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# Reducing the Incidence of Catheter-Associated Urinary Tract Infections in the Acute Care Setting Using Evidence-Based Guidelines

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## 1. Introduction

Urinary Tract Infections (UTIs) are the most common infections acquired in the hospitalized adult patients accounting for 30-40% of all nosocomial infections and 80% of these infections are caused by indwelling catheters (Bagshaw, Laupland, 2006) (National Center of Health Statistics, CDC, 2004). The daily risk of developing a catheter-associated urinary tract infection (CA-UTI) is 3-7% in the acute care setting (Lo, Nicolle et al, 2008). Between 15-25% of hospitalized patients receive short-term indwelling catheters (CDC, 2009). Often catheters are placed for inappropriate reasons and prescribers are unaware of their presence and stay in for extended periods of time. Reported rates of UTI among patients with urinary catheters vary substantially. National data from the National Healthcare Safety Network (NHSN), designed by the Centers for Disease Control (CDC) and Prevention, previously known as the National Nosocomial Infection Surveillance System (NNISS), reported acute care hospitals in 2006 showed an average range of CA-UTI rates of 3.1-7.5 infections per 1000 catheter-days (CDC, 2009). The Centers for Medicare and Medicaid Services (CMS) identified hospital acquired urinary tract infections as one of the eight conditions for which hospitals will not receive additional reimbursement (Beaver, 2008) (CMS, 2008). The CMS regulations emphasize complications and risk with CA-UTIs which include cystitis, periurethral abscess, prostatitis, epididymitis, acute or chronic pyelonephritis, gram negative bacteremia, sepsis secondary to CA-UTI, which can be fatal in 40-60% of cases and CA-UTIs are the second most common cause of nosocomial blood stream infection (Kunin, 1997, Smith, 2003, Rahn, 2008, National Center for Disease Statistics, CDC, 2004, Cravens, 2000, Warren, Damron et al 1987). The complication of a CA-UTI can increase a patient's hospital stay by 0.4 days for an asymptomatic UTI and 2 days for a symptomatic UTI (Leithauser, 2004). The CMS regulations also state the use of indwelling catheters in long-term acute care settings must be medically justified and that strategies must be in place to reduce the risk of infection for all patients and residents with catheters (CMS guidelines, 2008). An estimated 17% to 69% of CA-UTI may be preventable with recommended infection control measures, which means that up to 380,000 infections and 9000 deaths related to CA-UTI per year could be prevented (CDC, 2009). This chapter will focus on methods that have demonstrated in research and recommended to help prevent CA-UTIs in the acute care setting.

Based on the 2009 Infectious Diseases Society of America Guidelines (IDSA), CA-UTI infections refer to infections occurring in persons whose urinary tract is currently catheterized or has been catheterized within the previous 48 hours. UTI refers to significant bacteruria in a patient with symptoms or signs attributable to the urinary tract and no alternate source. These guidelines will pertain to patients with indwelling catheters, including short term ( $\leq 30$  days) and long-term ( $>30$  days) in the acute care setting. These guidelines in this chapter will not attend to intermittent catheterization or condom catheterization. Nor does it deal with patients who undergo complicated urologic catheterization procedures, such as those involving ureteral stents or nephrostomy tubes. This chapter will strictly deal with the prevention of CA-UTIs in the acute care setting. The diagnosis and treatment of a CA-UTI will not be addressed.

In the acute care setting, many CA-UTIs account for many episodes of nosocomial bacteremia (Noelle, Strausbaugh, Garibaldi, 1996), (Saint, Kowalski, Kaufman, 2008). CA-bacteruria has important implications for the patients and should have high priority for infection control programs, not only for patient safety but cost issues as well. One cost analysis of UTIs estimated an additional expense ranging from \$401 to \$1,727 per UTI (Tambyah, Knasinski, et al, 2002). Additional estimates have been as high as \$3,803 per infection (McConnel, 2000). In October 2008, The Centers for Medicare/Medicaid Services in the United States stopped reimbursement for healthcare acquired infections (Wald, Kramer, 2007) (Beaver, 2008) (CMS, 2008). Not surprisingly, the most effective way to reduce the incidence of CA-UTIs is removing the catheter promptly when it is no longer needed (Crouzet, Bertrand et al, 2007) (Infectious Diseases Society of America, 2009). However, despite the overwhelming link between urinary catheterization and subsequent UTI, US hospitals have not widely implemented strategies to reduce hospital-acquired UTIs.

The NHSN created benchmarks for CA-UTIs based on similar hospitals. The benchmark for CA-UTI in the ICU was a rate of 4 per 1000 catheter days pooled from 300 hospitals in 2004 (Edwards, Peterson, et al, 2007). In preparation for the new CMS guidelines for healthcare acquired infections, in 2007, PENN Presbyterian Medical Center in Philadelphia, Pennsylvania, launched a campaign to decrease the incidence of CA-UTIs by adopting a set of evidence based guidelines and studied the effects of these guidelines on the rate of CA-UTIs in a pilot study done in one of the intensive care units. Before adopting these set of guidelines PENN Presbyterian Cardiac Care Unit had a CA-UTI rate of 13.1 in 2006 after 1 year, following these guidelines, the rate dropped to 6.80 by the end of 2007. Each of the University of Pennsylvania Hospitals adopted parts of these guidelines and made changes according to their specific patient populations. This chapter will outline what PENN Presbyterian did but will highlight some of the interventions utilized by all three hospitals. All three hospitals in the University of Pennsylvania Health System utilize the same order entry system therefore any changes in documentation were implemented in all three hospitals. Committees in all three hospitals met on a quarterly basis to review interventions. The definition of practice guidelines are "systematically developed statements to assist practitioners and patients in making decisions about appropriate healthcare for specific circumstances. Attributes of high quality guidelines include validity, reliability, reproducibility, clinical applicability, clinical flexibility, clarity, multidisciplinary process, review of evidence and documentation. (IDSA, p 9. 2009). Table 1 outlines the strength of recommendation and quality of evidence as described in 1970, by the Canadian Task Force on the Periodic Health Examination. Throughout the chapter, the practice guidelines discussed will be labeled with the strength of recommendation and quality of evidence as

defined by this table and recommendation from the Infectious Disease Society of America, the Centers for Disease Control and Prevention and the most current research. These guidelines will represent what was adopted by the University of Pennsylvania Health System over the past three years and also what has been studied and proven as well in these past three years since the original study that was done at PENN Presbyterian Center in 2006-2007

