An APIC Guide

2008

Guide to the Elimination of Catheter-Associated Urinary Tract Infections (CAUTIs)

Developing and Applying Facility-Based Prevention Interventions in Acute and Long-Term Care Settings

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ISBN: 1-933013-39-7

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Acknowledgments

The Association for Professionals in Infection Control and Epidemiology (APIC) acknowledges the valuable contributions of the following individuals:

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Guide Overview

Purpose

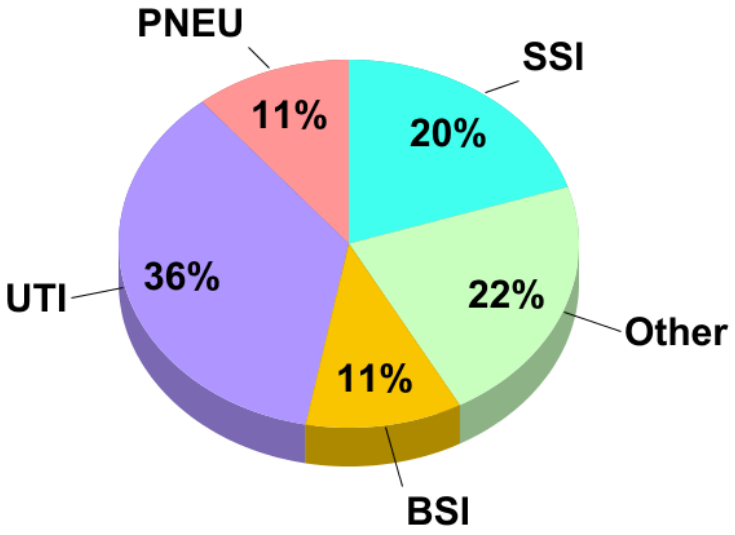
The purpose of this document is to provide evidence-based practice guidance for the prevention of Catheter-Associated Urinary Tract Infection (CAUTI) in acute and long-term care settings.

Background

Healthcare-associated infections (HAIs) are infections acquired during the course of receiving treatment for other conditions within a healthcare setting. HAIs are one of the top 10 leading causes of death in the United States, according to the Centers for Disease Control and Prevention (CDC), which estimates that 1.7 million infections annually were reported among patients. ("Questions and Answers about Healthcare-Associated Infections" may be accessed on the web at http://www.cdc.gov/ncidod/dhpq/hai_qa.html.)

It has long been acknowledged that CAUTI is the most frequent type of infection in acute care settings. In a study that provided a national estimate of healthcare-associated infections, urinary tract infections comprised 36% of the total HAI estimate. (See figure 2.1 below.)[1]

Figure 2.1. Infection types in acute care settings.



In a 2000 review of literature by Saint[2] on urinary tract infections related to the use of urinary catheters, it was reported that 26% of patients who have indwelling catheters for two to 10 days will develop bacteriuria, after which 24% of those with bacteriuria will develop a CAUTI. Of these patients, approximately 3% will develop bacteremia.

The 1997 APIC/SHEA position paper on urinary tract infections in long-term care (LTC) identifies CAUTI as the most common infection in LTC residents, with a bacteriuria prevalence without indwelling catheters of 25% to 50% for women, and 15% to 40% for men. Therefore, usage of indwelling urinary catheters in residents of LTC facilities can be expected to

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result in higher CAUTI rates with an associated risk of CAUTI-related bacteremia, unless appropriate prevention efforts are implemented. The 2008 SHEA/APIC Guideline "Infection Prevention and Control in the Long-term Care Facility"[3] notes that "guidelines for prevention of catheter-associated UTIs in hospitalized patients are generally applicable to catheterized residents in LTCFs."

Strategies contained in this resource will be helpful in any healthcare setting, when the facility's infection risk assessment identifies CAUTI as an infection prevention priority.

Legislative Mandates and CAUTI Risk Assessment

The impact of external factors is germane to facility decisions and interventions involving healthcare-associated infections, including CAUTI. Agencies such as the CDC, National Quality Forum (NQF), Agency for Healthcare Research and Quality (AHRQ), and the Institute of Medicine (IOM) have been focusing on ways to improve the outcomes of care for patients. The Medicare program, which represents the largest healthcare insurance program in the United States, has generally paid for services for patients without regard to outcome. But the Centers for Medicare & Medicaid Services (CMS), as a result of the Medicare Modernization Act of 2003 and the Deficit Reduction Act of 2005, has identified CAUTI as a "never event." It is reported that 12,185 CAUTIs, costing $44,043/hospital stay, occurred in fiscal year 2007.[4] Effective October 1, 2008, changes in the CMS inpatient prospective payment resulted in non-reimbursement for CAUTIs not present on admission in inpatients who were later discharged from acute care hospitals (*CR 5499* – Present on Admission indicator). [5]

Requirements cited in the CMS survey "Protocols for Long-Term Care Facilities" provide information and guidance regarding use of urinary catheters and CAUTI prevention for these facilities.[6]

Infection Prevention Interventions for CAUTI

The role of the infection preventionist in efforts to reduce the incidence of CAUTI includes policy and best practice subject matter expertise, provision of surveillance data and risk assessment, consultation on infection prevention interventions, and facilitation of CAUTI-related improvement projects. It is important that the infection preventionist communicates and networks with all members of the patient care team regarding CAUTI-related infection prevention. Providing subject matter expertise to those involved with clinical management of the patients/residents, including physicians, physician assistants, and nurse practitioners, is essential. An understanding of the elements of surveillance definitions, compared to primary or secondary diagnoses and complications, is essential for appropriate documentation and coding.

Direct patient/resident care personnel are responsible for insertion, care and maintenance of indwelling catheters. Therefore, success of a prevention project requires that these personnel be fully engaged and committed to this important patient safety initiative. Obtaining the resources that will engage direct care providers in CAUTI quality/performance improvement activities is a critical component of intervention development. Key players must be held accountable for compliance with the intervention. This can be facilitated through monitoring and reporting of the results of the intervention on a consistent basis, and instituting additional improvements when appropriate.

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Problem Identification

Basic Infection Prevention and Antimicrobial Stewardship

Although this guide focuses on infection prevention related to urinary catheter use, it is necessary to look at more global interventions that will impact HAIs, including urinary tract infections. It should be understood that the basics of infection prevention and control are the necessary underpinnings of programs, policies, and protocols that impact HAI[1] (appropriate hand hygiene, environmental and equipment considerations, compliance with standard and transmission-based precautions, etc.).

One component of HAI prevention deserves added attention in this guide. As highlighted in the CDC's campaign to prevent antimicrobial resistance, a program for antimicrobial stewardship in any healthcare setting (acute and long-term care) has the potential for positive impact on all HAIs. The development of biofilms, colonization, asymptomatic bacteriuria, and symptomatic urinary tract infections are common to urinary catheter use. 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.[2]

The MDRO guide, or "Management of Multidrug-Resistant Organisms in Healthcare Settings," produced by the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) in 2006, recommends that "systems are in place to promote optimal treatment of infections and appropriate antimicrobial use."[3] It is beyond the purview of this guide to explore the successful strategies for antimicrobial stewardship. A recent guideline developed by a joint Infectious Diseases Society of America and Society for Healthcare Epidemiology of America[4] committee on antimicrobial stewardship is available for further information.

Prevalence of Urinary Tract Infections

The risk of urinary tract infection (UTI) depends on a variety of factors, including age, gender, lifestyle, anatomy, and disease process. Nearly half of all women will develop a bladder infection over a lifetime, due to the short length of the female urethra. Diseases or underlying conditions that lead to urinary obstruction, including genetic abnormalities, prostatitis, kidney stones, and others, increase the risk of UTI. Inability to maintain good hygiene, impaired voiding, and incontinence may also increase the risk of UTIs.

Since the earliest days of national nosocomial infection reporting, UTIs have been shown to occur more frequently than other infections associated with healthcare, accounting for 36% of all HAIs in the United States.[5] Most healthcare-associated UTIs are associated with an indwelling urinary catheter. The risk of acquiring a UTI depends on the method of catheterization, duration of catheter use, the quality of catheter care, and host susceptibility.[6] Studies have shown a strong and direct correlation between catheter use greater than six days and CAUTI occurrence. In the same study, it was also reported that bacteriuria is nearly universal by day 30 of catheterization.[7]

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Table 3.1. Risk factors for CAUTI, based on prospective studies and use of multivariable statistical modeling.

