The Impact of an Evidence-Based Practice Protocol on Catheter-Associated Urinary Tract Infections and Urinary Catheter Days

DNP Final Project

Presented in Partial Fulfillment of the Requirements for the Doctor of Nursing Practice in the

Graduate School at The Ohio State University

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Graduate Program in Nursing

The Ohio State University

2014-2015

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Abstract

Background: The chronic critically ill are an extremely vulnerable population. Long Term Acute Care Hospitals (LTACH) are the proper venue for these patients. These patients are frequently admitted with urinary catheters, increasing the risk for hospital acquired catheter associated urinary tract infections (CAUTI). Urinary catheters can lead to CAUTI, mortality and increase healthcare cost. Use and duration of urinary catheters are prime risk factors for CAUTI.

Purpose: To determine if the implementation of an evidence based urinary catheter protocol (UCP) reduces urinary catheter days, CAUTI rates and the risk of CAUTI's.

Method: This quality improvement project was performed in two LTACH. Online synchronous education was provided to the hospitals leadership team in November 2014. Clinical leaders obtained UCP approval from their governing boards and educated their staff. The UCP was utilized for all patients admitted with a urinary catheter during the protocol implementation period. Patient days, urinary catheter days, and the number of CAUTIs were collected. Data analysis was completed utilizing data from a three-month retrospective period prior to protocol implementation (September-November 2014) and a three-month prospective period post protocol implementation (December 2014-February 2015).

Results: Overall urinary catheter days decreased from 2846 to 2383 a 463 day (16.3%) reduction. The incidence of hospital-acquired CAUTIs decreased from 18 to 6, a reduction of 66%. The CAUTI rate decreased from 6.32 to 2.52, a 3.8 (60%) reduction. The absolute risk reduction was 3.81 infections per 1,000 catheter days. The findings were statistically significant ($z= 1.82$, $p<0.03$). Therefore this suggests that an evidence based UCP can reduce catheter days and CAUTI rates.

This Doctor of Nursing Practice quality improvement project was designed to explore the impact of an evidence-based practice urinary catheter protocol (UCP) on catheter-associated urinary tract infections (CAUTI) within two Long Term Acute Care Hospitals (LTACH). This paper is divided into five sections: Chapter One- Introduction, Chapter Two- Review of Literature, Chapter Three- Methods, Chapter Four- Findings, and Chapter Five- Summary.

Chapter One: Introduction

Significance of the Problem

The proliferation of medical technology, disease chronicity and an aging population has resulted in a unique population of patients known as the Chronic Critically Ill (CCI). These patients face an uncertain trajectory of care and recovery, laden with social, emotional, financial burdens (Wiencek & Winkelman, 2010). The CCI are a vulnerable population and a significant volume of these patients require life sustaining treatments that result in an array of challenges, including catheter-associated urinary tract infections (CAUTI).

Long Term Acute Care Hospitals are the proper venue for the CCI patient. Staff members who work in LTACH's are experienced in dealing with the cadre of issues these patients present. This patient's are acutely ill and frequently require "devices" such as urinary catheters, central lines and ventilators. Managing these patients requires an interdisciplinary approach that is equipped to deal with a myriad of physiologic, physical, emotional, ethical and psychosocial issues. This patient population is "not sick enough" for ICU's, but typically "too sick" for other healthcare venues and is prone to device related infections.

The burden of CAUTIs is vast with regards to incidence, patient outcomes, cost, reimbursement, and suffering. Hospital urinary catheter prevalence rates range from 25% -35% while intensive care units rates range from 67%-76% (Gray, 2010). Until recently, literature referred to CAUTI as the most common hospital-acquired infection. According to the Center for Disease

Control (January 2014) urinary tract infections (along with pneumonia) are the second most common hospital-acquired infection (HAI) and account for more than 13,000 deaths annually.

Scott (2009) estimated that there are roughly 449,000 CAUTIs per year with an estimated annual cost between $340-450 million. It is estimated that 12%-25% of hospitalized patients will have an indwelling catheter at some point during their hospitalization and that 50% may be unnecessary (Institute for Healthcare Improvement (IHI), 2011). While removing unnecessary urinary catheters can reduce CAUTI's, there are appropriate indicators to maintain them. Appropriate indicators to utilize/maintain urinary catheters typically "drive" UC removal protocols and are specifically discussed in Chapter Two of this paper. In addition to the presence of a UC, the duration or "dwell" time of catheterization also contributes to the risk of developing a CAUTI. The likelihood of developing a CAUTI increases 3%-7% daily and by one month the risk is nearly 100% (IHI, 2011). Additionally, indwelling catheters inflict discomfort, pain and suffering for patients.

A great deal of research has resulted in the development of evidence-based guidelines to help mitigate CAUTI. Evidence-based practice (EBP) and quality improvement processes when used in tandem provide best practice strategies resulting in the best care possible. The foundation of patient care should be based on the best available scientific evidence and should be consistent from clinician to clinician. Healthcare professionals, especially nurses, are in a position to reduce CAUTI rates however studies show that implementing best practice guidelines is problematic (Abrahamson, Fox, & Doebbeling, 2012; Alanen, Valimaki, & Kaila, 2009; Ndomba, Smide, & Aarts, 2008). The gap between research and practice is further complicated by the implementation of processes that while vetted, do not work in all hospital settings and/or once implemented, are not

evaluated for further improvement opportunities. Utilizing an evidence based practice framework such as the Iowa Model is essential to assess and use research findings to support safe and effective change. Such frameworks provide systematic processes that help manage EBP quality improvement projects.