Table 1: Strength of Recommendation and Quality of Evidence	
Category/Grade	Definition
<b>Strength of Recommendation</b>	
a. Good Evidence to support a recommendation for or against use	
b. Moderate Evidence to support a recommendation for or against use	
c. Poor Evidence to support a recommendation for or against use	
<b>Quality of Evidence</b>	
i. Evidence from >1 properly randomized, controlled trial	
ii. Evidence from >1 well designed clinical trial, without randomization; from cohort or case-controlled analytic studies (preferably from >1 center); from multiple time-series; or from dramatic results from controlled experiments	
iii. Evidence from opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees	

Table 1. Defines the strength of recommendation and quality of evidence adapted from the Canadian Task Force on the Periodic Health Examination 1979.

2. Indications for insertion and discontinuing indwelling catheters

Indwelling catheters should be placed only when they are indicated (A-III, IDSA, 2009). Institutions should develop a list of appropriate indications for inserting indwelling catheters, educate staff about indications and periodically assess adherence to the institution-specific guidelines (A-III, IDSA, 2009). Institutions should require an order in the chart before a catheter is placed (A-III, IDSA, 2009). Institutions should consider use of a portable bladder scanner to determine whether catheterization is necessary for post-operative patient (B-II, IDSA, 2009).

At PENN Presbyterian, criteria for maintaining indwelling catheters were placed in a set of practice guidelines originally in 2005 and again reviewed by the policy and procedure committee in 2008 and 2009. The maintenance criteria are listed below in Table 3. These guidelines were originally adapted from *Wong and Hooton's Guidelines for the Prevention of catheter-associated urinary tract infections* from the Center for Disease Control and Prevention published in a landmark study in 1981, and modified in 2005. Most recently these guidelines were again updated and published in the 2009 International Clinical Practice Guidelines entitled *Diagnosis, Prevention and Treatment of Catheter-Associated Urinary Tract Infections in Adults* by the Infectious Diseases Society of America, led by Thomas Hooton and also by the CDC, entitled *Guideline for Prevention of Catheter Associated Urinary Tract Infections 2009*, led by Carolyn Gould. Although the IDSA guidelines do not specifically list indications for maintaining an indwelling catheter, it stresses the need for institutions to develop their own

set of criteria reducing the incidence of unnecessary catheterizations making it a responsibility of the prescribers (physician, nurse practitioner, or physician’s assistant) to ensure that indwelling catheters are utilized appropriately. In the CDC guidelines, listed below in table 2 there are recommendation for insertion of catheters but they are based on expert opinion and are classified as category B-I (2009).

<p><b>Examples of Appropriate Indications for Indwelling Urethral Catheter Use</b></p> <ol style="list-style-type: none"><li>1. Patient has acute urinary retention or bladder outlet obstruction</li><li>2. Need for accurate measurement of urinary output in critically ill patients</li><li>3. Perioperative use of selective procedures:<ul style="list-style-type: none"><li>- Patients undergoing urologic surgery or other surgery on contiguous structures</li></ul></li></ol> <p>In the genitourinary tract</p> <p>Anticipated prolonged procedure (catheters inserted for this reason should be taken out in the recovery room)</p> <p>Patients anticipated to receive large volume infusions or diuretics during surgery</p> <p>Need for intraoperative monitoring of urinary output</p> <ol style="list-style-type: none"><li>4. To assist in healing of open sacral or perineal wounds in incontinent patients</li><li>5. Patients requiring prolonged immobilization (i.e. potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures</li></ol> <p><b>Examples of inappropriate use of catheters</b></p> <ol style="list-style-type: none"><li>1. As a substitute for nursing care of the patient or resident with incontinence</li><li>2. As a means of obtaining urine for cultures or other diagnostic test when the patient can voluntarily void</li><li>3. For prolonged post-operative duration without appropriate indications (i.e. structural repair of urethra or contiguous structures, prolonged effect of epidural anesthesia etc.)</li></ol>
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Table 2. CDC: Guidelines for Prevention of Catheter-Associated UTIs 2009.

3. Prevention of catheter-associated urinary tract infections

There are many catheter factors that increase the risk for the development of CA-UTIs. Maki and Tambyah state that there are inherent risk factors that increase the risk for CA-UTIs in the acute care setting. These include being female, patients with other infections, major pre-existing chronic illnesses such as diabetes, patients suffering from malnutrition, patients with chronic renal insufficiency, insertion of a catheter outside the operating room or late in hospitalization and using a catheter to measure urine output (2001). The CDC suggests that the highest quality of evidence demonstrates that the elderly, those patients >70 years of age, patients with severe illness and finally those with prolonged catheterization are at the highest risk for development of CA-UTI. This section will define factors that have and can help prevent the development of CA- UTIs in the acute care setting. Table 4 lists PENN Presbyterian’s guidelines utilized to prevent catheter-associated urinary tract infections. Although most of these guidelines are based on research some guidelines in this table have been listed to help reduce the risk of CA-UTI development and may not have been proven by research but are supported by expert opinion and may need further research. These guidelines were adopted by PENN Presbyterian in 2006 and are continually reassessed