Table 3. Risk factors for catheter-associated urinary tract infection, based on prospective studies and use of multivariable statistical modeling (27-30)

Factor	Relative risk
Prolonged catheterization >6 days	5.1-6.8
Female gender	2.5-3.7
Catheter insertion outside operating room	2.0-5.3
Urology service	2.0-4.0
Other active sites of infection	2.3-2.4
Diabetes	2.2-2.3
Malnutrition	2.4
Azotemia (creatinine >2.0 mg/dL)	2.1-2.6
Ureteral stent	2.5
Monitoring of urine output	2.0
Drainage tube below level of bladder and above collection bag	1.9
Antimicrobial-drug therapy	0.1-0.4

Source: Dennis G. Maki and Paul A. Tambyah. Engineering Out the Risk of Infection with Urinary Catheters. Emerg Infect Dis 2001;7(2). http://www.cdc.gov/ncidod/EiD/vol7no2/pdfs/maki.pdf

A multivariate analysis reviewed by Salgado et al. reported five risk factors associated with the later development of a CAUTI: 1) duration of catheterization, 2) catheter care violations, 3) absence of systemic antibiotics, 4) female gender, and 5) older age.[8]

The presence of bacteria (bacteriuria) in the urine of otherwise healthy catheterized patients is often asymptomatic and will resolve spontaneously with the removal of the catheter. Even when not catheterized, older adults may have bacteria in their urine without any signs or symptoms of infection (asymptomatic bacteriuria, or ASB). ASB does not present an increased risk of progression to UTI unless other conditions that predispose the patient to UTI are present. The occurrences of uncomplicated ASB are problematic if antibiotics are inappropriately used as treatment or prophylaxis. Overuse of antibiotics, especially for ASB, may lead to selection for resistant strains.[9]

Urinary Catheter Use in Healthcare Settings

More than 30 million Foley catheters are inserted annually in the United States, and these catheterization procedures probably contribute to 1 million CAUTIs.[10] Estimates of how many patients are catheterized at any one time have ranged from 10% in acute care hospitals, to 7.5% to 10% of patients in long-term care facilities,[11] to a more recent estimate of 25%.[12] Reasons for this increased use include complexities of care, increased acuity, and severity of illness and decreased staffing levels.[13]

Many investigations have shown high frequency of inappropriate and unjustified use of urinary catheters, especially in older, female patients. Inappropriate urinary catheter use in acute care hospitals has been reported to range from 21% to greater than 50%. It is estimated that 30% of all Foley catheters are inserted in the Emergency Department (ED). [14] Using retrospective chart review, Hazelett and colleagues reviewed charts of all patients greater than 65 years of age, admitted through the ED during a one-month period in 2004. Of the 1,633 patients admitted to the hospital from the ED, urinary catheters had been inserted in 379 (23%); 277 of whom (73%) were older than 65 years. Only 46% of these catheters were later identified as appropriately placed. [15]

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In a study by Gokula and colleagues of inappropriate urinary catheter use, the charts of 285 patients older than 65 who had an indwelling Foley catheter were reviewed for catheter indications. It was found that 46% of the patients had appropriate indications for catheterization. Only 13% of the time was there adequate documentation by nurses and physicians regarding the use of the catheter. In addition, 13% of the time, there was no documented order for the catheter. [16]

Complications of Indwelling Urinary Catheters [17]

A CAUTI is often perceived as a benign or acceptable side effect of a clinical process, yet there is a wide range of adverse outcomes associated with the use of urinary catheters.

Infections related to indwelling urinary catheters include:

- Urinary tract infection (bladder)
- Secondary bacteremia/sepsis
- Acute pyelonephritis
- Late onset sequellae, e.g. metastatic osteomyelitis and meningitis

Adverse outcomes related to indwelling urinary catheters include:

- Prolonged hospital stay
- Secondary bacteremia /sepsis
- Increased mortality
- Late onset sequellae, e.g. metastatic osteomyelitis and meningitis
- Formation of encrustations and obstruction to flow
- Selection for multidrug-resistant organisms (MDROs)
- Urethral strictures, prostatitis and orchitis
- Reservoir for MDROs

Prevention of UTIs has been shown to decrease mortality in a large prospective study published in 1983.[18] However, whether or not increased mortality remains a factor in healthcare-associated UTIs in more recent years is not certain. In the October 2008 "Society for Healthcare Epidemiology and Infectious Disease Society of America Supplement on Strategies to Reduce Catheter Associated Urinary Tract Infections in Acute Care Hospitals," the authors note that although morbidity attributable to any single episode of catheterization may be limited, the high frequency of catheterization creates a substantial cumulative burden. [19] CAUTI is an often-overlooked cause of secondary bloodstream infections, responsible for 0.5% to 4% of these infections. Males develop secondary bacteremia twice as often as females.[20] Although mortality is generally associated with bacteremia, one study found that bacteriuria was associated with an almost threefold higher chance of dying than for patients without bacteriuria.

If urinary catheters were used only when deemed appropriate in a given population, thereby reducing the theoretical risk of CAUTI, it is logical to hypothesize that actual CAUTI rates would decrease. The impact of this intervention would be greatest in populations in which the duration of urinary catheter use is typically longer than a few days. Exposure to a urinary catheter is the major risk factor for infection.[21] Duration of catheterization is the secondary risk factor. The best strategy to create the safest patient situation would be to avoid unnecessary catheter use and to use appropriate catheters for as short a duration as medically possible for each individual patient.[22]

Developed as part of a performance improvement project with ICU nurses at a San Diego hospital, the following fishbone diagram identifies the many factors associated with the subsequent development of CAUTI.[23]

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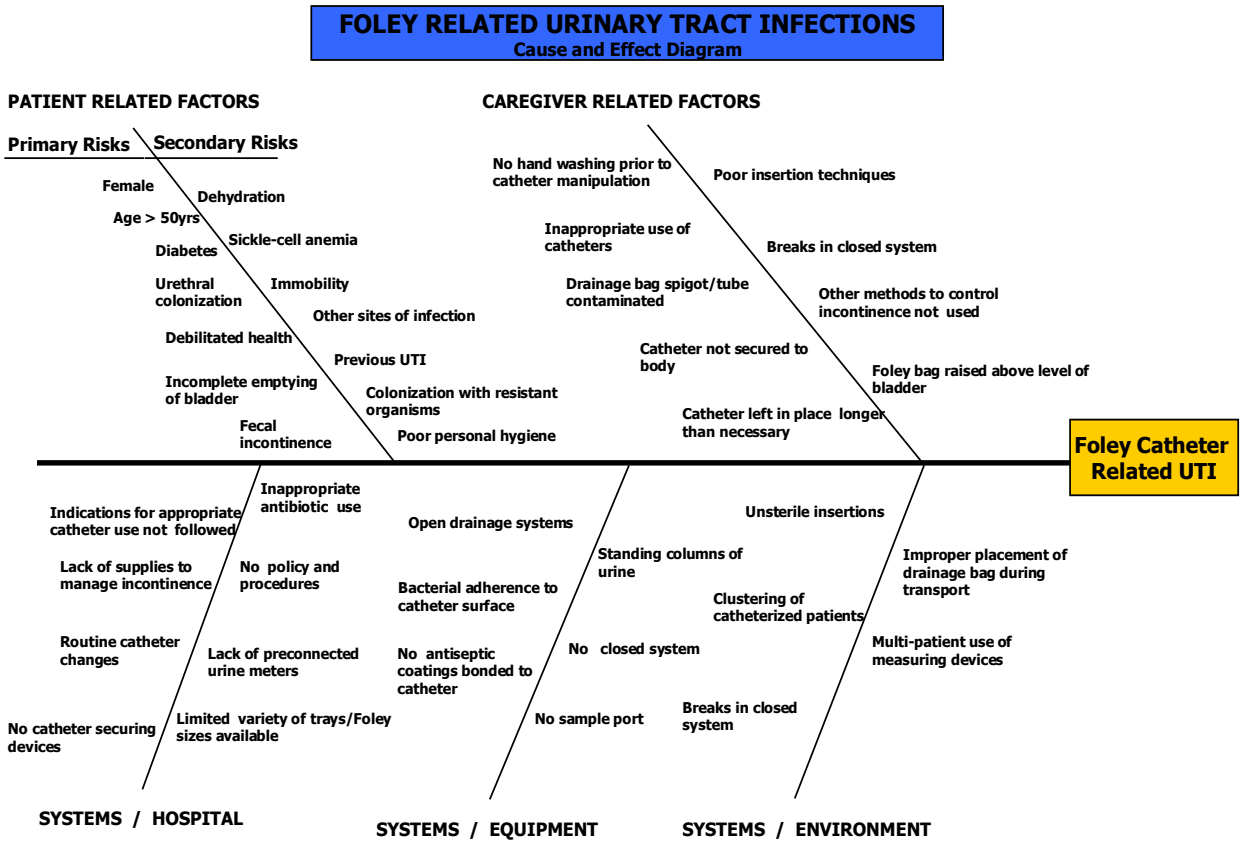

Figure 3.1. Cause and effect diagram: Foley related urinary tract infections.
Source: Carr HA. Catheter-Associated Urinary Tract Infections in Adults: Prevention through Care and Technology. Infection Control Today. Vol 2, No 8, August 1998, pp 26 – 29.

Urinary Tract Infection Pathogens[24]

Endogenous intestinal flora, including *Escherichia coli*, *Enterobacter*, *Klebsiella*, Enterococci, and *Proteus*, are common pathogens of the urinary tract and potential colonizers of urinary catheters. Inadequately decontaminated equipment and hands of healthcare workers may introduce environmental and common skin bacteria during insertion or maint:enance of the urinary catheter.[25] Therefore, *Pseudomonas*, *Serratia*, coagulase-negative *Staphylococci*, *Acinetobacter*, and other non-intestinal or environmental microbes can result in healthcare-associated CAUTI. Patients with long-term indwelling catheters often have polymicrobial bacteriuria. Candida species are a common organism isolated from urine in the intensive care unit (ICU) setting. The use of antifungal drugs and of broad-spectrum antibiotics for empiric therapy has led to increasing prevalence of drug-resistant fungi and bacteria in intensive care and long-term care settings.

Differences have been noted between the prevalence of pathogen-causing UTIs in different settings within a healthcare facility. The following table lists differences noted in pathogens recovered from patients with urinary tract infections in intensive care, as compared to the prevalence of pathogens hospital-wide.

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Table 3.2. Most Common UTI Pathogens

Hospital-wide	Distribution	Intensive Care Unit	Distribution
Escherichia coli	26%	*Candida* spp	25%
Enterococci	16%	*Escherichia coli*	18%
P. aeruginosa	12%	Enterococci	13%
Candida spp	9%	*P. aeruginosa*	11%
K. pneumoniae	6%	*Enterobacter* spp	6%
Enterobacter spp	6%	*K. pneumoniae*	6%

Source: Carr HA. Catheter-Associated Urinary Tract Infections in Adults: Prevention through Care and Technology. Infection Control Today 1998; 2(8):26-29. www.infectioncontroltoday.com

Pathogenesis

A urinary catheter provides a portal of entry into the urinary tract. Bacteria may ascend into the tract via either the external or internal surface of the catheter. Characteristics of each method of ascension are identified below.