Purpose

The primary purpose of this Doctor of Nursing Practice final project was to determine if a nursing UCP that identifies best practice for catheter removal used on admission, made a difference by decreasing CAUTI in a LTACH setting.

PICOT Question

Literature to support this project was collected based upon the following PICOT question: "In the adult long term acute care patient (P) does the implementation of a nursing urinary catheter protocol (UCP) on admission (I) compared to no protocol (C) affect catheter-associated urinary tract infections (CAUTI) rates (O) over a 3 month period.

Significance to Nursing and Health Care

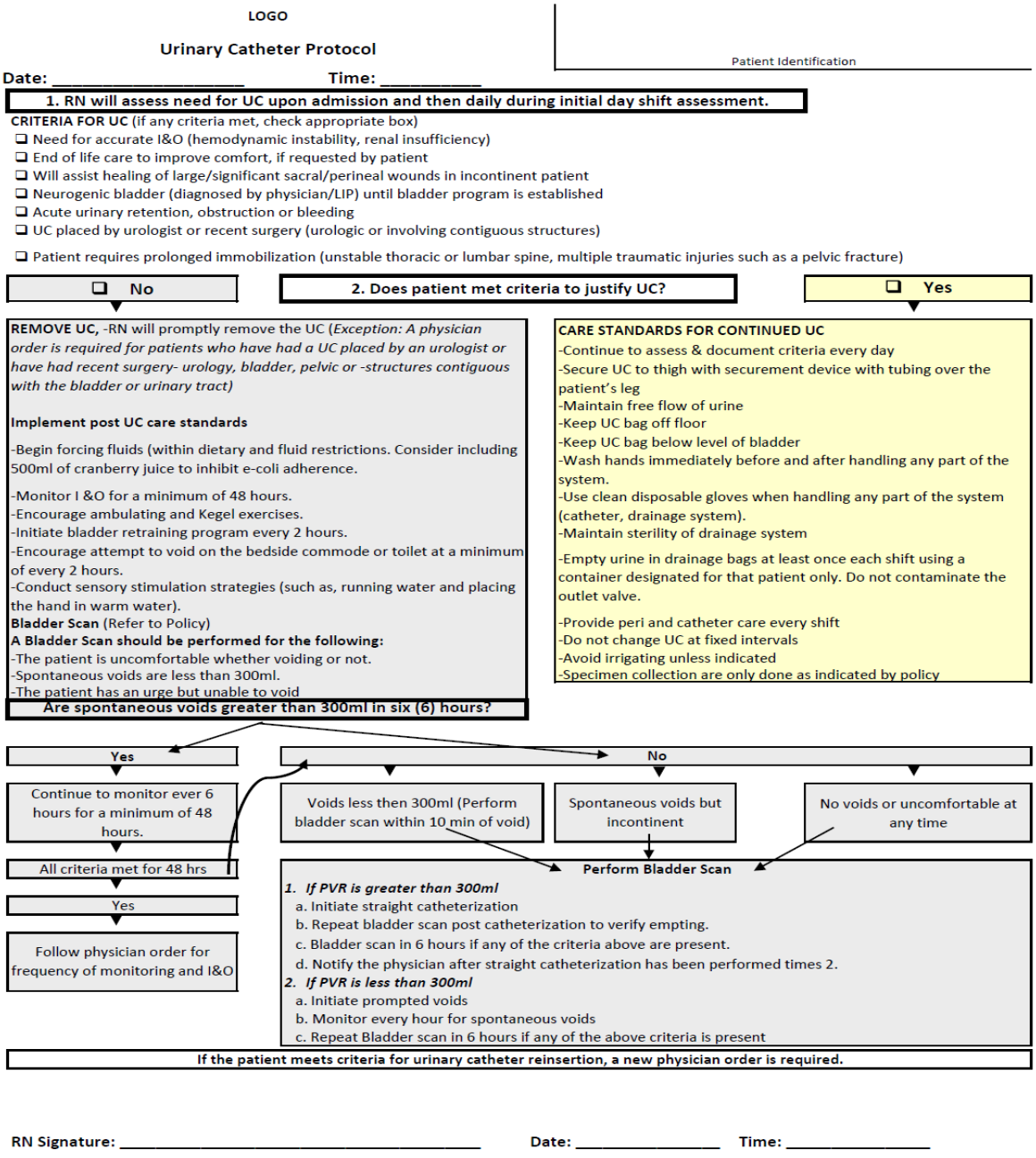
The duration of urinary catheterization is a major risk factor associated with CAUTIs. According to Chen et al. (2012) 41% of physicians, as well as nurses, fail to follow Centers for Disease Control and Prevention (CDC) recommendations to evaluate and determine if a catheter should be removed. Thus, CAUTIs may be linked directly to health care professionals inconsistently assessing the need to promptly remove unnecessary urinary catheters following best practice protocols. As a result, nurses are in the best position to independently remove unnecessary catheters.

