



How-to Guide: Prevent Catheter-Associated Urinary Tract Infections

Prevent catheter-associated urinary tract infections by implementing the four components of care recommended in this guide.

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How to cite this material:

How-to Guide: *Prevent Catheter-Associated Urinary Tract Infections*. Cambridge, MA: Institute for Healthcare Improvement; 2011. (Available at www.ihl.org).

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Introduction

What is the Institute for Healthcare Improvement (IHI)?

The Institute for Healthcare Improvement (IHI) is a not-for-profit organization leading the improvement of health care throughout the world. IHI helps accelerate change by cultivating promising concepts for improving patient care and turning those ideas into action. Thousands of health care providers participate in IHI’s groundbreaking work.

What is a How-to Guide?

IHI’s How-to Guides address specific healthcare interventions hospitals and/or entire health systems can pursue to improve the quality of healthcare. These interventions align with several national initiatives of the IOM, AHRQ, CMS, Joint Commission, CDC, as well as the Department of Health and Human Services’ “Partnership for Patients” initiative.

This material was developed for the IHI 100,000 Lives Campaign (2004-2006) and the 5 Million Lives Campaign (2006-2008), both voluntary initiatives to protect patients from medical harm. Both Campaigns involved thousands of hospitals and communities from around the United States in specific interventions.

5 Million Lives Campaign Donors

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100,000 Lives Campaign Donors

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- Robert Wood Johnson Foundation
- Baxter International, Inc.
- The Leeds Family
- David Calkins Memorial Fund

Contributors

The work of leading organizations has informed the development of this guide. These include APIC, Centers for Disease Control and Prevention, Infectious Diseases Society of America, and Society for Healthcare Epidemiology of America.

The Case for Preventing Catheter-Associated Urinary Tract Infections

The estimated number of hospital-acquired infections (HAIs) in US hospitals exceeds 1.7 million events annually, leading to an estimated 99,000 deaths. Urinary tract infections account for approximately 40% of all HAIs annually. Fully 80% of these hospital-acquired urinary tract infections are attributable to indwelling urethral catheters. If nursing homes are considered along with acute care hospitals, it is estimated that there are more than one million cases of catheter-associated urinary tract infections (CAUTI) annually.^{1,2,3}

In the US, up to five million urinary catheters are placed annually. Between 12% and 25% of all hospitalized patients will receive a urinary catheter during their hospital stay, with as many as half not having an appropriate indication. In one study, almost 40% of attending physicians caring for patients with unnecessary urinary catheters were not aware that their patients had a urinary catheter in place.^{4,5,6}

It is well established that the duration of catheterization is directly related to risk for developing a urinary tract infection. With a catheter in place, the daily risk of developing a urinary tract infection ranges from 3% to 7%. When a catheter remains in place for up to a week, bacteriuria risk increases to 25%; at one month, this risk is nearly 100%. Among those with bacteriuria, 10% will develop symptoms of UTI (fever, dysuria, urgency, frequency, suprapubic tenderness) and up to 3% will further develop bacteremia.^{7,8,9}

¹ Klevens RM, Edwards JR, Richards CL Jr, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* 2007 Mar-Apr;122(2):160-166.

² Saint S, Chenoweth CE. Biofilms and catheter-associated urinary tract infections. *Infect Dis Clin North Am.* 2003 Jun;17(2):411-432.

³ Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am J Med.* 2002 Jul 8;113 Suppl 1A:5S-13S.

⁴ Weinstein JW, Mazon D, Pantelick E, et al. A decade of prevalence surveys in a tertiary-care center: trends in nosocomial infection rates, device utilization, and patient acuity. *Infect Control Hosp Epidemiol.* 1999;20:543-548.

⁵ Saint S, Wiese J, Amory JK, et al. Are physicians aware of which of their patients have indwelling urinary catheters? *Am J Med.* 2000 Oct 15;109(6):476-480.

⁶ Saint S, Lipsky BA. Preventing catheter-related bacteriuria: Should we? Can we? How? *Arch Intern Med.* 1999 Apr 26;159(8):800-808.

⁷ Saint S. Clinical and economic consequences of nosocomial catheter-related bacteremia. *Am J Infect Control.* 2000;28:68-75.

⁸ Tambyah PA, Maki DG. Catheter-associated urinary tract infection is rarely symptomatic: a prospective study of 1,497 catheterized patients. *Arch Intern Med.* 2000 Mar 13;160(5):678-682.

⁹ Saint S, Lipsky BA. *Arch Intern Med.* 1999.

Potential Impact

The cost implications of CA-UTI vary considerably. Most sources suggest that an episode of CA-UTI will prolong a hospital stay from 0.5 to 1 day. With an incidence of more than one million cases annually, the Centers for Medicare & Medicaid Services (CMS) has concluded the annual cost of nosocomial UTI due to indwelling catheters to be between \$424 and \$451 million annually. Reported estimates from individual hospitals of attributable cost of CA-UTI are estimated to be between \$500 and \$700 per case. If the patient develops bacteremia secondary to CA-UTI, estimates of cost per case increase to between \$2,500 and \$3,000.^{10,11,12,13,14}

Beginning on October 1, 2008, CMS put into effect a new rule designed to eliminate payment for ten “preventable hospital-acquired complications”—including CA-UTIs. Under the new rules, if a patient develops a CA-UTI while hospitalized (meaning not present on admission), the hospital will be paid as if the complication were not present. CMS selected these ten hospital-acquired complications due to their high cost and high volume, and because they can be reasonably prevented through application of accepted evidence-based guidelines.