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.**

Presence of the Catheter Predisposes Infection:

- **Presence of urinary catheter can lead to a level of bacteriuria in the range of greater than 10^5cfu/mL within 24-48 hours.**
- **Catheter interferes with normal host defenses. Consequently clearance of microbes from voiding and bladder mucosa is diminished.**
- **Absence of urinary catheter results in a lower level of bacteriuria (if any).**

Bacteria can establish colonization of a patient's bladder within three days of their introduction onto the inner or outer surface of urinary catheters.[27] 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. Biofilm formation within invasive medical devices is proposed as a primary mechanism in the development of certain diseases, including CAUTI. [28]Once a biofilm has developed on the inside or outside surface of a urinary catheter, the only way to eliminate the risk of CAUTI is to remove the catheter.

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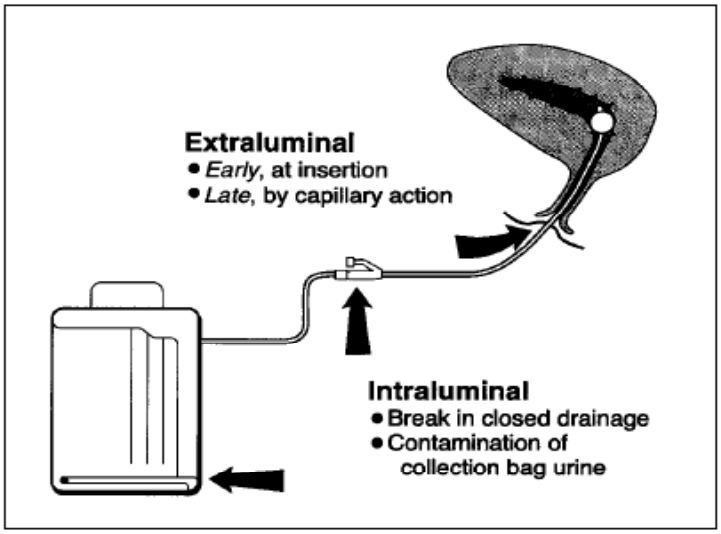

Figure 1. Routes of entry of uropathogens to catheterized urinary tract.

Figure 3.2. Routes of entry of uropathogens to catheterized urinary tract.
Source: Dennis G. Maki and Paul A. Tambyah. Engineering Out the Risk of Infection with Urinary Catheters. Emerg Infect Dis, Vol. 7, No. 2, March-April 2001. http://www.cdc.gov/ncidod/eid/vol7no2/makiG1.htm

Diagnosis of CAUTI - Urine Specimen Collection

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, since it is generally more concentrated, due 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 collect 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. Catheter tips should not be submitted for analysis.[29]

If a CAUTI is suspected, the best practice is removal of the old catheter before obtaining the specimen in order to eliminate the confounding factor of possible catheter biofilm. If an indication for urinary catheterization still exists in a patient suspected of having a CAUTI, obtain the urine specimen after replacing the old one. Specimens collected from an indwelling urine catheter must be noted on the laboratory requisition or in the urine culture order.

The Clinical and Laboratory Standards Institute (CLSI) Guidelines recommend that the urine specimen is cultured within two hours of its collection. If the specimen cannot be cultured within two hours of collection, there are two options for maintaining the specimen integrity: (1) Collection of the urine specimen in a container with a chemical preservative (most commonly, buffered boric acid); (2) Holding the urine specimen at (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.

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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.[30]

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Understanding the Definitions

Clinical Definitions of Urinary Tract Infection

In hospital settings, clinicians may use guideline-based definitions in the diagnosis of urinary tract infections. The Infectious Diseases Society of America definitions are included here for reference.[1]

- Asymptomatic bacteriuria, or asymptomatic urinary infection: Isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen obtained from a person without symptoms or signs referable to urinary infection.

- Acute uncomplicated urinary tract infection: Symptomatic bladder infection characterized by frequency, urgency, dysuria, or suprapubic pain in a woman with a normal genitourinary tract, and is associated with both genetic and behavioral determinants.

- Acute nonobstructive-pyelonephritis: Renal infection characterized by costovertebral angle pain and tenderness, often with fever; it occurs in the same population that experiences acute uncomplicated urinary infection.

- Complicated urinary tract infection: Symptomatic urinary infection involving either the bladder or kidneys, found in individuals with functional or structural abnormalities of the genitourinary tract.

- Pyuria: The presence of increased numbers of polymorphonuclear leukocytes in the urine, evidence of an inflammatory response in the urinary tract.

Catheter Definition

A catheter is defined as a drainage tube that is inserted into the bladder through the urethra, is left in place, and is connected to a closed drainage system. The catheter is sometimes called a “Foley catheter” or indwelling urinary catheter. CAUTI surveillance does not include straight in-and-out catheterizations. Suprapubic catheters and other urological diversions are also not included in CAUTI surveillance.

Surveillance Definitions

Definitions for the CDC and the National Healthcare Safety Network (NHSN), as well as the McGeer definitions for long-term care facilities, are included in this guide. CMS has determined that it will utilize administrative data for CAUTI not present on admission (see section on Value Based Purchasing or VBP).

CDC/NHSN Surveillance Definitions for CAUTI [2]

Acute care hospitals often use the CDC/NHSN classification of CAUTI, which currently falls into two groups: symptomatic urinary tract infection (SUTI) and asymptomatic bacteremic urinary tract infection (ABUTI). CAUTI includes those infections in which a patient had an indwelling urinary catheter at the time or within 48 hours before onset of the event.
NOTE: There is no minimum period of time that the catheter must be in place in order for the UTI to be considered catheter-associated.

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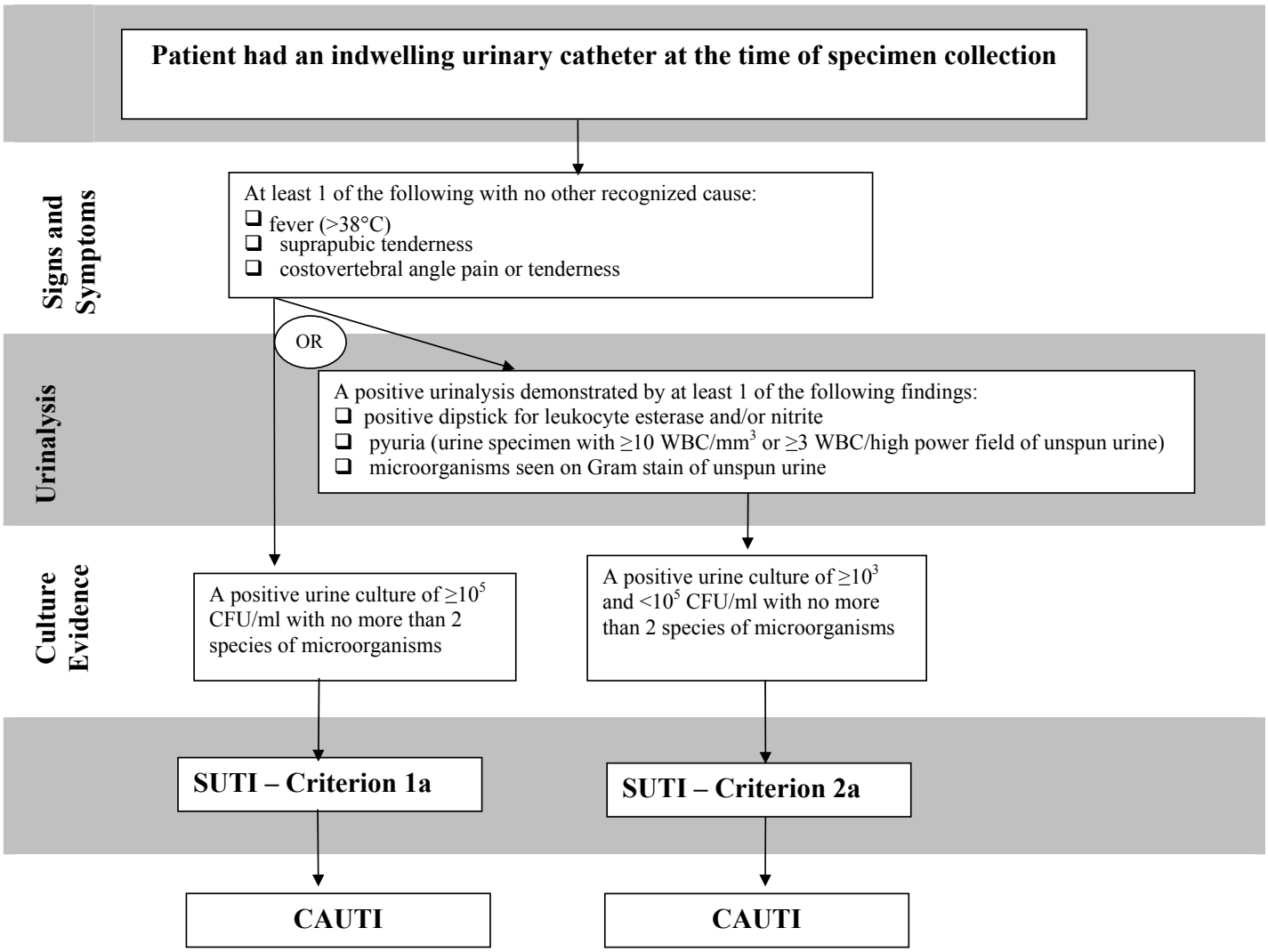
☐ **Identification and Categorization of SUTI Indwelling Catheter Discontinued in Prior 48 Hours**