Implementing an admission protocol enables nurses to make decisions on the removal of urinary catheters and improve the quality of care.

The significance of this quality improvement project is multifaceted. Catheter-associated urinary tract infection reduction strategies have not been systematically implemented in all LTACH settings in this students' organization. The vast majority of admission order sets only contained a prompt as to whether a "foley" was in place. The use of nursing UCPs was inconsistent and/or was not based on current best practice. Pre project quality metric data revealed that CAUTIs are problematic within the organization. In an effort to improve the quality of care, a corporate wide CAUTI initiative was needed. The implementation of a best practice protocol organization-wide would provide consistency in practice and help reduce CAUTI rates. The new protocol allowed for inclusion of best practice strategies including the removal of urinary catheters upon admission when criteria were not met. The intent was to provoke critical thinking and remind the admitting nurse and physician to remove the urinary catheter upon admission if specific evidence-based criteria were not met.

Utilizing a quality improvement methodology provided an avenue to identify successes and opportunities for improvement. Prior to designing this project it was identified that three LTACHs within the organization implemented a nursing urinary catheter removal protocol in October, 2013. However, review of the protocol revealed the need for revisions. Thus, prior to an organization-wide implementation of a revised UCP, a trial of the protocol was determined to be needed (see Figure 1). Ultimately this project served as a stepping stone to identify if the protocol successfully provided guidance and reduced CAUTI rates.

Figure 1 Urinary Catheter Protocol (UCP)



CAUTIs are a significant issue for quality patient care as well as best practice. They are associated with patient discomfort, increase morbidity and mortality, increased hospitalization and

increased health care costs (Lo, et al., 2014). Deployment of evidence-based practices is needed to mitigate CAUTIs, especially for the fragile LTACH patient population. Literature is limited with regards to CAUTI and the LTACH patient population. This project adds to the body of evidence with regards to quality improvement processes, use of admission best practice based UCP and CAUTI rates for LTACHs.

Consistency with DNP Essentials

The eight Essentials of Doctorate education outline core foundational competencies for advanced nursing practice doctoral education (AACN, 2006). This DNP project aligned with two key Essential areas: Essentials II and III.

DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking was relevant to this project. According to AACN, 2006 doctoral prepared nurses must engage organizational and system leadership skills to improve patient and healthcare outcomes. Specifically, they must possess, "…expertise in assessing organizations, identifying systems' issues, and facilitating organization-wide changes…" and "…be proficient in quality improvement strategies…" (American Association of Colleges of Nursing (AACN), 2006, p 10). This project was a part of a 114-hospital quality improvement initiative that continues to be co-chaired by this student with the corporate Quality Department.

DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice was also relevant to this project. Specific competencies identified in this Essential included the application and translation of research into practice by employing evidence-based practice (AACN, 2006, p 11). This project was based on the compilation of research that defines best practice

strategies to reduce/eliminate CAUTI. The availability of new research and recommendations require the review of current practices and implementation of new best practices. CAUTI rates are a clinical indicator of quality care. The review of current practice and its effectiveness were framed within a quality improvement initiative. An underlying goal was to ensure that up-to-date practices were in place that promote safe, timely, efficient, and patient centered care.

Project Objectives

Saint, Weiss, & Amory (2000) surveyed physicians and found that approximately one-third of the physicians were unaware that their patients had a urinary catheter. Additionally, a systematic review and meta-analysis done by Meddings, Rogers, & Saint (2010) concluded that a reminder and stop orders appear to reduce CAUTIs by fifty two percent. Thus, a major goal of this project was to implement a revised protocol based upon EBP that included a guide to direct the removal of urinary catheters if needed upon admission. CAUTI rates were reassessed following a three-month implementation. Pre and Post protocol CAUTI rates were compared to identify if CAUTI rates decreased. The likelihood of reduced risk if the protocol was followed was also assessed. To achieve these goals, the primary project objectives were to:

(1) Identify two hospitals within the organization for which urinary catheter quality metric data are not within the acceptable national guidelines set by National Healthcare Safety Network (NHSN),

(2) Implement a UCP upon admission for individuals meeting criteria that contains evidence based indicators for urinary catheters, and

(3) Evaluate if protocol implementation made a difference in CAUTI rates and reduced risks over a three-month period.