Numerous prospective studies have examined the impact of a range of interventions (nurse and physician education, electronic reminders, nurse-driven protocols, surveillance and feedback, condom catheters, closed systems, antimicrobial catheters, etc.) in a variety of hospital settings. These studies have achieved reductions in CA-UTI rates of 46% to 81%.^{15,16,17,18}

¹⁰ Saint S. 2000.

¹¹ Tambyah PA, Knasinski V, Maki DG. The direct costs of nosocomial catheter-associated urinary tract infection in the era of managed care. *Infect Control Hosp Epidemiol*. 2002 Jan;23(1):27-31.

¹² Wald HL, Kramer AM. Nonpayment for harms resulting from medical care: catheter-associated urinary tract infections. *JAMA*. 2007 Dec 19;298(23):2782-2784.

¹³ Centers for Medicare & Medicaid Services, 2007.

¹⁴ Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am J Med*. 2002 Jul 8;113 Suppl 1A:5S-13S.

¹⁵ Schumm K, Lam TB. Types of urethral catheters for management of short-term voiding problems in hospitalised adults. *Cochrane Database Syst Rev*. 2008(2):004013.

¹⁶ Wald HL, Kramer AM. 2007.

¹⁷ Topal J, Conkin S, et al. Prevention of nosocomial catheter-associated urinary tract infections through computerized feedback to physicians and a nurse-directed protocol. *Am J Med Qual*. 2005;20(3):121-126.

¹⁸ Reilly L, Sullivan P, et al. Reducing Foley catheter device days in an intensive care unit: using the evidence to change practice. *AACN Adv Crit Care*. 2006;17(3):272-283.

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The *Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals* published in 2008 by SHEA-IDSa (in partnership with The Joint Commission, Association for Professionals in Infection Control and Epidemiology (APIC), and the American Hospital Association) emphasized the importance of reducing CA-UTIs. Specifically, the document in this compendium entitled *Strategies to Prevent Catheter-Associated Urinary Tract Infections in Acute Care Hospitals* summarizes current recommendations based on review of the evidence by national clinical experts in infection control and prevention.¹⁹

¹⁹Lo E, Nicolle L, Classen D, et al. Strategies to prevent catheter-associated urinary tract infections in acute care hospitals. *Infect Control Hosp Epidemiol*. 2008 Oct;29 Suppl 1:S41-50. <http://www.shea-online.org/about/compendium.cfm>

Preventing Catheter-Associated Urinary Tract Infections: Four Components of Care

Prevention of infection with any invasive device relies on several key elements: using these devices only for an appropriate indication, inserting and caring for them properly, and removing them promptly. Indwelling urinary catheters are no exception. Despite their use in less intensive general medical and surgical wards, indwelling catheters pose significant infection risks to patients.

There are numerous studies of methods to prevent and reduce catheter-associated urinary tract infections, some of which date back several decades. Over time, some recommendations have changed; for example, routine irrigation of catheters was once a recommended strategy, whereas now this is considered a practice to avoid. Thus it is essential for organizations to ensure that their policies, practices and educational materials are consistent with the most current evidence-based recommendations.

This How-to Guide focuses on those recommendations with sufficient evidence to be uniformly recommended for all patients. Four components of care are recommended for all patients to prevent or reduce the risk of CA-UTI:

- 1. Avoid unnecessary urinary catheters.**
- 2. Insert urinary catheters using aseptic technique.**
- 3. Maintain urinary catheters based on recommended guidelines.**
- 4. Review urinary catheter necessity daily and remove promptly.**

In addition to the SHEA-IDS A Compendium, these practices are generally recommended by the Centers for Disease Control and Prevention (CDC), the National Health Service (NHS) in England, the Infectious Disease Society of America and in other frequently referenced studies.^{20,21,22,23,24}

Implementation of these four components requires a multidisciplinary approach involving physicians, nurses, leaders, and experts in infection prevention and urological care. APIC has published a CA-UTI Elimination Guide that can be used in complement with this How-to Guide. [APIC's comprehensive guide](#)

²⁰ Pratt RJ, Pellowe CM, Wilson JA, et al. Epic 2: national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *J Hosp Infect.* 2007;65(Suppl 1):S1-S64.

²¹ Saint S, Lipsky BA. *Arch Intern Med.* 1999.

²² Wong ES. Guideline for prevention of catheter-associated urinary tract infections. *Am J Infect Control.* 1983 Feb;11(1):28-36.

²³ Centers for Disease Control and Prevention. Gould CV, Umscheid CA, et al. Guideline for Prevention of Catheter-associated Urinary Tract Infections, 2009. Available at: http://www.cdc.gov/hicpac/cauti/001_cauti.html. Accessed 3 October 2011.

²⁴ Hooton TM, Bradley SF, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis.* 2010 Mar 1;50(5):625-63.

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is an excellent resource for ICPs who have an essential role on any CA-UTI improvement team. This requires teamwork; it cannot be achieved by any one discipline alone.

1. Avoid Unnecessary Urinary Catheters

No invasive device should ever be used unless absolutely necessary, including urinary catheters. Studies have found as many as 21% of hospital patients with indwelling urinary catheters lack proper indications for insertion, and as many as 41% to 58% catheters in place overall were subsequently found to be unnecessary.^{25,26}

Patients do not find indwelling catheters comfortable, and in one study nearly half described catheters as “uncomfortable” or “painful.” When catheters are in place, mobility may be significantly decreased, which may impair rehabilitation and recovery. Saint has described these catheters as “one-point restraints.” Limitations to mobility are not only dissatisfying to patients, but may increase the risk of complications such as DVTs and pressure ulcers.^{27,28}

Explicit criteria for appropriate catheter insertion should be in place at all organizations, and verification that these criteria are met should be required prior to the insertion of any indwelling urinary catheter. If the criteria are not met, alternatives should be evaluated and used. Recommendations from CDC, SHEA-IDSa, and NHS (plus publications by Wong and Saint) note the following indications for placement of urinary catheters:

- Perioperative use for selected surgical procedures;
- Urine output monitoring in critically ill patients;
- Management of acute urinary retention and urinary obstruction;
- Assistance in pressure ulcer healing for incontinent patients; and
- As an exception, at patient request to improve comfort (SHEA-IDSa) or for comfort during end-of-life care (CDC).

