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Effects of an Educational Intervention on Hospital Acquired Urinary Tract Infection Rates

Sharon Lanier Smith
University of North Florida

EFFECT OF AN EDUCATIONAL INTERVENTION ON HOSPITAL ACQUIRED URINARY TRACT INFECTION RATES

by

Sharon Lanier Smith

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CERTIFICATE OF APPROVAL

This project of Sharon Lanier Smith is approved: DATE

Signature Deleted

William H. Hepler, MSH, Committee Member 7/23/09

Signature Deleted

W. Patrick Monaghan, PhD, Committee Member

Signature Deleted

Kathaleen C. Bloom, PhD, Committee Chairperson 7/23/09

Accepted for the Department:

Signature Deleted

Lillia M. Loriz, PhD, Director, School of Nursing 7-23-09

Accepted for the College:

Signature Deleted

Pamela A. Chally, PhD, Dean, Brooks College of Health 7-31-09

Accepted for the University:

Signature Deleted

David E. W. Fenner, PhD, Dean of the Graduate School 8.5.09

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Abstract

In today's hospital environment, good care has become synonymous with positive patient outcomes. Marring this landscape is the alarming rate of hospital acquired (nosocomial) infections. Urinary tract infection (UTI) is one of the most common hospital acquired infections. The major cause associated with these infections is the use of indwelling urinary catheters. Bacteria invade the lower urinary tract by ascending through or around the catheter. Morbidity associated with urinary catheter-associated UTI can be minimized by prudent decisions concerning catheter usage and good catheter care. The principle route of dispersal of nosocomial infections is likely from patient-to-patient via transiently contaminated hands of hospital personnel. The purpose of this evidence-based project was to determine if hospital-acquired catheter-associated urinary tract infection rates among patients admitted to an acute care facility could be decreased through staff education and consistent application of nursing care using selected perineal infection control interventions.

The setting was a 43-bed medical/surgical floor in a 321 bed not for profit Magnet hospital in Northeast Florida. Twenty-four registered nurses and 18 patient care technicians completed targeted in-service education on general nosocomial infections, perineal care, and hand hygiene. A catheter dwell time notification system was also implemented. Chart review data was obtained from 383 admissions (197 pre-intervention, 133 after the educational intervention, and 53 after the dwell time notification). There was a significant difference in catheter-associated urinary tract infection rates after the interventions (11.17 pre-intervention, 10.53 after the educational intervention and 0.392

after the dwell time notification). A longer length of time in practice an on this hospital unit was associated with lower infection rates.

Chapter One: Introduction

The impact of hospital acquired infections (HAI) can have grave consequences for patients, their families, and hospitals. Now, more than ever, hospitals must look at reducing or controlling the spread of HAIs caused by antibiotic resistant pathogens. To date, the health care industry has done a poor job of managing this problem. Nosocomial infections acquired in a hospital reflect a multifaceted problem and require a multifaceted approach to solve. Urinary tract infections rank among the highest of the hospital acquired infections.

The American Medical Association describes antibiotic resistant pathogens as new, remerging or having developed drug resistance within the past two decades (as cited in Standiford & Aziz, 2005). Examples of pathogens (bacterium) which have become resistant include *Staphylococcus aureus (S. aureus)*, spectrum ß-lactamase-producing *Escheria coli (E. coli)* and *Enterococci*. The methicillin resistant *Staphylococcus aureus* (MRSA) has developed because of repeated exposure to the penicillin-class antibiotics such as ampicillin, oxycillin and methicillin (Standiford & Aziz, 2005). Each of these can play an active role in nosocomial urinary tract infections.

Solberg (2000) stated that there are only two sources of *Staphylococcus aureus* in hospitals, septic lesions, and carriage sites of patients and personnel. Carriage is the condition of harboring a pathogen within the body (e.g. nares). Carriage sites play a pivotal role in any approach taken to reduce the problem of hospital acquired nosocomial

infections. Nursing did not create the resistance to antibiotics; but research demonstrates they can and have been one of the facilitators in the spread of these resistant organisms (Boyce & Pittet, 2002; Hedderwick, McNeil, Lyons, & Kaufman, 2000; McGinley, Larson, & Leyden, 1988).

HAIs have been defined by the Centers for Disease Control (CDC, 2005) as infections that patients acquire during the course of receiving treatment for other conditions in a healthcare setting. They are not isolated just to the United States; but are a particular healthcare concern worldwide. The number of documented hospital acquired infections, including private and governmental, is estimated to be 1.7 to 2 million infections annually (Klevens et al., 2007; Lode, 2005) and these infections are the eighth leading cause of death in U.S. hospitals (Wenzel & Edmond, 2001, p 174). Borchert et al. (2008) associated a cost estimate of $1.6 billion to annual health care costs related to HAIs.

The principle route of dispersal in hospitals is most likely from patient-to-patient via transiently contaminated hands of hospital personnel who have acquired the microorganisms by direct patient contact or by handling contaminated materials. This method of transmittal will hold the key to the approaches used to decrease hospital acquired infections on the target unit.

As of 2008, hospitals are no longer reimbursed for costs associated with nosocomial infections because of changing economic conservatism stemming from reform within the Center for Medicare and Medicaid Services (2006). In the Deficit Reduction Act of 2005, Section 5001(c) of Pub. L. 209-171 payment for conditions that could reasonably have been prevented through the application of evidence-based

guidelines is denied reimbursement (Department of Health and Human Services, 2007). Hospital acquired infections fall within that definition. Therefore, reducing HAIs will be not only a patient safety issue, but also a cost containment issue. It is vital that an application of evidence based practices be used to decrease HAIs.

Purpose

The purpose of this evidence-based project was to determine if hospital-acquired catheter-associated urinary tract infection (HA-UTI) rates among patients admitted to an acute care facility can be improved through staff education and consistent application of nursing care using selected perineal infection control interventions. The specific unit was a 43-bed medical surgical unit in a 321 bed acute care hospital in northeast Florida serving gastrointestinal, respiratory and general medical patients. This unit ranked as the second highest in HA-UTI within the hospital, behind the intensive care units. The staff education and evaluation was based on an extensive review of the scientific literature that culminated in the development of a practice change on the target nursing unit.

Definition of Terms

Hospital-acquired infection (HAI). HAIs are infections that occur after 48 hours of admission or within 30 days after discharge.

Urinary tract infection (UTI). A UTI is a condition where one or more structures in the urinary tract become infected.

Nosocomial urinary tract infection. . A nosocomial urinary tract infection is an infection which is the result of treatment in a hospital or a healthcare service unit, but secondary to the patient's original condition.

Catheter-associated urinary tract infection (CA-UTI). This is a urinary tract infection caused by the introduction of a catheter(s), or tubes, placed in the urethra and bladder.

Chapter Two: Review of Literature

This chapter begins with a discussion of the prevalence and etiology of hospital-acquired infections, specifically catheter-associated urinary tract infections (CA-UTI). This is followed by a description of diagnostic measures for CA-UTI, accompanied by a discussion of the morbidity and mortality associated with CA-UTI and a discussion of current treatments. Finally a synthesis of the evidence regarding infection control measures and educational interventions is presented.

Hospital-acquired Nosocomial Infections

Hospital-acquired infections (HAIs) are infections diagnosed while the patient is hospitalized that were neither present nor incubating at the time of hospital admission. Infections are considered to be hospital acquired if they first appear 48 hours or more after hospital admission or within 30 days after discharge (Wenzel, 2001). Hospital-acquired infections are usually related to a procedure or treatment used to diagnose or treat the patient's initial illness or injury.

Hospital acquired infections are estimated to occur in 5% of all acute-care hospitalizations; the incidence rate is 5 infections per 1,000 patient-days (Wenzel & Edmond, 2001). Based on the 35 million patients admitted to 7,000 acute-care institutions in the United States, the incidence of HAIs is more than 1.7 million cases per year (Klevens, et al., 2007).

Risk Factors

The main risk factors for HAI are poor health condition, old age, compromised immune system, length of hospital stay and invasive procedures for diagnosis or therapy (Wenzel, 2001). The risk factors for catheter associated urinary tract infections (CA-UTI) include longer device dwell time with independent risk factors: gender, immunity, acute/elective admission, selective decontamination of the digestive tract, and systemic antibiotics at admission, dependent upon the infection type (Vanderkooi et al., 2007). Rao, Michalczyk, Nayeem, Walker, & Wigmore (2007) examined the prevalence and frequency of risk factors for MRSA colonization in emergency admission. The study of 6469 patients found that advanced age, increasing frequency of hospital admission, admission from a skilled nursing facility and previous MRSA colonization to be factors associated with MRSA.

Types of Infections

Hospital acquired infections are caused by viral, bacterial, and fungal pathogens. Urinary tract infections can occur when organisms, usually bacteria from the digestive tract, cling to the opening of the urethra and spread upward to the bladder. A common source of infection is catheters, or tubes, placed in the urethra and bladder. Bourzas, San Juan, Munoz, Voss, and Kluytmans (2001) found the six most commonly isolated micro-organisms in urinary tract infections were, in decreasing order: *Escherichia coli* (35.6%), *Enterococci* (15.8%), *Candida* (9.4%), *Klebsiella* (8.3%), *Proteus* (7.9%) and *Pseudomonas aeruginosa* (6.9%).

S. aureus can cause a range of diseases in man, including CA-UTI. The organism readily acquires resistance to antibiotics (Khatib et al., 2006). Antibiotic resistance results

from gene action resulting in one of three manifestations: spontaneous DNA mutation, transformation, and plasmid exchange (Lewis, 1995). The mortality rate for patients with MRSA infection is 2 to 2.5 times higher than for patients with *S. aureus* infections that are susceptible to methicillin (Huletsky et al., 2005).

The high carriage rates of *S. aureus* are important because bacteria colonizing the nares or other areas may be transferred or spread from patient to healthcare worker, patient to patient, or healthcare worker to patient (Henderson, 2006). The primary route of transmission within the hospital setting appears to be from patient to patient, carried on the hands of hospital personnel (Devine, Cooke, & Wright, 2001). *Staphylococcus aureus* and strains of *MRSA* can also exist on objects in the environment causing fomite transmission by health care workers. Huang, Metha, Weed and Savor-Price (2006) found that MRSA survived for 11 days on a plastic patient chart, more than 12 days on a laminated tabletop, and nine days on a cloth curtain.

