrite b. pyuria (urine specimen with ≥10 WBC/mm^3 of unspun urine or >5 WBC/high power field of spun urine c. microorganisms seen on Gram's stain of unspun urine *and* a positive urine culture of $\geq 10^3$ and $<10^5$ CFU/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause

Criterion	Urinary Tract Infection (UTI)
3	Patient ≤1 year of age with** or without an indwelling urinary catheter has at least 1 of the following signs or symptoms: fever (>38°C core); hypothermia (<36°C core); apnea*; bradycardia*; dysuria*; lethargy*; vomiting* *and* a positive urine culture of ≥10^5 CFU/ml and with no more than 2 species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause **Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1 and catheter was in place on the date of event.
4	Patient ≤1 year of age with** or without an indwelling urinary catheter has at least 1 of the following signs or symptoms: fever (>38°C core); hypothermia (<36°C core); apnea*; bradycardia*; dysuria*; lethargy*; vomiting* *and* at least 1 of the following findings: a. positive dipstick for leukocyte esterase and/or nitrite b. pyuria (urine specimen with ≥10 WBC/mm3 of unspun urine or >5 WBC/high power field of spun urine c. microorganisms seen on Gram's stain of unspun urine *and* a positive urine culture of between ≥103 and <105 CFU/ml and with no more than two species of microorganisms. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *With no other recognized cause **Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1 and catheter was in place on the date of event.

Criterion	Urinary Tract Infection (UTI)
4	Patient with* or without an indwelling urinary catheter has no signs or symptoms (i.e., for any age patient, no fever (>38°C); urgency; frequency; dysuria; suprapubic tenderness; costovertebral angle pain or tenderness OR for a patient ≤1 year of age; no fever (>38°C core); hypothermia (<36°C core); apnea; bradycardia; dysuria; lethargy; or vomiting) *and* a positive urine culture of ≤10^5 CFU/ml and with no more than 2 species of uropathogen microorganisms** (see Comments section below) *and* a positive blood culture with at least 1 matching uropathogen microorganism to the urine culture, or at least 2 matching blood cultures drawn on separate occasions if the matching pathogen is a common skin commensal. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements. *Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1, and catheter was in place on the date of event. **Uropathogen microorganisms are: Gram-negative bacilli, *Staphylococcus spp.*, yeasts, beta-hemolytic *Streptococcus spp*., *Enterococcus spp*., *G. vaginalis*, *Aerococcus urinae*, and *Corynebacterium* (urease positive)[+]. [+]Report *Corynebacterium* (urease positive) as either *Corynebacterium species unspecified (COS*) or as *C. urealyticum* (CORUR) if so speciated. (See complete list of uropathogen microorganisms at www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx#uropathogens)
Comments	• Laboratory cultures reported as "mixed flora" represent at least 2 species of organisms. Therefore an additional organism recovered from the same culture, would represent >2 species of microorganisms. Such a specimen cannot be used to meet the UTI criteria. • Urinary catheter tips should not be cultured and are not acceptable for the diagnosis of a urinary tract infection. • Urine cultures must be obtained using appropriate technique, such as clean catch collection or catheterization. Specimens from indwelling catheters should be aspirated through the disinfected sampling ports. • In infants, urine cultures should be obtained by bladder catheterization or suprapubic aspiration; positive urine cultures from bag specimens are unreliable and should be confirmed by specimens aseptically obtained by catheterization or suprapubic aspiration. • Urine specimens for culture should be processed as soon as possible, preferably within 1 to 2 hours. If urine specimens cannot be processed within 30 minutes of collection, they should be refrigerated, or inoculated into primary isolation medium before transport, or transported in an appropriate urine preservative. Refrigerated specimens should be cultured within 24 hours. • Urine specimen labels should indicate whether or not the patient is symptomatic. • Report only pathogens in both blood and urine specimens for ABUTI. • Report *Corynebacterium* (urease positive) as either *Corynebacterium species* unspecified (COS) or as *C. urealyticum* (CORUR) if speciated.

Available at: www.cdc.gov/nhsn/pdfs/pscManual/7pscCAUTIcurrent.pdf.

Table 4.1. Surveillance Definitions for Urinary Tract Infections (UTI) in Long-Term Care

Criteria	Comments
A. For residents without an indwelling catheter (both criteria 1 and 2 must be present)	UTI should be diagnosed when there are localizing genitourinary signs and symptoms and a positive urine culture result. A diagnosis of UTI can be made without localizing symptoms if a blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection. In the absence of a clear alternate source of infection, fever or rigors with a positive urine culture result in the noncatheterized resident or acute confusion in the catheterized resident will often be treated as UTI. However, evidence suggests that most of these episodes are likely not due to infection of a urinary source.
1. At least 1 of the following sign or symptom subcriteria a. Acute dysuria or acute pain, swelling, or tenderness of the testes, epididymis, or prostate b. Fever or leukocytosis (see Table 2) and at least 1 of the following localizing urinary tract subcriteria i. Acute costovertebral angle pain or tenderness ii. Suprapubic pain iii. Gross hematuria iv. New or marked increase in incontinence v. New or marked increase in urgency vi. New or marked increase in frequency c. In the absence of fever or leukocytosis, then 2 or more of the following localizing urinary tract subcriteria i. Suprapubic pain ii. Gross hematuria iii. New or marked increase in incontinence iv. New or marked increase in urgency v. New or marked increase in frequency	
2. One of the following microbiologic subcriteria a. At least $10^{(5)}$ cfu/mL of no more than 2 species of microorganisms in a voided urine sample b. At least $10^{(2)}$ cfu/mL of any number of organisms in a specimen collected by in-and-out catheter	Urine specimens for culture should be processed as soon as possible, preferably within 1–2 h. If urine specimens cannot be processed within 30 min of collection, they should be refrigerated. Refrigerated specimens should be cultured within 24 h.
B. For residents with an indwelling catheter (both criteria 1 and 2 must be present) **1. At least 1 of the following sign or symptom subcriteria** a. Fever, rigors, or new-onset hypotension, with no alternate site of infection b. Either acute change in mental status or acute functional decline, with no alternate diagnosis and leukocytosis c. New-onset suprapubic pain or costovertebral angle pain or tenderness d. Purulent discharge from around the catheter or acute pain, swelling, or tenderness of the testes, epididymis, or prostate	Recent catheter trauma, catheter obstruction, or new-onset hematuria are useful localizing signs that are consistent with UTI but are not necessary for diagnosis.
2. Urinary catheter specimen culture with at least $10^{(5)}$ cfu/mL of any organism(s)	Urinary catheter specimens for culture should be collected following replacement of the catheter (if current catheter has been in place for >14 d).
NOTE: Pyuria does not differentiate symptomatic UTI from asymptomatic bacteriuria. Absence of pyuria in diagnostic tests excludes symptomatic UTI in residents of long-term care facilities. cfu, colony-forming units.	

Figure 4.2. Criteria for Defining UTI Events in NHSN LTCF Component

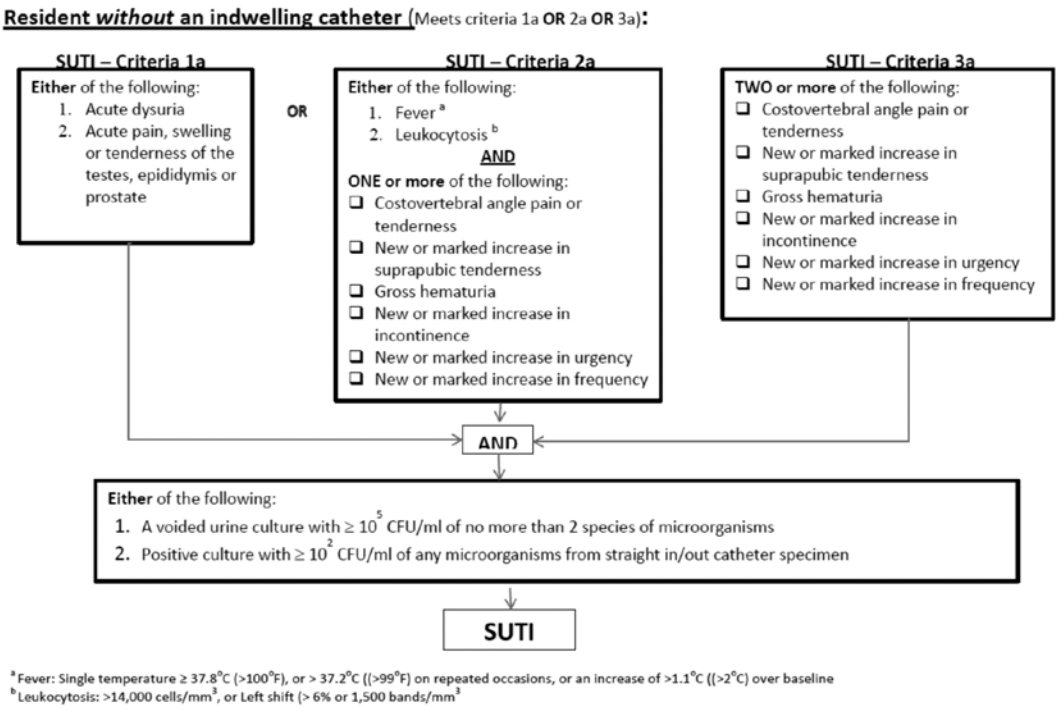


Figure 4.3

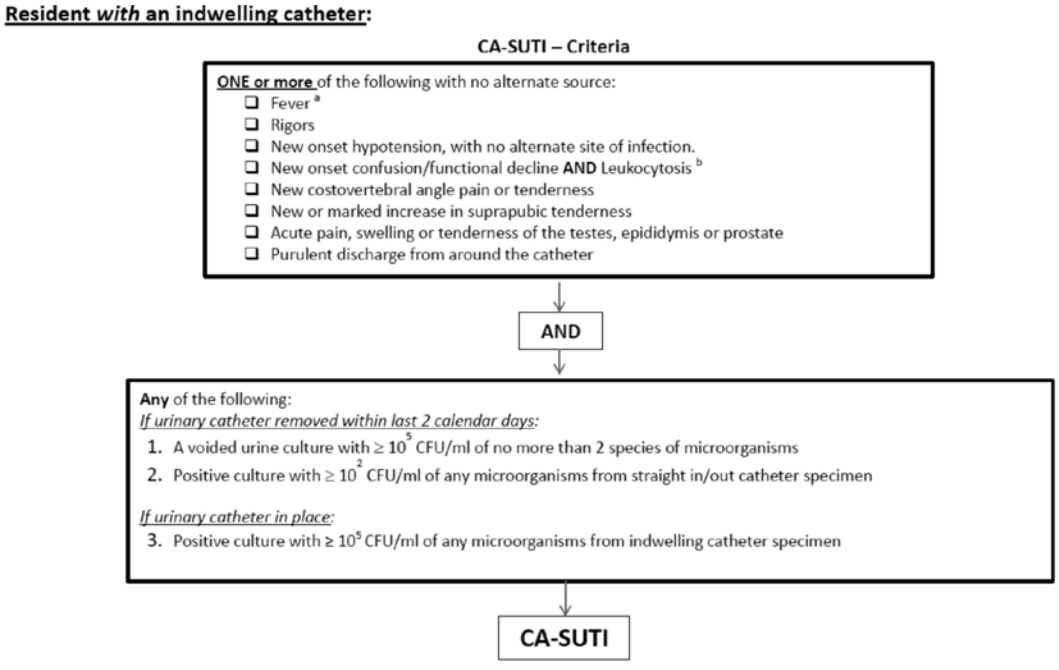
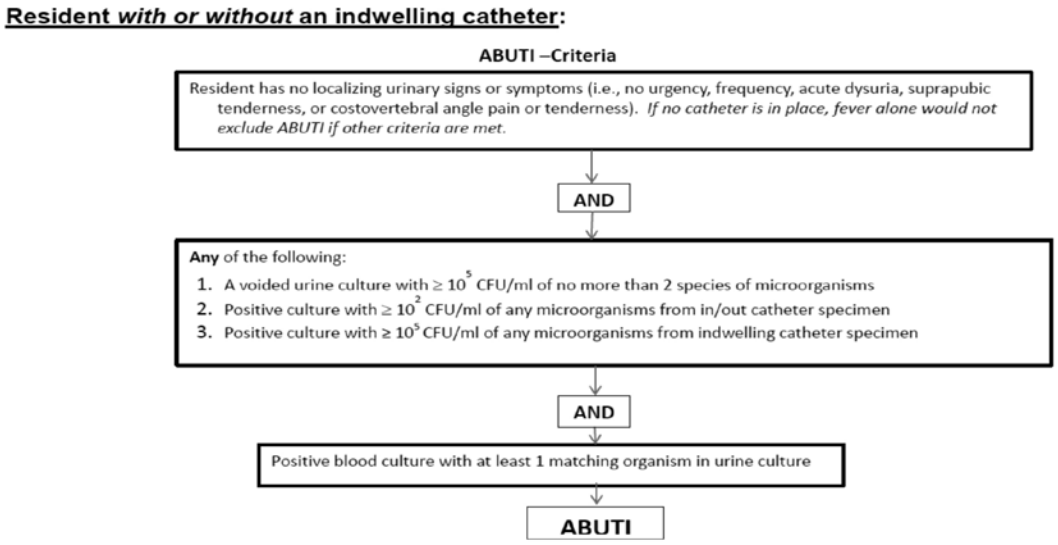


Figure 4.4



LTC facility protocols can be found at: www.cdc.gov/nhsn/PDFs/LTC/LTCF-UTI-protocol_FINAL_8-24-2012.pdf.

Use of Laboratory Data

The quality of the urine specimen for culture is important when determining if a true infection is present. The specimen of choice is the first morning void because it is generally more concentrated as a result of the length of time the urine was in the bladder. The preferred collection method is a midstream, clean-catch specimen. Techniques for this type of collection can be found in a standard nursing text and laboratory manuals.

Specimens collected from a newly inserted urine catheter are reliable, providing that proper insertion technique had been followed. Only specimens collected from a specifically designed sampling port or from the catheter directly should be submitted for analysis. Under no circumstances should a sample from a drainage bag be submitted for analysis. Urinary catheter tips should not be submitted for microbiologic analysis.

Appropriate urine specimen collection and transport is key to accurate urine culture results. Accurate results enable the clinician to appropriately treat the patient and also avoid overtreatment or a delay in culture results due to a contaminated specimen.

Bacteria reproduce by binary fission, a process where one parent cell divides to form two progeny (offspring of an organism) cells.[5] Since one cell results in two progeny cells, exponential growth occurs and can be illustrated in the following way:

Number of cells	1 2 4 8 16
Exponential	2^0 2^1 2^2 2^3 2^4

In this way, one bacteria will produce 16 bacteria after four generations. The doubling (generation) time of bacteria ranges from as little as 20 minutes for *Escherichia coli* (E. coli) to as long as 18 hours for *Mycobacterium tuberculosis.* Therefore, E. coli will reproduce more than 1,000 progeny in about 3 hours and approximately 1 million in about 7 hours.[6]

The ease with which some bacteria grow makes it imperative that specimens are sent to the laboratory in a timely manner. Physicians must be sure that the results provided by the microbiology laboratory are accurate, significant, and clinically relevant. Result interpretation depends entirely

Table 4.2. When to Obtain or Not Obtain a Urine Culture in a Patient with an Indwelling Urinary Catheter

Discourage urine culture Use	Appropriate urine culture use
Urine quality: color, smell sediments, turbidity (do not constitute signs of infection)	Part of an evaluation of sepsis without a clear source (CAUTI is often diagnosed by exclusion)
Screening urine cultures (whether on admission of before non-urologic surgeries)	Based on local findings suggestive of CAUTI (example: pelvic discomfort or flank pain)
Standing orders for urinalysis or urine cultures without an appropriate indication	Prior to urologic surgeries where mucosal bleeding is anticipated or transurethral resection of the prostate
"PAN" culturing (mindfulness in evaluating sources is key)	Early pregnancy (avoid urinary catheters if possible)
Obtaining urine cultures based on pyuria in an asymptomatic patients	
Asymptomatic elderly and diabetics (high prevalence of asymptomatic bacteriuria)	
Repeat culture to document clearing of bacteriuria (no clinical benefit to patients)	

Source: Fakih, M. Principles of highly reliable care: improving the culture of culturing: avoiding unnecessary urine cultures in catheterized patients. Ascension Health. Clinical Excellence Feb 2014 p.5

on the quality of the specimen submitted for analysis.[7]

Specimen Collection

The Clinical and Laboratory Standards Institute Guidelines recommend that the urine specimen is cultured within 2 hours of its collection. If the specimen cannot be cultured within 2 hours of collection, there are two options for maintaining the specimen integrity: collection of the urine specimen in a container with a chemical preservative (most commonly, buffered boric acid);[2] holding the urine specimen at a controlled temperature (2–8° C) until the specimen can be cultured. Overgrowth of bacteria can readily occur with mishandled specimens, and this will cause a false positive or unreliable culture result.

The collection container should be sterile and hold at least 50 mL of specimen. It should have a wide mouth for easy collection, a wide base to prevent spillage, and secure lid closure. Proper labeling on the container (not on the lid) includes the patient's name and/or unique identifier, collection date and time.