Each organization should adopt explicit criteria for appropriate catheter insertion. At a minimum, these should be based on the above criteria, with modifications for specific populations as needed.

²⁵ Saint S, Lipsky BA. *Arch Intern Med.* 1999.

²⁶ Jain P, Parada JP, David A, Smith LG. Overuse of the indwelling urinary tract catheter in hospitalized medical patients. *Arch Intern Med.* 1995;155:1425-1429.

²⁷ Saint S, Lipsky BA, et al. Urinary catheters: what type do men and their nurses prefer? *J Am Geriatr Soc.* 1999;47:1453-1457.

²⁸ Saint S, Goold SD, Lipsky BA. Indwelling urinary catheters: The one-point restraint? *Ann Intern Med.* 2002;137(2):125-127.

Standard application of the criteria should require that *all* orders for indwelling urinary catheters are assessed against the criteria *prior to insertion*. If the criteria are not met, nursing staff should be empowered and expected to contact physicians to discuss alternatives. Exceptional situations may occur and should be noted for later study to refine the criteria.

Alternatives to indwelling catheters include the following:

- External condom catheters for male patients without urinary retention or bladder outlet obstruction have been shown to have lower risk of bacteriuria or symptomatic UTI. Such catheters are reported by patients to be more comfortable and limit mobility less than indwelling catheters.
- Intermittent catheterization several times per day may have the same or lower risk of infection, yet provide the patient with greater mobility and ensure an indwelling catheter is not left in place longer than necessary.^{29,30,31,32}

Assessing a patient for urinary retention can be aided by a bedside bladder ultrasound. If urinary retention is found, a catheter can be placed safely; however, if minimal or no urine is found in the bladder, alternative strategies should be considered prior to urethral catheterization. Studies have shown that using bladder ultrasound can reduce catheterization rates by 30% to 50%. Bladder ultrasounds are easy to use, are cost effective, pose no risk to the patient, and are comfortable for patients. Nurses have been able to effectively and accurately perform this diagnostic procedure at the bedside in less time (2-3 minutes) than catheter insertion requires (15-20 minutes).^{33,34,35}

Some experts note that management of postoperative urinary retention may warrant its own specific protocol, especially as this may be transient. Bladder scanning in combination with intermittent catheterization may be beneficial in these cases and may help avoid placement of an indwelling catheter.

Hospitals should measure the number of urinary catheters and the number that met indications at the time of insertion in order to gain knowledge as to the percentage of unnecessary catheters that are being inserted. In a recent survey, researchers found that 56% of responding hospitals did not have systems in

²⁹ Lo E, Nicolle L. Oct 2008.

³⁰ Saint S, Lipsky BA. *Arch Intern Med*. 1999.

³¹ Lau H, Lam B. Management of postoperative urinary retention: a randomized trial of in-out versus overnight catheterization. *ANZ J Surg*. 2004;74:658-661.

³² Saint S, Kaufman SR, et al. Condom versus indwelling urinary catheters: a randomized trial. *J Am Geriatr Soc*. 2006 Jul;54(7):1055-1061.

³³ Stevens E. Bladder ultrasound: avoiding unnecessary catheterizations. *MEDSURG Nursing*. Aug 2005;14(4):249-253.

³⁴ Sparks A, Boyer D, Gambrel A, et al. The clinical benefits of the bladder scanner: a research synthesis. *Journal of Nursing Care Quality*. Jul-Sep 2004;19(3):188-192.

³⁵ Moore DA, Edwards K. Using a portable bladder scan to reduce the incidence of nosocomial urinary tract infections. *MEDSURG Nursing*. Feb 1997;6(1):39-43.

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place for monitoring which patients had urinary catheters. This can serve as a helpful metric in assessing the usefulness and compliance with insertion criteria and identify areas for possible education to clinical staff on appropriate use.³⁶

It is important to consider that when fewer catheters are used, there may be implications for nursing personnel time and resources. Patients without catheters may need regular and more frequent checks for assistance in accessing a toilet, a common cause of patient falls. Placement of catheters for convenience should be avoided at all times, and nursing personnel should be fully educated about all risks associated with catheters, including infections, decreased mobility, and urethral trauma. Patient preference and comfort is an important consideration.

Organizations should evaluate where urinary catheters are being inserted most commonly, as this will identify the areas in which to first test and implement criteria and where education may be most needed. For example, in a New Jersey Hospital Association Antimicrobial Resistance Collaborative, data collected from 70 participating organizations revealed that the majority of catheters were not inserted on nursing units: 37% were placed in the emergency department and 29% in the operating room.³⁷

What changes can we make that will result in improvement?

- Develop criteria for appropriate catheter insertion based on published guidelines.
- Require verification that criteria are met prior to every insertion.
- Use a checklist of catheter criteria to aid in verification.
- Empower and expect nursing and other clinical staff to not proceed with catheter insertion when criteria are not met and to contact physicians to clarify and discuss alternatives.
- Include a checklist in catheter insertion packs in a format that allows for easy documentation (e.g., sticker to place in medical record, small card).
- Build criteria for catheter insertion into computerized order entry systems and require documentation of need at time of order.
- Ensure that departments where catheters are inserted frequently, such as the ED, have adequate supplies of alternatives to indwelling catheters (e.g., intermittent and external condom catheters).