<p><b>PENN Presbyterian Medical Center Practice Guidelines for Placement and Maintaining Indwelling Catheter: Nursing Management for the Prevention of Catheter-Associated Urinary Tract Infections May 2005, Updated February 2008, updated January 2009.</b></p> <ol style="list-style-type: none"><li>1. Patients experiencing hemodynamic instability requiring intravenous vasoactive agents or aggressive intravenous fluid resuscitation for maintenance of blood pressure and/or cerebral perfusion</li><li>2. Female patient with spinal radiographic studies that have not been cleared (thoracic or lumbar regions)</li><li>3. Patients who are incontinent with skin breakdown in the buttocks, sacral region or perineum; as this puts patients at risk for further breakdown, contamination and/or infection or with existing stage 3 or 4 sacral wounds</li><li>4. Patients who are deeply sedated (patients who are obtunded due to injury, illness or chemical induction).</li><li>5. Patients with urological requirement for indwelling catheter (for example, patients who experience surgical disruption of the urinary tract system, or patient with actual or anticipated acute urinary retention due to bladder outlet obstruction or urethral strictures for whom medical intervention is necessary to drain urine).</li><li>6. Patients who are post-operative and who will be immobile for 48 hours (indwelling catheterization is only indicated for 48 hours)</li><li>7. Patients admitted with chronic indwelling catheters already in place for the diagnosis of chronic urinary retention due to spinal cord injury or disease</li><li>8. Patients who are made DNR-C with an indwelling catheter already in place (Do Not Resuscitate – Comfort Care only)</li><li>9. Patients with acute urinary retention or bladder obstruction</li></ol> <p><b>The following clinical situations are NOT automatic indications for placement of an indwelling urinary catheter</b></p> <ol style="list-style-type: none"><li>1. Presence of an epidural catheter</li><li>2. Diagnosis of acute or chronic renal failure</li><li>3. Patients who require aggressive monitoring of input and output</li><li>4. As part of the routine preparation for patients about to undergo surgical or other invasive procedures not otherwise excluded above</li></ol>
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Table 3. PENN Presbyterian Medical Center Administration Policy Manual: The Use of Indwelling Urinary Catheters: Policy # 11.147.

yearly according to the latest evidenced- based research. This section will describe each guideline and how it was adopted into practice and describes changes made to practice since their introduction in 2006 and the strength of recommendation and quality of evidence described in the literature.

3.1 Insertion/maintenance of indwelling catheter in acute care setting

The CDC and IDSA make clear recommendations that indwelling catheters in the acute care setting should be placed using aseptic technique and sterile equipment (B-III, IDSA, 2009) (B-I, CDC, 2009). It is important that staff inserting catheters is properly educated and that return demonstration is conducted to ensure proper insertion to prevent CA-UTIs. It is also recommended that a closed catheter drainage system, with ports for aspiration in the distal

catheter, be utilized to decrease the frequency of breakage thus reducing the risk of CA-UTIs (A-III, IDSA, 2009). Although the usage of prepackaged preconnected systems is utilized at the University of PENN Health System, there is not enough evidence to support whether such systems reduce the incidence of CA-UTIs (IDSA, 2009). Although the CDC, states that sterile, continuously closed drainage systems became the standard of care based on an uncontrolled study published in 1966 demonstrating a dramatic reduction in the risk of infection in short-term catheterized patients with the use of a closed system. Recent data also include the finding that disconnection of the drainage system is a risk factor for bacteriuria (2009). It's utilization at PENN has however decreased the incidence of breakage between the catheter and drainage system thus contributing to the lower incidence CA-UTIs.

### **3.2 Assessing the need for indwelling catheter**

First and foremost is the duration of catheterization that has been demonstrated to be the major independent risk factor for the development of CA-UTIs (Reilly, Sullivan, et al, 2006). Catheters left in place for >6 days have shown the most risk (Maki, Tambyah, 2001,) (A-II, IDSA, 2009). Indwelling catheters should be removed as soon as they are no longer required to reduce the risk of CA-UTIs (A-II, IDSA, 2009). Institutions should consider nurse-based or electronic physician reminder systems to reduce inappropriate urinary catheterization and CA-UTIs (A-II, IDSA, 2009). This intervention has been in place since February, 2008 at all three hospitals in the University of Pennsylvania Health System. Institutions should consider automatic stop orders to reduce inappropriate urinary catheterization (B-I, IDSA, 2009). An automatic stop order is placed in the University of Pennsylvania Health System order entry system after 48 hours reminding prescribers to reassess need for indwelling catheters then every 24 hours thereafter, which was introduced in February, 2010. Prescribers are stopped before any other order can be entered every 24 hours to address need for catheter and an option to place an order to discontinue the use of the catheter.

Nurses are on the frontlines of direct patient care and are the cornerstone in implementing good practice. If nurses are taught to embrace the criteria for maintenance and understand how it affects patient care and safety, assessing the need for an indwelling catheter on a routine basis becomes an easy task. At PENN Presbyterian, the focus was on nursing practice, it is simple for prescribers to enter an order to discontinue the use of an indwelling catheter but it is up to administrators, educators and infection control experts to reinforce that with concept with the nursing staff and giving timely feedback about practice good or bad. In an attempt to decrease the incidence of CA-UTIs, PENN Presbyterian's Coronary Care Unit, utilized an audit tool (table 3) to identify gaps in care. Nurses were then educated during staff meeting or individually by clinical nurse specialists and infection control specialists about noncompliance or gaps in care according to the guidelines. With this audit tool, over time, nursing began to embrace their accountability in infection prevention. They soon developed the "less is more philosophy". If nurses are convinced that they hold the key to prevention of CA-UTI typically they will embrace this concept as demonstrated in this pilot study (Gorman, 2009). Listed below is the audit tool used in Table 4. In addition, nursing was given monthly feedback about rates of infection in a monthly newsletter published by the infection control committee outlining infection rates.

### **3.3 Proper hand hygiene**

It is not a new concept that proper hand hygiene before and after catheter care prevents the spread of infection. The Institution of Healthcare Improvement (IHI) 100,000 lives campaign

introduced "Bundles" in December 2004. A bundle is a term developed by the IHI as a way to describe a collection of interventions to effectively care for patients undergoing particular treatments with inherent risks (IHI, 2004). Hand hygiene compliance was on the top of the list as a way to prevent infections. The Joint Commission on Accreditation of Hospital Organizations (JCAHO) recognizes hand hygiene compliance as a patient safety goal in 2004. The Center for Disease Control lists recommendations for indications for hand hygiene, hand hygiene techniques, surgical antisepsis, and selection of hand hygiene agents, skin care, health care worker (HCW) education, administrative measures and other aspects of hand hygiene. Listed below in table 5, are recommendations, including before and after handling of catheters. Because hand hygiene is the number one way to prevent the spread of any infection it was worth mentioning *all* the guidelines including those involved with an indwelling catheter. It can not be stressed enough that proper hand hygiene is the key element to infection prevention. Even if you have all other criteria in place if proper hand hygiene fails to be the number one priority, all other interventions to preventing infections are futile.