Iowa Model of Evidence Based Practice

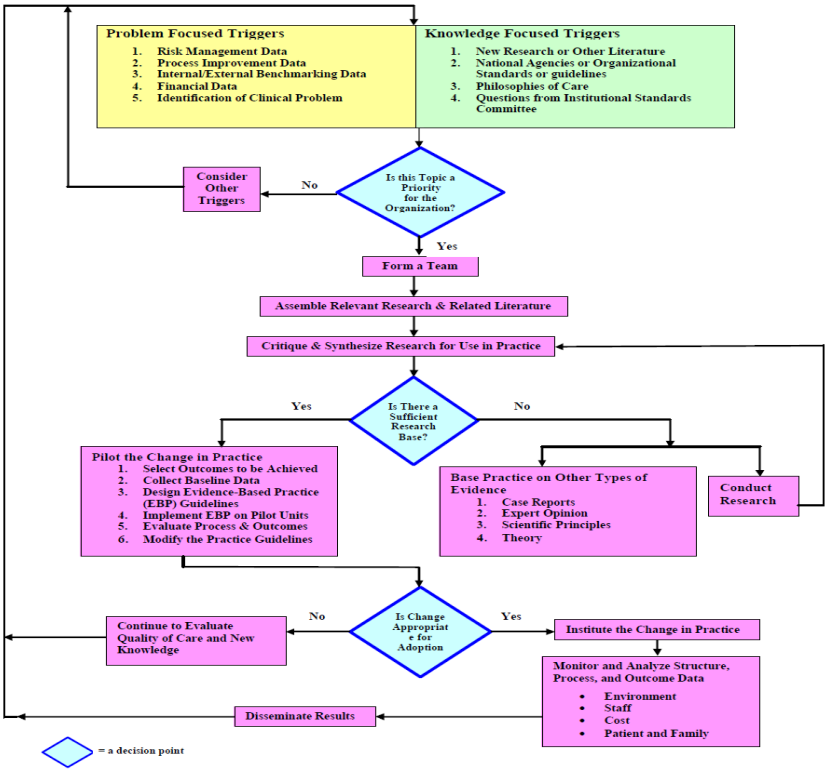
This DNP project was designed as a quality improvement initiative. The Iowa Model provided a systematic process to manage this quality-driven evidenced based practice change (see Figure 2). The initial step in this model involved identifying triggers for change which included problem focused triggers and knowledge focused triggers (Titler et al., 2001). This project involved implementing an UCP rooted in both triggers. The problem focused triggers for this project included the need to meet national quality metric benchmarks and to minimize financial penalties associated with CAUTIs. The knowledge focused trigger was to implement best practice guidelines/protocols (the UCP) that were based on current evidence.

In the Iowa model, once triggers for change were identified, three decision points and feedback loops provided directions to effectively manage the project. The first decision point involved assessing whether the practice change was a priority for the organization. This project aligned with the organization's goals to provide quality care that is based on evidence, increase market share in the LTACH industry, save lives and minimize loss of revenue. In following the Iowa model, a quality improvement CAUTI Reduction Task Force was formed, literature was reviewed, critiqued and synthesized and the second decision point revealed sufficient evidence to pilot the change in practice.

The "pilot the change in practice" step in the Iowa model was the focus of this DNP project. Key components of this step in the Iowa model included establishing outcome measures; collecting

baseline data, and; developing, implementing and evaluating an EBP change. While the goal of this project was to see if the UCP had an impact on CAUTI rates, the ultimate goal was to reduce CAUTI rates. A best practice UCP was developed and implemented. Pre and post protocol implementation data was obtained and analyzed as described in chapter three.

Figure 2 The Iowa Model of Evidence Based Practice to Promote Quality Care



From "The Iowa Model of Evidence Based Practice to Promote Quality Care." by M. G. Titler, et al, 2001. Critical Care Nursing Clinics of North America, 13(4), p 497-509

The Iowa model concludes with the third decision point- is the practice change appropriate for adoption. In this step the practice changes are instituted on a wider scale, outcomes are monitored and results are disseminated. This model provides organizations with a systematic

process to methodically trial evidence based practice change in real settings on a small scale. Additionally, this methodology can enhance EBP change success by refining practice changes prior to large-scale implementation which will be a future endeavor for this student post graduation.

Chapter Two: Review of Literature

There is a significant body of literature regarding CAUTI and the use of quality improvement methodologies to improve care. This chapter summarizes evidence that supports this project and introduces the Iowa Model of Evidence Based Practice to Promote Quality Care methodology that was used to frame this project. Additionally, definitions/concepts related to CAUTI, CCI, Long Term Acute Care Hospitals (LTACH), and practice recommendations are discussed.