³⁶ Saint S, Kowalski, CP et al. Preventing hospital-acquired urinary tract infection in the United States: a national study. *Clin Infect Dis*. 2008 Jan 15;46(2):243-250.

³⁷ Slideset: *Antimicrobial Resistance Collaborative Data Submission Update*, courtesy of Andrew Sylvester, NJAH, from Antimicrobial Resistance Collaborative Learning Session 3 – February 14, 2008.

- Modify routine admission assessment to include check for presence of a urinary catheter and verification of necessity if present; this should occur on arrival to nursing unit. Catheters that do not meet criteria should be removed.
- Review cases of insertion that do not meet criteria. This can serve to improve criteria and definition, as well as identify opportunities for further education and improvement.
- Educate staff regarding indications, criteria, and alternatives for urinary catheters initially and during ongoing education programs (such as for annual competencies).

2. Insert Urinary Catheters Using Aseptic Technique

Some patients will require the use of indwelling urinary catheters during their hospital stay. In those circumstances, it is essential that the catheter is inserted only by trained personnel following aseptic technique. Both CDC and SHEA-IDSA note the following basic elements for insertion:

- Utilize appropriate hand hygiene practice (in accordance with Centers for Disease Control and Prevention or World Health Organization guidelines) immediately before insertion of the catheter. (See [How-to Guide: Improving Hand Hygiene.](#))
- Insert catheters using aseptic technique and sterile equipment, specifically using:
 - gloves, a drape, and sponges;
 - sterile or antiseptic solution for cleaning the urethral meatus; and
 - single-use packet of sterile lubricant jelly for insertion.
- Use as small a catheter as possible that is consistent with proper drainage, to minimize urethral trauma.

Ensuring that the appropriate supplies are readily available, ideally in one place, will increase the likelihood of full compliance with all elements. Standard kits or packs that contain all items and only those items will save time for staff who might otherwise need to search for and collect supplies.

Multiple studies have examined the type of catheter to be used when patients have been determined to require a catheter. Early studies of silicone versus latex catheters found no difference between them. Studies report that antimicrobial catheters (nitrofurazone or silver alloy) have had favorable effects on reducing bacteriuria but remain inconclusive with respect to symptomatic CA-UTI. Clinicians should consult their institution's policies and recommendations when choosing catheter type.^{38,39,40}

A checklist may be a helpful tool for staff at the time of insertion and may also serve as a data collection tool to assess compliance. In Scotland, the Health Protection Scotland has developed an insertion checklist that includes both the indications for catheter use and the technique for the insertion.⁴¹

³⁸ Rupp, M, Fitzgerald T, et al. Effect of silver-coated urinary catheters: efficacy, cost-effectiveness, and antimicrobial resistance. *Am J Infect Control.* 2004;32:445-450.

³⁹ Johnson J, Kuskowski M, Wilt T. Systematic review: antimicrobial urinary catheters to prevent catheter-associated urinary tract infection in hospitalized patients. *Ann Intern Med.* 2006;144:116-126.

⁴⁰ Brosnahan J, Jull A, Tracy C. *Cochrane Database Syst Rev.* 2004;(1):CD004013.

⁴¹ Catheter Associated Urinary Tract Infection (CAUTI) Prevention bundle – Infection Control – HPS.

<http://www.hps.scot.nhs.uk/haic/ic/CAUTIPreventionBundle.aspx>. Updated September 2008. Accessed November 7, 2011.

Education and training of staff are fundamental. Organizations should train and verify competency of *all* clinical staff (nurses, physicians, residents, etc.) who may insert urinary catheters. Organizations should not assume that staff hired with previous experience have received appropriate training and are competent on proper technique. Standard materials for education, training, and competency assessment should be used throughout the organization. Periodic retraining or assessment of competency is especially important for personnel who do not insert catheters frequently.

What changes can we make that will result in improvement?

- Create standard supply kits that include catheter and all necessary items in one place, or work with supply vendors to revise kits.
- Include appropriate technique in insertion checklist (one checklist for criteria and technique).
- Use a small-sized checklist (index card or sticker) and place it in urinary catheter kits for reference and ease of documentation.
- Measure as an “all-or-nothing” process with the goal of ensuring that all checklist items are completed every time, for every patient. Regular monitoring is essential to ensure ongoing compliance.
- Assign responsibility for stocking standard kits to ensure adequate supply at all times, especially in high-use areas such as emergency department or operating room.

3. Maintain Catheters Based on Recommended Guidelines

Consistency is the key for maintenance of indwelling urinary catheters. The evidence in this area is well defined, with consensus across clinical expert organizations (CDC, SHEA-IDSA, and NHS). The challenge at the hospital front line is designing processes so that adequate maintenance occurs reliably – for every patient, every day, every shift, and with every clinical caregiver.

Appropriate hand hygiene practices are a basic standard of care and should be followed before and after any patient care activity. Standard precautions, including the use of gloves as appropriate, should be used during manipulation of the catheter site or apparatus. Catheter maintenance can be classified in two general categories: routine maintenance and practices that should be avoided.

Routine maintenance

- Maintain a sterile, continuously closed drainage system.
- Keep catheter properly secured to prevent movement and urethral traction.
- Keep collection bag below the level of the bladder at all times.
- Maintain unobstructed urine flow.
- Empty collection bag regularly, using a separate collecting container for each patient, and avoid allowing the draining spigot to touch the collecting container.

These five items should be verified frequently and ideally documented at least once per shift. Include them in existing nursing documentation forms (e.g., assessments or flowsheets) as a reminder to staff.

Routine hygiene (e.g., cleansing of the meatal surface during daily bathing) is appropriate. Do not clean the periurethral area with antiseptics to prevent CA-UTI while the catheter is in place.