Because urine is so easily contaminated with commensal flora (normal bacteria), specimens for culture of bacterial urinary pathogens should be collected with attention to minimizing contamination from the perineal area and from superficial mucosa. When obtaining a clean-catch specimen, skin cleansing is still recommended. Obtaining a specimen from a straight or "in and out" catheterization may provide a viable specimen if collected using aseptic techniques. For more information on this technique see appendix.[8]

Guidance on the collection of specimens from urinary catheters is limited two main authoritative sources:

1. *CDC HICPAC Guideline for the Prevention of Catheter Associated Urinary Tract Infections, 2009*

   This guideline states that a small volume of fresh urine for urinalysis or culture can be aspirated from the sampling port of the drainage system. The port must be cleansed with a disinfectant before accessing it with a sterile syringe/cannula adapter. Large volumes of urine for special analyses (not culture) can be obtained aseptically from the drainage bag.

The guideline does not address the length of time a urinary catheter has been in place at the time of specimen collection.

The same guidelines are also found in: *The SHEA/IDSA Practice Recommendation Strategies to Prevent Catheter-Associated Urinary Tract Infections in Acute Care Hospitals: 2014* Update mirrors the information presented in the *CDC HICPAC CAUTI Guideline*.

2. *Diagnosis, Prevention and Treatment of Catheter Associated Urinary Tract Infection in Adults: 2009* International Clinical Practice Guidelines published by the Infectious Disease Society of America.

   This document states that if an indwelling catheter has been in place for > 2 weeks at the onset of CAUTI and is still indicated, the catheter should be replaced to hasten resolution of symptoms and to reduce the risk of subsequent catheter-associated bacteriuria and CAUTI. The guidance also states that a urine culture should be obtained from a freshly placed catheter prior to the initiation of antimicrobial therapy to help guide treatment.[16]

   Another important aspect of specimen collection is the risk of fungal contamination. According to A Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2013 Recommendations, published by the Infectious Diseases Society of America (IDSA) and the American Society for Microbiology (ASM), yeast in urine must be carefully evaluated. Recovery of yeast, usually Candida spp, even in high cfu/mLis is not infrequent from patients who do no actually have yeast UTI. For that reason, interpretation of cultures yielding yeast is not as standardized as that for bacterial pathogens. Yeast in urine may rarely indicate systemic infection for which additional tests must be performed for confirmation (e.g., blood cultures, beta-glucan levels).[17]

   A urinalysis is frequently used as a screening tool to determine the general health of the urinary tract, including potential presence of infection.

Urinalysis Interpretation[9]

- Assessment of color, clarity, presence of proteins, glucose, ketones, blood, nitrite, and leukocyte esterase
- Microscopic examination of red blood cells (RBC), white blood cells (WBC), casts, crystals, bacteria, or yeast
- Positive leukocyte esterase (LE) indicating the presence of WBCs or debris from ruptured WBCs in the urine, with 90 percent accuracy
- If LE positive, microscopic examination may be performed to determine number of RBC and WBC casts present
- Possible infection if 10 or more WBC in urine
- Possible infection of the kindey if 10 or more WBC casts (WBC cast formation in urine may be indicative of inflammation or infection)[10]

Data Analysis and Reporting

One of the basic tenets of an effective infection prevention program is the ability to use data to drive improvement. The NHSN provides an excellent opportunity to aggregate, analyze, and benchmark important infection prevention information. In order to generate risk-adjusted incidence rates, standardized infection ratios, and other data for analysis, it is important to have accurate denominator data reflective of the population at risk. Collection of urinary catheter days may be manual or automated. Automated data must be validated prior to routine use. The NHSN allows the collection of denominator data electronically, but stipulates that electronic and manual data collection should take place simultaneously for a period of time and that the resulting difference between the two methods should not exceed ±5 percent. Alternately, if automated data are not available, staff should collaborate with others to obtain the data. For example, a ward clerk or other ancillary personnel might be trained to collect these data. Studies demonstrating automatio of collection of device days from electronic medical record systems have been published.[18]

Organizations may generate line lists, rate tables, and standardized infection ratios. An example of a Foley catheter line list is shown in Figure 4.6. For an example of prevalence, see Figure 4.5.

The CAUTI rate per 1,000 urinary catheter days is calculated by dividing the number of CAUTI by the number of catheter days and multiplying the result by 1,000. The urinary catheter utilization ratio is calculated by dividing the number of urinary catheter days by the number of patient days. These calculations will be performed separately for the different types of ICUs, specialty care areas, and other locations in the institution, except for neonatal locations.[10]

Figure 4.5. Foley Catheter Prevalence Sheet

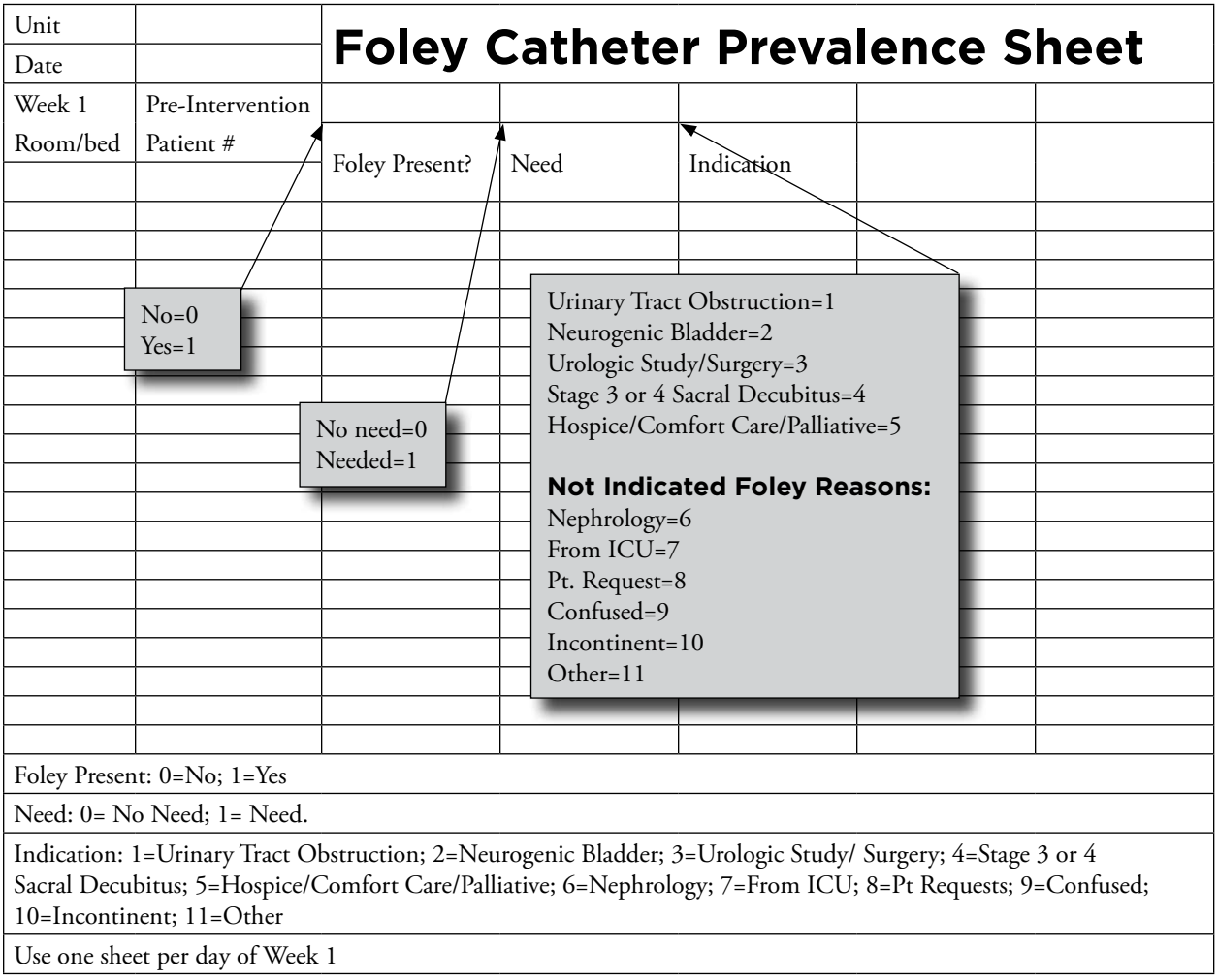


Figure 4.6. Example of Data Elements in a Line List

Patient ID	Date of urine culture	Organism	Urinary catheter yes/no	Date insertion	Temperature > 38 degrees C	Suprapubic tenderness or costovertebral angle pain or tenderness	HAI
XXXXXXXX	5/23/2013	E. coli	Yes	5/19/2013	38.9	No	Yes

Source: Table created and published with permission Mary Jo Bellush

Plan: Calculate the monthly rate of CAUTI in the medical ICU for calendar year 2007.

Criteria: NHSN criteria for CAUTI

Data Collection: Active surveillance of ICU patients

Numerator: Number of new CAUTI cases per month

Denominator: Number of urinary catheter days in medical ICU

Calculation of Incidence Rate:
Medical ICU CAUTI rate =
$$\frac{\text{Number of new CAUTI case(s) x 1,000}}{\text{Number of catheter days}}$$

Example: 2 UTI / 702 catheter days = .002847 x 1,000 = 2.8 per 1,000 urinary catheter days

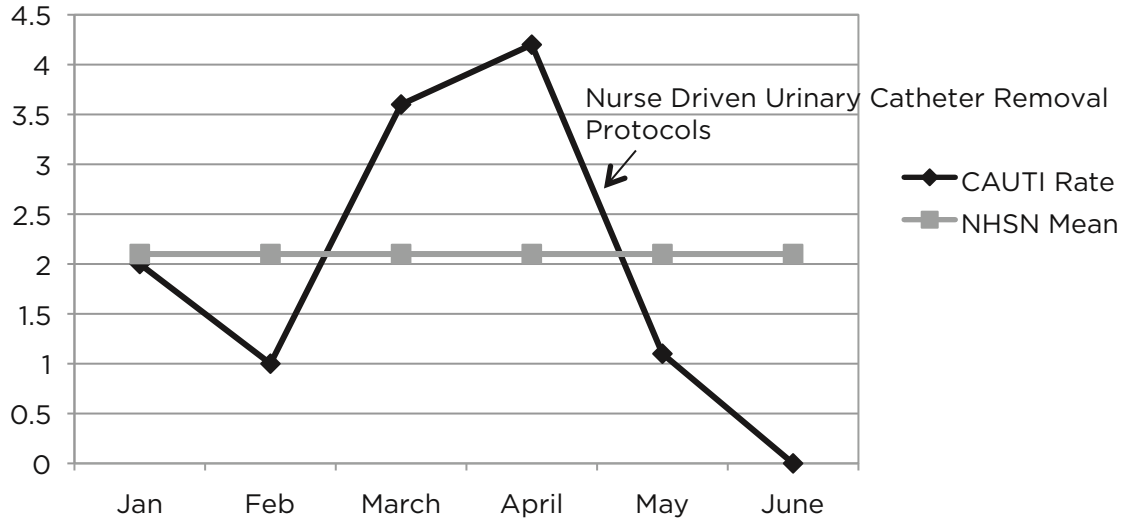
Population-Based CAUTI

One paradox of improved stewardship of urinary catheters is that as this increases the prevalence and frequency of use decreases. This lowers the device days in the denominator of the traditional NHSN defined CAUTI rate and as a result rates can appear to be increasing after implementation of a CAUTI prevention project. [see case study from Nevada; and Wright MO, et al. *Infect Control Hosp Epidemiol*. 2011 Jul;32(7):635-40.] Fakih and others have published a modeling study that demonstrated a population CAUTI rate (i.e., number of CAUTIs identified in a population in a month / total number of patient days in the same month x 1,000) is less susceptible to this paradox.[19] It is an alternative to the traditional NHSN rate and can be used as an alternative or additional metric to assess impact of prevention strategies on outcome. See Figure 4.7.

Device Utilization Ratio

Device utilization (DU) ratios can be important in surveillance methodology as another component toward the goal of reducing CAUTI. Calculation of this ratio over time allows for outcome or process methodology to be used to attempt to decrease urinary catheter days.[11] It is important to count device days at the same time daily (within a 24 hour period). Calculation of device utilization ratio requires collection of patient days for a selected time period. Patient days are the total number of days patients are in a location during a selected time period. For example, 20 patients were on a unit on the first day of the month; 22 on day 2; 20 on day 3; and so on. By adding 20+22+20, there would be a total of 62 patient days for the first 3 days of the month. This would be continued for the entire month in order to obtain the patient days for that month.

Figure 4.7 Rate of CAUTI per 1,000 Urinary Catheter days 2013 MICU



Source: Graph created and reprinted with permission Linda Greene, Highland Hospital Rochester, NY

DU ratio can be calculated by using the following formula:

$$\text{DU ratio} = \frac{\text{Number of device-days}}{\text{Number of patient-days}}$$

Standardized Infection Ratio

The standardized infection ratio (SIR) is a summary measure used to track HAIs at a national, state, or facility level over time. The SIR adjusts for the fact that each healthcare facility treats different types of patients. This indirect standardization method calculates the number of expected infections based upon a specific time frame known as the referent period.[12]

The method of calculating a SIR is similar to the method used to calculate the standardized mortality ratio, a statistic widely used in public health to analyze mortality data. In HAI data analysis, the SIR compares the actual number of HAIs in a facility or state with the baseline U.S. experience (i.e., standard population), adjusting for several risk factors that have been found to be most associated with differences in infection rates.

SIR is the number of observed infections divided by the number of expected infections. See Table 4.3. The expected number is based on the national average, the number of urinary device days, and historical data for those procedures. This method is helpful when small numerators and denominators are present.

- A SIR of **1** means the observed number of infections is equal to the number of expected infections.
- A SIR **greater than 1** means that the infection rate is higher than that found in the "standard population." For HAI reports, the standard population comes from data reported by the hundreds of U.S. hospitals that use the NHSN system. The difference above 1.0 is the percentage by which the infection rate exceeds that of the standard population.
- A SIR **less than 1** means the infection rate is lower than that of the standard population. The difference below 1 is the percentage by which the infection rate is lower than that of the standard population.

How the SIR is used: *The 2011 National and State Healthcare-associated Infections Standardized Infection Ratio Report* (Jan.–Dec. 2011) presents a comprehensive summary of HAI data collected in the NHSN. Healthcare facilities using the NHSN have real-time access to their data for local improvement efforts. The annual report provides analysis of national and state-level HAI data to help identify gaps in HAI prevention and is used by HHS to measure progress towards HAI reduction goals.[13]

In March 2014, updated state SIR results were released in the CDC's *National and State Healthcare-Associated Infections Progress Report.* This report is based on 2012 data from acute-care hospitals. The report is intended to help measure progress toward the five year HAI prevention goals outlined in the *National Action Plan to Prevent Healthcare-Associated Infections: Road Map to Elimination* (HHS HAI Action Plan) initially developed in 2009. According to this report, U.S. hospitals reported a significant increase in CAUTIs between 2011 and 2012. Thirteen percent of hospitals have a CAUTI SIR significantly worse then the national SIR of 1.03. The full report can be downloaded at: www.cdc.gov/HAI/pdfs/progress-report.pdf.

Table 4.3. Understanding the SIR

SIR less than 1	SIR greater than 1
Fewer infections than would have been predicted during a baseline period	More infections than would have been predicted during a baseline period
Infections prevented since the baseline period	More infections since the baseline period

Source: CDC. Available at: www.cdc.gov/HAI/surveillance/QA_stateSummary.html#a6.

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Section 5: Patient Safety, CUSP, and Other Behavioral Models

Once considered an inevitable consequence of receiving healthcare, HAIs are receiving considerable attention as a major cause of patient harm leading to increased morbidity, mortality, cost, and length of stay. The shift in the perception of patient harm started with the publication of the Institute of Medicine (IOM) report *To Err is Human* in 1999.[1] This report revealed that thousands of patients in U.S. hospitals were injured or died each year because of medical errors—and many of these injuries and deaths were preventable. HAIs were recognized as a leading cause of these preventable harm events. The IOM report was followed by articles in the *Chicago Tribune* that chronicled observed lapses in evidence-based infection prevention practices, such as hand hygiene. During 2005–2006, the publication of two studies about the prevention of CLABSIs brought increasing awareness to the magnitude of the HAI problem. Both the Pittsburgh Regional Healthcare Initiative and a collaborative project between The Johns Hopkins Hospital and the Michigan Hospital Association demonstrated consistent results that many CLABSIs could be prevented through team work, communication, feedback, and transparency. These projects helped highlight that a substantial portion of these infections could be prevented though implementation of a combination of technical evidence-based infection-prevention practices and socio-adaptive interventions.[2]

There are considerable data to suggest that, although evidence-based interventions exist, there is often lack of implementation at the unit or organizational level. In recent years, it has become clear that driving change and improving patient outcomes requires a combination of both technical and socio-adaptive skills. The success of the CLABSI project in Michigan was based largely on CUSP, the relatively new five-step program designed to change a unit's workplace culture, and in so doing bring about significant safety improvements by empowering staff to assume responsibility for safety in their environment. This is achieved through education, awareness, access to organization resources, and a toolkit of interventions.[3]

Adopted by about 40 units at The Johns Hopkins Hospital—and hundreds of units outside of Hopkins—CUSP has been used to target a wide range of problems: for example, patient falls, hospital-associated infections, and medication administration errors.