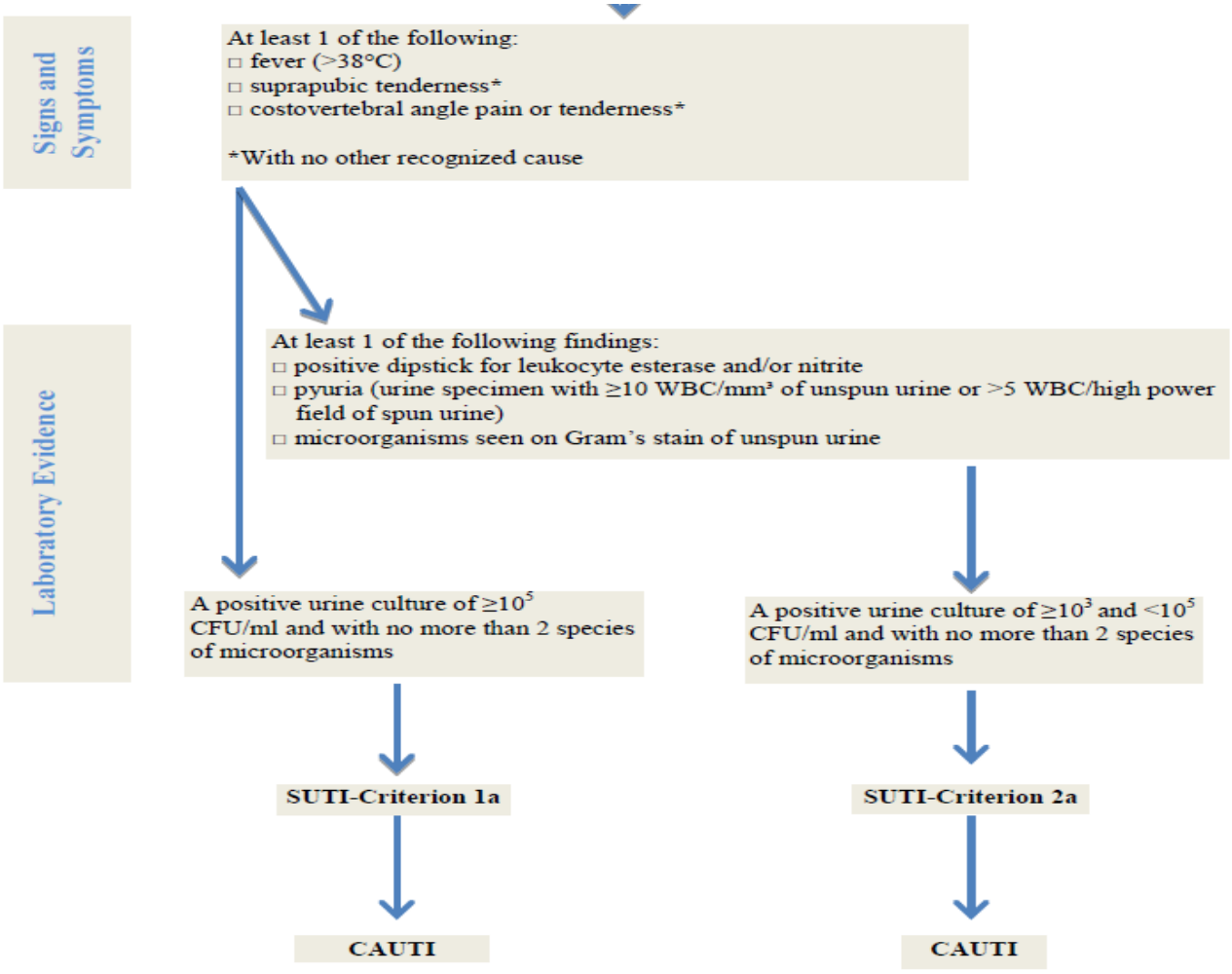
Cather Associated Urinary Tract Infections

In August of 2011, the Centers for Medicare and Medicaid Services (CMS) published the final rules in the *Federal Register* indicating the requirement for LTACHs to report CAUTIs via the Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN) (CDC, September 2012). This requirement was effective on October 1, 2012. CAUTI surveillance requires the use of standardized criteria set forth by NHSN definitions. Urinary tract infections are defined by two sets of criteria- symptomatic urinary tract infection (SUTI) or asymptomatic bacteremic urinary tract infection (ABUTI). In general terms, catheter-associated urinary tract infections are urinary tract infections when an indwelling catheter has been in place for greater than two calendar days on the date of the event, with the day of the device placement being day one and the urinary catheter was in place on the date of the event or the day before (CDC, January 2014).

The NHSN criteria for CAUTI that were in place at the onset of this project are listed in Figures 3-5. This criteria was updated and implemented beginning January 2015.

Figure 3 CDC/NHSN Identification and Categorization of Symptomatic Catheter-Associated Urinary Tract Infection with Indwelling Catheter