Hand hygiene compliance was and continues to be tracked monthly as well at PENN Presbyterian by anonymous observers and reported to the infection control committee with a goal of 100% compliance. Observers were and are continued to be educated to give private negative feedback so to provide a positive environment to encourage learning versus discipline. PENN Presbyterian launched an education campaign surrounding hand hygiene in 2004. To improve hand hygiene compliance, alcohol based dispensers were placed strategically around the hospital for easy access. Compliance rates started at 50-60% but presently are >90%. Clear guidelines were addressed in policies surrounding when to use alcohol based gels versus soap and water. Staff was educated explicitly on these guidelines. These guidelines are specifically outlined by the CDC.

### 3.4 Size/type of an indwelling urinary catheter

Although the IDSA does not make any recommendations on the size of an indwelling catheter it is well documented in the literature as recommended by expert opinion that size does matter when preventing a CA-UTI. The prevailing guideline for catheter size is to use the smallest diameter that will provide good drainage, typically 14-18 French unless the patient has blood clots or sediment that occlude the lumen. Larger catheters are uncomfortable and can lead to urethral erosion and impair paraurethral gland function. The paraurethral glands produce mucous that protects against ascending bacteria. Compression of these glands can result in urethritis or ascending infection (Robinson, 2001, Newman, 2007). At the University of Pennsylvania Health System, floors will only stock 14 French indwelling catheter insertion kits already attached to a drainage system. It avoids placement of any size catheter that happens to be available to staff. Specially required catheters are ordered from the store room if necessary, therefore careful thought must be taken before a larger catheter is necessary. Only if there is leakage from the catheter will a larger catheter size be considered. The IDSA suggests that in patients with short-term indwelling catheters, antimicrobial, silver alloy or antibiotic-coated catheters may be considered to reduce or delay the onset of CA-UTIs (B-II, 2009). In PENN Presbyterian, there was little difference in the rate of infection with or without the antibiotic coated catheters therefore the use was discontinued.



PENN Presbyterian CCU Infection Control Audit (CA-UTI Section only) 2007

Medical Record # \_\_\_\_\_

Nurse Auditing \_\_\_\_\_

Nurse Audited \_\_\_\_\_

Date \_\_\_\_\_

Indwelling Catheter

How many days in place \_\_\_\_\_ Size \_\_\_\_\_

Every shift needs assessment \_\_\_\_\_

Leg Strap in place \_\_\_\_\_

Bag below Level of bladder \_\_\_\_\_

Urinalysis/culture done on admission to CCU if from outside facility \_\_\_\_\_

Where was the catheter placed? ER OR OSH CCU Other \_\_\_\_\_

Reason for Indwelling Catheter Circle all that apply

Obstruction/Retention DNR-C (with catheter already in place),

Hemodynamic instability Stage 3 or 4 sacral wound neurogenic

bladder obtunded/sedated/paralyzed No reason discontinued catheter

DNR-C (Do Not Resuscitate – Comfort care only)

Infections Present on Admission Please Circle

UTI Pneumonia Blood Stream Infection

Table 4. PENN Presbyterian Nursing Audit Tool.

Recommendation:	Category
<b>1. Indications for handwashing and hand antisepsis</b>	
d. When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water.	IA
e. If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in all other clinical situations described in 1C-J.	IA
f. Alternatively, wash hands with an antimicrobial soap and water in all clinical situations described in items 1 C-J.	IB
g. Decontaminate hands before having direct contact with patients.	IB
h. Decontaminate hands before donning sterile gloves when inserting a central intravascular catheter.	IB
i. Decontaminate hands before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure.	IB

Recommendation:	Category
j. Decontaminate hands after contact with a patient’s intact skin (e.g., when taking a pulse or blood pressure, and lifting a patient)	IB
k. Decontaminate hands after contact with body fluids or excretions, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled.	IA
l. Decontaminate hands if moving from a contaminated-body site to a clean-body site during patient care.	II
m. Decontaminate hands after contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient.	II
n. Decontaminate hands after removing gloves	IB
o. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or a non-antimicrobial soap and water.	IB
p. Antimicrobial-impregnated wipes (i.e., towelettes) may be considered as an alternative to washing hands with non-antimicrobial soap and water. Because they are not as effective as alcohol-based hand rubs or washing hands with an antimicrobial soap and water for reducing the bacterial counts on the hands of HCW’s, they are not a substitute for using alcohol-based hand rub or antimicrobial soap.	IB
q. Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if exposure to <i>Bacillus anthracis</i> is suspected or proven. The physical action of washing and rinsing hands under such circumstances is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores.	II
r. No recommendation can be made regarding the routine use of nonalcohol-based hand rubs for hand hygiene in health-care settings.	Unresolved issue
<b>2. Hand-Hygiene Technique</b>	
a. When decontaminating hands with an alcohol-based hand rub, apply product to one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. Follow manufacturer’s recommendations regarding the volume of product to use.	IB
b. When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet.	IB IB
c. Avoid using hot water, because repeated exposure to hot water may increase the risk of dermatitis.	
d. Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water. When bar soap is used, soap racks that facilitate the drainage and small bars of soap should be used.	II