This five-step program has also provided a framework to get units involved with, and committed to, organization- and national-level safety goals. One of the main tenets of CUSP is that it focuses on cultural change.

CUSP tools and techniques:
The CAUTI CUSP tool kit contains specific policies, tools for implementation, and other strategies for overcoming barriers.
www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/index.html

CUSP Focuses on Five Steps:
1. Educate staff on the "science of safety."
2. Identify defects.
3. Assign executive to adopt unit.
4. Learn from defects.
5. Implement tools team work tool.

CUSP and CAUTI

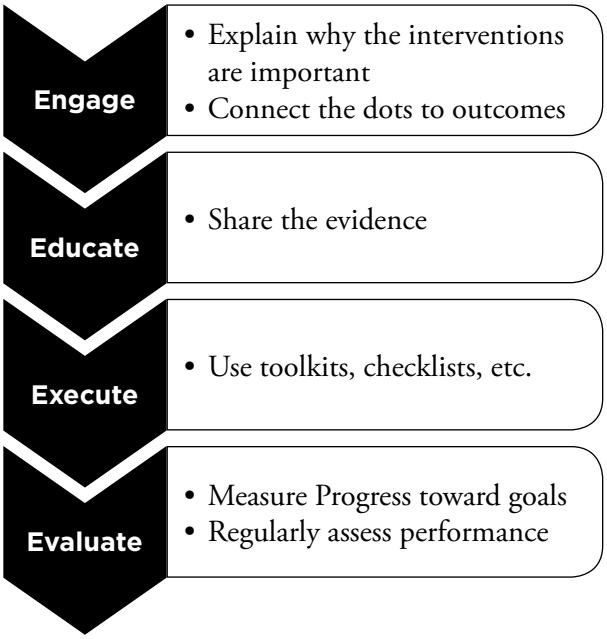
The HHS action plan specifically addresses implementation science and barriers to initiating evidence-based practices. The need for a better understanding of the human and organizational factors that affect the adoption and implementation of evidence-based practices is germane to the CUSP methodology. Given the success of the CLABSI CUSP project in demonstrating how a structured strategic framework for safety can result in dramatic improvements in care, the CUSP initiative has been expanded to CAUTI as well as units outside of the ICU.[5]

Implementation of standard processes is often difficult. Nurses are generally responsible not only for catheter insertion but also for ongoing catheter management and removal. Although nurses do not make the decision to insert a urinary catheter, they may have some influence on catheter use.[6] Indeed, there is evidence that nurses can have significant impact on use of urinary catheters and serve as effective stewards of appropriate use of this device. Requests from nurses to place a catheter for nursing convenience are not uncommon and represent a misuse of urinary catheters. Barriers to implementation of evidence-based practices include patients of size, patients with incontinence or ambulation difficulties, and consensus regarding the need for ongoing strict urinary output.

From Evidence to Implementation

Peter Pronovost and colleagues described a conceptual model used to translate evidence into practice. This model consists of a series of steps that include summarizing the evidence, identifying local barriers to implementation, measuring performance, and ensuring that all patients receive the intervention. Central to this model is the 4 E's, a method to increase reliability and to engage frontline staff. The 4 E's are described in Figure 5.1.[4] This conceptual model has been applied successfully to several projects and applies cultural change to rigorous interventions. Also see Table 5.2.

Figure 5.1. The 4 Es of Translating Evidence into Practice



CUSP Implementation: Stories from the Front Line

The team at the Tucson Medical Center's 16-bed ICU (neuro/neurosurgical, medical, pulmonary, vascular, and general surgery) decided to implement the CUSP program because of a need for improvement in CAUTI rates. They viewed the CUSP program as a venue for support and structure.

The Tuscon team engaged the staff with real-life stories of patients who were harmed and provide education on the "science of safety." They executed their plan with several actions and interventions.

The team developed an audit tool, which was utilized to identify defects. See Table 5.1.

Audit Process

- Customizing tool to evaluate deficits
- Identifying barriers

Case Reviews - Team

- Isolating root cause
- Review processes/practices
- Identifying vented patient populations – developed guideline

During case reviews, they identified process issues and noted that their device utilization was high. However, their policy had no specific guidelines for catheter use in patients on the ventilator. As a team, they engaged staff members and medical staff to develop catheter insertion guidelines for patients on the ventilator. See Figure 5.2.

The team also began collaboration with other departments, such as the emergency room, surgery, transport, and radiology to share their process and standards and to ensure that insertion and maintenance standards were shared and adhered to. Additionally, the team began product trials and evaluation of alternatives to urinary catheters in order to effectively reduce catheter days.

Results

Lessons learned: The team continues to decrease urinary catheter utilization and has found effective ways to gain staff input on barriers to implementation, identify that staff can change behavior when given the tools to change, gain physician "buy-in," and continue with constant conversations.

Other CUSP tools

Learning from Defects Tool

One helpful tool that is highlighted in the CUSP framework is the Learning from Defects (LFD) Tool. The tool is used when events (known as defects) occur. This tool can be utilized by

Table 5.1.

UNIT NAME: _____	Tucson Medical Center CAUTI PROJECT:															DATA COLLECTOR:____
DATE: _____	CATHETER APPROPRIATENESS DATA COLLECTION															PATIENT COUNT: __
Patient Number	50	52	54	56	60	62	64	66	51	53	55	57	61	63	65	67
Foley alternatives in place (P, C, or B)																
Is Catheter Present? (Yes or No)																
If yes, where was Catheter placed?																
Insertion Date																
MD order for foley? (Yes or No)																
Is drainage bag seal intact? (Yes or No)																
Is stat lock on? (Yes or No)																
Is patient vented? (Yes or No)																
Why does the patient have a catheter TODAY?(Check the MAIN reason for the catheter)																
APPROPRIATE Indications																
Accurate measurement of urinary output in critically ill patient *see reverse side of audit tool																
Acute urinary retention or obstruction																
Assist healing of perineal or sacral wound in an incontinent patient																
Chronic indwelling catheter on admission																
Hospice/comfort /palliative care																
Perioperative use in selected surgeries																
Required immobilization, for trauma or surgery																
If none of the above reasons apply, why does the patient have a catheter TODAY? (choose one from the list below):																
INAPPROPRIATE Indications																
Incontinence WITHOUT a sacral or perineal pressure sore																
immobility, confusion/dementia, patient request)																

Source: Chart and data created and published with permission Jennifer Tuttle, Tucson Medical Center

Table 5.2. Example of Applying the 4 E's to a CAUTI intervention.

Fields have been completed using examples and are not intended as a comprehensive list.

General activity	Essentials of CAUTI prevention (evidence based)	Adaptation of interventions for this organization	Identified gaps (knowledge, skills, behavior, resources, etc.)	Measures to address gaps	Key resources for implementation
Engage Explain why the interventions are important.	Rationale presented to all stakeholders. Case for prevention is clear, concise, compelling Rationale is part of Patient Safety Program. Active, visible participation by senior leaders and institutional champions (all levels).	Determine which groups are already engaged and if others need greater involvement. Verify that CAUTI prevention has a high profile/ priority within the organization's safety program. Consider novel, creative ways to showcase the involvement of senior leaders, including medical staff.	Check to see that all stakeholders are involved. Groups often overlooked include the lab, EVS, and patient transport. Determine if gaps may be associated with misperceptions, e.g. CAUTI is primarily a nursing issue, use of antibiotics easily mitigates any larger clinical risks, etc.	Note: Full engagement is required for the remaining three general activities (educate, execute, and evaluate) to be successful. Address any gaps with a targeted plan, include time frames.	HHS HAI Action Plan (2009) *See also* CDC HAI incidence data, progress reports at www.cdc.gov
Educate Share evidence supporting the interventions.	Share CAUTI data, including morbidity, mortality and cost data. Educate regarding use of prevention techniques. Describe need for thorough, accurate medical record documentation.	Teach and reinforce correct indications for catheter use, insertion and maintenance. Reinforce previous practices that should be discontinued Teach and reinforce organization standards for documentation.	Compare new content to what may have been used in the past. Address discrepancies, including practices no longer used. Verify accurate baseline knowledge among staff before proceeding.	Note: Do not assume that care staff familiar with catheters knows current best practices. Outdated information can be difficult to eradicate; long standing care routines are often resistant to change.	HICPAC Guideline for the Prevention of CAUTI (2009) SHEA/IDSA Compendium of Strategies to Prevent HAIs in Acute Care Hospitals (2014)

General activity	Essentials of CAUTI prevention (evidence based)	Adaptation of interventions for this organization	Identified gaps (knowledge, skills, behavior, resources, etc.)	Measures to address gaps	Key resources for implementation
Execute Design an intervention toolkit.	Implement CAUTI bundle Provide staff/ patient/family education. Conduct rigorous monitoring and offer frequent feedback.	Consider use of a CAUTI checklist as part of a CAUTI bundle approach. Determine need for alerts to physician and nurses re: potential catheter removal. Add catheter review to daily rounds. Consider nurse removal protocols to support timely discontinuation.	Bundles and checklist are important but must be analyzed in terms of attitude and behavior. Determine of the structural, programmatic as well as behavioral elements are aligned for successful implementation.	Note: Encourage care staff to suggest improvements to the implementation plan. Small adjustments can offer large benefits in the overall success of the program.	APIC Implementation (formerly Elimination) Guide, CAUTI (2014) AHRQ CAUTI Toolkit (2013)
Evaluate Regularly assess performance measures and unintended consequences.	Identify measures of success and report progress per schedule. Investigate errors and lapses as opportunity to improve. Include patients/ families in evaluation process. Communicate, celebrate success.	Describe both process and outcome measures for CAUTI Share progress towards goals at least once per month. Compare progress to other local, regional, and national measures. Show how results demonstrate the organization's commitment to patient safety and overall safety culture.	Evaluate both the program statistics as well as procedural compliance. Include students if they handle catheters. Do not overlook the opportunity for ongoing understanding and use of correct aseptic technique. Anticipate the need for follow up and periodic reminders.	Note: Use statistics wisely; do not overwhelm staff with data. Follow up on any complaints or adverse events in a non-punitive measure. Consider use of RCA as needed. Combining quantitative and qualitative information may be helpful when evaluating program impact.	Compare organizational results to state, regional and national data, as available. Consider use of CDC NHSN Include CAUTI SIR reporting in results. Include trend data from staff competency based education and training activities as available.

Adapted from Pronovost PJ, Berenholtz SM, Needham DM. Translating evidence into practice: a model for large scale knowledge translation. *BMJ*. 2008 Oct 6;337:a1714

***Implementation science:** the use of scientifically valid methods to promote the integration of research findings and other best practices into the evolving standard of care. In this way, research not only moves from the laboratory to the beside, but also results in improved, safer and more cost effective healthcare.

Additional reference: Saint S, Howell J Krein SL, Implementation Science: How To Jumpstart Infection Prevention *Infect Control Hosp Epidemiol*. 2010 November; 31(Suppl 1): S14–S17

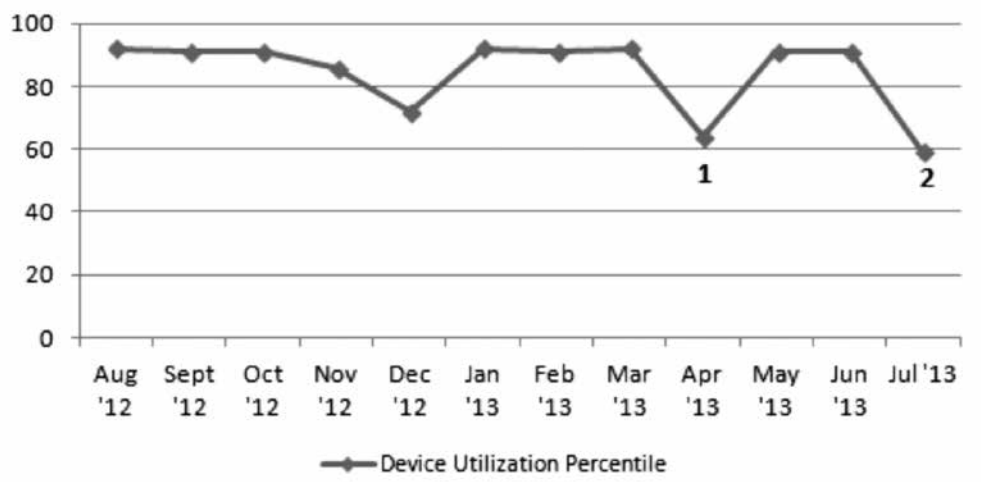
Table created by Marilyn Hanchett, RN, MA, CPHQ, CIC, from *Prevention Strategist*, Fall 2012

Figure 5.2. Urinary Catheter Guidelines for Critically Ill Patients on a Ventilator.

Conditions that require a Foley	Conditions that do not require a Foley	Case dependent conditions
Sepsis (first 24 hours) CRRT ARF Pressors with titration Artic Sun IABP SAH with triple H therapy	MIV Tube feeding Pressors with minimal titration Lasix Mild sedation or drowsiness	ARDS Paralysis or Sedation
Alternates to Foley **Incontinence Pad= P Condom Catheter = C Brief= B**		

Source: Chart and data created and published with permission Jamie Tuttle, Tucson Medical Center

Figure 5.3. ACCU Device Utilization Percentile



healthcare personnel to reduce the probability that a future patient will be harmed. A number of organizations have found that the tool is helpful in investigating CAUTI events. The tool prompts care providers to look at what happened and why it happened and helps them to develop a framework for a structured approach to analyzing events and identifying opportunities for improvement.

See example A for tool and example B for a completed LFD on pages 49 and 50.

Huddles

Generally any member of the team may call a huddle to address a new or changing circumstance. The huddle may be called when a single significant infection or increased incidence of infection occurs, such as CAUTI or increased incidence of CAUTI. The focus may be to heighten awareness of a situation or to enhance prevention efforts. The team huddle is powerful and effective and can work in real time, but the keys are short, patient-focused, efficient, problem solving, information sharing, and action oriented. The huddle is a tool for getting the team to work together effectively. Huddles can change a practice and improve teamwork and communication. These team events become partial solutions to real-time events, such as HAIs, clarifying patient care issues, and providing back-up behaviors with nurses, technicians, and providers, as well as helping each other with error avoidance. The huddle is a useful venue to begin utilizing the LFD tool. See SIR Tracking, Figure 5.4.

Example A: CUSP Learn from Defects Tool Worksheet

Learn from Defects Tool Worksheet

Date:_____

Attendees:_____

Topic of Focus:_____

What happened? (brief description)	
Why did it happen? (what factors contributed)	
+ **What prevented it from being worse?**	- **What happened to cause the defect?**

What can we do to reduce the risk of it happening with a different person?			
Action Plan	Responsible Person	Targeted Date	**Evaluation Plan – How will we know risk is reduced?**

With whom shall we share our learning? (Communication plan)			
Who	When	How	Follow up

Available at: www.onthecuspstophai.org/

Example B: Completed CUSP Learn from Defects Tool Worksheet

Learn from Defects Tool Worksheet

Date: September 2012

Attendees: ICU patient safety team Topic: Catheter associated UTIs (CAUTIs) in ICU patients

What happened? (brief description)
Too many CAUTIs in the ICU between first six months of 2012

Why did it happen? (what factors contributed)

+ factors **What prevented it from being worse?**	- factors **What happened to cause the defect?**
Part of daily ICU rounds to ask if urinary catheter in each patient was necessary	• All CAUTIs occurred when foley left in >6days • Poor daily documentation of necessity • Breaking the contained system to place urinometer onto drainage system • Urine reflux (bags are not emptied when traveling off unit or mobilizing the patient • Urine bag on floor • Inconsistent documentation regarding foley care and securement • Not having all the supplies available on unit

What can we do to reduce the risk of it happening with a different person?