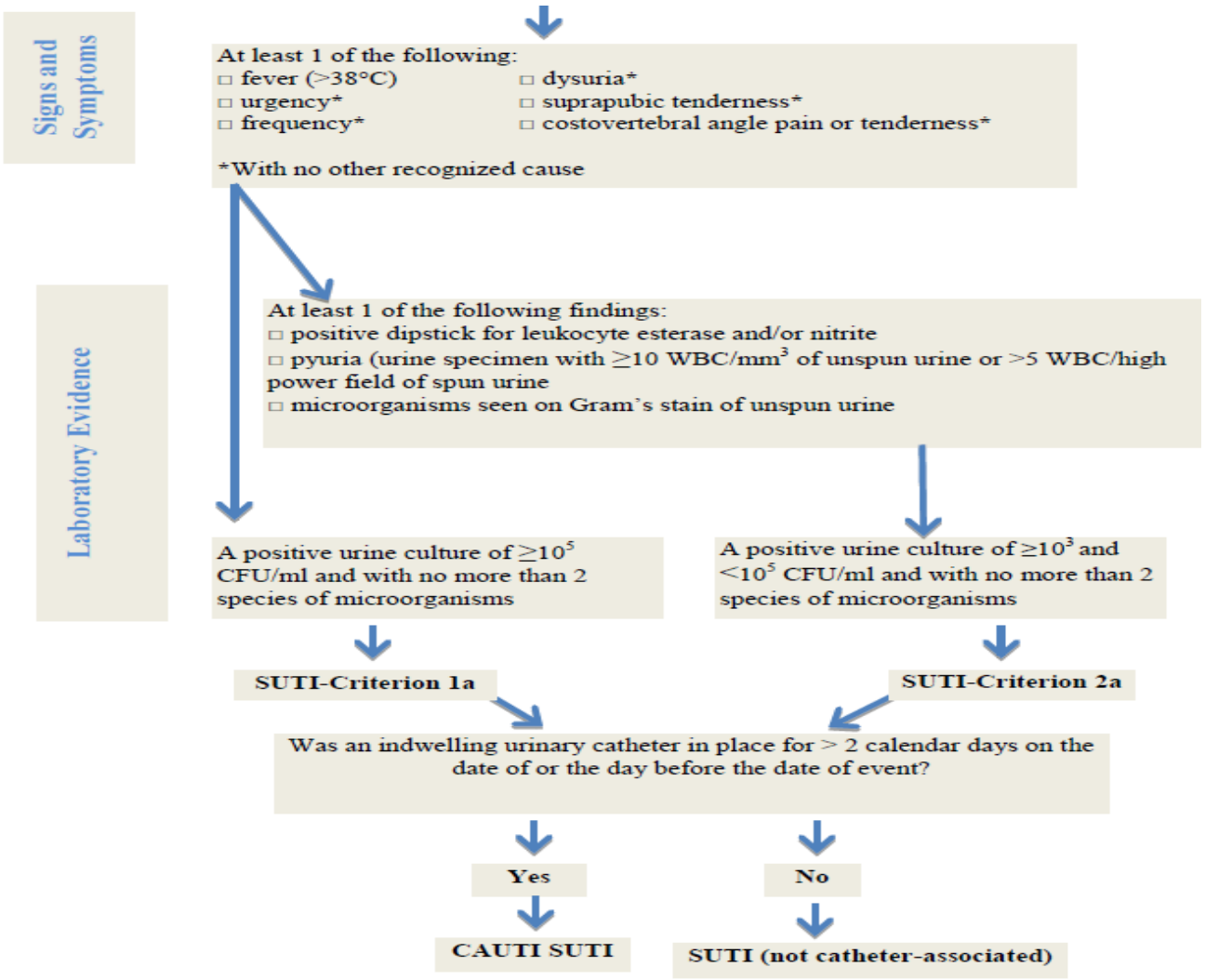
Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1, and catheter was in place on the date of event. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements.



From "Catheter-associated urinary tract infection (CAUTI): Event-device associated module." by CDC January 2014, p 7-9.

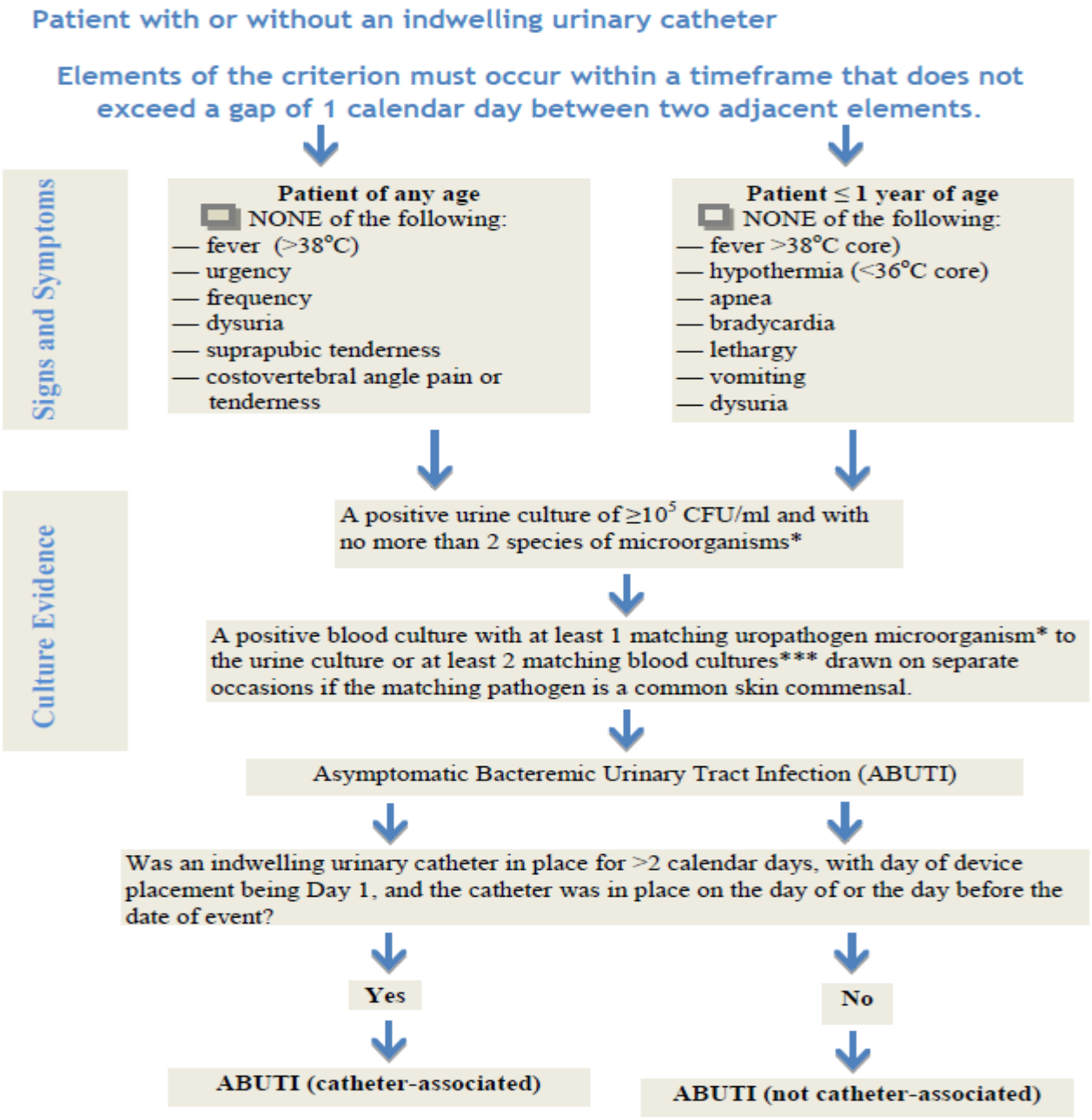
Figure 4 CDC/NHSN Identification and Categorization of Symptomatic Catheter-Associated Urinary Tract Infection When Indwelling Catheter has been removed