CDC/NHSN Definition for Symptomatic Urinary Tract Infection (SUTI)
Source: National Healthcare Safety Network (NHSN) Manual, March 2009

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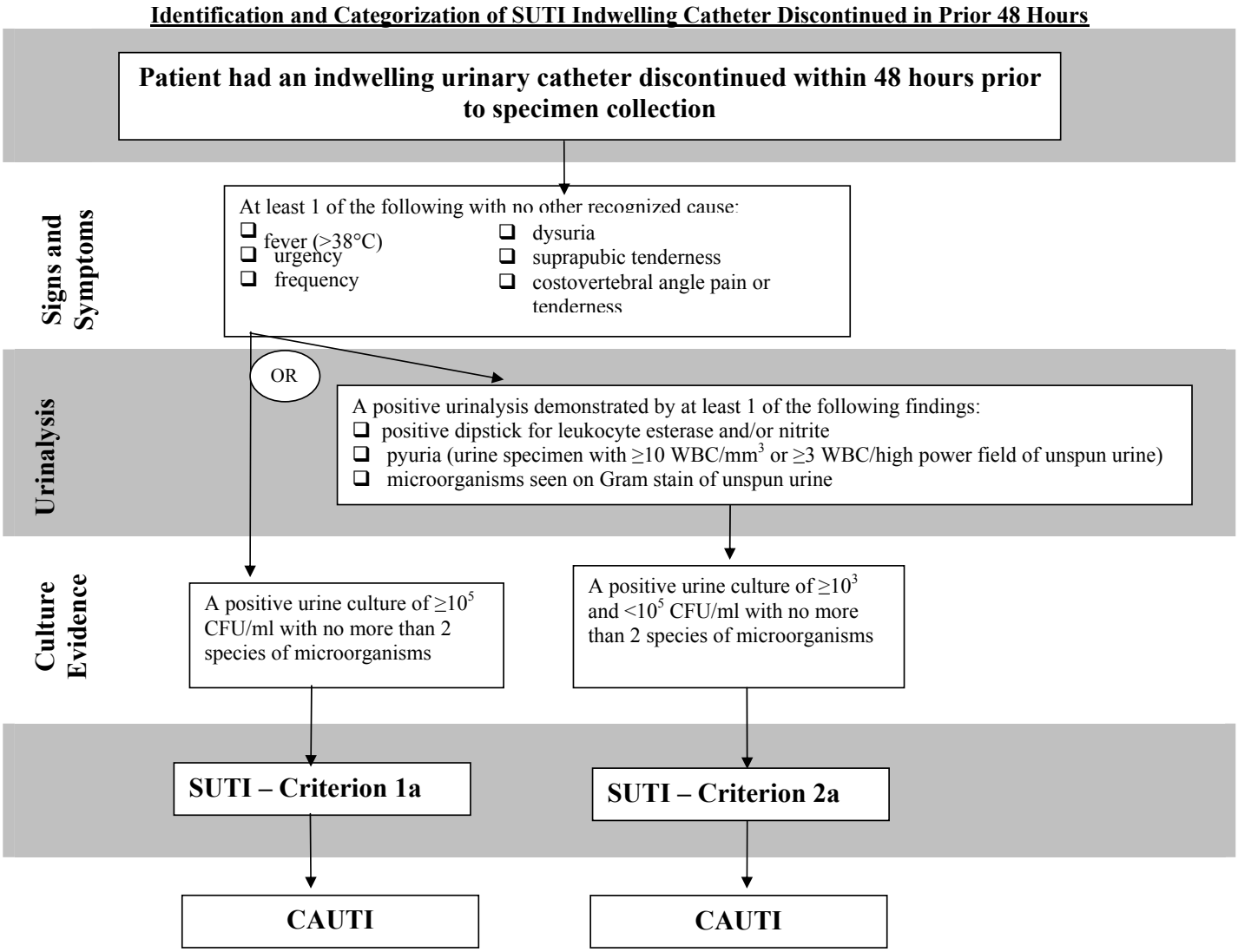

CDC/NHSN Definition for Symptomatic Urinary Tract Infection (SUTI)
Source: National Healthcare Safety Network (NHSN) Manual, March 2009

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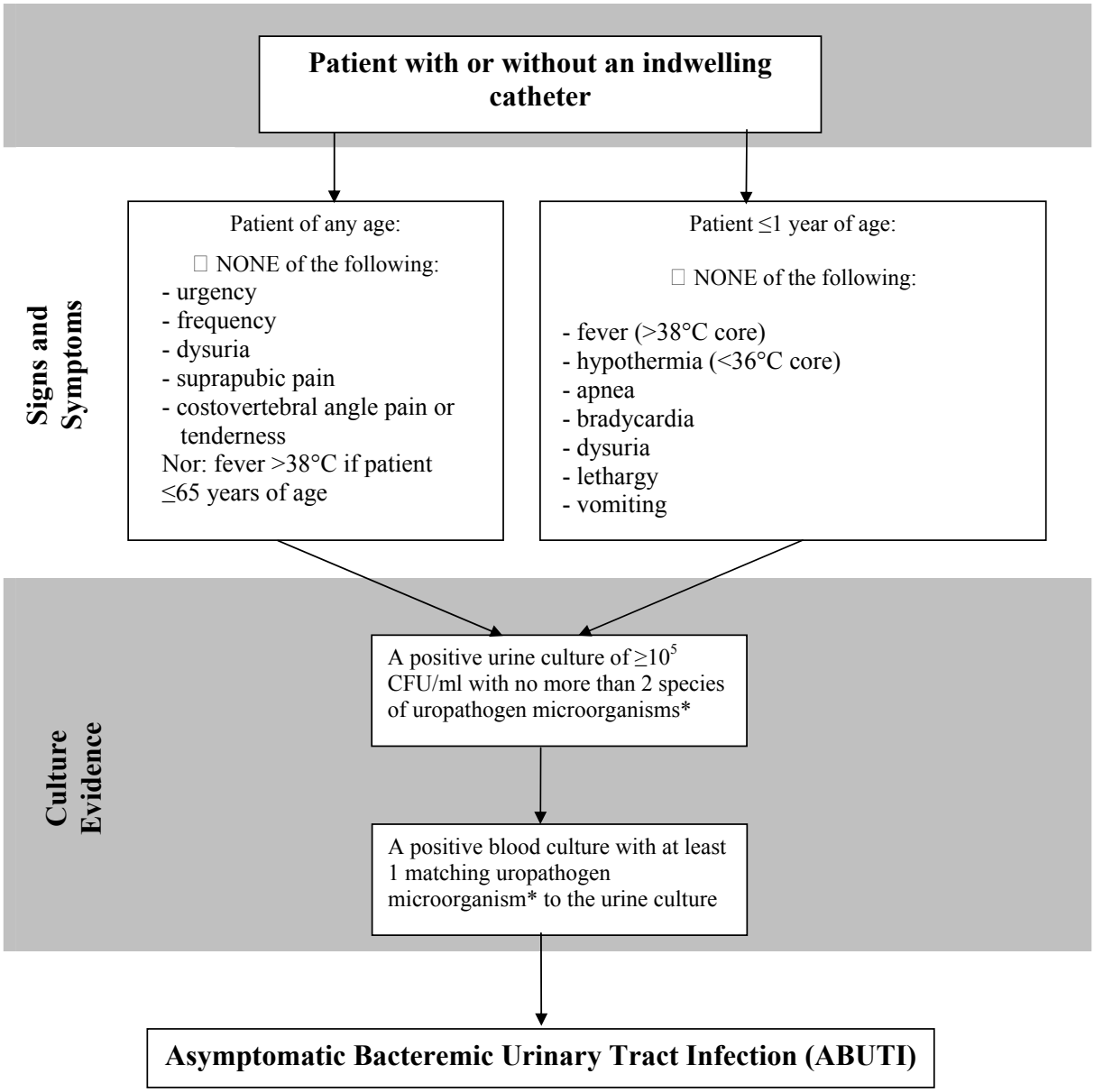
Identification of Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)



*Uropathogen microorganisms are: Gram-negative bacilli, *Staphylococcus* spp., yeasts, beta-hemolytic *Streptococcus* spp., *Enterococcus* spp., *G. vaginalis*, *Aerococcus urinae*, *Corynebacterium* (urease positive)[†].

[†]Report *Corynebacterium* (urease positive) as either *Corynebacterium species unspecified* (COS) or, as *C. urealyticum (CORUR) if so speciated.*.

CDC/NHSN Definition for Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)
Source: National Healthcare Safety Network (NHSN) Manual, March 2009

Bard Exhibit 1027.0019

Complete definitions, including those for patients ≤ 1 year of age, may be found in The National Healthcare Safety Network (NHSN) Manual at **http://www.cdc.gov/nhsn/PDFs/pscManual/pscManual_current.pdf**

McGeer Definitions for CAUTI in the Long-term Care Setting[3]

In the long-term care setting (LTC), the McGeer definitions of infection are often used to guide clinical diagnosis. Prevalence of urinary catheter use has been reported to range from 7% to 10% in these settings. The presence of a catheter predisposes the LTC resident to symptomatic and asymptomatic bacteriuria. It is important for the appropriate clinical management of a catheterized resident to be very clear regarding the diagnosis of clinical UTI.

Resident urinary tract infection includes only symptomatic urinary tract infections. Surveillance for asymptomatic bacteriuria (defined as the presence of a positive urine culture in the absence of new signs and symptoms of urinary tract infection) is not recommended, as this represents baseline status for many residents.