Collection of urine samples should follow aseptic technique, either by aspirating from the sampling port with a sterile syringe after cleansing the port with disinfectant (not by breaking the junction between catheter and collection tubing), or aseptically from the drainage bag when large samples are needed (SHEA-IDSA Compendium).

Some organizations have used a “bundle approach” for routine or daily care, incorporating elements into a checklist and measuring with an all-or-nothing approach. One example can be found in the Health Protection Scotland project, where a “maintenance bundle” was created. During their Antimicrobial Resistance Collaborative, the New Jersey Hospital Association created an Indwelling Catheter Bundle that included all of the above elements.

Practices to avoid

Recent guidelines also note that there are some practices that should be avoided, especially on a routine basis. These practices actually increase the risk of infection or other complications and include:

- Irrigating catheters, except in cases of catheter obstruction;
- Disconnecting the catheter from the drainage tubing;
- Replacing catheters routinely (in the absence of obstruction or infection); and
- If the collection system must be replaced, use aseptic technique.

Educating all staff and physicians about practices that should occur routinely and those that should be avoided is a fundamental first step. This may be particularly relevant for those with years of experience, as some recommendations have changed over time; thus it is important not only to educate staff as to what should and should not be done, but also to explain the rationale behind each recommendation (which increases the likelihood staff will retain the information). Periodic re-education may be beneficial for staff who care for patients with catheters intermittently, as they are more likely to forget requirements simply due to lack of application. Even more important in these cases is to design the system to avoid reliance on memory, i.e., by using checklists, reminders, and forcing functions.

What changes can we make that will result in improvement?

- Verify and document the five items listed under routine maintenance every shift (add to existing documentation systems).
- Ensure that all care items – hand hygiene supplies, individual containers for drainage, hygiene supplies for meatal cleaning – are always available at or near the point of care.
- Place paper documentation materials at the bedside so that they are visible and accessible to staff.
- Engage patients and families in the process by educating them about the appropriate care and encouraging them to ask or remind staff. This [document](#) available from CDC may serve as a helpful reference.
- Use alerts in computer systems to prompt staff on the five routine maintenance items and require documentation.
- Assign responsibility for checking and routine restocking of supplies.
- Provide supplies for collection of samples in one place or as a standard kit, at or near the point of care.

4. Review Urinary Catheter Necessity Daily and Remove Promptly

“The duration of catheterization is the most important risk factor for development of infection.”

This quote from the SHEA-IDS A Compendium practice recommendation is the crux of the issue. If use of an indwelling catheter is necessary, the most important strategy is removing the catheter as soon as possible. This has been well documented in studies dating back over the past 30 years.^{42,43,44,45,46}

Despite the significance of this risk factor, in a survey of hospitals Saint and Kowalski found that 74% of respondents did not monitor catheter duration, and Jain and Parada found that continued catheterization in 47% of patient days was not justified.^{47,48}

Lack of monitoring regarding duration may be one reason that urinary catheters remain in place longer than necessary. Another reason may be quite simple: physicians forget that catheters are in use. In a study that surveyed physicians, residents, and medical students regarding the presence of catheters in their patients, 28% were unaware their patients had catheters in place. Further, physicians were unaware of patients who were inappropriately catheterized 41% of the time.⁴⁹

Regular review of catheter necessity is recommended in the SHEA-IDS A Compendium as a special approach when CA-UTI rates are unacceptable even after implementation of the basic strategies. Given the increasing focus on and concern about CA-UTI and all such hospital-acquired infections, and with many hospitals and organizations striving for “getting to zero,” a daily review of catheter necessity should be conducted for all patients with urinary catheters (using the same criteria for appropriate insertion). This may be an important step towards preventing many of the CA-UTIs occurring at “low rates” and perhaps eliminating all.

Strategies that have been successful in reducing catheter duration should be used in conjunction with daily review. These include automatic stop orders, mandatory renewal orders that include documentation of indication, standardized reminders in patient records, or alerts in computerized ordering systems. A

⁴² Lo E, Nicolle L. 2008.

⁴³ Saint S, Lipsky BA. *Arch Intern Med.* 1999.

⁴⁴ Platt R, Polk BF, Murdock B, Rosner B. Risk factors for nosocomial urinary tract infection. *Am J Epidemiol.* 1986;124:977-985.

⁴⁵ Shapiro M, Simchen E, Izraeli S, Sacks TO. A multivariate analysis of risk factors for acquiring bacteriuria in patients with indwelling urinary catheters for longer than 24 hours. *Infect Control.* 1984;5:525-532.

⁴⁶ Garibaldi RA, Burke JP, Dickman ML, Smith CB. Factors predisposing to bacteriuria during indwelling urethral catheterization. *N Engl J Med.* 1974;291:215-219.

⁴⁷ Saint S, Kowalski. 2008.

⁴⁸ Jain P, Parada JP. 1995.

⁴⁹ Saint, Wiese, Amory, et al. 2000.

meta-analysis of published studies on the effectiveness of such approaches found that when reminders and/or stop orders are used, catheter duration was 37% lower and CA-UTI rates decreased by 52%.⁵⁰

These simple strategies eliminate one of the most unreliable factors in human behavior: reliance on memory. Combined with a daily review, most hospitals should be able to significantly reduce the duration of urinary catheters and thus the risk of associated infection.

What changes can we make that will result in improvement?

- Include catheter necessity in the daily nursing assessments at the start of every shift, with the requirement to contact physician if criteria are not met.
- Develop nursing protocols that allow for removal of urinary catheters if criteria for necessity are not met and there are no contraindications for removal (as defined in protocol).
- Implement automatic stop orders for 48 to 72 hours after insertion, with continuation only when indication is documented in renewal order.
- Place reminders in paper patient records requiring physicians to document indication for continuation of catheter (see appendix in SHEA-IDSA Compendium CA-UTI document for a sample).
- Use alerts in computerized ordering systems to indicate to physicians the presence of a catheter, and require documentation for continued need.