Factors known to decrease acquisition and transmission of these pathogens include appropriate antibiotic use. Overuse of antibiotics was partly driven by patients' pressure on doctors to prescribe them for conditions that didn't warrant their use. This led to a growing problem of antibiotic-resistant infections. Henderson (2006) describes that over time bacteria naturally mutate. Bacterial replication and mutation depend on a number of factors including environmental conditions that are influenced by antibiotic use. Antibiotic use encourages conditions which optimizes those bacteria with resistance giving them a competitive advantage. Other measures include early identification of carriers, proper hand hygiene, isolation of infected or colonized patients, and disinfection of equipment on which fomites transmission could occur (Henderson, 2006).

General Infection Control Measures

There are several infection control measures known to be helpful in preventing or controlling infection in a hospital setting. These include hand washing, contact isolation and environmental control.

Hand washing. Semmelwiss proved the importance of hand washing in the prevention of nosocomial wound infections (Best & Newhauser, 2004). Nightingale also kept meticulous surveillance data on infection and intervention. Since that time hand hygiene guidelines have been developed which underline the medical rationale for the practice that most nosocomial transmission occurs patient to patient via the hands of healthcare workers. However, hand washing practices are persistently suboptimal among healthcare professionals who are stubbornly resistant to change (Larson, Early, Cloonan, Sugrue, & Parides, 2000; Pittet et al., 2000). Adherence to hand hygiene recommendations rarely exceeds fifty percent in acute care institutions with physicians the worst offenders (Henderson, 2006). Studies have consistently demonstrated that nurses adhere to hand hygiene guidelines much more frequently than do physicians, but still far less frequently than warranted (Albert & Condie, 1981; Henderson, 2006; Meengs, Giles, Chisholm, Cordell, & Nelson, 1994; Pittet, Mourouga, & Perneger, 1999).

The 2002 CDC guideline for hand hygiene in health care settings gives a historical date for the concept of cleansing hands with an antiseptic agent as the early 19th century. The most explicit and high-profile support that Nightingale gave to the germ theory was in a chapter written in the late 1870s for *Quain's Medical Dictionary,* first published in 1882 (Small, 1998). Nightingale urged the use of antiseptic precautions (the use of chemicals against germs). Common failure of health care workers to properly

cleanse their hands or failure to clean at all improves the chance of transmittal of pathogens. The work of Ehrenkranz and Alfonso (1991) demonstrated that hand washing using bland hand soap was generally ineffective in preventing hand transfer of gram-negative bacteria while the use of an alcohol hand rinse was effective. Most of the hands washing products in current use have some kind of bacteriostatic agent added.

Contact isolation. Contact isolation, recommended by the CDC for the prevention of serious infections such as *MRSA* (Siegel, Rhinehart, Jackson, & Chiarello, 2007), and may decrease transmission by as much as 16-fold (Jernigan et al. 1996). Mangini et al. (2007) evaluated the impact of contact and droplet precautions in reducing rates, noting decrease from 10.0 to 4.3 cases per 1,000 patient days (95% CI, 0.17-0.97; p=.03).

Environmental control. There has been concern that the environment may play a role in the transmission of antimicrobial resistant pathogens between patients. Few outbreak investigations have implicated the environment in transmission of *S. aureus*, but most investigations have not focused on fomite transmission, concentrating instead on identifying pathogens on inanimate objects (Dietz, Raht, Wendt, & Martiny, 2001; Hayden et al., 2006; Smith, Iwen, Olson, & Rupp, 1996; Wendt, Wisenthal, Dietz, & Ruden, 1998). Muto et al. (2003) analyzed studies where, for example, *Entercocci* were inoculated onto environmental surfaces and procedures to prevent contamination of health care worker hands, apparel, and equipment. A significant reduction in rates of colonization and infection was seen.

Prevention of Nosocomial Urinary Tract Infections

Approximately 96 million urethral catheters are sold worldwide with almost 25% sold in the United States (Saint, Veenstra, Sullivan, & Fendrick, 2000). The daily rate of bacteriuria in catheterized patients ranges from 3 to 10%, (Dalen, Zvonar, & Jessamine, 2005) with the incidence directly related to the duration of catheter dwell time (Apisarnthanarek et al., 2007; Nicolle, 2005; Tenke et al., 2007). Approximately 26% of patients who have indwelling catheters for 2 to 10 days will develop bacteriuria (Saint et al., 2000) and 24-25% of those who develop bacteriuria will have symptoms of urinary tract infection such as suprapubic or flank pain (Saint et al., 2000; Tambyah & Maki, 2000). The effect of catheter-associated bacteriuria on mortality is unclear (Johnson, Kuskowski, & Wilt, 2006).

Definition of Urinary Tract Infection

A UTI is a condition where one or more structures in the urinary tract become infected. The CDC (2004) estimates that almost 8.3 million medical visits for urinary tract infections (UTI) occur annually in the United States. According to Garner et al. (1996) a symptomatic urinary tract infection must meet at least one of the following criteria:

1. Patient has at least one of the following signs or symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness and patient has a positive urine culture that is $>10^5$ microorganisms per cm^3.
2. Patient has at least two of the following signs or symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness and at least one of the following:
3. Pyuria (urine specimen with >10 wbc/mm^3)
4. Organisms seen on gram stain of un-spun urine
5. Physician diagnosis of a UTI
6. Physician institutes appropriate therapy for a UTI (p. A-3)

Epidemiology of Nosocomial Urinary Tract Infection

The foremost risk factor for acquisition of a hospital acquired urinary tract infection is catherization (Bourzas, San Juan, Munoz, Voss, & Kluytmans, 2001; Javaloyas, Garcia-Somoza, & Gudiol, 2002). The risk of acquiring a urinary tract infection depends on the method and duration of catherization, the quality of the catheter care, and host susceptibility (Apisarnthanarek et al., 2007; Nicolle, 2005; Tenke et al., 2007).

The urinary catheter is a common medical fact of life. It is a valuable instrument when used properly. The method and duration of catherization is dependent on the reason the catheter is placed. Catheters may be used in many situations, including: (a) to relieve urinary tract obstruction (e.g. benign prostatic hypertrophy); (b) to permit urinary drainage in patients with neurogenic bladder dysfunction/urinary retention (e.g. spinal cord injury); (c) as an aid to urologic surgery (e.g. transurethral resection of the prostate); or (d) to accurately measure urinary output in critically ill patients (e.g. congestive heart failure) (Cravens & Zwieg, 2000; Smith, 2003). The mechanisms for urinary infections usually arise from the patient's own organisms being transferred from the colonized area (urethra) to the sterile area (bladder) by hospital procedures (Litwin & Saigal, 2005).

Practice Guidelines

Guidelines for preventing catheter-associated UTIs have been developed, both in the United States, Great Britain, Europe and Asia. These guidelines have come from the CDC in the United States and from the Department of Health in England.

United States. The CDC published the Guideline for Prevention of Catheter-associated Urinary Tract Infections in 1981 (Wong & Hooton, 1981). The guideline has

not been updated since that time. The CDC guideline lists two methods to reduce the incidence of catheter-associated infection. The first is preventing the microorganisms at the meatus from entering the bladder by aseptic catheter insertion, daily meatal cleansing and daily application of antimicrobial solutions. The second method is eradicating micro-organisms that gain entry into the urinary tract before they can proliferate through irrigation of the bladder and use of prophylactic systemic antibiotics. The CDC guidelines suggest the following nursing strategies to reduce catheter-associated UTIs:

1. Correct technique aseptic insertion and maintenance.
2. Periodic in-service training stressing the correct techniques and possible complications of urinary catherization.
3. Catheters should only be inserted when necessary and left in place only for as long as necessary.
4. Hand washing should be done immediately before and after any manipulation of the catheter site apparatus.
5. Catheter size should be as small as possible consistent with good drainage.
6. Catheters should be properly secured after insertion to prevent movement and urethral traction.
7. Closed drainage system should be used and maintained. No disconnection unless irrigation is needed.
8. Urinary samples should be obtained from the distal sampling port.
9. Unobstructed flow should be maintained. No kinking and collection bag emptied regularly.
10. Meatal care twice daily using providone-iodine solution and daily cleansing with soap and water. (Wong & Hooton, 1981)

Kunin (2001) questions the lack of research related to catheter-associated UTI. A systematic review of nursing interventions advocated in the CDC guideline found that the methods used to identify research upon which the interventions were based were not specified (Gray & Center for Clinical Investigation, 2004).

The Association for Professionalism in Infection Control (APIC) does not have a position statement on urinary catheters in the hospital setting. APIC's guideline addresses infection in long-term care facilities, including a section on urinary interventions with

recommendations consistent with the CDC guidelines (Smith & Rusnak, 1997). The Infectious Disease Society of America (IDSA) has plans to publish Catheter-associated Urinary Tract Infections guidelines in late 2009 ("Standards, Practice," n.d.).

England. The Evidence-based Practice in Infection Control (EPIC) project comprises long-term government commissioned research projects focused on contributing to the development of the evidence base which underpins the practice of infection prevention and control in the National Health Service in England. The EPIC project developed national evidence-based guidelines for preventing hospital-acquired infections associated with the use of short-term indwelling urethral catheters in acute care in 2001 (Pratt et al., 2001). These were updated in 2007. The EPIC guidelines suggest the following nursing strategies to reduce catheter-associated UTIs:

1. Assessing the need for catherization.
2. Selection of catheter type and system.
3. Catheter insertion.
4. Catheter maintenance
5. Catheter removal
6. Education of patients, relatives and healthcare workers. (Pratt, et al., 2001 p. 56)

Europe and Asia. The European and Asian guidelines were developed through extensive meta analysis of the literature regarding development, therapy and prevention of UTIs (Tenke, et al. 2007) and provide guidance for all medical disciplines, with special emphasis on urology where catheter care is an important issue. The guidelines address methods of catherization, risk of UTI, alternative methods of urine drainage, prevention of bacteriuria, treatment and prevention of cross infection.

The recommendations can be summarized as:

1. Two clinical priorities: catheter system should remain closed and the duration of catherization is minimal and not changed at arbitrary fixed intervals.
2. Catheters should be inserted using aseptic technique and sterile equipment.