Recommendation:	Category
e. Multiple-use cloth towels of the hanging or roll type are not recommended for use in health-care settings.	II
<b>3. Surgical Hand Antisepsis</b>	
a. Remove rings, watches, and bracelets before beginning the surgical hand scrub.	II
b. Remove debris from underneath fingernails using a nail cleaner under running water.	II
c. Surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub with persistent activity is recommended before donning surgical gloves when performing surgical procedures.	IB
d. When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, usually 2-6 minutes. Long scrub times (e.g., 10 minutes) are not necessary.	IB
e. When using an alcohol-based surgical hand scrub product with persistent activity, follow the manufacturer’s instructions. Before applying the alcohol solution, prewash hands and forearms completely. After application of the alcohol-based product as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves.	IB
<b>4. Selection of Hand Hygiene Agents</b>	
a. Provide personnel with efficacious hand-hygiene products that have low irritancy potential, particularly when these products are used multiple times per shift. This recommendation applies to products used for hand antisepsis before and after patient care in clinical areas and to products used for surgical hand antisepsis by surgical personnel.	IB
b. To maximize the acceptance of hand-hygiene products by HCWs, solicit input from these employees regarding the feel, fragrance, and skin tolerance of any products under consideration. The cost of hand-hygiene products should not be the primary factor for influencing product selection.	IB
c. When selecting non-antimicrobial soaps, antimicrobial soaps, or alcohol-based hand rubs, solicit information from the manufacturers regarding any know interactions between products used to clean hands, skin care products, and the types of gloves used in the institution.	II
d. Before making purchasing decisions, evaluate the dispenser systems of various product manufacturers or distributors to ensure that dispensers function adequately and deliver an appropriate volume of product.	II
e. Do not add soap to a partially empty soap dispenser. This practice of “topping off” dispensers can lead to bacterial skin contamination.	IA

Recommendation:	Category
<b>5. Skin Care</b>	
a. Provide HCWs with hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or hand washing.	IA
b. Solicit information from the manufacturers regarding any effects that hand lotions, creams or alcohol-based hand antiseptics may have on the persistent effects of antimicrobial soaps being used in the institution.	IB
<b>6. Other Aspects of Hand Hygiene</b>	
a. Do not wear artificial fingernails or extenders when having direct contact with patients at high risk (e.g., those in intensive-care units or operating rooms)	IA
b. Keep natural nail tips less than ¼ inch long.	II
c.	
d. Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and non-intact skin should occur.	IC
e. Remove gloves after caring for the patient. Do not wear the same pair of gloves for the care of more than one patient, and do not wash gloves between uses with different patients.	IB
f. Change gloves during patient care if moving from a contaminated body site to a clean body site.	II
g. No recommendation can be made regarding rings in health-care settings.	Unresolved issue
<b>7. Health-care Worker Educational and Motivational Programs</b>	
a. As part of an overall program to improve hand-hygiene practices of HCWs, educate personnel regarding the types of patient-care activities that can result in hand contamination and the advantages and disadvantages of various methods used to clean their hands.	II
b. Monitor HCWs adherence with recommended hand-hygiene practices and provide personnel with information regarding their performance.	IA
c. Encourage patients and their families to remind HCWs to decontaminate their hands.	II
<b>8. Administrative Measures</b>	
a. Make improved hand-hygiene adherence an institutional priority and provide appropriate administrative support and financial resources.	IB
b. Implement a multidisciplinary program to improve hand-hygiene adherence of health personnel to recommended hand-hygiene practices.	IB
c. As part of a multidisciplinary program to improve hand-hygiene adherence, provide HCWs with a readily accessible alcohol-based hand rub product.	IA

Recommendation:	Category
d. To improve hand-hygiene adherence among personnel who work in areas in which high workloads and high intensity of patient care are anticipated, make alcohol-based hand rub available at the entrance to the patient’s room or at the bedside, in other convenient locations, and in individual pocket-sized containers to be carried by HCWs.	IA
e. Store supplies of alcohol-based hand rubs in cabinets or areas approved for flammable materials.	IC

Morbidity and Mortality Weekly Report (MMWR). Recommendations and Reports. October 25, 2002. Vol. 51, No. RR-16

Table 5. Centers for disease control and prevention.

3.5 Catheter securement

Although the IDSA does not make recommendations concerning the routine securement of indwelling catheters it is documented in the literature and has been apart of the practice in the University of PENN Health system. Unsecured catheters can lead to bleeding, trauma, pressure sores around the meatus and bladder spasms from pressure and traction (Hanchett, 2002). It has been recommended in the literature that the catheter be secured to the thigh for women and to the upper thigh or lower abdomen for men. The lower abdominal position in men decreases the potential for pressure necrosis and urethral erosion at the penile-scrotal junction (Cancio, Sabanegh et al, 1993). PENN Presbyterian utilizes a Velcro catheter strap around the thigh. If a patient’s thigh exceeds the size limit, metapore or paper tape is used to keep the catheter in place. Both methods of securement are changed when visibly soiled, also skin assessment under each method of securement is done during each shift or whenever necessary to prevent skin breakdown or pressure sores.

3.6 Catheter position and drainage

Again, the IDSA does not comment on the position of the catheter but suggestions from literature have commented however that the position of the catheter is important for the prevention of CA-UTI. The University of PENN Health System has utilized this advice by expert opinion and has incorporated into their practice. Studies have demonstrated that retrograde flow of bacteria from the urine drainage bag to be a major source of bacterial contamination. A study by Maki et al, found that by allowing the tubing to drop lower than the drainage bag was associated with a significant increase risk of CA-UTI (Smith, 2007). Recently drainage bags are designed with either an anti-reflux valve or anti-reflex chamber to prevent reflux of contaminated urine from the bag back into the tubing and ultimately into the patient. Even with the new design, the University of PENN Health System believes that keeping the bag below the level of the bladder is important in the prevention of CA-UTIs (B-I, CDC, 2009). Also included into practice is not allowing the outlet tube to touch the floor or inner aspects of the drainage container to prevent contamination. Keeping the bag empty to avoid traction on the catheter from the weight of the bag is also an important part of routine practice especially when transporting patients. Finally, preventing cross contamination by positioning the drainage bag on opposite sides of any fecal management system drainage bag.



### 3.7 Meatal care

Routine care of the perineum seems obvious. Cleansing the perineum with soap and water after a bowel movement and wiping from front to back especially in female patients decreases the risk of stool contamination. PENN Presbyterian uses disposable wash cloths and non risible spray soap and educates staff to utilize multiple cloths when cleaning. Staff is educated to clean the catheter with new pair of clean gloves after a bowel movement. The motion that is advised is moving away from the meatus down the catheter towards the drainage bag. The staff is also encouraged to clean the catheter whenever visibly soiled. Enhanced meatal care with povidone-iodine solutions, silver sulfadiazine, polyantibiotic ointment or cream or green soap and water is not recommended by the IDSA to reduce CA-bacteriuria (A-I, 2009).