Patient had an indwelling urinary catheter removed the day of or the day before the date of event. Elements of the criterion must occur within a timeframe that does not exceed a gap of 1 calendar day between two adjacent elements.



From "Catheter-associated urinary tract infection (CAUTI): Event-device associated module." by CDC January 2014, p 7-10.

Figure 5 CDC/NHSN Identification of Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)



From "Catheter-associated urinary tract infection (CAUTI): Event-device associated module." by CDC January 2014, p 7-12.

The primary changes are listed in Figure 6 and the new flowchart to identify UTI's is presented in Figure 7. Over the last decade NHSN and CDC have revised the definitions in an effort to provide clarity and uniformity in reporting. However, it should be noted that validity has not been established for the current CDC/NHSN definition for symptomatic CAUTI for facility-to-facility outcome comparisons (Lo, et al., 2014).

Figure 6 NHSN HAI Surveillance Changes for 2015: UTI

Definitional Changes

The Urinary Tract Infections (UTI) definitions will no longer include:

- Symptomatic UTI (SUTI) criteria 2 and 4 due to removal of the following elements:
  - Colony counts of less than 100,000 CFU/ml
  - Urinalysis results
- Urine cultures that are positive only for yeast, mold, dimorphic fungi, or parasites
- Uropathogen List for Asymptomatic Bacteremic UTI (ABUTI)

Additional Protocol Changes

1. Scenario:
   - Patient is > 65 years of age, AND
   - Patient has not had an indwelling urinary catheter on the day of ABUTI or the day before, AND
   - Patient meets all other ABUTI definitional requirements

-Previous to January 1, 2015 in the above scenario, the patient would not have met the ABUTI criteria because all UTI symptoms, including fever were excluded. For 2015, since fever alone is not a specific symptom of UTI in non-catheterized, elderly patients (i.e., > 65 years of age) presence of fever alone will not exclude ABUTI in this population only.

2. Users will also note that the seldom used symptom "dysuria" can no longer be used to meet the infant criteria for SUTI (SUTI 4).