3. For selected patients, other methods of urinary drainage such as condom catheter drainage, suprapubic catheterization, and intermittent urethral catheterization can be useful alternatives to indwelling urethral catheterization

Evidence-based Nursing Interventions

The guidelines and the evidence encompass six areas: (a) the need for catheterization, (b) type of catheter, (c) catheter insertion, (d) catheter maintenance and dwell time, (e) catheter removal, and (f) education of patients, families and health care workers.

Need for catheterization. The CDC guideline (Wong & Hooton, 1981) highlights the importance of limiting the use of urinary catheters to carefully selected patients thus reducing population risk. The guideline indicates that urinary catheterization should be used to relieve urinary tract obstruction; to provide urinary drainage for patients with neurogenic bladder dysfunction and urinary retention; to aid in urologic surgery or other surgery on contiguous structures; or to obtain accurate measurements of urinary output in critically ill patients. Similarly, the EPIC2 guidelines address the issue of selected usage of urinary catherization and highlight avoidance when possible (Pratt et al., 2007).

Type of catheter. Silver coated catheters are advocated in the EPIC guidelines because of the evidence that show reduction in infection rates. This was not addressed in the earlier CDC guideline, however, Schumm and Lam (2008) conducted a Cochrane Review examining the evidence with respect to the types of urethral catheters for management of short-term voiding problems in hospitalized patients. They concluded that the use of silver alloy indwelling catheters reduce the risk of CA-UTI. They cautioned that further economic evaluation was required to confirm that the reduction of infection compensated for the increased cost of silver alloy catheters.

Silver alloy–coated catheters have been shown by meta-analysis to be significantly more effective in preventing bacteriuria, the predecessor of urinary tract infections (Chaiban, Hann, Dvorak, & Raad, 2000; Cho et al., 2003; Gentry & Cope, 2005; Johnson, Kuskowski, & Wilt, 2006; Karchmer, Giannetta, Muto, Strain, & Farr, 2000; Lai, 2002; Madeo et al., 2005; Newton, Still, & Law, 2002; Niel-Weise, Arend & Van Den Broek, 2002; Rupp et al., 2004; Saint, Elmore, & Sullivan, 1998; Schumm & Lam, 2008; Thibon, LeCoutour, Leroyer, & Fabry (2000). Drekonja, Kuskowski, Wilt and Johnson (2008) conducted a systematic review to summarize and evaluate existing evidence, and to address areas of uncertainty. They found consistent but variable evidence that antimicrobial-coated catheters prevent catheter-associated bacteriuria/funguria during short-term catheterization; however, no study demonstrated a clinical benefit.

Catheter insertion. The CDC guideline (Wong & Hooton, 1981) stresses that catheters should be inserted using aseptic technique and sterile equipment. In a systematic review the use of aseptic technique was not shown to reduce CA-UTI (Dunn, Pretty, Reid & Evans, 2000). However, the EPIC guidelines concluded that urinary catheters must be inserted aseptically, after reviewing principles of good practice, clinical guidance (Ward, Taylor, Cookson & Glynn, 1997; Wong & Hooton, 1981) and expert opinion (Dieckhaus & Garibaldi, 1998; Kunin, 1997; Stamm, 1991, 1998), together with findings from systematic reviews (Pratt et al., 2001).

Only one dated randomized control trial focused on the influence of sterile versus clean technique for catheter insertion (Carpeti, Andrews, & Bentley, 1996). This study found no statistical difference between the two groups with respect to the incidence of

CA-UTI. There was a considerable cost difference between the two groups, the 'sterile' method being over twice as expensive as the 'clean' method. The investigators concluded that strict sterility was not necessary in preoperative short-term urethral catheterization and is more expensive and time consuming. However, this conclusion was based on one study of 156 patients.

Catheter maintenance and dwell time. The CDC guideline addresses adherence to the sterile continuously closed system of urinary drainage as the cornerstone of infection control, stressing that irrigation should be avoided unless there is a need to prevent or relieve obstruction (Wong & Hooton, 1981). The EPIC guidelines concur, stating that maintaining a sterile, continuously closed urinary drainage system is central to the prevention of CA-UTI (Pratt et al. 2001).. The use of a closed urinary drain system has been shown to be effective in multiple randomized control trials (Burke & Riley, 1996; Gardam, Amihod, & Orenstein, Consolacion & Miller, 1998; Kunin, 1997; Neil-Weise & van den Broeck, 2005; Saint, 2000; Stamm, 1991; Van den Eijkel & Griffiths, 2006; Warren, 1997).

The CDC guidelines (Wong & Hooton, 1981) stress the need to avoid meatal care using providone-iodine. The EPIC guidelines, based on expert opinion (Dieckhaus & Garibaldi, 1998; Kunin, 1997; Wong & Hooton, 1981) and one systematic review (Saint & Lipskey, 1999) recommend against vigorous meatal cleansing, stating it is not necessary, may increase the risk of infection, and that daily routine bathing or showering is all that is needed to maintain meatal hygiene (Pratt et al., 2001, 2007).

In three early studies that investigated meatal care strategies to prevent bacteriuria, little or no benefit was found in using anything other than standard personal

hygiene in caring for patients who have indwelling catheters (Burke et al., 1981; Burke, Jacobson, Garibaldi, Conti, & Alling, 1983; Classen, Larsen, Burke, Alling, & Stevens, 1991). Nicolle's 2005 literature review concluded that flushing catheters and daily perineal care do not prevent infection and may, in fact, increase the risk of infection.

Only one study examined different types of catheters in terms of infection rates (Lopez-Lopez, Pascual, Martinez-Martinez, & Perea, 1991). Examining the biofilm production rates and adherence to urinary catheters of *P. aeruginosa* and *E. coli* in vitro, the researchers determined that substances in the latex urinary catheter were toxic for *E. coli.*

Although the CDC guidelines do not recommend routine "changing out" of catheters (Wong & Hooton, 1981), there is a direct relationship between dwell time and incidence of infection (Crouset et al., 2007; Griffiths & Fernandez, 2007; Phipps et al., 2006; Saint, 2000). Matlow, Wray and Cox (2003) used a retrospective, descriptive observational study followed by point prevalence audits to measure duration of urinary tract catherization finding urinary tract catherization of at least 3 days associated with increased risk of urinary tract infection. Current evidence suggests that early removal is key to prevention of UTI (Apisarnthanarek et al., 2007; Nicolle, 2005; Saint, 2000; Tenke, et al., 2007). Early removal is also associated with shorter hospital stays (Griffiths & Fernandez, 2007; Schumm & Lam, 2008).

Catheter removal. Neither the CDC nor the EPIC guidelines discuss catheter removal. Griffiths and Fernandez (2007) reviewed 26 trials involving a total of 2933 participants to determine best strategies for removal of catheters. There was suggestive but inconclusive evidence of a benefit for midnight removal of indwelling catheters in

terms of the need for re-catherization or the time to first void. They found but little evidence of the effectiveness of catheter clamping to stimulate bladder filling. Schumm and Lam (2008) also found evidence suggesting that midnight removal was effective.

Education. The CDC guideline moderately recommends hospital personnel and others who take care of catheters should be given periodic in-service training stressing the correct techniques and potential complications of urinary catheterization (Wong & Hooton, 1981). The EPIC guideline stresses the importance of education of patients, families, caregivers and healthcare workers to include the signs and symptoms of UTI and how to obtain expert help. Healthcare workers must be confident and proficient in procedures associated with prevention of CA-UTI (Pratt et al., 2001, 2007). Neither guideline lists any citations to support these proposals.

Educational Strategies for Healthcare Providers

Education of healthcare providers can be one of the keys to the reduction of nosocomial UTIs. The focus of this initiative is education of nurses and nursing ancillary staff with the intent to impact physician notification of catheter dwell-time, assessment and documentation of catheter-associated issues by nurses and catheter care delivery by ancillary staff. Educational methods must be evaluated for optimal implementation of the planned interventions. Optimal methods must be chosen which significantly increase the chance of compliance and total teaching effectiveness.

Teaching Effectiveness

Teaching effectiveness is important because the evidence produced will be used for major decisions within the hospital environment. Formative decisions require the use of evidence to improve and shape the quality of teaching. The sources of evidence of

teaching effectiveness can be measured by student rating and learning outcome measures. Berk (2005) stated that student ratings provide an excellent source of evidence for formative decisions. The next step is to determine what educational methods will enhance learning outcomes.

Several recent studies have examined educational issues (Kretzer & Larson, 1998; Larson, et al., 2000; Pittet, Mourouga & Perneger, 1999; Suchitra & Lakshmi-Devi, 2007, Warren, Zack, Cox, Cohen & Fraser, 2004). The overall theme in these studies is that education has a positive impact on retention of knowledge, attitudes, and practices in all staff categories. Suchitra & Devi (2007), however, found that compliance declined over time. This would tend to support the contention that routine continuing education could be advantageous.

General Educational Principles

Intervention research commonly estimates an impact of a particular intervention over a specified follow-up time period to identify average differences between intervention and control groups (Lennon, McAllister, Kuang & Herman, 2005). Strategies that are individualized to meet the specific needs of a particular student, such as, the appropriateness to difficulty, the learning process, student motivation, and teaching methods are important. Strategies should focus on curriculum and instruction, task and environment, and the student. Time ensures that skills, norms, expectations, and behaviors learned earlier are reinforced. The individualized nature of the approach is based on the belief that success of an intervention cannot be predicted based on student characteristics, and no single intervention will be successful for all students (Fuchs, 2003; Fuchs & Fuchs, 2006). There is no standardized method for assessing student

responsiveness to intervention. Measurement may be based on performance at the end of the intervention, growth over the course of the intervention, or both (Fuchs, 2003).

The most important principle of behavioral learning is that such learning needs to be tied to immediate consequences (Redman, 2001). Grimshaw, Eccles and Tetroe (2004) concluded from their systematic review that decision makers must choose ways to implement research findings into routine practice with an imperfect evidence base which relies on their judgment about how best to implement interventions for clinical effectiveness. East and Jacoby (2005) conclude that many studies support the use of education programs; few assess observable, measurable practice changes made by staff as a result of the program. Hart (2007) studied hand washing and concluded its effectiveness to reduce the risk of infection as only a single mean and must be used in conjunction with education.

An analysis of lack of effect based on participants must concentrate on the learning experiences planned. Dreger and Trembach (2002) stress the importance of adapting teaching techniques to patients'/workers' special needs and recognizing limited literacy skills. U.S. Bureau of Labor Statistics findings highlight that over 57 million adults over sixteen and not in school have less than a high school education. Adkins and Ozanne (2005) determined that almost half of all consumers read below a sixth grade level.