### 3.8 Assessing for CA-UTI

Guidelines have changed over the past couple of years as to assessing appropriately for the presence of a CA-UTI. In January, 2010, the University of PENN Health System has developed a new procedure to asses the presence of a CA-UTI as recommended by the CDC to assure that false-positive CA-UTI are minimized. If the patient has a catheter in place and develops signs and symptoms of an infection, such as leukocytosis, and fever, and there is no other obvious source for infection, a urinalysis is sent. If the urinalysis demonstrates >5-10 WBCs, and the catheter is greater than 24 hours old, the catheter is changed and a new urinalysis is obtained. The reason a catheter needs to be changed is that catheters become encrusted overtime with a biofilm which may be interpreted as an active infection and lead to the misuse of antibiotic therapy (Marklew, 2004). If the urinalysis is still positive after the change, then a urine culture is sent off of the new catheter by aspirating from the port after cleaning with an alcohol swab. If the patient is symptomatic with new symptoms such as abdominal pain, dysuria, urgency or flank pain then the catheter should be changed immediately prior to initiating antimicrobial therapy to prevent resistance and a culture is then obtained as outlined above and treated accordingly. Unfortunately, most signs and symptoms in CA-UTIs are nonspecific and place a burden on the clinician who wishes to be diligent about antimicrobial therapy. IDSA suggest a new algorithm for catheterized patients in long-term care facilities. Use of this method has resulted in no adverse events and has been shown to decrease the use of antimicrobial prescriptions (2009). Symptoms appropriate for obtaining culture and initiating antimicrobial therapy include new costovertebral tenderness, rigors or new onset of delirium (2009). If a patient develops hemodynamic instability as in a drop in blood pressure, a broad-spectrum antibiotic is also initiated then narrowed when culture data is available. The IDSA does not have a specific algorithm for hospitalized patients.

## 4. Other considerations for introduction or deletion into practice based on literature and research

The University of PENN Health System continually looks at ways to decrease the incidence of CA-UTIs. This section will describe other recommendations for future practice.

### 4.1 Catheter irrigation

Periodic irrigation is intended to prevent catheter obstruction and infection. Catheter encrustation occurs in 50% of long-term indwelling catheters and can lead to many

emergency room visits and frequent catheter changes (Getliffe, 2003). Encrustation is caused by infection of the urinary tract by *Proteus mirabilis* or other urease-producing bacteria (Smith, 2007). The activity of the urease-producing bacteria raises the pH >7, causing precipitation of calcium and magnesium phosphates that attach to biofilm on the catheter inner and outer surfaces. Studies have demonstrated that antibiotics or antiseptic solutions are ineffective at eradicating biofilms (Stickler, Hewitt, 1991). Current recommendations or management of the encrustation and blockage include inspecting and palpating the catheter for signs of encrustation, scheduling catheter changes based on blocking history, (i.e. usual time to blockage), increasing fluid intake, keeping extra catheter kits available (Smith, 2007). At PENN Presbyterian, routine irrigation is not performed on indwelling catheters unless indicated and there are signs and symptoms of blockage (i.e. bladder distention, obvious clots). If blockage is suspected, a bladder scan is performed and irrigation is done at the site of the aspiration port. Although, utilizing a bladder scanner is not entirely proven in research it helps guide clinicians identifying bladder volumes. At PENN Presbyterian, a hemostat is placed on the tubing distal to the port the port is cleaned with alcohol and syringe filled with sterile saline is instilled into the port. If blockage is significant the entire catheter is changed, and a larger catheter is chosen. If blockage is still occurring even after the change in catheter Urology is then consulted for further evaluation and need of a closed irrigation system is specifically addressed.

#### 4.2 Routine catheter change

Data is still insufficient to make recommendations as to whether routine catheter change in patients with long-term indwelling catheters reduces the risk of CA-UTIs. Catheters are often changed at routine intervals to prevent CA-UTIs but its practice is not evidenced-based (IDSA, 2009). At PENN Presbyterian, routine catheter change is not practiced nor recommended by the infection control committee.

#### 4.3 Bladder scanners

The use of bladder scanners has become standard at PENN Presbyterian. Bladder scanners are present on each nursing unit to help prevent unnecessary catheter insertion. Most recently in 2009, The Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality has initiated a statewide initiative to decrease the incidence of CA-UTI through the use of a "bladder bundle" (Saint, Olmsted, et al, 2009). As previously described, a bundle is a term developed by the IHI, as a way to describe a collection of interventions to effectively care for patients undergoing particular treatments with inherent risks (IHI, 2004). Their *Bladder Bundle* included 5 interventions, including bladder ultrasound to avoid unnecessary indwelling catheterization. The CDC considers using a portable ultrasound device to assess urine volume in patients undergoing intermittent catheterization to assess urine volume and reduce unnecessary catheter insertions (A-II, 2009). They also suggest that further research is needed on the use of a portable ultrasound device to evaluate for obstruction in patients with indwelling catheters and low urine output. (2009). The use of bladder scanners at PENN Presbyterian has specifically been utilized in those patients that have had invasive procedures done and that have not voided in 6-8 hours post procedure to assess for acute urinary retention has been instrumental in preventing unnecessary catheterization. It also has helped assess the need for reinsertion of indwelling catheters when they have been removed. What needs to be considered is the amount of urine present to prompt catheterization. Currently it is up to the prescriber to determine the amount of urine

which prompts the use of a catheter at PENN Presbyterian. At the Hospital of the University of Pennsylvania, staff utilizes an algorithm, which is depicted below in Table 6. It has assisted the nursing staff in the unnecessary use of indwelling catheters by utilizing the use of a portable bladder scanner. It is important that all staff is educated in the use of a bladder scanner to ensure its proper use.