Action Plan	**Responsible Person**	**Targeted Date**	**Evaluation Plan – How will we know risk is reduced?**
Audit insertion procedure			
Ensure adequate foley kits and extra catheters are available on the unit			
Standardize documentation for foley care and securement			
Re-educate personnel on indications for irrigation of foley			
Explore changing all foley's to urinometer			
Follow up with IT to understand foley alerts and documentation expectation			
Implement Bladder Bundle			
Define educational Plan			

With whom shall we share our learning? (Communication plan)

Who	When	How	Follow up

Example of completed LFD worksheet

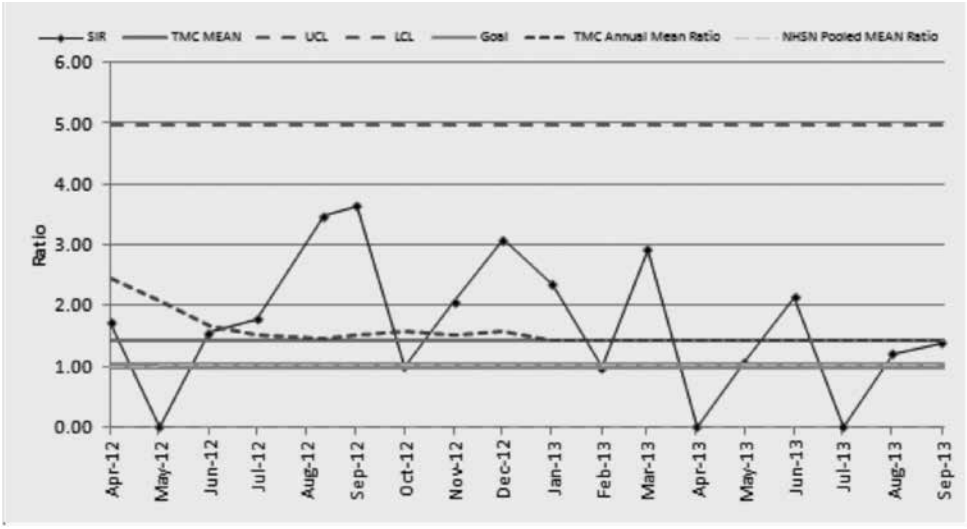
Team Check-up Tool

On the CUSP: Stop CAUTI collaborative has developed a team check-up tool (TCT) for use to facilitate identification of possible barriers to realizing success and to sustain the infrastructure to support an effective CUSP culture.

Key Lessons

Although CUSP offers a standard model, each facility will adapt it to its unique circumstances. To help ensure successful implementation, key CUSP-CAUTI lessons from early adopters are summarized in Table 5.4.

Figure 5.4. TMC CAUTI—Standardized Infection Ratio (SIR)



Source: Charts and data created and published with permission Jamie Tuttle, Tucson Medical Center

Table 5.4. Key Lessons for Success in Reducing CAUTI

1. Be clear in internal and external messages that CAUTI reduction is a priority for the organization, and when operational changes are made based on input from the front line, ensure that this is communicated to the unit teams.
2. All culture is local, and the best collective decisions are made when there is diverse and independent input. Make sure that front-line nurses nurse managers and physicians are at the table.
3. Ensure that all unit staff understands the Science of Safety (the complex systems in which care is delivered and how to improve these systems to make care safer). Encourage the front line to train other team members to encourage ownership.
4. Work with each unit team to build a system for collecting outcome data that will work best for the unit, and integrate data collection into existing unit workflows.
5. Allow teams to set aside designated staff time to collect and share data, and encourage cross-departmental collaboration, such as IT initiatives.
6. Work with the risk management team and talk with front-line staff to reveal stories of actual CAUTI cases to make the challenge real for the project team at all levels.
7. Front line staff will gain courage to speak up when granular, process-oriented gains are celebrated as successes. Widely communicating sustained rates of zero CAUTIs can set long-term goals that will help drive sustainability.

Source: Eliminating Catheter-associated urinary tract infections. Health Research & Educational Trust, Chicago: July 2013.

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Section 6: Prevention

Best practices are most often summarized in guideline documents published by professional organizations. These types of documents are developed using the most current scientific research; often the recommendations are ranked according to the strength of the research support their use. The CDC issues a wide range of guidelines, including the prevetnion of CAUTI. All of these guidelines are available online at www.cdc.gov/hicpac.

The *CDC HICPAC Guideline* has outlined some core strategies for CAUTI prevention:

- Insert catheters only for appropriate indications.
- Leave catheters in place only as long as needed.
- Ensure that only properly trained persons insert and maintain catheters.
- Insert catheters using aseptic technique and sterile equipment (acute-care setting).
- Following aseptic insertion, maintain a closed drainage system.
- Maintain unobstructed urine flow.
- Practice hand hygiene and standard (or appropriate isolation) precautions according to the *CDC HICPAC Guideline*.

The *HICPAC Guideline* identifies the following appropriate indications for insertion of a urinary catheter:[1]

1. *Acute urinary retention or obstruction*—Urinary catheters are indicated for the management of acute urinary retention due to mechanical obstruction. Urethral or bladder outlet obstruction is commonly related to benign prostatic hypertrophy, severe edema with penile swelling, urethral stricture or urinary blood clots. Urinary catheters also are indicated for acute urinary retention related to a neurogenic bladder most often related to spinal cord injury or progressive neurological disease or to medications that reduce bladder muscle contractility or sensation.
2. *Accurate measurement of urinary output in critically ill patients*—Catheters are indicated when accurate measurement of urinary output is required in critically ill patients receiving care in the intensive care setting. ICU patients who are hemodynamically stable and cooperative often do not require urinary catheters and are appropriate candidates for alternate means of measuring urine output
3. *Perioperative use in selected surgeries*—Urinary catheters are indicated perioperatively for selected surgical procedures. Catheters should be used when a surgery is expected to be prolonged, when a patient will require large volume infusions during surgery, or when there is a need for intraoperative urinary output monitoring. Catheters also are indicated for urologic surgeries or other surgeries on contiguous structures of the genitourinary tract.
4. *To assist healing of perineal and sacral wounds in incontinent patients*—This is a relative indication for urinary catheter use when there is concern that urinary incontinence is leading to worsening skin integrity in areas where there already is skin breakdown. Urinary catheters should not be used as a substitute for the use of skin care, skin barriers, and other methods to manage incontinence and limit skin breakdown.
5. *Hospice/comfort/palliative care*—This is an acceptable indication for catheter use in end-of-life care, if it helps with patient comfort.
6. *Required immobilization for trauma or surgery*—Urinary catheters may be used

Table 6.1. Summary Prevention Practice Issues Addressed in Guidelines

Intervention	CDC HICPAC	IDSA	SHEA Compendium	SHEA/APIC Prevention of Infections in Long Term Care	EPIC 2 2007
Use the smallest bore catheter possible	Y	N	Y	Y	Y- recommend 10 ml Baloon for adults
Meatal cleaning	Y- Routine without antiseptics	Y- Routine without antiseptics	Y- Routine without antiseptics	N	Y- Routine without antiseptics
Address indications for appropriate insertion of a catheter	Y	N – Recommend that organizations develop list of appropriate indications	Y	N	N
Do not routinely change catheters at fixed intervals	Y	Y Insufficient evidence to make recommendation on long term catheters	Y	Y	Y
Change indwelling urinary catheter before administering treatment for CAUTI	N	Y * Note greater than 2 weeks Recommend that initial urine specimen be obtained from a freshly placed catheter in cases where a long term urinary catheter has been in place	N	Y	N
Properly Secure Catheters	Y	N	Y	N	N
Replace catheter in breaks in aseptic technique or disconnection	Y	N	Y	N	N
Only trained personnel to insert catheters	Y	Y	Y	Y	Y
Maintain hydration	N	N	N	Y	N
Keep collection bag below the level of the bladder	Y	Y	Y	Y	Y
Avoid Routine Irrigation	Y	Y	Y	Y	Y
Care of leg bags	N	N	N	Y	N
Maintain closed collection system	Y	Y	Y	Y	Y

Adapted From:

- *CDC Guidelines for Prevention of Catheter – Associated Urinary Tract Infections* Available at: www.cdc.gov/hicpac/cauti/001_cauti.html
- SHEA Compendium of Strategies to Prevent CAUTI-www.shea-online.org/HAITopics/CompendiumofStrategiestoPreventHAIs.aspx
- *Diagnosis, Prevention and Treatment of Catheter-Associated Urinary Tract Infections in Adults: 2009 International Practice Guidelines* Available at: www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient_Care/PDF_Library/Comp%20UTI.pdf
- SHEA/ APIC Guideline: Infection Prevention and Control in the Long- Term Care Facility www.apic.org/Resource_/TinyMceFileManager/Practice_Guidance/id_APIC-SHEA_GuidelineforICinLTCFs.pdf
- epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England
- *Journal of Hospital Infection*(2007) S1-S64

Source: Used with permission, Linda Greene, RN, MPS, CIC, Highland Hospital, Rochester, NY

when patients require requires prolonged immobilization following trauma or surgery. Examples include instability in the thoracic or lumbar spine, multiple traumatic injuries, such as pelvic fractures, and acute hip fracture when there is risk of displacement with movement.[2]

In addition to documents developed and published by the CDC, other stakeholder groups, typically professional associations, may issue gudielines. Whitepapers and postion statemenst may also be used to communicate practice recommendations. A comparison of CAUTI prevention interventions among the major gudielines is shown in Table 6.1.

Primary Prevention: Avoiding Unnecessary Use of Urethral Catheters

Meddings and others recently reviewed available evidence on avoiding unnecessary use of urethral catheters as well as other key prevention strategies. Figure 6.1 identifies key aspects of urinary catheter use that can be targeted for prevention:

Figure 6.1. Lifecycle of the Urinary Catheter

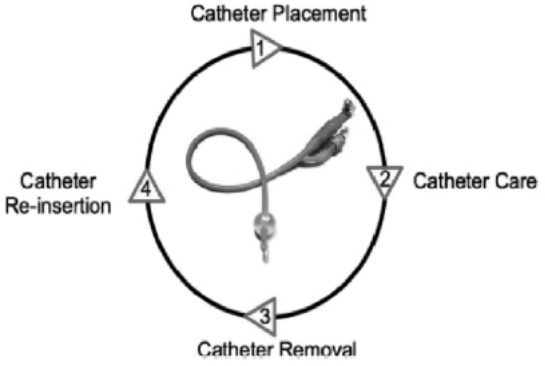


Figure 1 Lifecycle of the urinary catheter.[21] This conceptual model illustrates four stages of the urinary catheter lifecycle as targets for interventions to decrease catheter use and catheter-associated urinary tract infection.

Source: Medding J, Rogers M, Krein S, et al. *Reducing unnecessary urinary catheter use and other strategies to prevent catheter-associated urinary tract infection: An integrative review. BMJ Qual Saf* May 2014.

If no urinary catheter is placed then the risk of CAUTI has been eliminated. This key point in medical decsion making is best informed by high level of awareness of appropriate indications for this device. *HICPAC Guidelines* offers useful, albeit not necessarily comprehensive of high enough descriptive elements to optimize urinary catheter stewardship. The challenge for providers, therefore, is to establish and sustain adherence with appropriate use at point of provider order. Once placed, the key awareness of the presence of the device in the patient. In this same review, Meddings summarized that reminders, automatic stop orders, or a combination are associated with a significant reduction in the icidence of CAUTI.

Prevention Bundles

This "bundle" concept, has been reported in the prevention of Central CLABSI, ventilator-associated pneumonia, and SSI and has been applied with some demonstrated success in some CAUTI prevention. Combining a set of process measures together to improve care may enhance interdisciplinary communication and facilitate process improvement. However, there is no consensus on which elements are to be included in a bundle, and individual elements vary across facilities. Bundles may be helpful in intrafacility care coordination and communication. Evidence on bundles is limited to before and after studies.[3] An example of a bundle is described in Figure 6.2.

Table 6.2 presents an example of how bundled interventions can be incorporated into a standard clinical protocol.

Physician Reminder Systems

Quality improvement projects have been effective in reducing CAUTI.[4] To reduce the incidence and duration of catheter use, it is important to assess and communicate the presence of a urinary catheter to the medical team on a daily basis. Physicians are often unaware that a patient has an indwelling urinary catheter. One study in an ICU demonstrated that a simple,

continuous quality improvement program based on nursing staff reminding physicians to remove unnecessary catheters significantly reduced the duration of urinary catheterization as well as the rate of catheter-associated urinary tract infections.[5] Similar results were obtained when a specially trained nurse participated in daily multidisciplinary rounds on 10 medical/surgical units. Patients with catheters were assessed, and if any failed to meet appropriate criteria, the patient's nurse was requested to obtain an order to remove the catheter.[6]

In another study, automated reminders to physicians were generated through a computerized medical record. The study concluded that the average length of catheterization was decreased, although there were insufficient data to determine if there were a corresponding decrease in urinary tract infections.[7] A similar study used a simple written reminder in a pretest/posttest design with a nonequivalent control group. The intervention notification, which was attached to patients' charts, was designed to remind the care providers that the patient had a urinary catheter. The primary outcome measure was the number of catheter days and the rate of recatheterization. After adjusting for age, gender, and length of stay, the proportion of time patients were catheterized increased in the control group but decreased significantly in the intervention group. There was no significant difference in the rate of recatheterization.[8]

Figure 6.2. Bladder Bundle Example

Bladder Bundle

- **A**septic insertion and proper maintenance is paramount.
- **B**ladder ultrasound may avoid indwelling catheterization.
- **C**ondom or intermittent catheterization in appropriate patients.
- **D**o not use the indwelling catheter unless you must!
- **E**arly removal of the catheter using reminders or stop orders appears warranted.

Jt Comm J Qual Patient Saf. 2009 September; 35(9): 449–455.

Table 6.2. CAUTI Maintenance Bundle

DATE	BUNDLE CRITERIA							
	DAILY DOCU-MENTED ASSESSMENT OF NEED	TAMPER EVIDENT SEAL IS INTACT	CATHETER SECURED—SECUREMENT DEVICE IN PLACE	HAND HYGIENE PERFORMED FOR PATIENT CONTACT	DAILY MEATAL HYGIENE PERFORMED WITH SOAP AND WATER	DRAINAGE BAG EMPTIED USING A CLEAN CONTAINER	UNOB-STRUCTED FLOW MAINTAINED	ACTION REMOVE OR CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE
	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	REMOVE CONTINUE

Use with permission from: George Allen, PhD, CIC, CNOR, Downstate Medical Center, Brooklyn, NY

Athens Regional Medical Center

NON-SURGICAL PATIENT NURSING PROTOCOL FOR INDWELLING FOLEY CATHETER DISCONTINUATION

(NOTE: Surgical patients will have foley D/C'd on POD 1 or 2 unless physician documents otherwise)

Instructions:

- Indications for an indwelling urinary catheter are to be evaluated upon insertion (use *Foley Insertion Criteria & Documentation note template*) and daily (use *Daily Need for Indwelling Catheter note template*)
- Remove foley catheter as soon as possible: If patient does not meet criteria, check the box in the discontinuation section below and **REMOVE** the indwelling urinary catheter.

*Note: Do not use this form for **suprapubic** catheters.*

CRITERIA FOR INDWELLING FOLEY CATHETER

Mark the appropriate indication for foley catheter:

- Acute urinary retention or bladder outlet obstruction
- Strict urinary output measurement
- Incontinence in patients with open sacral or perineal wounds (Key Point: Incontinence in general is not an indication)
- Prolonged immobilization (e.g., unstable thoracic or lumbar spine, pelvic fractures, etc.)
- Improve comfort for end of life care

DISCONTINUATION OF INDWELLING URINARY CATHETER

Does not meet above criteria: Remove indwelling urinary catheter

- Document removal in HMS (use *Foley Catheter Discontinued note template*)
- Monitor patient's ability to urinate post-catheter removal.

RN Signature: _____

Removal Date_____ Time _____

Sample policy provided with permission by Linda Greene, Highland Hospital, and Rochester, NY

Used with permission from Geri A. Brown, RN, CIC, Starr Regional Medical Ctr., Athens, TN

Nurse-Driven Protocols

Two of the most important strategies for prevention of CAUTI are to limit insertion to only those conditions for which there is an indication and to remove catheters as soon as possible. Although the indwelling urinary catheter may be indicated in critically ill or perioperative patients, the timing of removal is often influenced by nurse or physician convenience rather than individual care needs. One of the strategies that has proven successful is the implementation of nurse-driven protocols for removal. These protocols allow a nurse to remove a urinary catheter when pre-established criteria are met. Multiple studies support nurse-driven protocols and have demonstrated a relationship between the implementation of such protocols and CAUTI reduction.[9, 10, 11] Case Study 3 describes the importance of nurse participations and accountability in a systemwide CAUTI prevention initaitives.

CASE STUDY 3: Down with CAUTIS Was Our Battle Cry!

Background

The Centers for Disease Control and Prevention's (CDC) January 2013 CAUTI (catheter-associated urinary tract infections) event statistics reported that urinary tract infections (UTIS) account for more than 15 percent of all hospital-acquired infections. Approximately 75 percent of all those documented UTIS are associated with use of urinary catheters (CAUTIs). These infections can result in serious complications for the hospitalized patient including increased length of stay and risk of sepsis in the setting of financial loss for the institution. CAUTIS at our hospital represented 11.89 percent of the total number of infections for fiscal year (FY) 11. While this percentage was lower than the national average of 15 percent it pointed to an increase from the previous year. In light of these events, we developed a plan to reduce our CAUTI rate by engaging our nurses to assume ownership of the CAUTI problem. Our hypothesis for a CAUTI reduction initiative was that the combined ownership of a program by a Shared Governance Practice Council (SPGC) of nurses with adherence to evidence-based practices, along with a nurse driven protocol to remove Foley catheters would decrease the number of CAUTIS within 1 year (see Figure 1). We needed a battle plan.