In teaching the application of effective reinforcement, a well-defined behavior change as applied to clinical competence must be encouraged (Brenner, 1982). In implementing any of the listed steps to prevent the spread of nosocomial infection, education will play a pivotal role in the success of teaching strategies and evaluating the

effectiveness in reducing nosocomial infection rates within the target floor (Chang et al., 2002). Ambiguity of tasks could lead to faulty conclusions concerning how physicians, nurses and ancillary staff have learned. Evidence must come from established interventions or standards which adequately address past successful performance.

The role of educational research can help establish teaching goals and define methods, give insight in how to best attain them, and more importantly the ability to evaluate their effectiveness. The educational interventions should help fulfill the missing element found within the evidence and highlight and evaluate the importance of the educational impact on this unit's nosocomial infection problem.

Evidence-based Educational Strategies

Warren et al. (2003) determined that educational programs may lead to substantial decrease in medical-care cost and patient morbidity when implemented as part of mandatory training. Satterlee, Eggers and Grimes (2008) examined the evidence from several Cochrane reviews to determine what educational methods had the greatest impact on learning. They stressed that the most effective educational methods were the most interactive. The following strategies were identified: (a) continuing education meetings and workshops; (b) local opinion leaders; (c) audit and feedback; (d) teaching critical appraisal skills; (e) tailored interventions to overcome barriers. In order to have an impact on care delivery, learning experiences must lead to voluntary behavior modification. Satterlee et al. (2008) also found that education was more effective when more than one intervention occurred, especially if these interventions occurred over an extended period. "Targeted education should focus on changing a behavior that is simple, because effect

size, is inversely proportional to the complexity of the behavior" (Satterlee et al., 2008, p. 329).

Continuing education meetings and workshops. Interactivity appears to be a key component of successful continuing education. Davis et al. (1999) concluded that interactive sessions that enhance participant activity and provide the opportunity to practice skills can effect change in professional practice. Thomson-O'Brien et al. (2001) reviewed 32 studies of the effect of continuing education on changes in practice behavior and found that interactive workshops led to a significant improvement in at least one clinical practice parameter. Satterlee et al. (2008), in their analysis of Cochrane systematic reviews, found that an overall educational benefit was correlated to the interactivity of the learner and that traditional didactic presentations were ineffective in changing professional behavior.

Local opinion leaders. Satterlee et al. (2008) coined the phrase "local opinion leader" as a professional nominated by peers as being educationally influential. They found that evidence concerning the effectiveness of opinion leaders is limited and mixed. O'Brien, Freemantle and Oxman (2001) analyzed eight RCTs which examined the impact of such leaders on practices ranging from cancer pain to urethral catherization technique. This Cochrane review found that interactive educational workshops can result in moderately large changes in professional practice.

Oxman Thomson, Davis and Haynes (1995) found there are no "magic bullets" for improving the quality of health care, but more complex interventions, such as the use of outreach visits or local opinion leaders ranged from ineffective to highly effective but were most often moderately effective resulting in reductions of 20% to 50% in the

incidence of inappropriate performance. If local opinion leaders are used appropriately this could lead to important improvements in professional practice and patient outcomes.

Audit and feedback. Oxman et al., (1995) defined audit and feedback as any summary of performance of health care over a specified period, with or without recommendations for action. Audit and feedback has been studied more than other interventions (Satterlee et al., 2008) with two Cochrane reviews devoted to the subject (Jamtvedt, Young, Kristoffersen, O'Brien, & Oxman, 2006; O'Brien, Freemantle & Oxman, 2001). These reviews found the relative effectiveness of audit and feedback is likely to be greater when baseline adherence to recommended practice is low and when feedback is delivered more intensely.

Teaching critical appraisal skills. Satterlee et al., (2008) concluded that critical appraisal skills are a prerequisite to the practice of evidence-based medicine but caution whether these skills translate into better practice. Only one relevant randomized controlled trial of teaching critical appraisal met the inclusion criteria (Parks, Hyde, Deeks, & Milne, 2001). This trial found evidence that teaching critical appraisal techniques has positive effects on participants' knowledge. The validity of drawing general conclusions about the effects of teaching critical appraisal based on one trial is debatable.

Tailored interventions to overcome barriers. The most commonly used approach to tailoring could be termed "behavioral construct tailoring" (Kreuter, Oswald, Bull & Clark, 2000). This approach has been used in all previously published research. Using behavioral construct tailoring, programs draw almost exclusively upon constructs from established theories as the basis for tailored messages (Kreuter et al., 2000). Use of this

approach may result in overlooking differences in educational, contextual, cultural and personality factors that can affect the way the information is processed.

Satterlee et al. (2008) found effectiveness of strategies to overcome identified barriers to better care to be unclear. Flottorp, Oxman, Havelsrud, Treweek, and Herrin (2002) found it is difficult to change practice, and large changes over short periods are not typical. Citing the importance of using rigorous methods to measure the effects of the interventions used, it was equally important for clinicians to find the time needed to change routines.

Tailored education is generally more effective than non-tailored in helping individuals change health-related behaviors; one must remember there is considerable variation in the effectiveness of any single communication approach in any given population (Kreuter et al., 2000).

Chapter Three: Methodology

This chapter includes a description of the design, setting and sample for the project and the methods and procedures for the study. This is followed by a discussion of the feasibility, data analysis plan and protection of human subjects.

Study Design

This project was the implementation of an evidence-based practice change based on the Clinical Guideline for the Prevention of Catheter-associated Urinary Tract Infections (Wong & Hooton, 1981), recommended guidelines for hand hygiene, and Shea guideline for preventing nosocomial transmission of multidrug-resistant strains (Muto et al., 2003).

Setting

The setting for the study was a 43-bed medical/surgical unit located in a 321-bed not for profit hospital in Northeast Florida. This unit admits patients with gastrointestinal issues, as well as, general medical diagnoses and selected surgical procedures. Patients admitted from nursing homes comprise approximately 30 to 40% of the patient load. This unit had the highest nosocomial infection rate of the medical/surgical floors and is second only to the critical care areas for nosocomial infections in the hospital. Urinary tract infections are higher than any other nosocomial infections on the unit and are slightly more prevalent for patients with indwelling Foley catheters (55%).

Sample

The sample consisted of the team members on this unit, including registered nurses and patient care technicians.

Current Practice

Current policies and procedures on the target unit included: (a) use of a closed drainage system with STAT Lock application and irrigation only as ordered; (b) use of silver coated catheter kits; (c) an established aseptic insertion protocol; (d) routine charting of daily catheter care in the patient's electronic medical record done during the shift assessment; and (e) infection control hand washing protocols consisting of the use of alcohol based hand wash with reminder notices to wash hands located on each alcohol dispenser and hand washing with soap and water routinely encouraged.

Current practices in place in the hospital included: (a) early identification of carriers through nasal culture, cost absorbed by hospital; (b) isolation of patients known to have active nosocomial processes; (c) cohorting; (d) urinary culture within 48 hours of hospital admission.

Practice Change

Changes in practice included development and implementation of: (a) educational modalities for nursing staff; (b) a dwell time notification system to alert physicians; (c) an audit and feedback system related to catheter care, hand washing, and perineal care; and (d) annual competency assessment for catheter care, hand washing and perineal care with remediation as needed.

Development of Educational Modalities

Targeted in-services in the area of general nosocomial infection information, perineal care, hand hygiene, and the catheter dwell time notification protocol were developed. Several educational modalities were used, including: computer based, real time instruction, use of local opinion leaders and one-on-one or small group demonstration and return demonstration. Sample PowerPoint presentation with sample handouts may be found in Appendices A, B and C respectively.

Dwell-time Notification.

Notification of physicians was done by the shift nurse caring for the patient each day. The written notification (see Appendix D) alerted the physician as to the number of days of dwell for the catheter and queried whether the catheter should be continued or discontinued. Nursing documentation provided the basis for this compliance. Routine change out of catheters occurred only if the physician requested this intervention.

Audit and Feedback

Continued quality assessments evaluated compliance and feedback and were provided at staff meetings, in the floor newsletter and with one-to-one caregiver feedback (see Appendices E and G for samples). This allowed the effected employee to see the application of their skills in a wider context of care. It allowed for greater personal ownership of the problem or issue and helped the employee with accountability.

Annual Competency Assessment

Competency can be defined as the formal exhibition of a skill, ability, or aptitude of a professional nurse or assistant (Meretoja & Leino-Kilpi, 2001). Mustard (2002, p. 39) wrote "... self-reporting and self-testing are the least reliable assessments.

Conversely, the most reliable assessment is observing actual performance." This hospital currently assesses and administers nursing yearly competencies to all staff using identified nursing steps consistent with each identified skill (see example in Appendix F). The current annual competencies include infection associated risks, hand washing, the method and duration of catherization and catheter care, and the importance of using a closed system of urinary drainage.

The revised annual competency assessment included the following topics: hand hygiene knowledge assessment pre and post test, employee report of hand hygiene compliance, Foley catheter insertion using accepted insertion steps, Foley catheter care, rationales for hand washing/glove usage, general infection knowledge and isolation procedures. These competencies included high-risk, low-volume, problem-prone skills and were assessed using a hospital defined clinical competency tool (see Appendices E, F, and G), which was used to measure compliance with expected practice. Critical aspects of the competency were written into the competency statements. These statements reflected overall responsibility of the nurse or ancillary team member in regard to the specific competency. They were designed to reflect knowledge, psychomotor skills, interpersonal skills, and critical thinking used during an actual patient encounter.

A summary sheet was used to document completion of the competencies; either Met or Unmet (see Appendix F) and were submitted with the employee's annual evaluation and filed in the human resources file. Bedside assessment allowed the nurse or ancillary staff member to be evaluated consistently on how well the competency was met. If the nurse or ancillary staff member failed to meet the expectations, he or she were remediated and reassessed at a later time.

Change Process

Nursing education training was by nurses selected from the target floor's education team. These nurses act in the role of "local opinion leader" having been identified by their peers as knowledgeable resources based on their own clinical competency and education. The floor educators have developed a yearly skills program which highlights a selected nursing intervention for reevaluation of competency each month of the calendar year. These interventions were chosen by the nursing staff as having the greatest need on this medical/surgical unit based on the general nature of the medical/surgical patients served.