In a symptomatic urinary tract infection, one of the following criteria must be met:

1. The resident does not have an indwelling urinary catheter and has at least three of the following signs and symptoms:
    a. fever (≥38ºC) or chills
    b. new or increased burning pain on urination, frequency or urgency
    c. new flank or suprapubic pain or tenderness
    d. change in character of urine*
    e. worsening of mental or functional status (may be new or increased incontinence)

2. The resident has an indwelling catheter and has at least two of the following signs or symptoms:
    a. fever (≥38ºC) or chills
    b. new flank or suprapubic pain or tenderness
    c. change in character of urine*
    d. worsening of mental or functional status

**Change in character may be clinical (e.g. new onset bloody urine, foul smell, or increase in amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria). For laboratory changes, this requires comparison to a previous urinalysis result.*

Note that urine culture results are not included in the criteria. However, if an appropriately collected and processed urine specimen was cultured and if the resident was not taking antibiotics at the time, then the culture result will help guide clinical management of the resident who has met the criteria for symptomatic urinary tract infection.

In catheterized residents, the most common occult infectious source of fever is the urinary tract. The combination of fever and worsening mental or functional status in such residents meets the criteria for a urinary tract infection. However, particular care should be taken to rule out other causes of these symptoms. If a catheterized resident with fever and worsening mental or functional status meets the criteria for infection at a site other than the urinary tract, then the clinical diagnosis is of an infection at the other site.

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URINARY TRACT - Check ONLY the signs or symptoms that are present in your resident		
Catheter	□ indwelling □ suprapubic □ In and Out catheter	
	Date of insertion (if known): _____ Date of last catheter change: _____	
	□Chills □New or increased burning pain on urination, frequency or urgency □New flank or suprapubic pain / tenderness □Change in character of urine □Worsening of mental or functional status □New or increased incontinence	Date
		Time:
		UA/Micro □ yes □ no
		Urine Culture □ yes □ no
		Antibiotic

Figure 4.1. LTC resident surveillance tool.
Source: Martha M. Harris, MT(ASCP), INOVA Continuum of Care, Clifton, VA

Home care definitions of infection are described elsewhere and are not addressed here. The 2007 "APIC-HICPAC Surveillance Definitions for Home Health Care and Home Hospice Infections" can be found at www.apic.org under Guidelines & Standards or at the CDC web site at http://www.cdc.gov/ncidod/dhqp/gl_home_care.html.

References

[1] Nicolle LE. Infectious Diseases Society of America Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults. *Clinical Infectious Diseases* 2005; 40:643-54.

[2] Horan T., et al. CDC/NHSN surveillance definitions of healthcare-associated infection and criteria for specific types of infections in the acute care setting. *Am J Infect Control* 2008; 36:309-32.

[3] McGeer A., et al. Definitions of Infection for Surveillance in Long-term Care Facilities. *Am J Infect Control* 1991; 19(1); 1-7.

Bard Exhibit 1027.0021

Conducting a CAUTI Risk Assessment

The infection preventionist can contribute to the prevention of CAUTIs by conducting surveillance on a facility-wide or unit basis. High-risk and problem-prone populations, patient care units and/or care practices can be identified through the use of the CMS definition and/or the CDC/NHSN definition to evaluate specific risks of CAUTI. When the risk assessment demonstrates opportunities for improvement, the infection preventionist can link the CMS present-on-admission reimbursement rule and CMS' conditions of participation to justify resources to reduce infection rates.

The purpose of performing a CAUTI risk assessment is to guide the development of a surveillance, prevention, and control plan that is based on facility-specific data and conditions. To develop a CAUTI risk assessment, the following elements must be available:

- Patient demographics
- Historical CAUTI surveillance data for patient populations and/or for designated departments (as appropriate to the healthcare setting)
- Suitable resources, including adequate personnel, data, tools
- Focused, committed leaders
- Results of previous or existing performance improvement interventions related to prevention of CAUTI.

Baseline CAUTI Risk Assessment

For the CAUTI risk assessment, first determine the demographics of those patients or residents who have the highest utilization of indwelling urinary catheters. Patients who reside in nursing homes, surgical service line patients (e.g. orthopedic, cardiac surgery), or patients in the ICU often have urinary catheters more frequently than other populations.

Surveillance performed for the CAUTI risk assessment provides the information needed to identify whether CAUTI is increasing, decreasing or remaining the same in a facility, on a designated unit, in a clinical service, or in an otherwise defined population. Processes used to capture the data must be standardized so that statistical evaluation is relevant and comparative over time. It is important to note that if the NHSN definition for CAUTI is utilized for identifying infections, the definition must be applied consistently over time. Also note that NHSN-defined CAUTI is not comparable to data mined from administrative data.

Conducting the CAUTI Risk Assessment

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 guidelines to identify and remove catheters that are no longer necessary, e.g. physician reminders, automatic stop orders or nurse-driven protocols?

Bard Exhibit 1027.0022

- Are there policies or guidelines for use of a bladder scanner prior to insertion of a catheter for urinary retention?
- Are there mechanisms to educate care providers about use and care of urinary catheters?
- *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 indentifying areas of high urinary catheter usage. These areas include critical care areas, 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.

If data concerning device use days are not readily available, a point prevalence study may be useful. The goal of this type of study would be 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 stress 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?
- What type of Foley catheter is in use (e.g. three-way catheter, temperature-sensing catheter, Coude catheter, etc.)?
- Is this the type of catheter normally used in this facility?
- Is a closed system being maintained?
- Is the Foley inserted using a pre-connected tray?
- 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?
- 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 measuring device marked with his/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. However, if the monitor related to the measuring device is included, the denominator for that measure is the total number of patients at the time of surveillance who have a urinary catheter.

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- Consider obtaining catheter usage data from your 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 facility-wide or by high-risk area.

Step 3: Assess baseline outcome data.

Baseline outcome data can be collected utilizing the surveillance methodology defined in "Surveillance Methodology Basics" in 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 CAUTIs caused by epidemiologically important pathogens based on other HAI surveillance data or experience. Consider crude uropathogen analysis of urines obtained > 48 hours after admission.

- 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 attributable 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 section on Value Based Purchasing).

Method 2:

Utilize published data to estimate financial impact, based on average frequency and cost of UTIs. In 2005, Stone and colleagues published their review of the current literature addressing the economic ramifications of adverse events such as HAIs. 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. The studies examined the average costs of the following common HAIs: surgical site infections, ($25,546); bloodstream infections, ($36,441); ventilator-associated pneumonia, ($9,969); and urinary tract infections, ($1,006).[1]

Method 3:

Calculate actual excess costs of infections and excess length of stay. Tools such as APIC's HAI Cost Calculator Tool are available and can generate tables and graphs which 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.

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Step 5: Use all of the above information to complete the CAUTI portion of the overall organizational risk assessment.

The risk assessment should involve a multidisciplinary team and is a crucial step in developing the overall organizational surveillance plan.

Two examples of facility risk assessments are included below.

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												

Figure 5.1. Risk assessment chart.
Source: Connie Steed, MSN, RN, CIC, Greenville Hospital System University Medical Center, Greenville, SC

Scope of Services	Sharp Healthcare						
	Infection Control Risk Assessment						
	Benchmark	High Risk	High Volume	Potential Negative Outcomes	National Initiative	Financial Incentive	Risk Rating
		(relative risk rating on a scale of 0-3)					
	0	0	0	0	0	0	
	1	1	1	1	1	1	
	2	2	2	2	2	2	
	3	3	3	3	3	3	
Device Related Risk							
Central Line Sepsis (ICU)	<10th percentile						
House-wide Central Line Sepsis	internal						
House-wide Central Line site care/dressing change	internal						
CAUTI (ICU)	NHSN< 25%						
VAP (ICU)	NHSN< 25%						
House-wide UTI	no						

Figure 5.2. Alternate example of facility risk assessment.
Source: Shannon Oriola, RN, CIC, COHN, Sharp Metropolitan Medical Center, San Diego, CA

References

[1] Stone , PW, Braccia D, Larson E. Systematic review of economic analyses of health care-associated infections. *American Journal of Infection Control*, 33(9):501-509.

Bard Exhibit 1027.0025

Surveillance Methodology Basics[1]

Surveillance is a dynamic, essential element of any infection prevention and control program. The primary purpose of surveillance is to turn data into useful information that can be utilized to drive interventions.[2]

The elements of surveillance are as follows:

- Assessment of the population and identification of those at greatest risk for the outcome or process of interest
- Selection of outcome or process for surveillance
- Determination of observation time period
- Choice of surveillance methodology
- Monitoring for outcome or process using standardized definitions
- Collection of appropriate denominator data
- Analysis of surveillance data
- Collection and dissemination of findings

Surveillance Considerations and Definitions

- Surveillance criteria must be clear and consistent throughout the monitoring period.
- Surveillance for UTIs can be either patient- (symptom-) based or laboratory-based. Patient-based surveillance includes counting documented urinary tract infections, assessing risk factors and monitoring care procedures and practices. It includes ward rounds and discussions with care providers. Laboratory-based surveillance is detected solely on the findings of laboratory studies or clinical isolates.
- The **numerator** for the rate calculation is the number of events.
- The **denominator** for the rate calculation is the number of event-related days (e.g. urinary catheter days). Patient days may be utilized as a surrogate, but this method is less accurate and cannot be used for comparison to national surveillance data.
- **Incidence** is the number of new cases in a given time period.
- **Prevalence** is the number of cases at a particular point in time divided by the total population being studied.