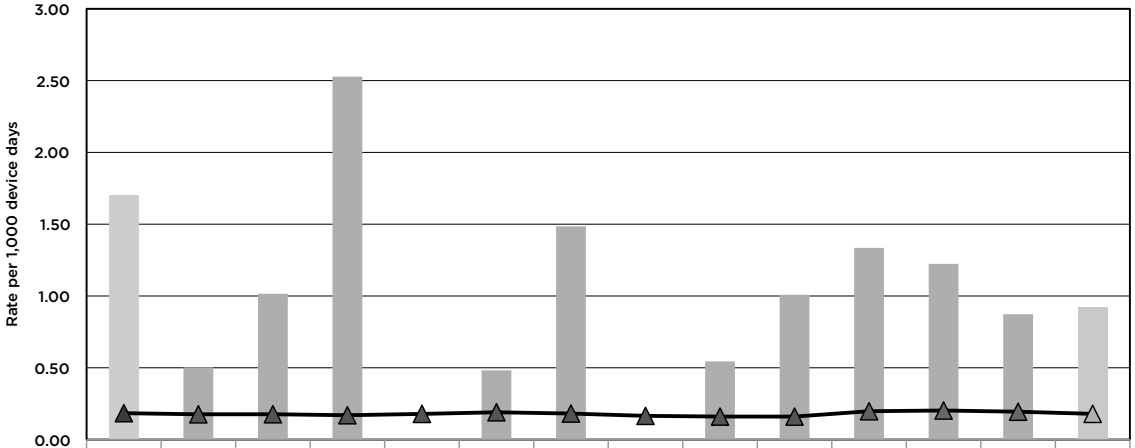
Project

As part of a large multi-hospital health system we follow the Health System's quality initiatives. The System initiatives included the following:

- Develop and validate accurate electronic data collection system
- Development of a mandatory online educational program for all nurses, nursing assistants, and technicians
- Reduce Foley catheter days
- Develop and initiate a nurse-driven protocol

While we used the above concepts and were part of the System process, we needed to identify a mechanism to make these processes work in our institution. Our hospital-based battle plan was developed over two years. The focus of the first year was to decrease catheter days through daily rounding on all patients with urinary catheters. This task was the responsibility of the Unit director. During the first year of the initiative, the number of CAUTIS was reduced from 55 to 44 with an associated rate of 1.71 per 1,000 catheter days.

Figure 1. CAUTI Initiative Rate of Change



	FY2011 TOTALS	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	FY2012 TOTALS
Rate	1.71	0.50	1.02	2.53	0.00	0.48	1.49	0.00	0.54	1.01	1.34	1.22	0.87	0.92
Util.	0.18	0.18	0.18	0.17	0.18	0.19	0.18	0.17	0.16	0.16	0.20	0.20	0.19	0.18

The second year of the initiative, the responsibility for further reducing CAUTIS was given to the SGPC. SGPC was charged with process improvement by the hospital nursing leadership. The SGPC is composed of nursing representatives from all of the nursing units and is given structural empowerment to identify problems and develop solutions for these problems. A select subgroup of the SGPC was formed to develop and drive our hospital based initiative. The group also included a nursing administrator, a quality person, and an Infection Preventionist (IP).

Methods

Components of the initiative included the following:

- Involve the Shared Governance Practice Council to identify risk factors for CAUTIS within our hospital; develop mandatory competencies for all nurses, nursing assistants, and technicians; perform process improvements; and empower the nursing representatives to identify strategies to prevent CAUTIs
- Develop and initiate a nurse-driven protocol to remove the catheters to reduce Foley days

Process

The IP presented information about CAUTIS to the members of subgroup. This education included, the NHSN definition for a CAUTI, evidence-based reduction strategies, and the importance of proper handling of devices and sterile technique. Each member was given a packet of information to share with their units. The subgroup then discussed possible issues and decided to round on all nursing units to identify current practices regarding urinary catheters on their individual units. They developed an audit tool to standardize their observations.

The group discussed their strategies for reducing CAUTIs and identified their main focus. They identified several risk factors related to CAUTIs as a result of their rounding and chart audits.

The review process looked at multiple strategies through monthly rounding and auditing of nurses notes by chart review:

- Review of daily documentation of catheter necessity using a standardized electronic medical record (EMR)
- Daily rounding by the charge nurse or the unit director focus on Foley necessity to prompt early removal

- Examining compliance with catheter care and maintenance practices, including use of proper securement devices
- Focusing attention on locations where catheters were being inserted (e.g., OR, Emergency Department)
- Auditing the EMR for the required order to place a Foley
- Monthly review of all CAUTIS identified during the month and possible problems associated with them

Their first focus was on education and re-education of the nursing staff related to catheter insertions, maintenance of the catheter, catheter necessity, and sterile technique. Recognizing that ancillary staff was also responsible for positioning and moving patients they developed education for this group as well. Special in-services for the transport department were conducted to ensure that the Foley bag was kept below the level of the bladder during transportation of the patient. Each unit based CAUTI leader provided feedback to their units regarding infections and the catheter days.

Results: FY 11 CAUTI rate was 1.71 and FY 12 rate decreased to 0.92/1,000 Foley days (p=0.0106). Overall infection numbers decreased from 44 to 23 (47.7 percent decrease). Device utilization rate remained the same at 0.18/1,000 patient days.

Conclusions

Success occurred when the nurses accepted responsibility and ownership for the process improvement on their own units. Holding each staff member accountable helped promote better practices for Foley placement and care. Their excitement with each success led to enthusiasm and support from the whole staff. Nursing leadership's support to unit management further infused energy into the initiative. Each unit identified and developed strategies to address their own needs. Mandatory competencies improved catheter care.

While a decrease in catheters days was not seen during the second year of the initiative, implementing changes in use of and care of catheters did result in a significant decrease in infections.

Decrease in catheter days was not seen, in part due to a change in data collection methodology during this time period. Nurses and medical staff need further education in promoting use of the nurse-driven removal protocol.

Additional Information

UPMC Mercy is a 495-bed acute care tertiary facility with 53 intensive care unit beds, a combined Level 1 Regional Resource Trauma and Comprehensive Burn Center and includes 76 rehabilitation beds including general rehabilitation, traumatic brain injury, stroke, and a spinal cord injury unit. We are part of a large health system involving 23 hospitals, most of those located in western Pennsylvania. The Infection Prevention Department consists of 4 full-time Infection Preventionists, 1 Coordinator, a Medical Director who is an infectious disease physician, a part-time data analyst, and an administrative assistant.

Contributed by Susan A. Grossberger, BSN, Infection Preventionist

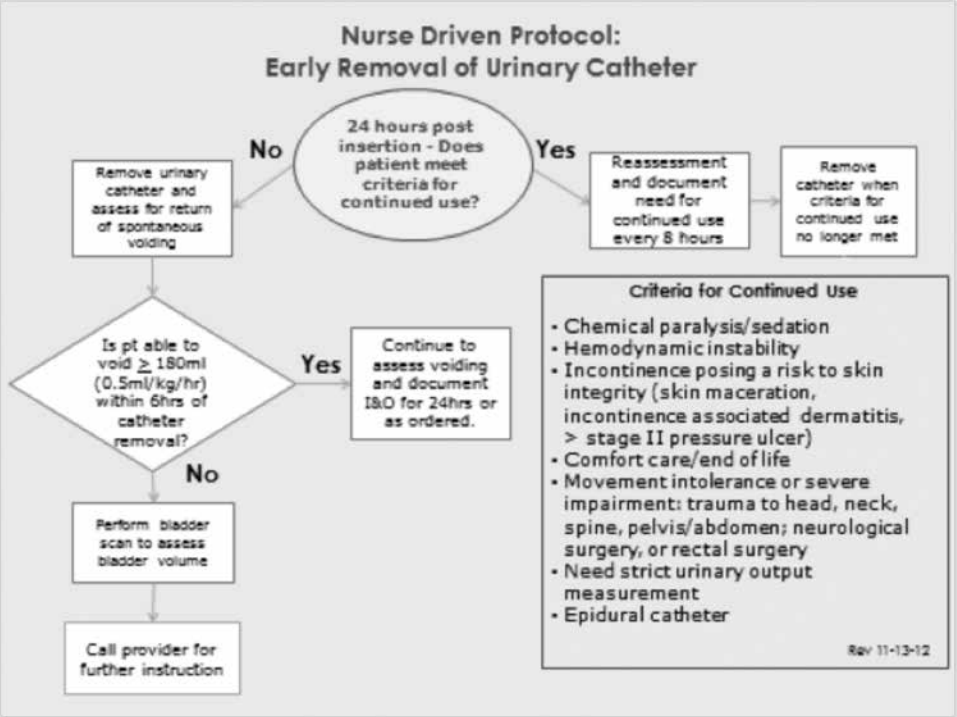
Policy for Early Removal

Organizations that wish to develop policies for early removal need to ensure that the protocol is developed collaboratively with medical staff input.

An example of a successful collaborative approach is described in Case Study 4.

An example of an early removal protocol is provided in Figure 6.4.

Figure 6.4. Early Removal of Urinary Catheter Protocol



Source: Protocol published with permission from Shari Nersinger, Highland Hospital, Rochester, NY

CASE STUDY 4: How the Implementation of Nurse-Driven Catheter-Associated Urinary Tract Infection (CAUTI) Prevention Measures Resulted in Improved Patient Outcomes

Urinary tract infections (UTIs) are the most common type of reported healthcare-associated infection, with 75 percent attributed to the presence of an indwelling urinary catheter. Catheter-associated UTIs (CAUTIs) result in increased morbidity, mortality, length of stay, healthcare costs, and patient pain and inconvenience. Evidence has shown that implementing and following recommended best practices results in decreased infection rates and improved patient outcomes.

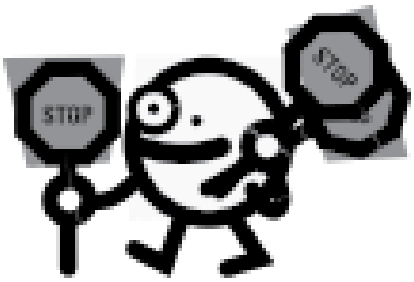
In 2010, with the support of hospital leadership, a multidisciplinary CAUTI Prevention team was formed to research and review nursing best-practices, guidelines, and evidence-based recommendations for the prevention of CAUTIs. The primary objective of this team was to identify and implement best-practice nursing initiatives for the reduction of CAUTIs throughout the organization. The CAUTI

prevention team included nursing representation from Critical Care, Medical Services, Surgical Services, Quality Department, Infection Prevention, and also included a Physician Champion.

The team started by developing and carrying out organization-wide education to heighten awareness and highlight important CAUTI prevention strategies. Education was delivered using a variety of methods, including placing informative table tents in the staff cafeteria, hanging posters in staff lounges, presentations at unit/department staff meetings, articles written in the organization newsletter, and providing educational information to the medical staff.

Prevention Initiatives by the CAUTI Prevention Team

- A nursing assessment tool that included set criteria for catheter continuation (named C.H.O.R.U.S.; see below), daily assessment of all urinary catheters by nursing staff, and documentation correlating with the catheter continuation criteria (C.H.O.R.U.S.) was developed for the Electronic Medical Record (EMR) and implemented.
- A nurse-driven urinary catheter discontinuation protocol for the early removal of unnecessary urinary catheters was developed based on the CDC recommended best practice guidelines.
- Additional bladder scanners were purchased by nursing administration to support the elements of the urinary catheter discontinuation protocol.
- A nursing educational competency for use of the bladder scanner was developed and implemented and is now completed yearly by all in-patient nursing staff.



DOES YOUR PATIENT REALLY NEED A URINARY CATHETER?

INDICATIONS FOR URINARY CATHETER USE
(Remember C.H.O.R.U.S)

C = COMFORT
- Comfort Measures for the terminally ill
- Open sacral or perineal wounds in an incontinent patient

H = HEMODYNAMIC MONITORING
- Close monitoring of urinary output
- Aggressive treatment with diuretics or fluids

O = OBSTRUCTION
- Anatomic or physiologic outlet obstruction (enlarged prostate, blood clots, etc.)

R = RETENTION
Urinary retention not manageable by any other means

U = UROLOGIC
- Urologist or other physician placed urinary catheter, urologic studies, neurogenic bladder

S = SURGERY
- Urologic, gynecological or perineal surgeries
- Epidural Catheter in place
- Orthopedic fracture prior to repair

- The Intensive Care Unit (ICU) was chosen to conduct a two-month trial of the nurse-driven discontinuation protocol, followed by a two-month trial on all in-patient units.
- Full implementation of the discontinuation protocol occurred after final approval by the Medical Executive Committee and Nursing Shared Leadership Committees in December of 2011.
- CAUTI rates and catheter utilization ratios are now reported to each patient care unit on a quarterly basis and shared with team members during staff meetings.
- Infection Prevention began sending CAUTI Review Letters to unit nurse managers when a CAUTI was identified so that a drill down and review of practices can be done for each infection reported.

CAUTI rates throughout the organization were reduced following implementation of evidence-based prevention measures, including the nurse-driven discontinuation protocol. Initiatives resulted in an overall 44 percent reduction in the number of CAUTIs from the beginning of prevention initiatives in 2010 until December 2012. To date, there have been zero CAUTIs identified in our ICU for more than 38 months (last CAUTI reported June, 2010). The ICU was the lead unit in implementing CAUTI prevention initiatives, trialing the nurse driven protocol, and helping to educate other patient care units throughout the hospital. Also, as of July 2013, our hospital has had only one CAUTI reported for the year. Our goal is to have zero CAUTIs.

Lessons Learned

Leadership and staff buy-in were both essential components for the success of our CAUTI prevention initiatives and required ongoing education and support throughout the process.

We learned that we should not assume fundamental infection prevention strategies were being followed at all times (e.g., proper hand hygiene, safe handling of indwelling catheters, aseptic technique for catheter insertion, and daily catheter care). Reinforcement of these important nursing concepts had to be included early and throughout implementation of the CAUTI prevention project. For optimal success of CAUTI prevention initiatives, the urinary catheter discontinuation protocol must be truly nurse-driven and supported by medical staff. Orders to initiate the nurse-driven discontinuation protocol need to be included on all provider order sets, and provider education must be ongoing to improve compliance with ordering the protocol. Nursing staff need continued encouragement to take ownership of their practice and understand the important role they have in patient safety initiatives.

Additional Information

Beebe Medical Center is a not-for-profit community healthcare system with a charitable mission to encourage healthy living, prevent illness, and restore optimal health for the people residing, working, or visiting in the communities we serve. It offers multiple services throughout Southern Delaware including a 210-licensed-bed hospital, a cancer center, and outpatient facilities at multiple sites providing lab, imaging, physical rehab services, and walk-in care. The Medical Center has received the Heathgrades® *Distinguished Hospital Award for Clinical Excellence™ for four years in a row (2010-2013).* It is certified by the Joint Commission as an Advanced Primary Stroke Center, and for hip and knee replacement surgical programs. It is designated as a Breast Imaging Center of Excellence by the American College of Radiology (ACR), and named a Center of Excellence in Women's Health by the American Institute of Minimally Invasive Surgery (AIMIS). The infection Prevention department consists of 1 full-time and 1 part-time Infection Preventionist (IP) and is supported by an Infectious Disease Medical Director.

By: Theresa Houston, RN, BSN, CCRN, Critical Care Educator, and Donna Anderson, RN, CIC, Infection Preventionist

In addition, an example of a nurse-driven urinary catheter protocol in policy and procedure format is shown below:

Baylor Orthopedic and Spine Hospital at Arlington	INFECTION CONTROL POLICIES AND GUIDELINES	
Nurse-Driven Urinary Catheter Protocol	**ISSUED: July 2012** **REVISED:**	**NUMBER: 35**

PURPOSE:
To reduce the incidence of catheter-associated urinary tract infections (CAUTI).

POLICY:
Patients will be assessed on admission for symptoms of existing urinary tract infection and patients meeting specific criteria will have their urinary catheter removed by the nurse.

DEFINITION:
Catheter-Associated Urinary Tract Infection: A hospital-acquired infection that can develop in patients who have had an indwelling urinary catheter.

PRINCIPLES:
- Urinary tract infection is the most common hospital acquired infection; 80 percent of these infections are attributable to an indwelling urethral catheter.
- The duration of catheterization is the most important risk factor for development of infection.

PROCEDURE:
Assessment for Pre-existing UTI:
1. Obtain urine specimen on admission from any patient admitted with an existing urinary catheter.
2. Obtain urine specimen for symptoms of urinary tract infection (i.e. dysuria, frequency, urgency, nocturia, suprapubic pain, or hematuria).
3. Promptly transport urine samples to the laboratory for culture to prevent inaccurate culture results.
4. Document indications for catheter insertion (if not inserted intraoperatively).

Basic Practice for Prevention of CAUTI:
1. Insert urinary catheters only when necessary for patient care and leave them in place only as long as indicated.
2. Consider other methods for management, including condom catheters or straight catheterization after bladder scan.
3. Practice hand hygiene immediately before insertion of the catheter and before and after any manipulation of the catheter site or apparatus.
4. Insert by use of aseptic technique and sterile equipment.
5. Use as small a catheter as possible, which is consistent with proper drainage, to minimize urethral trauma.
6. Properly secure indwelling catheters after insertion to prevent movement and urethral traction.
7. Maintain a sterile, continuously closed drainage system unless the catheter must be irrigated.