Educational in-services were offered using live class presentation or self directed learning using computer modules. This included the requirement that staff complete a Web-based training series with classroom competency validation and re-demonstration. Remediation was conducted on all team members who failed to meet the competency requirements. Staff was given a fifteen question pre test prior to training and completed a post test to measure their competence. Nurses also attended a session on implementation of the catheter dwell notification system. They were tested on the procedure. Manipulation test were performed which included direct observation, checks of documentation compliance, and nursing self reports for hand washing. Observational studies were conducted with audit and feedback on compliance with hand washing.

The team selected real life situations for measuring annual clinical competency. The clinical educator observed the nurse or ancillary staff member performing the selected procedure on the patient. The educator acting in the role of a nonparticipant observer noted deviation from the accepted guidelines. Based upon the observable

competency, the staff member were certified or remediated as indicated by their technical performance.

Evaluation Plan

Knowledge related to CA-UTIs was assessed using e-Learning modules or in service live presentations which include written pre and post knowledge testing. E-Learning provides opportunity at the point of need. Written testing incorporated into both the e-Learning environment and the live in-service facilitated the individual's measure of the understanding of facts and principles, and interpretation of material. Test-retest reliability for these evaluation measures were obtained by administering the same test twice over a period of time to a group of individuals prior to the start of the project. During the study, the scores of nurses involved in the project were obtained prior to the practice change and at three months post educational retraining.

Performance testing required the employee to demonstrate proficiency in conducting the required task, executing a series of steps in a reasonable time, following instructions, manipulating materials or equipment; and reacting to real or simulated situations. These tests were administered individually with specified criteria used for rating (See Appendix G). Content validity was achieved by using content which represented an adequate sampling of the knowledge and skills which should already by mastered by employees based on the prior nursing or health care education and hospital initial orientation and by their daily interaction with patients. Reliability was measured based on employee compliance and the consistency of employee to incorporate the teachings into their daily nursing routine.

The development of a nosocomial infection was determined by examining CA-UTIs that occur in patients admitted with an indwelling catheter in place. All patients admitted with an in-dwelling catheter in place will have a urine culture done within the first 48 hours. Any CA-UTI that is diagnosed within the first 48 hours of admission was not considered a nosocomial infection (Wong & Hooton, 1981). Infection data were collected for three months prior to the educational retraining using systems already in place at the target facility (see Appendix H). Infection rates were determined by measuring the absolute number of urinary tract infections occurring on a monthly basis on the target floor. Post training nosocomial infection rates were monitored for three months to determine whether the educational and practice interventions effected a change in nosocomial urinary tract infections.

Protection of Human Subjects

Institutional Review Boards (IRB) approval was obtained from both the University of North Florida and from the hospital where the practice change was initiated. This project involved a fundamental change in nursing practice on a particular nursing unit and, as such, is not research with human subjects. It, therefore, does not require informed consent. Nursing staff are subject to the rules of employment which require practice competency as outlined in their employee handbook. No consent from patients will be required, as the only patient data collected will be aggregate data regarding infection rates on the nursing unit.

Chapter 4: Results

This chapter presents the results of this evidence-based practice change directed at decreasing hospital-acquired catheter-associated urinary tract infection rates. The chapter begins with a description of the sample. This is followed by discussion of the pre- and post-test data relative to scores on the knowledge test, the self-reported hand washing audit, the competency assessment and catheter dwell-time notification. Finally, the impact of the intervention on hospital-acquired catheter-associated urinary tract infection rates is presented.

Sample

Forty two staff members consisting of 24 Registered Nurses and 18 Patient Care Technicians participated in the project. Seventy eight percent of the RNs have less than 4 years on the unit and in practice. Seventy percent hold an Associate Degree in nursing (ASN), 16% are Bachelor of Science degree in nursing (BSN), and 6% a Diploma in nursing. Seventy eight percent of the PCTs have been on the unit less than 4 years. For a detailed breakdown of the sample demographics see Table 4.1.

Outcomes of Intervention: Nursing Staff

Knowledge

The overall mean score on the perineal and Foley catheter pre-test care was 13.67 (SD = 1.16) for the post test 13.95 (SD = 0.96) for the post-test. The overall mean score on the MRSA/skin care test was. 11.24 (SD = 1.10). There was no significant change in

Table 4.1

Sample Demographics

Characteristic	Registered Nurses N = 24		Patient Care Technicians N = 18	
	N	%	N	%
Gender				
Female	22	91.67	13	72.22
Male	2	8.33	5	27.73
Educational Level				
Diploma in Nursing	3	12.50		
Associate in Nursing	15	62.50		
Bachelor's in Nursing	3	12.50		
RN-BSN Nursing Student	2	8.33		
Master's Nursing Student	1	4.17		
Graduate Nurse			2	11.11
Prelicensure Nursing Student			1	5.56
Foreign Nurse (no license)			2	11.11
EMT/Paramedic Training			2	11.11
High School			10	55.55
Bachelor Degree (Other)			1	5.56
Certified	1	41.17	12	66.67
Years of Experience				
< 6	17	70.83	14	77.78
6-10	4	16.67	2	11.11
>10	3	12.50	2	11.11
Years on this Unit				
1-2	13	54.17	11	61.11
3-4	4	16.67	3	16.66
5-6	0	0	0	0
7-8	2	8.33	1	5.56
9-10	2	8.33	1	5.56
>10	3	12.50	2	11.11

the overall means (t = 1.00, p = 0.5) (see Table 4.2), although there was a definite improvement in MRSA/Skin Care. The test had moderate internal consistency (Chronbach's alpha = 0.81).

The overall mean score on the Skin Care/MRSA test was 11.24 (SD = 1.10) for the pretest and 12.98 (SD = 1.65) post test. There was no significant change in the overall

means (see Table 4.2). The test had moderate internal consistency (Chronbach's alpha = 0.80).

Table 4.2
*Comparison of Before and After Results for Knowledge Test**

Group	Perineal/Foley Care (N=42)		Skin Care/MRSA (N=42)	
	Pretest (n=15) # Correct Items	Posttest (n=15) # Correct Items	Pretest (n=15) # Correct Items	Posttest (n=15) # Correct Items
Registered Nurses	14.20	14.17	11.04	12.83
Patient Care Technicians	12.94	13.67	11.50	13.17
Total	13.67	13.95	11.24	12.98

* $p > .05$ for all groups

Hand Washing

There were no changes pre- to post-education with respect to self-reported hand washing for either the RNs or the PCTs. All of the nursing staff reported that they carried out hand washing before and after clean procedures, invasive procedures and before touching wounds, urethral catheters and before glove use. All of the PCTs and all but one of the RNs reported using correct hand washing technique. The one RN who reported that she did not do so, reported that her error was not washing her hands prior to invasive procedure or clean procedure.

Competency/Proficiency Exam

All of the RNs passed the perineal/Foley care competency exam on the first try. Three (17.67%) of the PCTs required re-mediation in their competency.

Documentation of Perineal Care

Documentation of perineal care was obtained from the Electronic Medical Record (EMR) on each patient. Documentation reflected a 4% compliance (14 out of 323) with twice daily documentation, mainly lacking night shift documentation.

Dwell Time Notification

Once the dwell time notification procedures were put into place, there was 100% compliance with placement of the notification on the medical record. There was good response by the physicians to the notification (see Table 4.3).

Table 4.3
Response to Dwell Time Notification

Notification	N	%
# Notices place on medical records	107	100
Signed by physician	82	76.6
Not signed by physician	25	23.4
Outcome		
Continue Foley	55	51.4
Change Foley	2	1.9
Remove Foley	23	21.5
No Directions Either Way	27	25.2

Chart Review Data

Chart review data was obtained on 197 admissions in the pre-intervention period, 133 in Phase I (post educational but pre-dwell time notification) and 53 admissions in Phase II (post-dwell-time notification). There were no differences in patient characteristics, catheter-associated characteristics, or catheter dwell-time (see Tables 4.4 to 4.6).

Outcome of Intervention

The average dwell-time was 7.25 days pre-intervention, 5.71 during Phase I and 5.68 during Phase II. There were significant differences in length of dwell time before and after the educational intervention (Chi-square = 12.56; $p = <.002$). The overall infection rate per 1000 patient days was 3.88 pre-intervention, 3.36 during Phase I and 0.89 during Phase II. There were no differences in infection rate by dwell time, patient characteristic or co-morbidity.

Table 4.4

Patient Characteristics Obtained by Chart Review

Characteristic*	Pre-Intervention (N=197)		Phase I (N=133)		Phase II (N=53)	
Age						
Mean	77.0		77.0		79.5	
Range	73		72		84	
Standard deviation	5.16		18.1		1.581	
	N	%	N	%	N	%
Gender						
Male	79	40.12	46	34.59	18	33.96
Female	116	58.88	87	65.41	35	66.04
Co-morbidities (Females)						
History of neurologic disease	51	25.89	78	58.65	10	18.87
Fecal impaction	1	0.05	0	0	0	0
Cystocele	0	0	0	0	0	0
Anticholinergic drugs	52	26.40	82	61.65	18	33.96
Co-morbidities (Males)						
Benign prostatic hypertrophy	156	79.19	115	86.47	5	0.094

p> .05

Table 4.5

Catheter-associated Characteristics Obtained by Chart Review

Characteristic*	Pre-Intervention (N=197)		Phase I (N=133)		Phase II (N=53)	
	N	%	N	%	N	%
Catheter in place on admission	15	7.61	5	3.76	1	1.89
Culture within 48 hours	157	79.70	90	67.67	37	69.81
Urinary infection on admission	94	47.72	81	60.90	30	56.60
Antibiotics during hospitalization	176	89.34	113	84.96	43	81.13
CA-UTI infection at discharge	22	11.17	14	10.53	1	3.92

p> .05

Table 4.6

Dwell Time Information Obtained by Chart Review

Characteristic	Pre-Intervention (N=197)	Phase I (N=133)	Phase II (N=53)
Total dwell time			
Mean	7.43	5.81	6.29
Range	1-36	1-24	1-28
Standard deviation	5.33	4.17	4.49

p> .05

The CA-UTI rate per 1000 patient days was 11.17 pre-intervention, 10.53 during Phase I and 0.392 during Phase II. There were significant differences in infection rates before and after the educational intervention in CA-UTI (Chi-square = 254.237; p = .000), with primary difference occurring in Phase 2. There were significantly more females than males with CA-UTI (Chi-square = 13.06; p = .000).