CAUTI Surveillance Denominator

A count of the device days utilized per month is necessary to calculate the CAUTI rate in an ICU. Electronic medical record documentation can generally provide a report of the number of patients with indwelling catheters each month. If this is not available, a manual count must be done of the number of patients with indwelling catheters, at the same time

Bard Exhibit 1027.0026

each day. The total number of indwelling urinary catheter days is calculated at the end of each month. If device days are not available in a unit other than an ICU, patient days may be utilized. The rate of CAUTI per 1,000 patient days can then be trended over time. CAUTI rates using this denominator are not comparable to published NHSN data.

CAUTI Surveillance Numerator

This surveillance can be done prospectively at the time that positive urine culture is reviewed and evaluated, or retrospectively by printing out all positive urine cultures within a designated area for a period of time and determining if the positive culture meets the NHSN definition of a CAUTI.

CAUTI Surveillance Methods

There are two primary methods for determining a baseline rate of CAUTI. The first method is to utilize the NHSN methodology and definition of CAUTI. By using NHSN methodology to determine the rate of CAUTI in the ICU, the rate is risk-stratified by the type of ICU, and is also comparable to the rates of participating NHSN hospitals.

The second method is to use infection surveillance software to "mine" administrative data – either in "real time" or by running a retrospective report from administrative data. It is important to note that several studies have demonstrated case finding inconsistencies when utilizing NHSN definition (the "gold standard" for infection prevention and control) versus the use of administrative data. Administrative data can give the infection preventionist a sense of the occurrence of CAUTI in the target population or site. However, for accurate identification and quantification of CAUTI cases, the NHSN definition should be applied.

Evaluation and Outcomes

Once the hospital-specific CAUTI risk assessment baseline is established, CAUTI rates can be compared over time to determine if there are trends within patient populations and/or departments. Depending on the evaluation of the CAUTI risk assessment, it may be decided that the CAUTI surveillance, prevention and control plan will target symptomatic CAUTI (i.e. exclude asymptomatic bacteriuria) based on the identified requirements for performance improvement interventions. Currently, national comparative data includes asymptomatic CAUTIs as well as symptomatic CAUTIs. Consequently, when an organization conducts surveillance on symptomatic CAUTIs only, the data cannot be used for comparative purposes, but can be trended internally over time for trending purposes.

The infection prevention and control staff, in collaboration with identified key patient care or process stakeholders, can establish priorities for reducing CAUTIs when a need for improvement is identified. Evidence-based interventions can be applied, monitored and evaluated using the established CAUTI surveillance method.

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Example of CAUTI Surveillance in an Identified High-Risk Population/Location

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:

$$\text{Medical ICU CAUTI rate} = \frac{\text{Number of new CAUTI case(s)}}{\text{Number of catheter days}} \times 1{,}000$$

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

Displaying and Disseminating Data

Surveillance data is presented most effectively when used to tell a story and drive interventions. Annotated run charts and graphs are frequently used to display information, as in the example below.

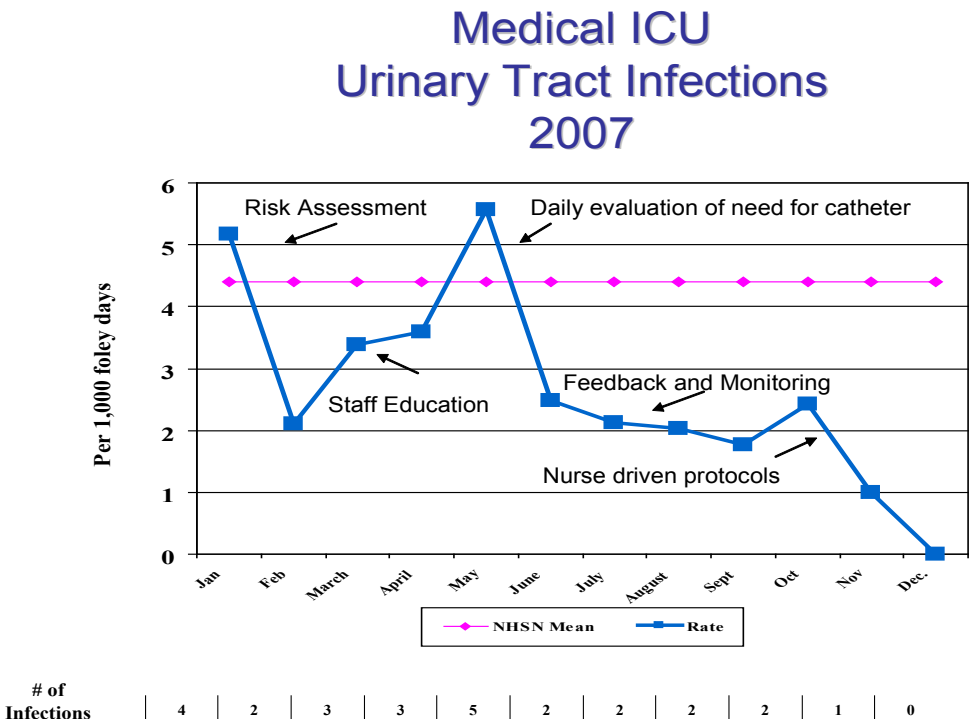

Figure 6.1. Example run chart.

Bard Exhibit 1027.0028

References

[1] CDC Outline for Healthcare-Associated Infections Surveillance. April 2006.

[2] Lee TB, Montgomery OG, Marx J, Olmsted RN, Scheckler, WE. Recommended practices for surveillance: Association for Professionals in Infection Control and Epidemiology (APIC), Inc. *American Journal of Infection Control* 2007; 35(7):427-440.

Bard Exhibit 1027.0029

Understanding the Big Picture: Healthcare Reimbursement

Value Based Purchasing (VBP)

In a report issued in 2005 by the Pennsylvania Health Care Cost Containment Council (PHC4), UTIs again were demonstrated to be the most frequently occurring facility-wide HAI, and occurred with increased frequency in those patients greater than 60 years of age.

The passage of the Deficit Reduction Act of 2005 required the Secretary of Health and Human Services to select at least two conditions that:

1. Are high cost, high volume, or both
2. Result in the assignment of a case to a diagnostic related group (DRG) that has a higher payment when present as a secondary diagnosis
3. 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 six healthcare-associated conditions selected, three are related to infections not considered present on admission: Catheter-Associated Urinary Tract Infection, Vascular Catheter-Associated Infection, and Mediastinitis after Coronary Artery Bypass Graft Surgery.

Not All CAUTI Surveillance Criteria are the Same

The goal of CMS' VBP is to improve quality, safety and efficiency of care to CMS beneficiaries. An important aspect of IPPS is that coding of claims for reimbursement of care involving healthcare-associated conditions does not necessarily match criteria that infection preventionists use in surveillance of HAIs. Infection preventionists perform surveillance and infection risk assessment based on epidemiological principles. Because the preventionist applies surveillance criteria and gathers data from multiple sources, findings may often differ from those abstracted from the patient's medical record. In contrast to infection surveillance results, present on admission (POA) codes and diagnosis codes will be based on ICD-9CM guidelines used by coding professionals in collaboration with patient provider documentation.

The coder's work is very dependent upon the clarity and extent of diagnoses outlined by the provider in the medical record. A recent study by Stevenson et al. compared negative and positive predictive values for coding data to HAI surveillance data and found that three of every four HAIs identified by codes did not meet infection surveillance criteria developed by the CDC/NHSN.[1] Comparison of surveillance data and coded UTIs was not undertaken in this review, but it is anticipated that the same deficiencies identified here would also be present in that review.

Infection preventionists, facility coders, and providers have their work cut out for them in the era of VBP. They must collaborate and communicate clearly and consistently in order to provide meaningful, comparable infection assessments, and to avoid confusion and misinterpretation in the crossover of these important components of patient/resident care.[2] The primary goal of infection control activities is to create a safe environment for patients and their caregivers, and these activities should be based on evidence-based practices designed to eliminate preventable mortality.

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"Present on Admission" Definition Using Administrative Data

Determining infection rates from administrative databases using ICD 9-CM codes has been proposed as a method for case finding and reporting. The method for determining such codes is based on ICD 9-CM codes for infections or conditions not present on admission. The determination is therefore based solely on provider (physician) documentation of a CAUTI. At the time of this publication, "present on admission" is defined as "present at the time that the order for inpatient admission occurs." Conditions that occur during an outpatient encounter or Emergency Department visit are considered present on admission.

Some experts have suggested that this method may be useful in combination with other information such as laboratory or other clinical data in certain situations (e.g. public health reporting). Recent studies suggest, however, that data is imprecise, due to variations in documentation and coding.[3,4,5] Although the hospital discharge data method has been instituted for VBP, this method alone is not recommended for infection prevention surveillance activities. HICPAC discourages sole reliance on administrative data for surveillance of healthcare-associated infections. Table 7.1 compares coding and surveillance data.

Table 7.1. Summary of differences between coding and surveillance data.

Criteria for CAUTI	Coding	HAI surveillance data
Physician documentation of UTI, cystitis, urethritis or pyelonephritis	Used to establish UTI	Surveillance definition must be used
Documentation or clarification that the UTI is associated with a urinary catheter	Physician must document, or coder seeks clarification from physician Catheter association code is assigned 996.64 "Infection or inflammation due to indwelling urinary catheter"	Documentation by the provider is not used Presence of a catheter is confirmed either by direct observation or documentation in the medical record by any member of the healthcare team
Antibiotic treatment	Not sole criteria but may be used by coder to seek further physician clarification	Not used Surveillance definition must be used
Laboratory data	Not used to establish UTI May be used to determine organism and request physician documentation of specific organism	Surveillance definition Combined with other criteria in some cases
Clinical signs and symptoms	No coder may query physician for further clarification May prompt coder to query physician for cause of signs and symptoms	Surveillance definition Combined with other criteria

Source: Linda R. Greene, RN, MPS, CIC, Rochester General Health System, Rochester, NY

Bard Exhibit 1027.0031

Surveillance for CAUTI in the Era of Value Based Purchasing

According to an estimate from the CDC published in 2001, healthcare-associated UTIs resulted in an excess cost to the U.S. healthcare system of more than $400 million annually. In a study published in 2002, every catheter-related incidence of bacteriuria added an average of $589 (1998 dollars) to the financial burden of the healthcare system.[6] It follows that, given an expected excess cost higher than reported in 2002, and given the high proportion of CAUTIs in healthcare settings, the effect of CAUTIs on present-day healthcare dollars is significant. Healthcare facilities can rely on CAUTI surveillance to support interventions that will positively impact cost and reimbursement.