⁵⁰Meddings J, Rogers MA. Systematic review and meta-analysis: reminder systems to reduce catheter-associated urinary tract infections and urinary catheter use in hospitalized patients. *Clin Infect Dis*. 2010 Sep 1;51(5):550-60.

Forming the Team

IHI recommends a multidisciplinary team approach to improvements in patient care. Improvement teams should be heterogeneous in make-up, but homogeneous in mindset. The value of bringing diverse personnel together is that all members of the care team are given a stake in the outcome and work to achieve the same goal.

All the stakeholders in the process must be included, in order to gain the buy-in and cooperation of all parties. For example, teams without nurses are bound to fail. Teams led by nurses may be successful, but often lack leverage; physicians must also be part of the team.

Some suggestions to attract and retain excellent team members include using data to define and solve the problem; finding champions within the hospital who are of sufficiently high profile and visibility to lend the effort immediate credibility; and working with those who want to work on the project rather than trying to convince those who do not.

The team needs encouragement and commitment from an authority who actively works in the patient care areas where this work is being done. Identifying a champion increases a team's motivation to succeed. When measures are not improving fast enough, the champion re-addresses the problems with all clinical staff, including physicians, and helps to keep everybody on track toward the aims and goals.

Eventually, the changes that are introduced become established. At some point, however, changes in the field such as new evidence will require revisiting the processes that have been developed. Identifying a "process owner," a figure who is responsible for the functioning of the process now and in the future, helps to maintain the long-term integrity of the effort.

Setting Aims

Improvement requires setting aims. An organization will not improve without a clear and firm intention to do so. The aim should be time-specific and measurable; it should also define the specific population of patients that will be affected. Agreeing on the aim is crucial; so is allocating the people and resources necessary to accomplish the aim.

An example of an aim that would be appropriate for reducing CA-UTIs can be as simple as, "Decrease the rate of CA-UTIs by 50% within one year by achieving high levels of performance in the preventive measures."

Teams are more successful when they have unambiguous, focused aims. Setting numerical goals clarifies the aim, helps to create tension for change, directs measurement, and focuses initial changes. Once the aim has been set, the team needs to be careful not to back away from it deliberately or "drift" away from it unconsciously.

Using the Model for Improvement

In order to move this work forward, IHI recommends using the Model for Improvement. Developed by Associates in Process Improvement, the Model for Improvement is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organizations to improve many different health care processes and outcomes.

The model has two parts:

- Three fundamental questions that guide improvement teams to 1) set clear aims, 2) establish measures that will tell if changes are leading to improvement, and 3) identify changes that are likely to lead to improvement.
- The Plan-Do-Study-Act (PDSA) cycle to conduct small-scale tests of change in real work settings — by planning a test, trying it, observing the results, and acting on what is learned. This is the scientific method, used for action-oriented learning.

Implementation: After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the team can implement the change on a broader scale – for example, begin by testing use of an insertion checklist with one patient at the time of catheter placement.

Spread: After successful implementation of a change or package of changes for a pilot population or an entire unit, the team can spread the changes to other parts of the organization or to other organizations.

You can learn more about the Model for Improvement on www.ihl.org.

PDSA Worksheet

CYCLE: 1

DATE: 1/10/11



Project: Reducing Catheter-Associated Urinary Tract Infections

Objective for This PDSA Cycle: Test whether a nurse using criteria for continued need of urinary catheter can determine readiness to remove in concurrence with the physician, as a basis for possible nurse-driven protocol.

PLAN:

Develop a list of criteria for continued need of urinary catheters and test with assessment of several patients.

Questions: Will nurses using the criteria concur with physicians as to whether catheter is ready for removal? Will nurses feel comfortable making recommendation for catheter removal? Will physicians be willing to approve nurse-driven protocol for catheter removal?

Predictions: Nurses and physicians will concur for patients for whom criteria clearly apply. If there is concurrence during testing, nurses and physicians will be comfortable moving to a protocol.

Plan for change or test – who, what, when, where:

What: Assess two patients with urinary catheters using the criteria, and compare nurse recommendation to physician decision about whether to remove catheter.

Who: Stan (nurse), Margaret (physician)

Where: 3 South medical unit

When: Tomorrow day shift

Plan for collection of data – who, what, when, where:

Who: Stan

What: Note nurse recommendation using criteria and physician decision.

When: Tomorrow day shift, while assessing patients and then during discussion with physician

Where: 3 South medical unit

Do: Carry out the change or test. Collect data and begin analysis.

Stan identified two patients with urinary catheters with the criteria and determined that patient A met the criteria for continued catheter necessity and patient B did not. He noted that patient B could have the catheter removed. Margaret (MD) reviewed Stan's assessments with him and concurred; she ordered that patient B's catheter be removed.

STUDY: Complete analysis of data:

How did or didn't the results of this cycle agree with the predictions that we made earlier?

Summarize the new knowledge we gained by this cycle:

Nurse and physician did concur on whether catheters in these patients should be continued. More testing with other nurses and physicians is necessary to ensure criteria are clear and understood.

ACT: List actions we will take as a result of this cycle:

Train other nurses in use of the criteria and test further, monitoring concurrence between nurses' recommendations and physicians' orders.

Plan for the next cycle (adapt change, another test, implementation cycle?):

Test the criteria with all day shift nurses on 3 South for three days. Stan will train nurses on using criteria. Margaret will be liaison to other physicians and communicate that this is still a test.