Infection rate at discharge was significantly affected by years in practice for both RNs (Chi-Square = 16.88, p = .000) and PCTs (Chi-Square = 14.00, p = .000). The same was true for years on unit (Chi-Square = 18.08, p = .001 for RNs and Chi-Square = 21.50, p =.000 for PCTs).

For individuals with urinary infections during the study period, pathogens varied between admission and discharge. The most common admission infections were *Escheria Coli* and *Enterococcus*, while the pathogens most common at discharge were of the *Candida* species and *Escheria Coli* (see Table 4.7). This distribution did not vary pre and post-intervention, by patient characteristic or co-morbidity.

Table 4.7
Distribution of Pathogen by Species at Admission and on Discharge

Pathogen	Admission (N=101)		Discharge (N= 42)	
	N	%	N	%
Escheria Coli	26	25.74	8	19.05
Enterococcus	20	19.80	7	16.67
Candida species	14	13.86	19	45.24
Klebsiella species	13	12.87	1	2.38
Proteus	10	9.90	1	2.38
Pseudomonas	7	6.93	2	4.76
Morganella	3	2.97	1	2.38
Streptococcus	3	2.97	0	0
Citrobacter species	2	1.98	1	2.38
Staphylococcus	2	1.98	2	4.76
Providencia	1	1.00	0	0

Chapter 5: Discussion

This chapter presents a discussion of results and recommendations formulated as an outcome of the project. The project identified evidence-based practice changes needed to decrease hospital-acquired catheter-associated urinary tract infection rates. The study can easily be replicated in other facilities as one approach to reducing CA-UTI. The chapter begins with a discussion of the findings related to infection rates and impact of the interventions. It is followed by suggested changes to the current nursing practice in the institution. Finally a discussion of these recommendations relative to the designed outcome of reduction of hospital acquired CA-UTI; thoughts on this project's continuation and rationale are given.

The project's intent was to determine if urinary tract infections could be reduced by consistent application of selected nursing interventions outlined in the clinical guidelines to include: education in the area of perineal care, hand washing, Foley catheter care, and implementation of a dwell time notification system with the purpose of reducing CA-UTI.

Findings

For the study period, the prevalence of overall infection rate per 1000 patient days was 3.68. This is well below the national average of 5.0 but still higher than 2.45 for the hospital overall. In 2008, the hospital rate was 5.95 and the target floor rate was 6.31. While staff was offered evidence-based information with improvement in knowledge pre-

and post-intervention, this increased knowledge did not result in a change in reported or documented behavior. There was, however, a change in urinary catheter infection rates. The question of Hawthorne effect with respect to behaviors was considered, and cannot be totally ruled out. It is possible that the educational intervention did, in fact, change awareness and behavior that was not captured by the measurements used in this study. It is possible that implementing the dwell-time notification heightened awareness of the CA-UTI issue even more on the part of the nursing staff. It is also possible that the extreme dip in infection rate in Phase II was a seasonal thing. In 2008, the infection rate in April was 0.00 while in May in was 7.78/1000 patient days. Total catheter dwell time in June was 274 total catheter days with 1 infection very similar to June, 2009 results.

Hand washing audits were completed pre and post intervention by self-report. The lack of change in self-report pre- to post- intervention is not surprising, since all but one person indicated they always complied with hand washing guidelines. The validity of self-report in this instance is questionable, since previous real-time audits of hand washing behaviors revealed only about 50 percent compliance.

Twice daily documentation of perineal care reflected only 4 percent compliance with documentation. Perineal care documentation by the night staff was virtually non-existent. It may be that the perineal care was being done, but without documentation, it is impossible to say.

It is interesting to note the species of pathogenic infection varied from admission to discharge with only one commonality *Enterococcus faecalis.* The 20% admission rate of *Enterococcus faecalis* identified by urine culture was more than the discharge rate of 17%. Nosocomial *Enterococci* infections typically occur in very ill debilitated patients

who have been exposed to broad-spectrum antibiotics. These results support the evidence that the majority of clinical isolates are *Enterococcus faecalis* and *Enterococcus faecium* (Fraser, Lim, Donskey, & Salata, 2008; de Perrio, Yarnold, Warren & Noskin, 2006). Microorganisms of the *candida* species were the predominant discharge pathogens identified, a common occurrence when antibiotic use alters the ecology of normal body flora permitting overgrowth. The fact that more than 80% of the patients whose charts were reviewed were on antibiotics during their hospitalizations may well explain the frequent *candida* infections at discharge.

Although there was a decrease in catheter dwell time over the course of this study, dwell time was still far in excess of the recommended 3 days. It is interesting to note that there was no change in average dwell time after the dwell time notification system was put in place. One negative issue resulted when a physician questioned being notified about dwell time on two particular patients and wrote orders to refrain from placing the notification on the medical record again. This could be understood since one of the patients in question required continual catherization. The other patient was terminal; the Foley being used as a comfort measure as part of her palliative care. At this time the system has no way to differentiate these special type circumstances.

Recommendations for Research and Practice

Based on the analysis of data from this evidence-based project, recommendations are being made to appropriate committees, councils and groups. These include the Magnet Research Council, the Nursing Practice and Nursing Leaderships Councils and the Infection Control Committee.

Recommendations to the Magnet Research Council

Recommendations to the Magnet Research Council included continuing data collection, including hand washing audits and BID perineal care documentation for another three to six months to identify more long-term results of the educational intervention. It may be that three months is not long enough to see a sustained benefit of education. Consider changing the hand washing audits to real-time audits as opposed to self-reports.

Continuation of data collection is essential for the dwell time notification, since information on notification and its effects on CA-UTI are based on only one-month's worth of data. It may be that 1 month is insufficient time to see any change in practice or outcomes.

Further research is needed on (a) the effectiveness of the catheter dwell time notification system over a longer time interval, (b) innovative ways to change behavior among staff, (c) monitoring CA-UTI over another 3 months to assess any change in impact positively/negatively. The Council should continue to monitor evidence-based literature in the area of CA-UTI, for new evidence-based clinical practice guidelines such as APIC (2008), EPIC (Pratt, 2001) and the CDC when they are updated.

Reflecting on the project results, the researcher would not attempt to prove the value of two different interventions running concurrently. The different interventions made it difficult to evaluate the true impact of each intervention. The educational intervention had sufficient validation to be a stand alone project. While the educational interventions had significance but not an impact, concern over the behavioral aspects of change is still needed. On the surface, the dwell time notification appears to have a more

viable and measureable impact. It is necessary to continue to monitor this aspect to assess consistency and effectiveness over a longer time span.

Certainly, it is imperative to continue routine in-service to keep staff abreast of changes in the evidence effecting their patients and practice. However, since education alone does not change behavior, then continuing clinical competency with demonstration should occur more frequently than yearly.

Recommendations to the Nursing Practice and Nursing Leadership Councils

Consider changes in nursing practice to include changes in nursing documentation practices. Current nursing admission assessment documentation makes it extremely difficult to determine (a) if a patient is admitted with a Foley in place, (b) how long the Foley was in place prior to admission, (c) whether or not the Foley was changed out in the Emergency Room, and (d) was the Foley inserted based on clinical guidelines. While guidelines are in place about catheter insertion and maintenance, none addresses limitations to insertion. This will need to be discussed at the physician level. Addition of this information to the nursing admission assessment form would facilitate better communication on issues such as catheter dwell time.

A centered search for the evidence upon which BID perineal care for patients with indwelling catheters is based will be conducted. Does the evidence support BID perineal care? If it does, then mechanisms to improve the practice and documentation of BID perineal care on this unit need to be set in place. Such mechanisms might include routine quality assurance with audit/feedback on documentation to staff in timely manner, consequences for failure to appropriately document, and the institution of a reward system for correct documentation. If, in fact, the evidence does not support BID perineal

care as important in preventing CA-UTIs, then change the policy to whatever is supported.

Ongoing proficiency is needed to affect the behavioral aspects identified. Constant reinforcement is needed to improve and shape the quality of teaching to help formative decisions required to use the evidence. The sources of evidence of teaching effectiveness can be measured by learning outcome measures, but success is dependent on consistent application to actual practice. For this reason, it will be necessary to routinely offer in-service education, but more importantly, semi-annual competency demonstration/return demonstration to re-enforce the behavior aspect. Constant reinforcement is necessary because evidence shows that compliance declines over time.

While adequate surveillance strategies are in place, it was noted urine cultures on admission were missed either through oversight or the culture was contaminated and never repeated. If infections are not caught within the 48 hour window, then the infection becomes hospital acquired with no Medicare reimbursement. Currently the only way to identify these patients is through nursing diligence. Some consideration should be given to find alternative ways to identify this population.

While the evidence is still being developed, Lo et al. (2008) talked about similar issues in their research synthesis. These authors found important measures for decreasing CA-UTIs included limiting the dwell time, effective surveillance using feedback that is unit specific, and competence in catheter placement, their use and maintenance.

Recommendations to the Infection Control Committee

Hospital wide implementation of physician dwell time notification system is recommended. In this study, catheter dwell time far exceeds best practice, placing the

patient at greater risk for negative outcomes. Reduction of dwell time should help meet the hospital strategic goal of reducing nosocomial infections, providing both a clinical and financial benefit. The dwell time notification used in this study could be modified to add a third option for the physician, so that they could check (a) continue, (b) continue and do not notify me again, or (c) or discontinue. This might alleviate some of the antagonism experienced under those special circumstances where the long-term catheter placement is, in fact, desired.

Summary

When the project began two years ago its main goal was to measure education's impact on CA-UTIs. While knowledge regarding catheter and perineal care and skin care did increase, there was negligible change in documentation of BID perineal care or in hand washing behavior. This was not anticipated, but does reinforce the theory that changes in behavior rarely occur as a result of increased knowledge alone. It is imperative that nursing administrators continue to seek ways to facilitate changes in the behavior of their nursing personnel when such change is warranted.

Hospital acquired infections, including CA-UTIs, have a negative impact on the patient and the hospital. The patient suffers impaired health and well-being along with a prolonged length of stay, while the hospital suffers an adverse financial impact. It is essential to continue to improve outcomes, monitor surveillance and encourage staff education on the most current, evidence based information. By consistently applying these interventions, we gain the opportunity to minimize hospital acquired CA-UTI, thus lowering infection rates.