8. Replace system if a break in asepsis occurs.
9. Maintain unobstructed urine flow.
10. Keep collection bag below the level of the bladder at all times.
11. Provide routine hygiene for meatal care.
12. Empty collecting bag regularly, using a separate collecting container for each patient, and avoid allowing the drainage spigot to touch the collecting container.
13. Obtain urine samples aseptically using catheter-sampling port.

Nurse-Driven Urinary Catheter Assessment and Catheter Removal:

1. The RN will assess the need to continue urinary catheter every 12 hours as a part of the RN shift assessment.
2. If none of the indications for continued catheter use are met:
   a. The RN will discontinue the catheter.
   b. The RN will continue to reevaluate and assess the need to reinsert the catheter following removal.
   c. Notify the physician if the patient is unable to void within 8 hours or as ordered.
   d. The RN will document the assessment and removal of the urinary catheter and continued reassessment post removal, in the patient's medical record.
3. If indications for urinary catheter are present:
   a. Continue catheter care per policy.
   b. Place form behind the Physician Order tab in the Medical Record if the catheter is continued past POD #2.
   c. Ensure securing device is used (e.g., Stat-lock).
   d. No dependent loops.
   e. Secure tubing to bed.
   f. Drainage bag is not overfilled or touching the floor.
4. Handoff communication for readiness to discontinue catheter to on-coming shift RN.

Patient Education:

1. The RN will educate the patient on:
   a. The risk associated with indwelling urinary catheters.
   b. Importance of adequate fluid intake after catheter removal.
   c. Measurement of intake and output to be done to assess the patient's ability to empty bladder after removal of urinary catheter.
2. Patient education after catheter removal will include:
   a. Importance of calling for assistance for toileting.
   b. Importance of activity: up in chair, ambulating in room and around unit.
   c. Reinforce safety precautions: *"Call don't Fall"*

Addapted from: *HICPAC. Guideline for Prevention of Catheter-Associated Urinary Tract Infections 2009*

2009, used with permission from Maxine Garcia, RN, Irving, TX

Coated Catheters

Use of an antiseptic or impregnated coated catheter is an area that has received considerable attention. The 2009 *HICPAC Guideline* identified low-quality evidence to support the use of antiseptic or antimicrobial catheters. Most of the studies were observational studies that involved relatively small populations in which asymptomatic bacteriuria was an outcome. Considerable doubt and controversy remain as to whether silver-coated catheters reduce CAUTI rates. In 2012, Pickard published a large randomized control study that showed no benefit with the use of silver catheters. Patients requiring short-term urinary catheterization were randomly allocated 1:1:1 to receive a silver alloy-coated catheter, a nitrofural-impregnated catheter, or a Polytetrafluoroethylene (PTFE)-coated catheter (control group). Compared with 271 (12.6 percent) of 2,144 participants in the control group, 263 (12.5 percent) of 2,097 participants allocated a silver alloy catheter developed a symptomatic CAUTI by 6 weeks, as did 228 (10.6 percent) of 2,153 participants allocated a nitrofural catheter. They concluded that silver alloy-coated catheters were not effective for reduction of the incidence of symptomatic CAUTI and that the reduction in CAUTI associated with nitrofural-impregnated catheters was not significant enough to be considered clinically important. Routine use of antimicrobial-impregnated catheters is not supported by this trial.[12] Trautner and colleagues also studied E. coli adherence to silver catheters and concluded, "Silver impregnation had little effect on bacterial adherence in our model and nitrofurazone impregnation had a significant effect only for the first 5 days. Our results do not support a role for silver urinary catheters to prevent catheter associated urinary tract infection by decreasing bacterial adherence."[13]

Drainage System Safety

Sterile, continuously closed drainage systems became the standard of care based on an uncontrolled study published in 1966 demonstrating a reduction in the risk of infection in short-term catheterized patients with the use of a closed system. Recent data also include the finding that disconnection of the drainage system is a risk factor for bacteriuria. The catheter tubing should allow free flow of urine and kinking of tubing should be avoided. The urine bag should be kept below the level of the bladder and kept off the floor. Urine samples should be obtained aseptically. If breaks in aseptic technique, disconnection, or leakage occur, the catheter and collecting device should be replaced.[14]

The following represents a summary of prevention practices outlined in the 2009 *HICPAC Guideline*:

Programs, Practices, and Interventions that May Be Implemented in CAUTI Prevention Efforts (2009 *HICPAC Guideline*)

- Perform hand hygiene immediately before and after insertion or any manipulation of the catheter device or site.
- Use indwelling catheters only when medically necessary.
- Use aseptic insertion technique and sterile equipment with standard precautions to include hand hygiene and gloves.
- Allow only trained healthcare providers, family members, or patients to insert catheter.
- Properly secure catheters after insertion to prevent movement and urethral traction.
- Maintain a sterile closed drainage system.
- Maintain good hygiene at the catheter-urethral interface.
- Maintain unobstructed urine flow by keeping the catheter and collecting tube free from kinking.

- Maintain drainage bag below level of bladder at all times. Do not rest the bag on the floor.
- Remove catheters when no longer needed.
- Do not change indwelling catheters or urinary drainage bags at arbitrary fixed intervals.
- Document indication for urinary catheter on each day of use.
- Use reminder systems to target opportunities to remove catheter.
- Use external (or condom-style) catheters if appropriate in men without urinary retention or bladder outlet obstruction.
- Consider alternatives to indwelling urethral catheters, such as intermittent catheterization, performed at regular intervals to prevent bladder distension. Some studies have reported fewer complications with use of a suprapubic catheter, but the surgical procedure required to insert the suprapubic catheter is associated with additional risks. Current evidence is not sufficient to support the routine use of a suprapubic catheter for short-term catheterization to prevent symptomatic urinary infection or other complications.
- If breaks in aseptic technique, disconnection, or leakage occur, replace the catheter and collecting system using aseptic technique and sterile equipment.

Saint, et al. have recently borrowed a page from navigation tools and developed a guide to patient safety (GPS) assessment tool to assist providers with prevention of CAUTI.[15] This tool, provided below, has been tested and was able to identify barriers to realizing improvement in performance as well as "diagnose" on a macro level the behavioral aspects limiting progress in prevention of CAUTIs. This study identifies that prevention of CAUTI is more reliant on changing behavior and beliefs of providers in contrast to CLABSI, where technical elements like specific skin antiseptic and aseptic technique during insertion yield significant improvement. The GPS is also available from the author's web-based knowledge resource on CAUTI prevention [www.catheterout.org]

References

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Section 7: Preventing Catheter-Associated Urinary Tract Infections in Children

The prevention of CAUTI in children, especially HAIs is not procedurally different from the concerns confronted in serving adult patients. While CAUTI is known to be the leading cause of HAIs in adults, CAUTI incidence rate and relative significance in pediatrics is only now being established. According to the 2011 data of the Ohio Children's Hospitals' Solutions for Patient Safety (OCHSPS) National Children's Network,* CAUTI is the third most frequent HAI in children, after CLABSI and SSI.

In pediatrics, the rationale for catheter insertion, catheter size, attention to aseptic technique on insertion, and the reliance on a "bundle" strategy for quality of care in managing the device are all necessary to prevent these infections. Children are, however, not merely small adults. Those who care for them, especially in a hospital setting, must appreciate that there are several additional issues and concerns related specifically to their age. For patients of any age there are potential adverse consequences of an indwelling catheter including trauma, discomfort, immobility, loss of dignity, increased antimicrobial use, and the creation of reservoirs for pathogens. However, the additional concerns specifically inherent in the care of children include, but are not limited to, the following for the clinician's consideration:

1. **The child's age and the use of developmentally appropriate approaches to care** are essential considerations and should be addressed in every aspect of the child's care. Consider using a textbook reference, such as the table "Age-Specific Approaches to Physical Examination During Childhood," in Wong's *Nursing Care of Infants and Children.*[1] Further, it is not developmentally inappropriate for young children to be incontinent of both urine and stool; even children who have attained continence as a developmental milestone may regress when confronted with illness or hospitalization.

2. **Attention to family-centered care, cultural competency of the clinicians, and health literacy of the family** can create a more cooperative and collaborative patient experience. Family-centered care, a common tenant in pediatric care, reminds clinicians to learn the child's particular worries and behavior patterns. This is information best obtained from a family-identified expert, including family members in the child's care, to the degree that they wish to participate, and is an essential ingredient in gaining the child's trust and cooperation. Consider a tool, such as "The Evolution of Family-Centered Care" published in *Pediatric Nursing* in 2009, as a guide.[2] A sample tool is shown in Figure 7.1.

*__Ohio Children's Hospitals' Solutions for Patient Safety (OCHSPS),__ a nonprofit corporation, collects and analyzes patient safety data to improve children's safety and healthcare outcomes, and the quality of pediatric healthcare delivery overall. OCHSPS is funded in part through the Partnership for Patients initiative, a public-private collaboration to improve the quality, safety, and affordability of healthcare for all Americans and led by HHS. OCHSPS was founded in January 2009 by Ohio's eight children's hospitals to improve quality and safety in children's hospitals statewide. It is now one of 26 HENs funded under this federal initiative, and the only one specifically addressing the health of children.

Family-centered care also requires cultural competency on the part of the clinicians and an assessment of the family's health literacy in order to advance a bond of partnership and cooperation with families. Failure to consider the cultural implications of care could easily put the clinician at odds with the patient and or the family. Health literacy is central to enhancing the involvement of patients and families in their care. The clinician should try to use any care delivery moment, especially one as intimate as the provision of indwelling urinary catheter care, as an opportunity to increase the family's understanding of the child's needs and condition.

Related patient education must be delivered to and comprehended by the child's caregivers, not only the child him/herself who may or may not be mature enough to understand such information. A well-informed and thoughtfully participative family acting as the child's advocate contributes to preventing infections in any healthcare situation. The use of creative tools with cheerful illustrations and well-selected, simple language can enhance the child's and family's learning.

3. **Provision of emotional comfort (presence of parent, comforting objects, music, positive distraction)** can be of enormous support to children in an unfamiliar, uncomfortable, or frightening situation. Hospital procedures can induce great anxiety in children, which, if not managed well, can interfere with the safe completion of the procedure. Having toys, especially the child's own favorite toys, blankets, or objects, can provide safe and helpful comfort and distraction so that the procedure can be completed safely and efficiently.[3] If possible, any invasive procedures should be performed in a procedure room separate from the child's hospital bed so that the child may perceive the hospital room as a safe, nonthreatening environment.

4. **Daily care and assessment for allergies, skin sensitivities, especially in the choice of cleansing agents and issues of catheter securement** are common concerns in the care of children.
   a. Allergies and skin sensitivities are problematic especially in infants where the skin has unique and specific microstructures. Infant stratum corneum is a full 30 percent thinner and infant epidermis is as much as 20 percent thinner than in adults.[4] These differences in skin microstructure explain some of the functional differences, such as healing times, heat loss, and easy tearing of the young child's skin.
   b. Given the physiological differences seen in pediatrics, greater precaution is required in the selection and use of preparation and maintenance solutions used on the skin and mucous membranes. Iodine sensitivity is a common concern. The clinician may substitute an approved, antiseptic towelette, such as the benzalkonium chloride towelettes frequently used in cleansing prior to capture of a clean-catch specimen in adults. Regular cleansing of the meatus with mild soap and water is recommended. Only one published study has assessed the difference in effectiveness in the selection of periurethral cleaning solutions in children.[5] Additional research is warranted.
   c. Securement of the catheter can be problematic. The most common securement devices have proven themselves difficult to use, especially on very small children. They may slip, failing to prevent catheter movement; their adhesives may cause a rash; and their friction may lead to excoriation. Clinicians must not take for granted that the tools which work on larger children or adults will be adequate for use in young children. Adaptation, experimentation, and resourcefulness may be necessary to secure a indwelling urinary catheter in pediatrics where limiting the

Figure 7.1. CAUTI Prevention

Catheter-Associated Urinary Tract Infection (CAUTI) Prevention

Your child's doctor has recommended a Foley catheter for your child. A Foley catheter is a tube inserted through the urethra into the bladder to allow urine to drain out. It is also called an indwelling urinary catheter. A Foley is useful in situations requiring careful checking of how much urine is made, immobilization for a long period of time, in certain types of surgery, with certain types of medication, and to help with the healing of some wounds near the buttocks. Your child's doctor determines how long your child will need the Foley catheter.

Foley catheters are helpful for taking care of your child; however, they can increase the risk of infections when germs grow in or on the catheter and travel to the bladder. When this happens, it is called a catheter-associated urinary tract infection or CAUTI. A CAUTI can be serious and treatment may require extra medications or a longer hospital stay.

Fortunately, there are steps we can take to prevent CAUTIs. The most important step is hand washing. At Children's, we check all Foley catheters for signs of infection every day. We also take steps to keep infections from happening by:

- Washing our hands and/or using alcohol-based hand rub frequently;
- Using antiseptic soap on the skin before inserting the Foley catheter;
- Careful handling of the Foley catheter, the tubing and the collection bag;
- Securing the Foley catheter so it doesn't tug or pull;
- Ensuring unobstructed urine flow by carefully positioning the tubing and collection bag;
- Emptying the collection bag at least every eight hours;
- Checking Foley catheters daily for signs of infection;
- Checking daily to see if the Foley catheter is still needed.

We also follow strict protocols when inserting Foley catheters as recommended by the Centers for Disease Control and Prevention (CDC).

How should I care for my child?

Parents and patients also have a role to play in preventing CAUTIs:

- Wash your hands with soap and water, or use alcohol-based hand rub found in each room, when you enter and leave your child's room;
- Wash your hands with soap and water before and after you prepare food, eat or feed your child and before and after you use the bathroom or change a diaper.
- Ask your child's visitors to wash their hands when they enter and exit your child's room.
- Do not allow visitors to touch the Foley catheter, tubing or collection bag.
- Watch your nurses and doctors to make sure they wash their hands before and after handling the Foley catheter. Do not be afraid to remind them to wash their hands!
- Keep the Foley catheter clean when changing the diaper, and always clean in the direction from the body towards the Foley catheter.
- Help make sure the collection bag is always below the level of your child's belly button.
- If you have any concerns about your child's Foley catheter, or the way it is cared for, talk to your child's doctor or nurse.

We value providing safe care for your child during their illness. Thank you for your help in providing a safe environment for your child's Foley catheter. If you have any questions, ask your child's nurse or doctor.

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Table 7.1. Urinary Catheter Size Selection

TABLE 1	Urinary Catheter Size Selection[2,5,6,9] *(Level II*)*	
Age	Male Catheter Size	Female Catheter Size
Premature infant	3.5F to 5F	3.5F to 5F
Newborn	5F	5F to 6F
Infant	5F to 6F	6F to 8F
Toddler/preschooler	8F to 10F	8F to 10F
School-aged	8F to 10F	8F to 12F
Adolescent	12F	12F to 14F

*Level II: Theory-based; no research data to support recommendations; recommendations from expert consensus group may exist.

Data from Bukowski TP, Freedman AL: Catheterization problems of infants, *Contemp Urol* 66-74, 1999; Elizondo AP, Gilbert J, Wearden ME, et al: Elimination of bleeding associated with urinary catheterization in neonates, *Neonatal Network* 20:25-34, 2001; Smith AB, Adams L: Insertion of indwelling urethral catheters in infants and children: a survey of current nursing practice, *Pediatr Nurs* 24:229-234, 1998; Hockenberry MJ, Wilson D, Winkelstein ML, et al, editors: *Wong's nursing care of infants and children*, ed 7, St Louis, Mosby, Inc.

excursion of the device and preventing its accidental and traumatic removal is perhaps even more critical than in adults. Newer designs are entering the market that may permit the clinician to anchor under the catheter at the access valve side of the tubing bifurcation, providing a gentle adherence to the child's skin and prevention of migration of the indwelling urinary catheter itself.

5. Anatomic or positional issues (such as altered anatomy within the genitourinary system or elsewhere) whether encountered in the initial attempts to insert an indwelling urinary catheter or discovered on imaging studies can certainly complicate the clinician's ability to protect the child from injury or infection. Altered anatomy may be as straightforward and visible as the presentation of a child in lower extremity casts that while therapeutically positioning the legs, may cause potential interference with safe technique for catheterization. If adequate visualization or access is complicated and/or distraction and other comfort techniques prove unsuccessful, the child may require insertion of the catheter under analgesia or even anesthesia. Pediatric facilities might use conscious sedation or nitrous oxide administration to help the child relax.