Getting Started

Hospitals will not successfully implement all the preventative elements or eliminate all CA-UTIs overnight. If you do, chances are that you are doing something suboptimally. A successful program involves careful planning, testing to determine if the process is successful, making modifications as needed, re-testing, and careful implementation.

- Select the team and the venue. It is often best to start with one nursing unit. Determine where urinary catheters are used most frequently, as this will make the choice easier.
- Assess where you stand presently. Are you measuring unnecessary catheters? Is there a process in place for daily review of inserted catheters? If not, work with staff to begin preparing for changes.
- Contact the infectious diseases/infection control department. Learn about your catheter-associated urinary tract infection rate and how frequently the hospital reports it to regulatory agencies.
- Ensure that all of the needed equipment and supplies for compliance with appropriate insertion technique are available at the point of care before testing.
- Organize an educational program. Teaching the core principles to the staff will open many people's minds to the process of change.
- Introduce the evidence and rationale for avoiding use of catheters to the staff.

First Test of Change

Once a team has prepared the way for change by studying the current process and educated the affected parties, the next step is to begin testing elements to prevent CA-UTI at your institution.

- Begin using an insertion checklist with one patient at the time of catheter placement.
- Work with each nurse who cares for the patient to be sure they are able to follow the daily maintenance procedures and assess patients for continued catheter necessity using criteria.
- Make sure that the approach can be carried over from shift to shift to eliminate gaps in teaching and utilization.
- Process feedback and incorporate suggestions for improvement.
- Engage in additional PDSA cycles to refine the process and make it more reliable.
- After achieving reduction in CA-UTI in the pilot unit, spread the changes to other units, and eventually to all places in the hospital where urinary catheters are inserted.

Measurement

Measure compliance with each of the key components of evidence-based CA-UTI care. Document whether each component of care was provided or contraindicated; these are “process measures.” While improvements in individual measures indicate the processes surrounding those care elements have improved, improvement in actual patient outcomes requires improvement in all component measures.

IHI recommends the use of some or all of the following measures, as appropriate, to track your progress. In selecting your measures, consider the following:

- Whenever possible, use measures you are already collecting for other programs.
- Evaluate your choice of measures in terms of the usefulness of the final results and the resources required to obtain them; try to maximize the former while minimizing the latter.
- Try to include both process and outcome measures in your measurement scheme.
- You may use different measures or modify the measures described below to make them more appropriate and/or useful to your particular setting. However, be aware that modifying measures may limit the comparability of your results to others’.
- Posting your measure results within your hospital is a great way to keep your teams motivated and aware of progress. Try to include measures that your team will find meaningful and exciting.

How-to Guide: Prevent Catheter-Associated Urinary Tract Infections

Process Measures

Process Measure 1: Unnecessary urinary catheters (Urinary catheters not meeting criteria for appropriate insertion)

Numerator:	<p>Number of new indwelling urinary catheters inserted without appropriate indication documented at time of insertion</p> <p>Criteria should include at a minimum: Perioperative use for selected surgical procedures Urine output monitoring in critically ill patients Management of acute urinary retention and urinary obstruction Assistance in pressure ulcer healing for incontinent patients As an exception, at patient request to improve comfort (SHEA-IDSA) or for comfort during end-of-life care (CDC)</p> <p>Hospitals may add to or modify these criteria for local needs; criteria may be defined in policies or procedures.</p>
Denominator:	Number of records reviewed of patients with new indwelling urinary catheters
Calculation:	Divide numerator by denominator and report as percent
Frequency:	<p>Monthly at minimum</p> <p>Weekly reporting may be helpful during improvement effort.</p>
Sampling & Measurement Tips:	<p>Start by collecting data for patients on unit where improvement efforts are focused or urinary catheter usage is high.</p> <p>Collect random samples by reviewing records of all patients on the unit with new indwelling urinary catheters on one day each week. Vary the day and time of review.</p> <p>Review records only for patients admitted recently (such as prior 72 hours or since last review) to ensure patients are not counted more than once.</p> <p>Specify a timeframe in which documentation of indication must be noted in order to count in numerator (e.g., within four hours of insertion time). Ideally, indication should be documented at the time of insertion. Do not include indications documented after the day of insertion.</p> <p>Include all patients with new indwelling urinary catheters in the denominator, whether or not indication for insertion is documented. Those without documented appropriate indication will not be included in the numerator and represent opportunities for improvement.</p> <p>If insertion of indwelling urinary catheters in the ED is high, consider measuring this separately for that area to determine the percent of unnecessary insertions in the ED.</p> <p>This measure can also be reported in the converse, i.e., Appropriate indwelling urinary catheter usage, where the numerator is the percent of patients with an indication documented at insertion that meets criteria.</p>

Process Measure 2: Urinary catheters inserted with aseptic technique

Numerator:	<p>Number of patient records or forms with documentation of aseptic technique</p> <p>Technique documented should include at a minimum: Hand hygiene immediately prior to insertion Use during insertion of: Gloves, a drape, and sponges Sterile or antiseptic solution for cleaning the urethral meatus Single-use packet of sterile lubricant jelly for insertion Catheter size</p>
Denominator:	Number of records reviewed of patients with new indwelling urinary catheter
Calculation:	Divide numerator by denominator and report as percent
Frequency:	<p>Monthly at minimum</p> <p>Weekly reporting may be helpful during improvement effort.</p>
Sampling & Measurement Tips:	<p>Start by collecting data for patients on unit where improvement efforts are focused or indwelling urinary catheter usage is high.</p> <p>Data may be collected by documentation in the patient medical record or on other data collection forms, such as checklists, stickers or forms included with catheter insertion kits. Each organization must determine whether these other forms of data collection become part of the permanent medical record.</p> <p>When using patient records, collect random samples such as reviewing records of all patients on the unit with indwelling urinary catheters on one day each week. Vary the day and time of review.</p> <p>Review records only for patients admitted recently (such as prior 72 hours or since last review) to ensure patients are not counted more than once. Insertion technique should be documented at the time of insertion.</p> <p>Include patients in the denominator if there is no documentation of insertion technique. These will not be included in the numerator and represent opportunities for improvement.</p>
Resources:	<p>Centers for Disease Control and Prevention or World Health Organization guidelines</p> <p><u>How-to Guide: Improving Hand Hygiene</u></p>