Appendix A: PowerPoint Hand Washing Education

The Skin: Background Knowledge

Hand Washing Education

The Skin
- Largest organ in the body
- Organ of the integumentary system
- Comprises multiple layers of epithelial tissues that guard underlying muscles and organs.
- Plays the most important role in protecting against pathogens.
- Function as insulator and temperature regulator.

Anatomy of the Skin
- Three primary layers
  - Epidermis
    - Provides waterproofing and serves as a barrier against infection
  - Dermis
    - Serves as a location for the appendages of skin
  - Subcutaneous (basement membrane)

Skin Irritations
- Contact dermatitis from frequent & prolonged contact with water
- Surfactants and prolonged wearing of gloves lead to irritant skin damage

Consequence of Skin Irritations
- Epidermis becomes more permeable and harmful substances can penetrate more easily.
- If irritation continues small lesions or sores will appear.
- 2nd most common type of occupational disease

Skin Flora
- 3 Types
  - Transient
  - Resident
  - Infection

Transient
- Microorganisms that temporarily colonize skin
- Enterobacteriaceae, Pseudomonas, yeasts, viruses and aerobic spore formers.
- Can be pathogenic and aiders of healthcare-acquired infections.

Resident

- Live on the skin
- Staphylococcus epidermidis, Micrococcus luteus and certain Corynebacteria
- Do not have pathogenic effect
- Some might elicit infections in sterile cavities, on non-intact skin or in patients with weakened immune systems.

Infection
- Pathogens of existing infections on the hands (e.g. abscesses, suppurative inflammation on the finger, or eczema
- Cannot be killed or reduced by hand antisepsis.

Healthcare Associated Infections
- Affect millions of people worldwide
- Complicate the delivery of health care
- Contribute to patient deaths and disability
- Promote resistance to antibiotics
- Add additional cost to patient stays
- No longer reimbursed after Oct. 2008

Statistics
- Infections are considered healthcare associated if they first appear 48 hours or more after hospital admission.
- Between 5-10% of patients will acquire one or more infections
- 14-40% of those admitted to critical care are affected

  Vincent (2003)

Agents for Reducing Pathogens on Hands
- Non medicated soap
  - No antimicrobial activity
- Antiseptic hand wash
  - Can reduce the transient bacterial count
- Aseptic hand wash (Alcohol based)
  - Very good activity against vegetative bacteria, mycobacteria, yeasts, dermatophytes and various viruses.
  - Can reduce transient bacteria by 2.6 to 6.8 $\log_{10}$

Appendix B: PowerPoint Hand Hygiene

Hand Hygiene

5th Floor Skin Care Series

Three Elements of Hand Hygiene

- Hand washing
- Hand antisepsis
  - Rubbing with alcohol based product
  - Washing with antimicrobial soap
- Skin care
  - Prevention of skin-stressing activities

Hand Hygiene

- Microorganisms are everywhere.
- It is about protecting our patients.
- Transmission
  - Direct (skin to skin)
  - Indirect (fomite to skin)
- Hands
  - Main transmitter of hospital associated infections.

Fomite Transmission

- Most pathogens can persist on inanimate surfaces for months.
- *Klebsiella species* up to 30 months
- *Pseudomonas aeruginosa* up to 16 months
- *Escherichia coli* up to 16 months
- *Staphylococcus aureus* up to 7 months

Effective Hand Hygiene

- Hand hygiene begins with the personal hygiene of each employee.
- Several studies have documented the area beneath the fingernails of the hands are colonized with high concentrations of bacteria.

Fingernail Recommendations

- CDC: natural nail tips < ¼" long
- WHO: natural nails short (<0.5 cm).
- APIC: nails should be short enough to allow the individual to thoroughly clean underneath them and not cause glove tears.

Artificial Nails

- Whether artificial nails contribute to the transmission of pathogens hasn't been determined.

Flagler Dress Policy- HR008

- For all employees with patient contact, fingernails must be kept less than ¼ inch long, and free of chipped polish. Wearing of artificial nails or extenders by staff with direct patient contact is prohibited because it is a bacterial vector.

Jewelry

- Several studies demonstrate that skin underneath rings is more heavily colonized than comparable areas of skin on fingers without rings.

Hand washing

- Plain soap & water remove visible soiling.
- Frequent hand washing attacks the skin's protective acid mantle and skin lipids are washed off.
- The gold standard is use of alcohol based products which have the fastest and broadest antimicrobial efficacy (Hand antisepsis).

DOs of Hand washing

- Wash when visible soiled
- Should last at least 15 seconds
- Use lukewarm water
- Use only hospital-approved soaps/lotions
- Rinse hands well

Indications for Hand Hygiene Antisepsis

- Before any direct contact with patients
- Before donning exam & sterile gloves
- Before inserting indwelling catheters or other invasive devices that do not require a surgical procedure.
- During patient care
- After any contact with the patient or the patient's environment

Hand Cleansing Reminders

- No hot water
  - Strips natural oils from skin and causes it to swell
- No direct contact with harsh detergents
  - Can damage skin or cause allergic reactions

Areas Missed During Hand washing

Hand washing Sequence

- Soap and warm running water, fingers pointing down, rub hands vigorously for 20 seconds. Wash all surfaces including:
- Backs of hands
- Wrists
- Between fingers
- Tips of fingers
- Thumbs
- Under fingernails (nailbrush is best)
- Dry vigorously with paper or clean cloth towel
- Turn off faucet with towel
- Open door with towel

Antisepsis Sequence

- When applying an alcohol-based hand antiseptic, particular attention must be paid to the areas of the hand that harbor the highest concentrations of microorganisms, e.g., under the nails.

Compliance

- Knowing when to perform hand hygiene
- Applying the right measure
- Performing selected hygiene procedure correctly

Key Facts

- Experts estimate that approximately 1/3 of all healthcare-associated infections is preventable.

Ponder This

- Elaine Larson, editor of the American Journal of Infection Control. .
- "We expect the public to understand how important our work is and why we have a 'legitimate' excuse for deficient practices, and, yet, we would not tolerate a mechanic who was too busy to assemble the care engine correctly or the pilot too busy to ensure that all systems are functioning before a flight."

A Simple Task

- Should be second nature to healthcare workers but,
  - Average compliance is <50% Pittet (2000)
- Requires personal responsibility & behavior modification

Benefits from Better Compliance

- Enhanced public image – low infection rates provide consumer confidence
- Major cost savings—a single healthcare associated infection can cost up to $40,000 (Jarvis, 1998)
- Improved working environment – satisfied employees enjoy their work more (Lasinger, 2004)

Summary

- Hand hygiene compliance begins with you
- Healthcare workers have a responsibility to "do no harm".

Appendix C: Sample of Educational Handouts

BOX 1. Factors influencing adherence to hand-hygiene practices*

Observed risk factors for poor adherence to recommended hand-hygiene practices

- Physician status (rather than a nurse)
- Nursing assistant status (rather than a nurse)
- Male sex
- Working in an intensive-care unit
- Working during the week (versus the weekend)
- Wearing gowns/gloves
- Automated sink
- Activities with high risk of cross-transmission
- High number of opportunities for hand hygiene per hour of patient care

Self-reported factors for poor adherence with hand hygiene

- Handwashing agents cause irritation and dryness
- Sinks are inconveniently located/shortage of sinks
- Lack of soap and paper towels
- Often too busy/insufficient time
- Understaffing/overcrowding
- Patient needs take priority
- Hand hygiene interferes with health-care worker relationships with patients
- Low risk of acquiring infection from patients
- Wearing of gloves/beliefs that glove use obviates the need for hand hygiene
- Lack of knowledge of guidelines/protocols
- Not thinking about it/forgetfulness
- No role model from colleagues or superiors
- Skepticism regarding the value of hand hygiene
- Disagreement with the recommendations
- Lack of scientific information of definitive impact of improved hand hygiene on health-care–associated infection rates

Additional perceived barriers to appropriate hand hygiene

- Lack of active participation in hand-hygiene promotion at individual or institutional level
- Lack of role model for hand hygiene
- Lack of institutional priority for hand hygiene
- Lack of administrative sanction of noncompliers/rewarding compliers
- Lack of institutional safety climate

* Source: Adapted from Pittet D. Improving compliance with hand hygiene in hospitals. Infect Control Hosp Epidemiol 2000;21:381–6.

TABLE 8. Hand-hygiene adherence by health-care workers (1981–2000)

Ref. no.	Year	Setting	Before/ after	Adherence baseline	Adherence after intervention	Invervention
(280)	1981	ICU	A	16%	30%	More convenient sink locations
(289)	1981	ICU	A	41%	—	
		ICU	A	28%	—	
(290)	1983	All wards	A	45%	—	
(281)	1986	SICU	A	51%	—	
		MICU	A	76%	—	
(276)	1986	ICU	A	63%	92%	Performance feedback
(291)	1987	PICU	A	31%	30%	Wearing overgown
(292)	1989	MICU	B/A	14%/28%*	73%/81%	Feedback, policy reviews, memo, and posters
		MICU	B/A	20%/23%	38%/60%	
(293)	1989	NICU	A/B	75%/50%	—	
(294)	1990	ICU	A	32%	45%	Alcohol rub introduced
(295)	1990	ICU	A	81%	92%	Inservices first, then group feedback
(296)	1990	ICU	B/A	22%	30%	
(297)	1991	SICU	A	51%	—	
(298)	1991	Pedi OPDs	B	49%	49%	Signs, feedback, and verbal reminders to physicians
(299)	1991	Nursery and NICU	B/A†	28%	63%	Feedback, dissemination of literature, and results of environmental cultures
(300)	1992	NICU/others	A	29%	—	
(71)	1992	ICU	N.S.	40%	—	
(301)	1993	ICUs	A	40%	—	
(87)	1994	Emergency Room	A	32%	—	
(86)	1994	All wards	A	32%	—	
(285)	1994	SICU	A	22%	38%	Automated handwashing machines available
(302)	1994	NICU	A	62%	60%	No gowning required
(303)	1994	ICU Wards	AA	30%29%	—	
(304)	1995	ICU Oncol Ward	A	56%	—	
(305)	1995	ICU	N.S.	5%	63%	Lectures, feedback, and demonstrations
(306)	1996	PICU	B/A	12%/11%	66%/55%	Overt observation, followed by feedback
(307)	1996	MICU	A	41%	58%	Routine wearing of gowns and gloves
(308)	1996	Emergency Dept	A	54%	64%	Signs/distributed review paper
(309)	1998	All wards	A	30%	—	
(310)	1998	Pediatric wards	B/A	52%/46%	74%/69%	Feedback, movies, posters, and brochures
(311)	1999	MICU	B/A	12%/55%	—	
(74)	2000	All wards	B/A	48%	67%	Posters, feedback, administrative support, and alcohol rub
(312)	2000	MICU	A	42%	61%	Alcohol hand rub made available
(283)	2000	MICU	B/A	10%/22%	23%/46%	Education, feedback, and alcohol gel made available
		CTICU	B/A	4%/13%	7%/14%	
(313)	2000	Medical wards	A	60%	52%	Education, reminders, and alcohol gel made available

Note: ICU = intensive care unit, SICU = surgical ICU, MICU = medical ICU, PICU = pediatric ICU, NICU = neonatal ICU, Emerg = emergency, Oncol = oncology, CTICU = cardiothoracic ICU, and N.S. = not stated.