6. **Appropriate assessment and management of the child's pain, neurological function, and hydration status, including possible dehydration and urinary retention,** is important prior to placing an indwelling urinary catheter.
   a. Assessing the child's pain, especially with nonverbal children, can be challenging for even the most seasoned pediatric clinician. Relying on the parent to report the child's typical discomfort behaviors may help.
   b. Assessing neurologic function is essential. Certain medications can impede neurological function causing urinary retention. Neurogenic bladder with symptoms of overactivity or underactivity can be chronic in children with underlying neurological diagnoses. Clinicians should take into consideration the neurologic bladder function before inserting or discontinuing an indwelling urinary catheter especially in children. The child or the family tired of dealing with intermittent catheterization may even request the placement of an indwelling urinary catheter, but the inherent risks of placing it outweigh their preference for convenience.
   c. Assessing the cause of urinary retention requires the assurance of adequate hydration. Accurate assessment relies largely on clinical examination, including palpation, and the careful observance of fluid intake and urine output, which can be difficult to measure. Weighing diapers and guessing at the intake of breastfeeding infants are only two of the hindrances to accuracy. Some clinicians, eager to do what works in adult medicine, turn to the bladder scanner for more accurate results, but studies show that such techniques may be less reliable in pediatrics.[6] One

significant consideration is the concurrent administration of medications with urinary retention as an adverse side effect.

7. Sizes and lengths of catheters appropriate for children should be available at all times. All too often having an insufficient selection or a lack of familiarity with selecting the size of the equipment required can delay the success of the catheterization procedure and increase the pediatric patient's discomfort. In a study published in 2012, data from 2006 demonstrated that "roughly one-half of emergency departments had 85 percent or more of recommended pediatric supplies, but only 7.2 percent of emergency departments had all recommended pediatric supplies, suggesting that inventories could be improved at most emergency departments."[7] Hospitals with pediatric intensive care units fared better than hospitals without a high acuity pediatric service, but if your emergency department sees children, being well supplied is imperative. Table 7.1 is a quick guide to the selection of an appropriately sized catheter:[8]

   On every insertion, the clinican is reminded to adhere to these standards:

   a. Don't test the balloon prior to insertion; the deflated balloon may cause a harmful ridge on the catheter.
   b. Fill the balloon per manufacturer's guide.
   c. Insert the catheter into the urethral meatus and gently advance for child's age and gender. The female urethra is approximately 3.5 to 4 cm long. Advance the catheter at least 2 to 3 cm beyond the point at which urine flow is noted. The male adult urethra is 18 to 20 cm in length. Introduce and advance the catheter the **entire length of the catheter,(up to the juncture of the connector or to the two-way bifurcation),** wait for spontaneous urine passage, confirming proper placement of the catheter to prevent damaging urethra.
   d. Assess patient for proper size catheter to prevent leakage.
   e. Remember to prewash patient before prepping for insertion.
   f. If a catheter cannot be passed successfully, consider urology consult. Switching to a smaller catheter may not be helpful and can be harmful.
   g. Use a *new* catheter if sterility of catheter is jeopardized or female urethral meatus is not accessed with the first try. See Figure 7.2 for an example of CAUTI prevention tool.

8. **The risk of self-contamination to the indwelling catheter is prevalent with children.** Practical issues of hand hygiene for everyone, the child included, and the risk of the child's curiosity with or playing with the catheter requires extra vigilance. Attention to stool incontinence and the potential for migration of pathogens up the catheter is critical. The child's anxiety with the device could lead the child to take it apart, disrupting the closed system. This eventuality requires removal and reinsertion. The catheter may limit the child's mobility leading to many complications. Finally, the duration of catheter's presence in the child should be limited to prevent infection; this requires daily reassessment of the need for the device.

   In some cases, clinicians may be tempted to see the young child with an indwelling urinary catheter as requiring hand or arm restraints. Before turning to restraints, consider the use of distraction and emotional support, especially engaging the child's parent(s). The clinician is urged to always include the family in hand hygiene instruction, to utilize their unique relationships with the child to keep his or her hands clean and away from the catheter. The family can also learn to spot the visitor or even the clinician who fails to observe safe hand hygiene when entering the room and can thereby add an important layer of protection for the child.

Figure 7.2. CAUTI Prevention Standard

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KEY PROCESS	DETAILS	TIPS FOR PRACTICE	RATIONALE
Identify Indication	Use indwelling catheter ONLY when clinically necessary • Identify clinical indication prior to insertion and daily • Discuss need for catheter during rounds	- If catheter not removed, discuss criteria for removal - Consider proper time for removal so that replacement of catheter is NOT necessary	Using catheters only when clinically necessary will reduce the population at risk for CA-UTI
Hand Hygiene 	Hand hygiene BEFORE and AFTER patient care • Hand sanitizer: Cover all surfaces, rub together until dry • Soap and water: wet hands before applying soap, wash for 15-20 seconds (sing ABC's), thoroughly rinse hands under running water, dry hands with a paper towel and use to turn off manually operated faucet or use hands free technique (e.g. forearm or elbow)	- Visibly Soiled Hands Require Soap and Water - Wash hands/change gloves after contacting dirty surfaces in the room (diaper, computer keyboard, plugs, etc.) - Use standard precautions with ALL catheter interventions	Hand hygiene is the #1 prevention of the spread of germs.
Insertion	Prior to insertion, cleanse perineum with soap and water gauze/cloth, comfort bath, baby wipes – Do NOT use antimicrobial soap/wipes Use ASEPTIC technique with sterile gloves and field Use Prepackaged Insertion Kit	- Do NOT inflate balloon prior to insertion - Lubricate catheter generously - If unsuccessful, use NEW catheter - Insert to hub PRIOR to inflating balloon - Use only STERILE WATER to inflate balloon	Reduce risk of injury to urethra & bladder
Secure Catheter 	Secure catheter to inner thigh • Catheter is secured at the BIFURCATION • There is NO tension on catheter with leg movement • Flexitrak is the preferred method of securement	- Check securement and tension with EVERY assessment - Preventing tension will prevent pressure-related injury of the Meatus - Alternate methods of securement may be indicated for small patients and non-balloon catheters	Limits movement and migration that could damage tissues and permit bacterial invasion
Perineal & Catheter Care	Cleanse perineum PRIOR to catheter care • Do NOT use anti-microbial soap on perineum Cleanse catheter a minimum of EVERY 12 hours at 0800 & 2000, after bowel movements or if secretions develop around meatus • Use soap and damp gauze/cloth, comfort bath/baby wipes • Cleanse about 4 inches of catheter, from meatus stroking toward drainage bag Inspect meatus for any signs of pressure-related injury	- Females: retract labia, clean from pubis to anus, use clean side of cloth which each wipe - Males: gently retract foreskin, clean around catheter first THEN wipe in circular motion around meatus and glans - Catheter care should be done at set times regardless of insertion time. - Preventing tension will prevent pressure-related injury of the meatus	Decreases chance of bacteria migrating up the catheter
Drainage System 	Change ONLY with catheter changes and/or when soiled Keep drainage device below level of bladder Empty drainage device using clean container: • EVERY 8 hours • When more than ½ to ¾ full • PRIOR to transport/transfer	- Keep tubing below bladder AND above bag - Keep tubing FREE of kinks - Ensure free-flow of urine without stasis	Maintains the drainage devise as a closed system Allows urine to free flow and decreases chance of urine backflow

v.3.13.13

9. **Possibility of pregnancy in girls is often overlooked as a concern** when deciding to catheterize a female child. Many pediatric hospitals require girls of childbearing age (post menarche), even if she is not known to be sexually active, to have a urine pregnancy test prior to surgery or any invasive or anesthetized procedure. Any chance that she could be pregnant creates a complication for the clinician. Pregnancy could be the reason the child presents seemingly in need of catheterization. Pregnancy can cause stress, incontinence, or overactive bladder, and the pressure of an expanding uterus on the bladder sphincter could mimic the discomfort and urgency of a bladder infection and should be considered prior to placing an indwelling urinary catheter in any girl of child-bearing age.

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Section 8: Special Populations

Surgery Patients

Recent evidence has suggested limited use of urinary catheters in surgery patients. The Surgical Care Improvement Project (SCIP) Inf-9 guideline promotes removal of indwelling urinary catheters within 48 hours of surgery.[1]

Catheters will be removed on postoperative day one or postoperative day two with day of surgery being day zero. Patients who had urological, gynelogical, or perineal surgery are excluded from this measure.

In 2006, a study demonstrated a 60 percent reduction of CAUTI using a multifaceted intervention for orthopedic surgery patients. An early intervention in the study was to remove indwelling catheters by post-op day two for total hip replacements and day one for total knee replacements.[2]

The SCIP measure requires that if the patient meets criteria for extended catheter use, the physician must document the justification. However, some data suggest that current exemptions may still contribute to postoperative CAUTI. A 2012 report published in the *Archieves of Surgery* assessed whether an association exists between UTI rates and SCIP Inf-9 exemption status. This retrospective case control study reviewed 2,459 patients, SCIP Inf-9 compliance increased over time, but this was not correlated with improved monthly UTI rates. Sixty-one of the 69 UTIs (88.4 percent) were compliant with SCIP Inf-9; however, 49 (71 percent) of these were considered exempt from the guideline and, therefore, the urinary catheter was not removed within 48 hours of surgery. Retrospective review of 100 random controls showed a similar compliance rate (84 percent, $P = .43$) but a lower rate of exemption (23.5 percent, $P < .001$). The odds of developing a postoperative UTI were eight times higher in patients deemed exempt from SCIP Inf-9.The authors concluded that most UTIs occurred in patients deemed exempt from SCIP Inf-9. They also concluded that although compliance rates remained high, practices were not actually improving. The authors suggested that SCIP Inf-9 guidelines should be modified with fewer exemptions to facilitate earlier removal of indwelling urinary catheters.[3]

Wald and colleagues noted that extended use of urinary catheters in the postoperative period in elderly patients is associated with poor outcomes. A total of 170,791 Medicare patients ages 65 years or over who were admitted to skilled nursing facilities after discharge from a hospital with a primary diagnosis code indicating major cardiac, vascular, orthopedic, or gastrointestinal surgery in 2001. A total of 39,282 (23 percent) of the postoperative patients discharged to skilled nursing facilities had indwelling urinary catheters. After adjusting for patient characteristics, the patients with catheters had greater odds of rehospitalization for UTI and death within 30 days than patients who did not have catheters.[4]

Historically, urinary catheters have often been used in orthopedic patients who received spinal anesthesia.The use of spinal anesthesia, commonly used for elective joint arthroplasty, has also considered to be an indication for the use of a urinary catheter. The rationale is that spinal anesthesia can lead to the loss of the ability to sense bladder distention, which may then lead to neurogenic bladder problems.

A recent study published in the *Journal of Bone and Joint Surgery* randomized patients into two groups; 200 patients were included in the study. The catheter group was subjected to a standard postoperative protocol, with postoperative removal of the indwelling catheter within 48 hours. The experimental group was monitored for urinary retention and, if necessary, had straight catheterization up to two times prior to the placement of an indwelling catheter. There was no significant difference between the two groups in terms of the prevalence of urinary retention, prevalence of urinary tract infection, or length of stay. Nine patients in the no-catheter group and three patients in the catheter group (following removal of the catheter) required straight catheterization because of urinary retention. Three patients in the catheter group developed UTI; none in the no-catheter group did. The study concluded that a routine catheter is not needed for patients for patients undergoing total hip replacement who receive spinal anesthesia given that the risk of urinary retention is low.[5]

The *CDC HICPAC Guideline* evidence suggested some benefit to the use of intermittent catheterization over indwelling urethral catheters in selected populations. This was based on a decreased risk of SUTI and bacteriuria/unspecified UTI but an increased risk of urinary retention in postoperative patients with intermittent catheterization. In one study, urinary retention and bladder distension were avoided by performing catheterization at regular intervals (every 6 to 8 hours) until return of voiding.[6] Studies in operative patients whose catheters were removed within 24 hours of surgery found no differences in bacteriuria with intermittent vs. indwelling catheterization, while studies where catheters were left in for longer durations had mixed results.[7]

Protocols to Support Early Removal

A number of hospitals have developed protocols that do not include the use of a urinary catheter as a routine standard of care in select surgical populations. Often, if a catheter is used, it is removed in surgery or in the post-anesthesia care unit as soon as the patient is awake. Protocols for removal of catheters postoperatively should be part of standard order sets. As hospitals have transitioned to electronic health records (EHRs), the potential for electronic reminders and orders sets has intensified. Examples of a post-surgery protocol and an electronic order are shown in Figure 8.1.

Spinal Cord Injury

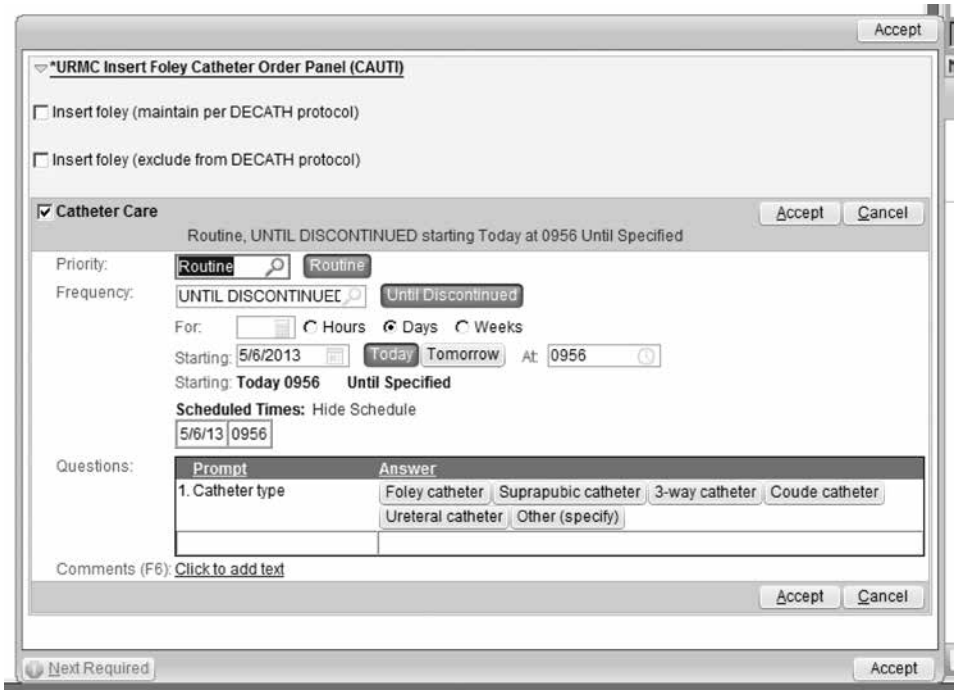
UTI is responsible for major morbidity in patients with spinal cord injury (SCI). Although there are improved treatments, UTI still ranks as the second leading cause of death in SCI patients. Spinal cord injury alters lower urinary tract function, producing elevated intravesical pressure, incontinence, reflux, stones, and neurological obstruction. These commonly found conditions in the SCI population increase the risk of UTI. Incomplete voiding and catheter use contribute to an increased risk of symptomatic UTI.[8]

In patients practicing clean intermittent catheterization, the mean incidence of UTIs is 10.3 per 1,000 catheter days; after 3 months, the rate is fewer than 2 per 1,000 catheter days. Once a urethral catheter is in place, the daily incidence of bacteriuria is 3 to 10 percent.[9]

Organisms that commonly cause infections include *Proteus, Pseudomonas, Klebsiella, Serratia,* and *Providencia* species, along with enterococci and staphylococci. Approximately 70 percent of infections are polymicrobial.[10]

The 2009 CDC HICPAC CAUTI prevention recommendations cite low-quality evidence suggesting the avoidance of urinary catheters. Intermittent catherization is generally associated with lower rates of CAUTI. It is often a preferred method of catherization for patients who can perform this function independently. However, it may not be suitable for all patients.[11]

Figure 8.1. Electronic Order for Removal as per Protocol



Source: Sample provided with permission by Shari Nersinger, Highland Hospital Rochester, NY.

Certain patients with spinal cord injury may require an indwelling urinary catheter or a suprapubic catheter. Although the incidence of CAUTI may be somewhat lower in patients with a suprapubic catheter, the decision on the appropriate strategy is determined on a case-by-case basis. The most recent HICPAC recommendations call attention to the fact that the studies indicating preferential use of a suprapubic catheter were based upon decreased risk of bacteriuria, unspecified UTIs, reduced strictures, need for recatheterization, and patient satisfaction. There was not a decreased risk of SUTI.

Because nearly all patients with chronic indwelling catheters will develop bacteriuria, it is extremely important to instruct patients and their families on CAUTI prevention. In addition to prevention strategies described in previous sections, hydration and encouragement of fluids is important in patients with chronic catheters.[12] Catheters should be changed only when necessary; however, some experts recommend that catheters be changed prior to the collection of a urine specimen for a suspected CAUTI. The *2009 Clinical Practice Guidelines* of the Infectious Diseases Society recommend replacing an indwelling urinary catheter if it has been in place for more than 2 weeks prior to starting antibiotic therapy for CAUTI or to obtaining a culture for suspected CAUTI. The presence of cloudy or odorous urine should not be used as criteria for routine urine culturing or antibiotic treatment.[13]

Intensive Care Unit Patients

The ICU represents a juncture between the most seriously ill patients receiving aggressive therapy and the most resistant pathogens, which are selected by the use of broad spectrum antibiotic therapy. ICU patients require invasive devices, putting them at risk for infection and often limiting mobility. The ICU is a particular challenge for CAUTI prevention. Patients who are critically ill often require strict intake and output monitoring and are limited in often limited in their mobility.[14]

CAUTI in ICUs is often associated with a higher mortality and excess cost. Risk factors include female gender, comorbidities, location of insertion (ED vs. ICU), and excess duration of the urinary catheter.