Infection prevention surveillance activities range from facility-wide surveillance to a more targeted approach, and are based upon annual infection risk assessment. A recent survey of hospitals in the U.S. found almost 30% did not include CAUTI in their surveillance programs; 74% of surveyed hospitals did not monitor catheter duration; and only 56% had a system for monitoring urinary catheters placement in patients.[7] In larger facilities, surveillance for infectious outcomes associated with indwelling urinary catheterization is often limited to designated patient care units instead of facility-wide surveillance. For example, when CAUTI is identified as a high-risk or problem-prone infection indicator in a facility, the indicator surveillance has often been conducted in a critical care area, as this is the type of comparative data available either historically from the National Nosocomial Infections Surveillance (NNIS) System, or currently from the NHSN.

When an opportunity for improvement in CAUTI prevention is identified, recommendations for best practice and for improvement interventions can be accessed from various guidelines and infection prevention resources. Although the CDC's "Guideline for Prevention of Catheter-Associated Urinary Tract Infections" was issued in 1981, a revision of the guideline is expected to be released in early 2009. Guidelines have also been published by a group of health professionals in the U.K., commissioned by the Department of Health (EPIC Project), among which is prevention of CAUTI.[8] A revision of the SHEA/APIC Guideline "Infection Prevention and Control in the Long-term Care Facility" was published in September 2008.[9]

Given the fact that Value Based Purchasing will heighten care provider awareness of CAUTIs not present on admission, the infection preventionist must ensure that evidence-based practices are adhered to and embraced by all members of the healthcare team. Activities to screen asymptomatic patients for UTIs on admission should be discouraged. Obtaining routine urine cultures on asymptomatic patients is not a recommended practice.[10]

References

[1] Stevenson, KB; Kram, Y; Dickman, J. Administrative coding data, compared with CDC/NHSN criteria are poor indicators of health care associated infections. *American Journal of Infection Control* pp 163

[2] Edmond M and Eickhoff TC. Who is Steering the Ship? External Influences on Infection Control Programs. Clinical Infectious Diseases; 2008: Vol 46,June 1, pp 1746 – 1750.

[3] Srevenson, KB; Kram, Y; Dickman, J. Administrative coding data, compared with CDC/NHSN criteria are poor indicators of health care associated infections. *American Journal of Infection Control* pp. 163

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Prevention of Catheter-Associated Urinary Tract Infections

Adherence to a sterile, continually closed system has historically been the cornerstone of infection prevention. In a literature review by Trautner and Darouiche, they concluded the following:

> Use of a closed drainage system, or catheter drainage into a connected bag, rather than into an open container, reduces the incidence of bacteriuria to approximately 50% at 14 days of continuous catheterization. This finding contrasts favorably with the documentation of significant bacteriuria in 95% of patients receiving open catheter drainage for 96 hours. Another very effective strategy is to avoid prolonged catheterization, or even to avoid catheterization at all. Clean, non-sterile, intermittent catheterization can lead to bladder colonization rates as low as 20% to 40% over more than a year of follow-up. Although randomized comparisons are lacking, the rates of bacteriuria and UTI are lower with suprapubic catheterization, condom catheters, and intermittent catheterization than with chronic indwelling urethral catheters.[1]

Since the strongest predictor of catheter-associated bacteriuria is the duration of catheterization,[2] a variety of interventions have been implemented to shorten this duration by identifying methods to effectively identify catheterized patients and discontinue their catheters when no longer needed. A few examples are included on the following pages.

Additional prevention measures are offered in *Prevention and Control of Nosocomial Infections*, Fourth Edition, Editor Richard P. Wenzel, Chapter 21, "Prevention of Catheter Associated Urinary Tract Infections." and "Guidelines for preventing infections associated with the insertion and maintenance of short-term indwelling urethral catheters in acute care." *J Hosp Infection* 2001:47 (Supplement):S39-46.

Removing Unnecessary Urinary Catheters: Assessments and Process Interventions

Assessing the Need for a Urinary Catheter on a Daily Basis

Strategies to incorporate catheter usage into daily rounds have been successful. During rounds, each patient may be assessed for the presence of a urinary catheter. The reason for use is reviewed. If there is no indication, nurses are instructed to contact physicians to obtain an order to discontinue the catheter. An example of a document used to record the necessity of a urinary catheter is provided in Figure 8.1.

Figure 8.1. Sample document used to record the need for a urinary catheter
Source: Janice E. Rey, BSMT (ASCP), CIC, St. John Hospital & Medical Center, Grosse Pointe Woods, MI

Physician Reminder Systems

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.[5] 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.[6] 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 they failed to meet appropriate criteria, the patient's nurse was requested to obtain an order to remove the catheters.[7]

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Programs, Practices, and Interventions that may be Implemented in CAUTI Prevention Efforts

- Use indwelling catheters only when medically necessary
- Use aseptic insertion technique with appropriate hand hygiene and gloves
- Allow only trained healthcare providers 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
- Maintain drainage bag below level of bladder at all times
- 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
- Use portable ultrasound bladder scans to detect residual urine amounts
- Consider alternatives to indwelling urethral catheters, such as intermittent catheterization.[3] 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.[4]

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 was insufficient data to determine if there was a corresponding decrease in urinary tract infections.[8] A similar study used a simple written reminder in a pre-test/post-test design with a non-equivalent 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 re-catheterization. After adjusting for age, sex, 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 re-catheterization.[9]

Automatic Stop Orders

One recent technological intervention is the use of automatic stop orders. The computerized physician order entry system allows the physician to select an option for minimizing the duration of catheter use. In a study conducted at Yale New Haven Hospital, when a urinary catheter was inserted, the documentation of the insertion became part of the automatic report to the floor. This in turn sent an electronic report to the patient's physician, prompting him/her to choose among discontinuing the device, maintaining the catheter for a predetermined time period (48 hours), or maintaining it chronically.[10] A similar study at the VA Puget Sound Health Care System used a computer order for each indwelling

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urinary catheter. The computer entry required an indication for placement and routine care instructions, and noted a default stop date of 72 hours after placement. Both studies demonstrated decreased catheter duration as a result of intervention. [11]

Unit		Foley Catheter Prevalence Sheet				
Date						
Week 1	**Pre-Intervention**					
Room/bed	**Patient #**	**Foley Present?**	**Need**	**Indication**		

No=0
Yes=1

No need=0
Needed=1

Urinary Tract Obstruction=1
Neurogenic Bladder=2
Urologic Study/Surgery=3
Stage 3 or 4 Sacral Decubitus=4
Hospice/Comfort Care/Palliative=5

Not Indicated Foley Reasons:
Nephrology=6
From ICU=7
Pt. Request=8
Confused=9
Incontinent=10
Other=11

Foley Present: 0=No; 1=Yes
Need: 0= No Need; 1= Need.
Indication: 1=Urinary Tract Obstruction; 2=Neurogenic Bladder; 3=Urologic Study/ Surgery; 4=Stage 3 or 4 Sacral Decubitus; 5=Hospice/Comfort Care/Palliative; 6=Nephrology; 7=From ICU; 8=Pt Requests; 9=Confused; 10=Incontinent; 11=Other
Use one sheet per day of Week 1

Nurse-driven Protocols

Nurse-driven protocols have been used with success in some organizations. These protocols allow a nurse to discontinue a catheter independent of a physician order when the patient no longer meets established criteria for catheter use. Such protocols usually are part of an algorithm that excludes patients who meet criteria for continued urinary catheter usage.[12,13] An example of a nurse-driven protocol related to urinary catheter indications can be found at www.apic.org/EliminationGuides.

Surgical Patients

Perioperative urinary catheter usage is intended to reduce bladder dysfunction related to surgical effects of anesthesia, analgesia and immobility. In a study which included 35,904 Medicare patients undergoing major surgery, Wald and colleagues identified that 50% of these patients had urinary catheters for longer than two days, and were twice as likely to develop urinary tract infections as those with catheterization of two days or less. They concluded that indwelling urinary catheters are routinely in place longer than two days postoperatively. This may result in excess CAUTIs and other

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adverse outcomes such as increased length of stay or readmission. The authors suggest that this association with adverse outcomes makes postoperative catheter duration a reasonable target of infection control and surgical quality-improvement initiatives.[14]

Catheter Usage and CAUTI

Although there have been several articles related to decreasing catheter usage, it is important to note that not all of these studies measured CAUTI as an outcome, or identified a decrease in CAUTI rates. In an April 2008 article published in the *Journal of General Internal Medicine*, stop orders safely reduced the duration of inappropriate urinary catheterization in hospitalized patients, but did not reduce UTIs. It is important that the infection preventionist keep in mind that reducing catheter usage is a step in a comprehensive organizational strategy to reduce CAUTIs. [15]

Use of Bladder Scanners

Portable bladder scanners have been used to measure urinary retention, and may reduce the need for catheterization. A systematic review concluded that protocols which implemented bladder scans were found to reduce the number of intermittent catheterizations and potentially decrease urinary tract infections.[16] Bladder scanners have also proved effective in reducing unnecessary irrigation by confirming whether a decrease in urine output is due to a blockage or reduced urine in the bladder, thereby minimizing breaks in the closed drainage system.[17] A number of performance improvement projects surrounding the reduction of CAUTIs include routine use of bladder scanners. In a recent study by Saint et al., bladder scanners were used in less than one-third of study hospitals.[18]

Use of Technology as Process Interventions in Prevention of CAUTI

If the rate of CAUTI has not decreased despite implementing several prevention strategies, such as those described above, novel technology or products designed to reduce the incidence of bacteriuria or candiduria may be helpful in high-risk patients. It is important, however, that technology be part of a comprehensive program that includes all of the interventions discussed earlier in this document.