* Percentage compliance before/after patient contact.

† After contact with inanimate objects.

TABLE 9. Strategies for successful promotion of hand hygiene in hospitals

Strategy	Tool for change*	Selected references†
Education	E (M, S)	(*74,295,306,326,393*)
Routine observation and feedback	S (E, M)	(*74,294,306,326,393*)
Engineering control		
Make hand hygiene possible, easy, and convenient	S	(*74,281,326,393*)
Make alcohol-based hand rub available	S	(*74*)
(at least in high-demand situations)	S	(*74,283,312*)
Patient education	S (M)	(*283,394*)
Reminders in the workplace	S	(*74,395*)
Administrative sanction/rewarding	S	(*12,317*)
Change in hand-hygiene agent	S (E)	(*11,67,71,283,312*)
Promote/facilitate skin care for health-care–workers' hands	S (E)	(*67,74,274,275*)
Obtain active participation at individual and institutional level	E, M, S	(*74,75,317*)
Improve institutional safety climate	S (M)	(*74,75,317*)
Enhance individual and institutional self-efficacy	S (E, M)	(*74,75,317*)
Avoid overcrowding, understaffing, and excessive workload	S	(*11,74,78,297,396*)
Combine several of above strategies	E, M, S	(*74,75,295,306,317,326*)

* The dynamic of behavioral change is complex and involves a combination of education (E), motivation (M), and system change (S).
† Only selected references have been listed; readers should refer to more extensive reviews for exhaustive reference lists (*1,8,317,323,397*).

Appendix D: Physician Notification of Dwell Time

Dwell time is recorded for the first time when a patient is admitted. The target floor uses computerized documentation which will facilitate collection of this information. The nurse will place the developed tool on the physician order form daily. This form gives the physician an option to continue or discontinue the catherization.

CATHETER DWELL TIME NOTIFICATION:

Your patient's foley catheter has been indwelling for _____ days.

At this time do you wish to:

____Continue

____ Discontinue

Additional Orders: _____

Physician Signature: _____ Date_____

Appendix E: Self Report of Hand Washing

Self Report Audit

HANDWASHING AUDIT

Please place ' X ' inside boxes to indicate your response.
One form to be completed by each person audited

Today's date: _____/____/_____
Month Day Year

Grade of staff:

___ PCT ___ Staff Nurse ___ Physician ___ RT ___ PT

___ Other please explain_____

1. ___Yes ___No Was hand washing carried out prior to patient contact i.e. a clean procedure?

2. ___Yes ___No Was hand washing carried out following patient contact i.e. a clean procedure?

3. ___Yes ___No Was hand washing carried out prior to invasive procedures and before touching wounds, urethral or IV catheters and before glove use?

4. ___Yes ___No Was hand washing carried out following invasive procedures and after touching wounds, urethral or IV catheters and after glove use?

5. ___Yes ___No Was hand washing technique correct?

6. ___Yes ___No If hand washing technique was incorrect; indicate the discrepancies.

___ A. Hand cleaning procedure were not followed

___ B. Taps turned off using bare hands

___ C. Bin lid lifted by hand

___ D. Hand washing did not take 20 seconds

Appendix F: Sample of Annual Competency

Staff Name: _____ Date: _____

Staff Credential: □ RN □ PCT

	Procedure Observed	Met	Unmet	Remediation Needed
1.	Nursing staff use the correct procedure for decontaminating hands (observe practice).			
2.	Staff member can indicate when it is appropriate to use alcohol rub.			
3.	Hand washing is done following:			
	a. patient contact			
	b. after removal of gloves			
	c. prior to clinical procedures			
	d. prior to handling food			
	e. after handling contaminated items			
	f. after leaving an isolation room			

Assessment completed by: _____ Date: _____

I agree with the above assessment. If remediation is recommended, I will comply with the reeducation necessary to meet competency.

Employee: _____ Date: _____

Appendix G: Knowledge Questionnaires

PRE-TEST _____ Perineal and Foley Care

Please answer the following questions to test your knowledge before you begin the in service. Please do not write your name on this test. You may choose any numbered test you wish to use. Once you have completed the in-service you will be asked to take a post test. Please make sure that your pre and post test have the same numbers. Thank you for your participation.

___ 1. What are the purposes of perineal care?
   a. Prevents skin breakdown of perineal area.
   b. Prevents itching, burning, odor and infections.
   c. Important in maintaining the patient's comfort.
   d. All of the above.
   e. A and C

____ 2. Which of the following statements is correct regarding perineal care?
   a. Gloves are optional during perineal care.
   b. Wash the perineal areas with soap and water.
   c. Wash from front to back when performing perineal care.
   d. The client lies on his/her stomach during perineal care.
   e. A and D

T or F 3. The patient is offered the bedpan or urinal before beginning perineal care because warm water on the perineal area may stimulate the need to urinate.

T or F 4. When providing perineal care **always** wash from back to front.

T or F 5. Perineal care is done **less often** when the patient is incontinent.

T or F 6. When performing perineal Foley care, wash the catheter to about 4 inches away from the body, then rinse starting at the urinary opening to about 4 inches away from the body.

_____ 7. The purpose of a urinary catheter is to:
   a. relieve urinary retention
   b. accurate measurement of urinary output
   c. collect sterile urine sample when ordered.
   d. none of the above
   e. all of the above

T or F 8. You do not need to wash your hands before and after care, as long as you wear gloves.

T or F 9. It is not important to worry about kinked, coiled or looped tubing.

T or F 10. You only have to empty a Foley catheter at the end of the shift and document once.

T or F 11. The urine bag can be above the level of the bladder.

T or F 12. To help avoid an infection the Foley should be a closed system as much as possible.

T or F 13. Document Perineal care once daily.

T or F 14. The nurse is the only one responsible for documenting Foley care.

T or F 15. The Foley collection bag should be emptied when 400ml have accumulated.

PRE-TEST _____ Skin Care/MRSA

Please answer the following questions to test your knowledge before you begin the in service. Please do not write your name on this test. You may choose any numbered test you wish to use. Once you have completed the in-service you will be asked to take a post test. Please make sure that your pre and post test have the same numbers. Thank you for your participation.

1. T or F The skin is the largest organ of the body.

2. T or F Contact dermatitis is caused by frequent and prolonged contact with soap.

3. T or F Transient bacteria **are usually** pathogenic and aid healthcare acquired infections.

4. T or F Antiseptic hand washes **do not reduce** transient bacterial counts.

5. T or F Bacteria's identified within 48 hours of admittance are considered hospital acquired.

6. T or F MRSA is commonly carried on the skin or nose and account for most skin infections in the U.S.

7. T or F Health care associated infections can be surgical, urinary, bloodstream or pneumonia.

8. T or F The main mode of transmission of pathogens is through the human hands.

9. T or F The three elements of hand hygiene include: hand washing, hand antisepsis, skin care.

10. T or F Staph aureus can live for up to 7 months on inanimate (fomites) objects.

11. T or F Artificial nails can be worn by direct care givers under hospital policy.

12. T or F Hand hygiene should be done before direct patient care.

13. T or F Experts estimate that approximately 2/3 of all healthcare associated infections are preventable.

14. T or F The average hand washing compliance nationally is less than 50%.

15. T or F A single health care associated infection can cost up to $4,000.

Appendix H: Data Collection Tool

Sex of Patient	F	M
Age of Patient		
Was the catheter in place on admission?	Y	N
What was the sell time of the Catheter (days)?		
Was a urine culture performed within 48 hours of admission?		
What were the results of the culture?	+	=
For ALL Patients		
Was there documented perineal care BID?	Y	N
What was the total dwell time for the catheter (days)?		
By discharge, did this patient develop a nosocomial urinary tract infection?	Y	N
Was this patient on antibiotics?	Y	N
For all FEMALE Patients		
Is there a history of neurologic disease including stroke?	Y	N
Is there a fecal impaction?	Y	N
Is there a cystocele?	Y	N
Is there documented use of anticholingergic drugs?	Y	N
For all MALE Patients		
Is there a history of benign prostatic hyperplasia?	Y	N

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Vita

Sharon Lanier Smith has been a registered nurse since 1997. She obtained her ASN/AA from Florida Community College her BSN, MSN and MBA/Health Care Management from the University of Phoenix. She has been employed by Flagler Hospital, Inc., St. Augustine, Florida since 1997, and is currently serving as Director of Medical Nursing. She was born July 12, 1949 in Jacksonville, Florida. Her first career was in law enforcement where she was the second female to serve as a road deputy in St. Johns County. She served with the St. Augustine Beach Police Department and the U.S. Navy, Department of Defense and retired in 1983 with the rank of Sergeant. She had been active in community activities including St. Augustine Little League, St. Augustine High Band Boosters, Youth Activities Council, 4-H and Police Benevolent Society. She currently is President of District 11, FNA, sits on the National Practice Council for the Academy of Medical Surgical Nurses, and is a member of Northeast Florida Nurse Executives and Sigma Theta Tau. She has two publications on the clinical nurse leader role in acute care:

Smith, S. L., Manfredi, T., Hagos, O. Drummond-Huth, B. & Moore, P. (2006) Application of the clinical nurse leader role in an acute care delivery model. *Journal of Nursing Administration 36*(1), 29-33.

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