In April of 2013, the NHSN posted its 2011 device-associated module infection report. Pooled means for CAUTI ranged from 1.2 in medical-surgical ICUs with fewer than 12 beds to 4 in burn ICUs.[15]

On September 24, 2013, The AHRQ released an interim reportrelated to the On the CUSP: Stop CAUTI initiative. The report, "Eliminating CAUTI: A National Patient Safety Imperative—Interim Data Report on the National Project," describes a 16 percent average reduction in CAUTI rates among hospital units that have completed 14 months of CUSP implementation. However, the report noted that the most significant reductions occurred in non-ICU settings and that there was no significant reduction in device utilization.[16]

Although other methods of urinary drainage, such as condom catheters, frequent toileting, earlier ambulation of ventilator patients, and incontinence products, can assist in earlier catheter removal in acutely ill patients, minimal data have been collected in ICUs to assess these alternatives.[17]

A prospective prevalence study of unjustified use of urinary catheters in 202 medical patients, of whom 135 were admitted to the medical ICU, was conducted at a large tertiary care center. Patients were evaluated for appropriate insertion and timely removal of urinary catheters by a trained observer applying predetermined criteria. The independent observer assessed the indication for initial catheterization by chart review and interview with the patient and the nurse. The need for continued catheterization was assessed daily by the same observer, who also documented complications as a result of urinary catheterization. Of the 202 patients who were studied, the initial indication for the placement of the urinary catheter was found to be unjustified in 21 percent (95 percent confidence interval [CI], 15 percent to 27 percent). Continued catheterization was unjustified in 47 percent (95 percent CI, 42 percent to 57 percent) of 912 patient-days with a catheter studied. In the medical ICU, 64 percent (95 percent CI, 58 percent to 70 percent) of the total unjustified patient-days with a urinary catheter resulted from its excessively prolonged use for monitoring urine output.[18]

Although prevention efforts in ICUs are challenging, a number of reports have demonstrated improvement through the application of evidence-based practices, early removal, and implementation of CAUTI bundles. Tisworth and colleagues reported a significant and sustainable reduction in a neurosurgical ICU through a comprehensive program of education, feedback, rounding, and timely removal of catheters. Urinary catheter use fell by 25 percent and Infection rates 13.3 to 4 per 1,000 urinary catheter days.[19] Summary of prevention strategies in the ICU are reviewed in Table 8.1.

Long-Term Care

Long-term care facilities (LTCFs) may be defined as institutions, such as nursing homes and skilled nursing facilities that provide healthcare to people who are unable to manage independently in the community. This care may include custodial or chronic care management or short-term rehabilitative services. Efforts to reduce healthcare costs have led to fewer hospitalizations and shorter hospital lengths of stay resulting in increased outpatient, home care and LTCF stays. As a consequence nursing homes and rehabilitation units are seeing patients with higher acuity and use of more invasive devices such as indwelling urinary catheters, feeding tubes, and central venous catheters. Urinary tract infections are one of the most common infections in LTCFs and account for 20 to 30 percent of reported infections. Although the prevalence of indwelling urinary catheters is lower than the acute care

Table 8.1. Prevention Strategies in the ICU

ICU strategies	Comments
Educate nursing staff and providers.	Nursing staff and providers often view ICU patients as requiring a urinary catheter during their entire ICU stay. Review CAUTI cases with caregivers as they occur. Help staff "connect the dots" to other harm events, such as decubiti or *Clostridium difficile*, after treatment for CAUTI fails. Consider using huddles or other methods to review events as a team. Ensure that providers understand the difference between symptomatic and asymptomatic bacteriuria and avoid treating asymptomatic bacteriuria. Utilize infectious disease (or other experts) and pharmacy to review CAUTI treatment and importance of inappropriate treatment of asymptomatic bacteriuria. Give immediate feedback when this[[**antecedent?**]] occurs.
Develop ICU specific indications for insertion.	Consider circumstances where a catheter may not be necessary. Incorporate indications into protocols, policies, and procedures. Give feedback on inappropriate insertion.
Consider annual competencies for aseptic insertion and maintenance.	Assess need and develop competency as appropriate. Develop and monitor maintenance bundle.
Consider flags, nurse-driven protocols, or other removal reminders. Discuss during multidisciplinary rounds.	Quality improvement examples support this approach. Minimally, discontinue on transfer to floor care when possible.
Specimen collection	Process urine specimens as soon as possible If urine cannot be processed within 30 min. – refrigerate urine Refrigerated specimens should be processed within 24 hours If catheter has been in place for more than 14 days, replace catheter prior to specimen collection
Leg bags are often used for patients to improve ambulation	Leg bags may increase the risk of UTI because of reflux and potential for contaminating port Disinfect ports with alcohol Change bags at regular intervals Disinfect with dilute vinegar 1:3, and allow to dry thoroughly
Consider alternatives to catheters	Condom catheter, toileting protocols, incontinence products, intermittent catheterization
Assure staff are competent to insert catheters	Staffing and turnover issues create challenges Consider annual competency or training requirements

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setting, CAUTIs can lead to complications such as cystitis, pyelonephritis, bacteremia and sepsis. CMS requirements for detailed care plans for urinary incontinence and catheter use necessitating documentation of appropriate insertion and removal protocols have been instrumental in promoting the use of catheters only when indicated and the prompt removal of catheters when no longer needed.

The prevalence of indwelling urinary catheters In the LTCF has been reported at 5 percent. Residents in the LTCF are colonized with bacteria mainly attributable to biofilm on the catheter. The most common pathogen associated with CAUTI in the LTCF is Escherichia coli. E. coli accounts for about 40 percent of infections in these settings. Other pathogens frequently found in this population are Klebsiella sp., Proteus and Morganella.

In 2012, the Mc Geer Infection Surveillance definitions for long term care facilities were revised. An expert consensus panel updated these definitions based upon current literature. Significant changes were made to the criteria for urinary tract infections. The revised definitions require clinical criteria in addition to the need for microbiologic confirmation for diagnosis. The Mc Geer definitions can be located at www.jstor.org/stable/full/10.1086/667743. New NHSN LTCF surveillance definitions have recently been released by NHSN and are discussed in Section 4 of this Guide.

Prevention of CAUTI remains a challenge in the LTCF. Unlike the acute care setting, urinary catheters are usually placed for appropriate reasons such as urinary obstruction, impaired bladder emptying secondary to benign prostatic hypertrophy and other acceptable reasons. Therefore, many patients with indwelling catheters may require long term catheterization. Urinary catheter maintenance is of upmost importance in this setting. Although strategies for prevention of CAUTI in acute care are applicable to the LTCF, some strategies need special attention and are reflected in Table 1.

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Appendix: Recommendations for Spinal Cord Injured Patients*

Intermittent Catheterization

Intermittent catheterization is a method by which an individual with SCI or his or her caregiver empty the bladder at a specified time frequency by inserting a catheter into the bladder, draining the bladder, and then removing the catheter. Intermittent catheterization does not require an intact sacral micturition reflex to be present. The method is an effective alternative during spinal shock when the bladder is not contracting. Intermittent catheterization provides complete bladder emptying and offers a practical means of obtaining a catheter-free state.

1. **Consider intermittent catheterization for individuals who have sufficient hand skills or a willing caregiver to perform the catheterization.**

(Scientific evidence–III;
Grade of recommendation–C;
Strength of panel opinion–Strong).

Rationale: Intermittent catheterization provides a method of emptying the neurogenic bladder without leaving an indwelling catheter and lessens the frequency of long-term complications such as hydronephrosis, bladder and renal calculi, and autonomic dysreflexia encountered with other methods of neurogenic bladder management (Bennett et al., 1995; Chai et al., 1995; Chua, Tow, and Tan, 1996; Dmochowski, Ganabathi, and Leach, 1995; Giannantoni et al., 1998; Perkash and Giroux, 1993). Intermittent catheterization should not be used in individuals who do not have adequate hand function to perform the procedure themselves or who do not have a caregiver willing and able to perform this function. Additionally, an alternative to intermittent catheterization may be needed in individuals with:

Abnormal urethral anatomy such as stricture, false passages, and bladder neck obstruction. Bladder capacity less than 200 ml. Poor cognition, little motivation, inability or unwillingness to adhere to the catheterization time schedule or the fluid intake regimen, or adverse reaction toward having to pass the catheter into the genital area multiple times a day.

2. Consider avoiding intermittent catheterization in individuals with SCI who have one or more of the following:

- Inability to catheterize themselves. A caregiver who is unwilling to perform catheterization. Abnormal urethral anatomy, such as stricture, false passages, and bladder neck obstruction.
- Bladder capacity less than 200 ml. Poor cognition, little motivation, or inability or unwillingness to adhere to the catheterization

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Copies of PVA's Guidelines are available at www.pva.org or through the PVA Distribution Center (toll free 888-860-7244).

time schedule. High fluid intake regimen. Adverse reaction to passing a catheter into the genital area multiple times a day. Tendency to develop autonomic dysreflexia with bladder filling despite treatment.

(Scientific evidence–III;
Grade of recommendation–C;
Strength of panel opinion–Strong)

Rationale: Intermittent catheterization requires insertion of a catheter into the bladder at a routine time interval to prevent over distention of the bladder. Inability to catheterize oneself and/or lack of a willing caregiver to perform the catheterization may lead to bladder over distention. Urethral abnormalities may make it difficult to pass the catheter into the bladder to prevent bladder over distention. High fluid intake may require frequent catheterization, which may not be practical. Aversion to passing a catheter into the bladder may lead to over distention. Upper tract complications can still occur with intermittent catheterization in the presence of high bladder pressures (Dmochowski, Ganabathi, and Leach, 1995; Giannantoni et al., 1998; Weld and Dmochowski, 2000; Weld et al., 2000; Zermann et al., 2000).

3. Advise individuals with SCI of the potential for complications with intermittent catheterization, such as:

- Urinary tract infections.
- Bladder over distention.
- Urinary incontinence.
- Urethral trauma with hematuria.
- Urethral false passages.
- Urethral stricture.
- Autonomic dysreflexia (in those with injuries at T6 and above).
- Bladder stones.

(Scientific evidence–None;
Grade of recommendation–None;
Strength of panel opinion–Strong)

Rationale: The normal capacity of the bladder is less than 500 ml. Catheterizing the bladder every 4–6 hours prevents over distention of the bladder.

4. If bladder volumes consistently exceed 500 ml, adjust fluid intake, increase frequency of intermittent catheterization, or consider alternative bladder management method.

(Scientific evidence–None;
Grade of recommendation–None;
Strength of panel opinion–Strong)

Rationale: Keeping bladder volumes below 500 ml will usually prevent over distention of the bladder. Limiting fluid intake will decrease the amount of urine produced and can be helpful in decreasing the frequency needed for intermittent catheterization. Limiting fluids after dinner may prevent the need for intermittent catheterization in the middle of the night.

5. Institute clean intermittent catheterization teaching and training for individuals prior to discharge from the acute phase of rehabilitation.

(Scientific evidence–III;
Grade of recommendation–C;
Strength of panel opinion–Strong)

Rationale: Waiting until fluid resuscitation is complete before starting intermittent catheterization will prevent over distention of the bladder. Clean intermittent catheterization provides a successful long-term option that is less cumbersome and costly than the sterile technique (Chang et al., 2000; Chua, Tow, and Tan, 1996; Dmochowski, Ganabathi, and Leach, 1995; Giannantoni et al., 1998; Mitsui et al., 2000; Perkash and Giroux, 1993; Weld and Dmochowski, 2000; Weld, Graney, and Dmochowski, 2000).

6. Consider sterile catheterization for individuals with recurrent symptomatic infections occurring with clean intermittent catheterization.

(Scientific evidence–III;
Grade of recommendation–C;
Strength of panel opinion–Strong)

Rationale: Lower infection rates can be achieved with sterile techniques and with prelubricated self-contained catheter sets (Giannantoni et al., 2001; Waller et al., 1995).

7. Investigate and provide treatment for individuals on intermittent catheterization who leak urine between catheterizations.

(Scientific evidence–III;
Grade of recommendation–C;
Strength of panel opinion–Strong)

Rationale: Individuals may leak urine between catheterizations for various reasons, such as urinary tract infections, problems with the bladder or sphincter, or problems with fluid intake. Upper tract complications still occur with intermittent catheterization in the presence of high bladder pressures (Dmochowski, Ganabathi, and Leach, 1995; Giannantoni et al., 1998; Weld and Dmochowski, 2000; Weld et al., 2000; Zermann et al., 2000). Bladder capacity can be increased, and uninhibited contractions can be decreased, with the use of anticholinergic medications or with botulinum toxin injections (see *Botulinum Toxin Injection*).

8. Monitor individuals using this method of bladder management.

(Scientific evidence–None;
Grade of recommendation–None;
Strength of panel opinion–Strong)

Rationale: Routine urologic follow-up is central to any bladder-management program to monitor complications, such as urinary tract infections, bladder or kidney stones, hydronephrosis, vesicoureteral reflux, and autonomic dysreflexia. The specific tests for monitoring and the frequency of those tests vary among practitioners. One approach is suggested by the VA SCI annual examination recommendations (VHA Handbook 1176.1 Spinal Cord Injury and Disorders System of Care). Many centers evaluate the upper and lower tracts of a person with a neurogenic bladder on a yearly basis. This may be done more frequently if a person is having a problem.

Nursing Considerations for Intermittent Catheterization

Individuals who choose intermittent catheterization for bladder management will need education on proper techniques and care as well as routine follow-up to detect potential complications. There are many variations on intermittent catheter technique and care. One example follows.

Catheter selection: The catheter should be easy to insert without trauma or curling in the urethra. If a latex allergy is present, nonlatex catheters must be used. A nonlatex product with straight tip is recommended. (For types of catheters and economic considerations, see appendix A.)

Hand washing. Hands should be washed or aseptic towelettes used both before and after catheterization.

Technique. Follow the procedure recommended by the prescribing institution, health-care professional, national guideline, or health-care organization.

Catheter care. To control introduction of bacteria into the bladder, catheters must be washed after every use. Rinsing and allowing catheters to air-dry between each use was found to be the most effective means of keeping the bacteria count low on catheters (Lavallee et al., 1995). Catheters should be cleaned with mild soap and water, air-dried, and placed in a paper bag until ready

to reuse. If recurrent urinary tract infections are a problem, latex catheters can be sterilized by heating them in a microwave oven (Mervine and Temple, 1997).

Recurrent urinary tract infections. Symptoms of UTIs need to be investigated and documented as follows:

Technique and bladder check: The catheterization technique should be assessed and the bladder checked for stones, mucus, or other debris.

Single-use catheter: If no reason for UTIs can be found, a single-use catheter may be used to see if UTIs subside.

Single-use hydrophilic catheter: If urethral irritation appears to be the cause, a single-use hydrophilic catheter may be tried. Sterile water for injection, which may or may not be included with the catheter, needs to be used to activate this type of catheter.

Antibacterial catheter: If UTIs continue, a single-use catheter impregnated with an antibacterial substance may be tried.

Touchless catheter. When toilet facilities are not readily available, such as during sports activities or travel, a touchless catheter with a collection device may be a good alternative. These catheters, which are contained within the collection device, lubricate themselves as they are introduced into the urethra by a prelubricated outlet on the bag. When the bladder is drained, the catheter is withdrawn from the urethra and returned to the collection device, the top is capped, and the entire device discarded without ever being touched directly by the hands.

Fluids. Fluid consumption should be moderate and spaced throughout the day.

Timing. Catheterization typically occurs every 4–6 hours so that the amount of urine obtained with each collection is less than 500 ml. Individuals may need to awaken at night to catheterize.

Assistance required. Adequate hand function and sufficient cognitive ability are needed to insert the catheter or else a caregiver must be available to do so.

Cosmesis. No changes will be noted.

Interference with social/sexual functioning. None.

Medications. If urinary leakage and a highpressure bladder (as determined by urodynamic studies) are creating difficulties, medications will be prescribed to help with overactive bladder. If urinary leakage is the result of an incompetent sphincter, additional medication may be prescribed. If the problem is catheterization at the bladder neck, an alpha-blocker may be prescribed to relax the bladder neck and facilitate catheterization.

Reversibility. This method can be discontinued at any time.

Adapted from Joseph, A.C., A. Hixon, J. Giroux, D. Briggs, M. Gardenhire, D. Diaz, and J. Wells. Nursing clinical practice guideline: neurogenic bladder management. *Spinal Cord Injury Nursing* 15 (2) (1998): 21–56.

Credé and Valsalva

Credé is a method of applying suprapubic pressure to express urine from the bladder. Credé is usually used when the bladder is flaccid or a bladder contraction needs to be augmented. The effectiveness of Credé is limited by sphincter pressure. Valsalva is a method in which an individual uses the abdominal muscles and the diaphragm to empty the bladder. Valsalva is used when the bladder is flaccid from spinal cord injury affecting the sacral reflex arc or when the bladder contracts but does not empty completely. Valsalva increases intraabdominal pressure but does not ensure complete bladder emptying.