4.4 Alternative to indwelling catheters

The CDC makes recommendations to consider the use of external catheters as an alternative to indwelling urethral catheters in cooperative male patients without urinary retention or bladder outlet obstruction (II, 2009). They also suggest intermittent catheterization in spinal cord injury patient and in patients with bladder emptying dysfunction instead of the use of suprapubic catheters (II, 2009). Further research is recommended regarding the risks and benefits of suprapubic catheters as an alternative to indwelling catheters in selected patients requiring short or long term catheterization, especially with respect to complications related to catheter insertion or the catheter site.

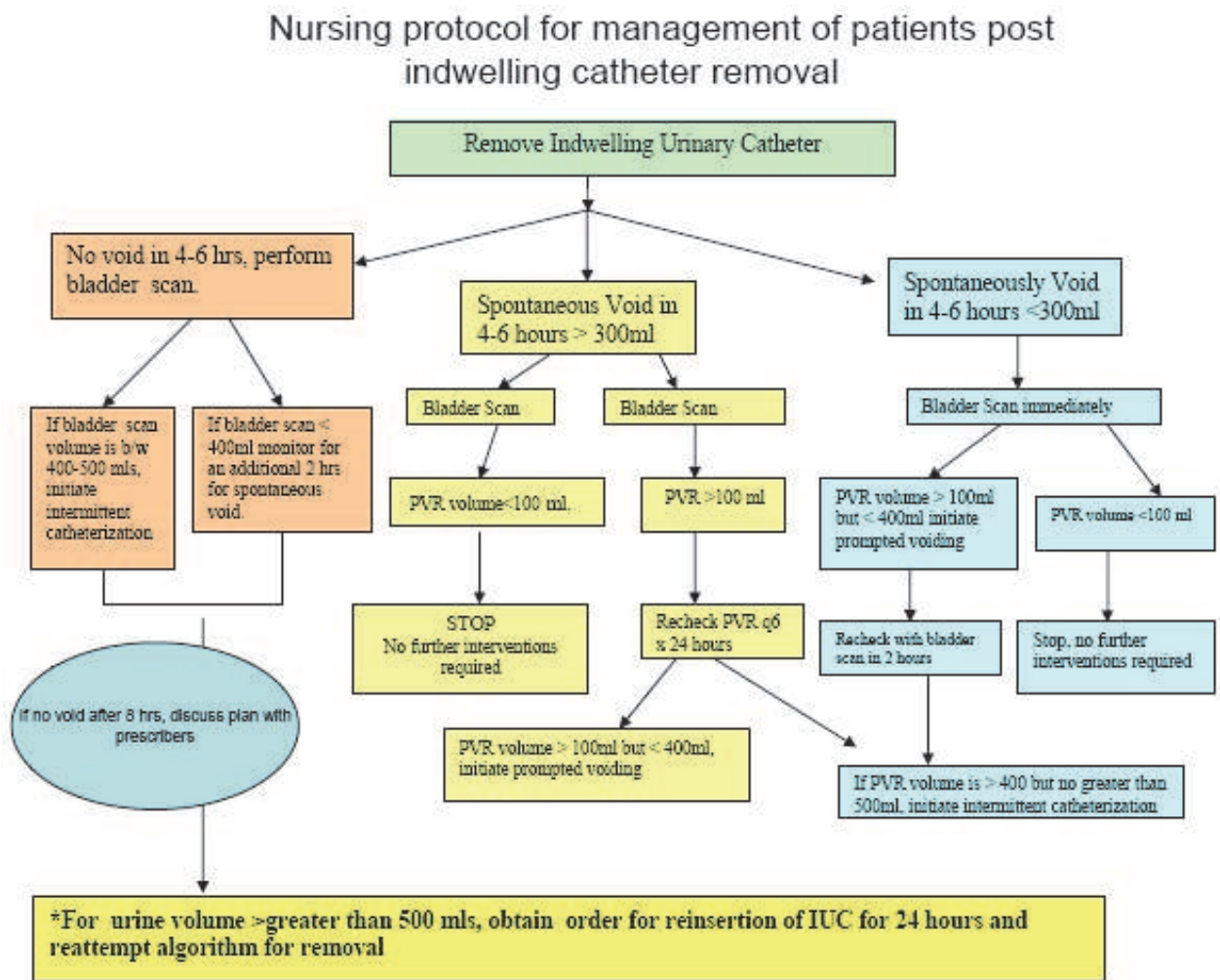


Table 6. Hospital of the University of Pennsylvania NURSING 4C-03-06 Nursing Practice Manual Clinical Practice Policy/Procedure Bladder Scanner. Patraca, K. (2005) Measure bladder volume without catheterization. Nursing 2005, 35 (4), 46-47. (PVR: post-void residual, IUC: Indwelling Urinary Catheter)

5. Conclusion

Although great strides in the prevention of CA-UTIs have been made, research still needs to be done to solve unanswered questions and problems surrounding CA-UTI. Specifically, around good practice and prevention, focusing on first, if a catheter is necessary, if so, then steps taken to continually assess the need for an indwelling catheter at least daily if not more often, the use of alternative approaches and adherence to good infection control practices, including proper hand hygiene. .

Urinary Tract Infection	FY05	FY06	FY07	FY08	FY09	FY10	FY11 Annualized YTD	FY11 YTD	FY11Q1	FY11Q2	Jan-11	Feb-11	Mar-11	FY11Q3
number														
HUP	716	758	717	709	381	236	500	250	48	49	6	13	9	28
PAH			150	161	63	30	80	40	9	5	4	1	1	6
PPMC			53.00	35.00	71	20	40	20	4	3	0.00	3.00		3
UPHS	716	758	920	905	515	286	620	310	61	57	10	17	10	37
denominator														
HUP	48,424	51,495	51,441	52,712	45,405	45,733	131,252	65,626	10909	11095	3,713	3,337	3,759	10809
PAH			24,160	23,848	22,249	21,339	60,908	30,454	5081	5022	1,871	1,566	1,687	5124
PPMC			5,396	5,262	10,548	11,803	29,028	14,514	2806	2644	870	937		1807
UPHS	48,424	51,495	80,997	81,822	78,202	78,875	221,188	110,594	18796	18761	6,454	5,840	5,446	17740
Urinary Tract Infection Rate	FY05	FY06	FY07	FY08	FY09	FY10	FY11 Annualized YTD	FY11 YTD	FY11Q1	FY11Q2	Jan-11	Feb-11	Mar-11	FY11Q3
HUP	14.79	14.72	13.94	13.45	8.39	5.16	3.81	3.81	4.40	4.42	1.62	3.90	2.39	2.59
PAH			6.21	6.75	2.83	1.41	1.31	1.31	1.77	1.00	2.14	0.64	0.59	1.17
PPMC			9.82	6.65	6.73	1.69	1.38	1.38	1.43	1.13	0.00	3.20		1.66
UPHS	14.79	14.72	11.36	11.06	6.59	3.63	2.80	2.80	3.25	3.04	1.55	2.91	1.84	2.09

Table 7. UPHS CAUTI rates from Fiscal Year 2005-2011.