It is well known that biofilms containing microorganisms can develop intraluminally or extraluminally in urinary catheters. A technological innovation that may prevent biofilm formation is a logical goal for reducing risk of CAUTI.

Antibiotic-Coated and Antiseptic-Coated Urinary Catheters

A few studies have investigated the effectiveness of antibiotic-coated urinary catheters (nitrofurazone-impregnated or minocycline/rifampin-coated) for the prevention of bacteriuria in patients with short-term urinary catheterization. Although there have been some promising results, there are too few studies to adequately evaluate this technology.[19]

Silver has long been used as an antimicrobial agent and in the treatment of burns and pressure ulcers. Silver ions have a broad-spectrum activity against gram-positive, gram-negative, aerobic, and anaerobic microorganisms. A number of studies have evaluated the effectiveness of antiseptic (silver) urinary catheters in preventing bacteriuria and CAUTI. A study performed at the Nebraska Medical Center looked at infection outcomes associated with the implementation of a silver alloy/hydrogel-coated urinary catheter. The study observed a significant decline in CAUTI rates.[20]

A randomized crossover trial involving silver-coated catheters also demonstrated a decline in infection outcomes among those receiving the coated catheter. The risk of infection declined by 21% among study wards randomized to silver-coated catheters, and by 32% among patients in whom silver-coated catheters were used on the wards.[21]

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In the *Annals of Internal Medicine's* systematic review of antimicrobial urinary catheters, the authors concluded that these catheters can prevent bacteriuria in hospitalized patients during short-term catheterization, depending on the antimicrobial coating and several other variables.[22]

The 2008 Cochrane review of short-term urinary catheterization with antiseptic or antibiotic catheters concluded that silver alloy catheters may reduce incidence of CAUTI for short-term indwelling catheter use in hospitals, and that antibiotic-impregnated urinary catheters may reduce incidence of CAUTI, although more studies are needed.

There have also been a significant number of institution specific clinical studies and quality improvement projects which have been presented through poster presentations at the national APIC and SHEA conferences. These results have concluded that silver technology can provide a positive impact in the reduction of CAUTIs at specific healthcare facilities across the continuum of care. As institutions develop more robust surveillance programs which include routine CAUTI surveillance and application of more recent CAUTI definitions, it may be possible to validate the effectiveness of catheter coating technologies within specific healthcare settings

Zero Tolerance for CAUTI Requires Updated Definitions

All healthcare delivery systems have been charged to comply with zero tolerance for preventable HAIs. Some CAUTI studies have used CDC/NHSN definitions of CAUTI, and have either combined or failed to adequately differentiate between symptomatic and asymptomatic bacteriuria. Patients with indwelling urinary catheters, especially when catheterization is long-term, may develop asymptomatic bacteriuria that should not be treated. Therefore, the true focus of CAUTI prevention must relate to preventing symptomatic urinary catheter infections.

Some previously published studies have come under scrutiny because study results do not distinguish between preventable infectious outcomes from non-infectious or non-preventable outcomes (e.g. when a CAUTI-related study definition includes both symptomatic and asymptomatic bacteriuria). The recently released report issued by the National Quality Forum, entitled "National Voluntary Consensus Standards for the Reporting of Healthcare-Associated Infection Data," has requested that the CDC update the definition of CAUTI to "improve the likelihood of comparable implementation across hospitals and other healthcare entities."

Currently, CAUTI is a previously endorsed National Voluntary Consensus Standard (endorsed in the NQF Nursing-Sensitive Care 2004 project). As noted earlier in this document, the NHSN definitions are under revision, and asymptomatic bacteriuria will most likely be removed from the surveillance definition.

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Putting it All Together – The Bundle Approach

Until recently, catheter-associated urinary tract infections have received little attention compared to many of the other types of HAIs. However, research and best practices for the prevention of CAUTI are readily available. Despite the link between urinary catheters and urinary tract infections in hospitals and other healthcare settings, a recent survey of U.S. hospital practices identified that no strategy is consistently or universally used in U.S. hospitals to prevent these infections.[1]

Literature reports numerous organizations that *have* implemented successful strategies to reduce CAUTI. These organizations have utilized multidisciplinary teams to implement evidence-based changes in practice; have incorporated practice changes into the routine standard of care; and have performed ongoing or periodic review of progress to reinforce successful strategies.

This bundle concept has been embraced by many organizations, including the Institute for Healthcare Improvement (IHI). Implementation of bundles has resulted in documented prevention of Ventilator-Associated Pneumonia (VAP), Central Catheter-Associated Bloodstream (CCAB) infections and Surgical Site Infections (SSIs), and it has demonstrated success in some CAUTI prevention efforts. Although the concept of a collaborative is not new to infection prevention, patient safety initiatives such as the Michigan Keystone Project and Collaborative are introducing programs that incorporate strategies to prevent CAUTI, utilizing a bundle concept.2 Links to IHI's CCAB and VAP bundles can be found at www.apic.org/EliminationGuides.

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.

Figure 9.1. Bladder "Bundle" Concept
Source: Sanjay Saint, MD, MPH, Ann Arbor VA Medical Center, Ann Arbor, MI

Summary

CAUTIs can lead to increased length of stay, higher morbidity and mortality, and increased healthcare costs. Although many CAUTIs are not serious infections, a complication of a CAUTI can increase a patient's hospital length of stay from 0.4 days to 2 days, with additional average expenses of $3,803 per episode, as reported in an ICU CAUTI study.[3] Possible complications of an occurrence of CAUTI may include urethritis, urethral strictures, hematuria, bladder obstruction and sepsis secondary to the UTI. Also, a urinary drainage bag containing large numbers of undetected resistant organisms becomes a reservoir of potential pathogens that can result in more serious HAIs.[4]

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Asymptomatic CAUTIs (also known as asymptomatic bacteriuria, or ASB) are common in hospitalized patients and catheterized long-term care residents. They are associated with a low incidence of sequelae and morbidity, and in most patients resolve spontaneously on removal of the catheter. However, ASB comprises a reservoir of microorganisms in healthcare settings.[5] Although it is well established in the literature that ASB should not be routinely treated with antimicrobial therapy, studies show that many patients are treated unnecessarily.[6] Routine urine cultures should not be obtained on patients admitted to the hospital, with or without a urine catheter, nor should routine urine cultures be obtained upon insertion or removal of a urine catheter. Urine cultures should only be obtained from patients with symptoms of a urinary tract infection and, in the absence of signs and symptoms, may result in inappropriate treatment for ASB.[7] Such unnecessary antimicrobial use may result in an increase in antimicrobial resistance and subject patients to otherwise avoidable adverse effects.

Although other types of healthcare associated infections have a far greater impact on length of stay, cost and mortality than do CAUTIs, their unintended consequences are of increasing concern to healthcare providers. Because CAUTIs can comprise one of the largest reservoirs of multidrug-resistant bacteria in healthcare settings, it is essential that we find effective ways to decrease their occurrence. And because these are potentially preventable healthcare-associated infections, it is important to demonstrate zero tolerance in all healthcare settings for CAUTIs.

Strategies for success in preventing CAUTI include:

1. Incorporate prevention strategies into policies and protocols
2. Adequately assess and document the need for urinary catheters based on recognized indications*
3. Use catheters in operative patients only as necessary
4. Utilize the UTI prevention bundle
5. Remove urinary catheters as soon as possible (for operative patients who have an indication for a catheter preferably remove within 24 hours)
6. Implement systems to alert care providers to evaluate the necessity for urinary catheters on a daily basis
7. Do not use catheters in patients and nursing home patients for management of incontinence.
8. Provide regular feedback to staff on process and / or outcome measures.
9. Implement quality improvement programs to reduce catheter use and reduce the risk of urinary tract infections.

* Indications for the use of indwelling urethral catheters are limited and include the following:[8]

1. Perioperative use for selected surgical procedures (e.g. surgeries involving the Genitourinary Tract, anticipated prolonged surgery, operative patients with urinary incontinence, need for intraoperative hemodynamic monitoring, patients anticipated to receive large volume diuretics during surgery)
2. Urine output monitoring in critically ill patients
3. Management of acute urinary retention and urinary obstruction
4. Assistance in pressure ulcer healing for incontinent residents
5. As an exception, at patient request, to improve comfort (i.e. end-of-life care)

Key Points

- Overuse of urinary catheters contributes to the frequency of urinary tract infections (UTIs)
- Urinary tract infections increase morbidity, length of stay, and increase healthcare delivery costs
- Differences in CAUTI definitions have led to confusion and misinterpretation of the actual numbers of CAUTI

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- A risk assessment and surveillance system must be established in order to identify areas of improvement in the prevention of CAUTI
- Promote appropriate use of antibiotics, targeting infection rather than colonization
- Prevention strategies must focus on clear indications for the insertion of a urine catheter, proper maintenance while in use, and early catheter removal
- Despite significant research on preventing UTI, bedside interventions such as assessment for, and communication about, unnecessary urinary catheters are inconsistently applied in healthcare settings

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