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Process Measure 3: Urinary catheters maintained according to recommended guidelines

Numerator:	<p>Number of records of patients with indwelling urinary catheters and daily documentation of recommended practices</p> <p>Daily documentation should include at a minimum: Verification of: Sterile, continuously closed drainage system Catheter properly secured Collection bag below the level of the bladder Unobstructed urine flow Regular emptying of collection bag</p>
Denominator:	Number of records of patients with indwelling urinary catheters reviewed
Calculation:	Divide numerator by denominator and report as percent
Frequency:	<p>Monthly at minimum</p> <p>Weekly reporting may be helpful during improvement effort.</p>
Sampling & Measurement Tips:	<p>Start by collecting data for patients on unit where improvement efforts are focused or indwelling urinary catheter usage is high.</p> <p>Collect random samples such as reviewing records of all patients on the unit with indwelling urinary catheters on one day each week. Vary the day and time of review.</p> <p>Documentation should be present daily (or more frequently if required by policy); include the record in the numerator only if documentation is present for every day the catheter is/was in place – an “all-or-none” measure.</p>

Process Measure 4: Daily review of urinary catheter necessity

Numerator:	<p>Number of records of patients with indwelling urinary catheters and daily documentation of indication for continued catheter necessity</p> <p>Indication should include at a minimum: Perioperative use for selected surgical procedures Urine output monitoring in critically ill patients Management of acute urinary retention and urinary obstruction Assistance in pressure ulcer healing for incontinent patients As an exception, at patient request to improve comfort (SHEA-IDSA) or for comfort during end-of-life care (CDC)</p> <p>Hospitals may add to or modify these criteria for local needs; criteria may be defined in policies or procedures.</p>
Denominator:	Number of records of patients with indwelling urinary catheters reviewed
Calculation:	Divide numerator by denominator and report as percent
Frequency:	<p>Monthly at minimum</p> <p>Weekly reporting may be helpful during improvement effort.</p>
Sampling & Measurement Tips:	<p>Start by collecting data for patients on unit where improvement efforts are focused or indwelling urinary catheter usage is high.</p> <p>Collect random samples such as reviewing records of all patients on the unit with indwelling urinary catheters on one day each week. Vary the day and time of review.</p> <p>Documentation should be present daily (or more frequently if required by policy); include the record in the numerator only if documentation is present for every day the catheter is/was in place – an “all-or-none” measure.</p> <p>Include patients in the denominator if there is no documentation or documented indication does not meet criteria. These will not be included in the numerator and represent opportunities for improvement.</p>

Process Measure 5: Unnecessary urinary catheter days

Numerator:	<p>Number of days an indwelling urinary catheter is in place with no documentation of indication for continued necessity or documented indication does not meet criteria</p> <p>Indication should include at a minimum: Perioperative use for selected surgical procedures Urine output monitoring in critically ill patients Management of acute urinary retention and urinary obstruction Assistance in pressure ulcer healing for incontinent patients As an exception, at patient request to improve comfort (SHEA-IDSA) or for comfort during end-of-life care (CDC)</p> <p>Hospitals may add to or modify these criteria for local needs and be defined in policies or procedures.</p>
Denominator:	Number of indwelling urinary catheter-days from records reviewed x 1000
Calculation:	Multiply by 1000 for rate per 1000 catheter days
Frequency:	<p>Monthly</p> <p>Weekly reporting may be helpful during improvement effort.</p>
Sampling & Measurement Tips:	<p>Start by collecting data for patients on unit where improvement efforts are focused or indwelling urinary catheter usage is high.</p> <p>Collect random samples such as reviewing records of all patients on the unit with indwelling urinary catheters on one day each week. Vary the day and time of review.</p> <p>Documentation should be present daily (or more frequently if required by policy); include the record in the numerator only if documentation is present for every day the catheter is/was in place – an “all-or-none” measure.</p>
Resources	Refer to the CDC NHSN Manual for recommendations on counting catheter days.

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Outcome Measures

Outcome measures are also essential and should be collected in addition to the process measures for each of the key components of CA-UTI care. Aligning your measures with those used for national programs or required reporting (such as the CDC and/or state requirements) will ease the burden of measurement.

Outcome Measure 1: Urinary catheter-associated symptomatic urinary tract infection (CA-UTI) rate

Numerator:	Number of symptomatic CA-UTIs
Denominator:	Number of indwelling urinary catheter-days x 1000
Calculation:	Multiply by 1000 for rate per 1000 catheter days
Frequency:	Monthly
Sampling & Measurement Tips:	This measure is typically reported by location and type, e.g., inpatient nursing units (medical, surgical, etc.) or critical care units (medical, surgical, trauma, burn, etc.). It may be helpful to begin data collection on a unit where utilization of urinary catheters is high.
Resources:	This measure is utilized by CDC in the NHSN Manual and is recommend in the SHEA-IDSA Compendium .

Outcome Measure 2: Unnecessary urinary catheters or unnecessary catheter days

These can serve as proxy outcome measures (i.e., reducing these measures may decrease the CA-UTI rate based on the available evidence). Because measurement of unnecessary catheters is determined from process documentation, the definitions are included in the section on process measures (see Process Measures 1 and 5).