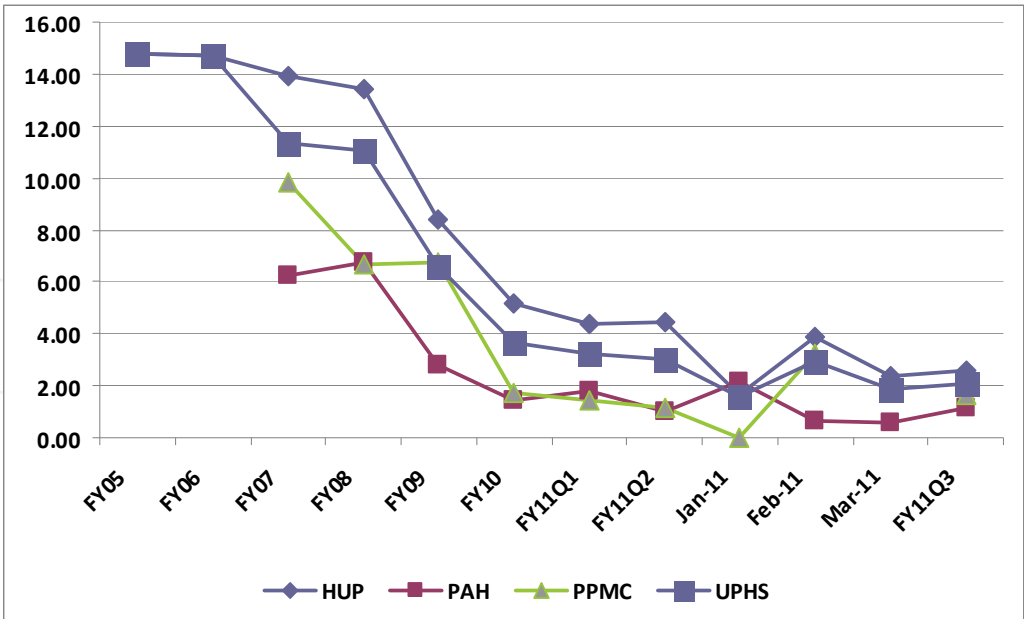


Table 7-7a. Reproduced with permission from the (UPHS) University of Pennsylvania Health System Infection Control Department 2011 (HUP): Hospital of the University of Pennsylvania, (PAH): Pennsylvania Hospital, (PPMC): Penn Presbyterian Medical Center. Rate per 1000 catheter days, (FY) Fiscal Year, (Q) Quarter



The focus also needs to be on continually reassessing gaps in care and re-educating staff as the need arises. Table 7 and 7a depicts the rates of CA-UTI since 2005 in all three University of Pennsylvania Health System hospitals. The rates of CA-UTIs started at about 6-15 infections in 1000 catheter days in 2005 and have been progressively going down over the past seven years to a rate of 0-2 infections in 1000 catheter days. Which demonstrates with hard work and perseverance rates can come down

## 6. Acknowledgment

I would like to thank Dr. Jack Ende and the PENN Presbyterian Department of Medicine for funding this text book chapter, my first. I would also like to thank Drs. Judy O'Donnell, Neil Fishman (Heads of Infectious Diseases at PENN Presbyterian and University of Pennsylvania respectively and Kevin Fosnocht at the time Chief Patient Safety Officer now Chief Medical Officer, for supporting my research and standing behind the CA-UTI policy when it was being developed and enforced. The infection control department especially, Georganne Ryan, for always having infection control data at hand and finally the CCU nursing staff, Julie Galen, nurse manager, for being participants in the research project from 2006-2007 when I asked them to be advocates even when they received push back from various services. Finally, my family, my husband Brian, my children Danny, Madeline, Gwen and Jacquelyn for standing behind me on all my projects. I am very proud of the work that was accomplished at PENN Presbyterian Medical Center and the University of Pennsylvania Health System.

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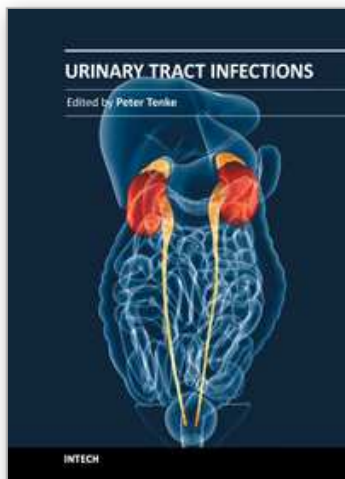


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## **Urinary Tract Infections**

Edited by Dr. Peter Tenke

ISBN 978-953-307-757-4

Hard cover, 360 pages

**Publisher** InTech

**Published online** 30, September, 2011

**Published in print edition** September, 2011

Urinary tract infections (UTIs) are among the most common bacterial infections worldwide, and they are also the leading cause of hospital-acquired infections. Therefore, the appropriate management of UTIs is a major medical and financial issue. This book covers different clinical manifestations of UTI, with special emphasis on some hard-to-treat diseases, and special conditions in respect of treatment; antibiotic resistance and the available alternative strategies for the prevention and treatment of UTIs and it deals with urinary tract infections in children. The aim of this book is to give a summary about the different aspects of the diagnosis, management and prevention of urinary tract infections for all medical disciplines.

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