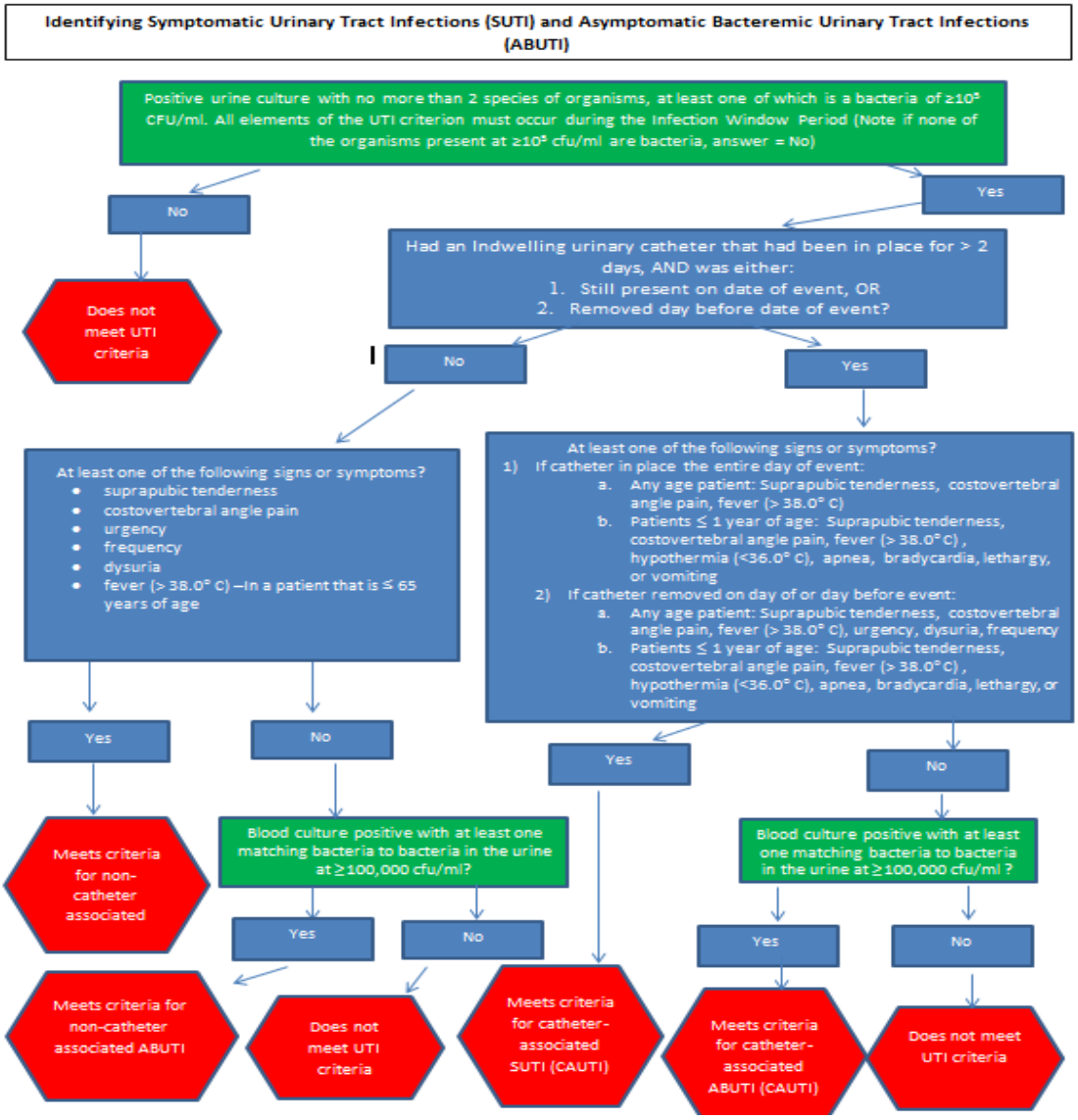
3. Core temperatures will no longer be required for infant fevers. Additionally, for all NHSN HAI surveillance, no conversion of temperatures based on route should be performed, even if hospital policy exists to say otherwise. Instead, facilities will use the documented temperature for all NHSN HAI surveillance.

What These Changes Mean for Facilities Reporting UTIs to NHSN in 2015

- Only urine cultures with a colony count of at least 100,000 CFU/ml for at least one bacteria will be used to meet NHSN UTI criteria.
- Only bacteria will be accepted as causative organisms of UTI.
- ABUTI criteria will use the same pathogen list as SUTI.

From "The Center for Disease Control Prevention NHSN e-News." by CDC/NHS September 2014, p 6.

Figure 7 CDC UTI Flowchart



From “Urinary tract infection (catheter-associated urinary tract infection [CAUTI] and non-catheter-associated urinary tract infection [UTI] and other urinary system infection [USI] events): Device-associated module CAUTI.” by CDC January 2015, p 7-11.

Chronic critical illness

Chronic critical illness is a relatively new phenomenon. Literature addressing CCI did not begin to appear until the 1980's. There is currently no universally accepted definition of CCI. While the definition of CCI is elusive, multi-system failure and/or the need for prolonged mechanical ventilation (PMV) tend to be common variables associated with the CCI patient. Simplistically, CCI is a combination of a systematic inflammatory response and multi-organ dysfunction. In a broad sense, patients with CCI are those who have survived an acute critical illness or injury, but continue to require life-sustaining care (Carson, 2012) such as persistent mechanical ventilation, dialysis, and vasoactive drips.

Chronic critical illness is believed to be the result of complex chemical and metabolic changes. Humans have unique intrinsic physiologic defense mechanisms that are activated in the event of an acute illness or injury. These mechanisms result in a variety of chemical responses from the sympathetic, neuroendocrine and immune systems that are adaptive and advantageous to mount an effort towards recovery. For patients who do not initially recover, these chemical mechanisms persist and set up the deleterious sequela of CCI.

Stress, allostasis and inflammation

Stress research has a long history and has evolved over time. In 1878, Claude Bernard first described physiologic feedback mechanisms that served to regulate and stabilize organs and tissues of living organisms. He used the term milieu intérieu which was later coined "homeostasis" by Walter Cannon in 1932. In 1950, Hans Selye proposed the General Adaptation Theory as a physiological response to stress that when unrelieved resulted in a pathological state. He

conceptualized that when faced with stress, multiple interconnected systems (e.g., adrenal-endocrine system, autonomic nervous system, immune system, and neural systems-hippocampus and pituitary gland) respond to restore physiologic stability. Bernard, Cannon and Selye's classic findings inspired future studies.

A variety of literature has been published that proposes homeostatic theory modification. Of particular interest is the work of Sterling, Eyer, McEwen and Van Den Berghe. Sterling & Eyer (1988) suggests that the brain is the central regulator that promotes adaptive responses to stress. The limbric brain (hippocampus, amygdale, prefrontal cortex) orchestrates physiological mediators of the neuroendrocrine system, autonomic nervous system and immune system, in response to stress. This intrinsic regulatory process is called "allostasis" ("stability through change") which acts in an effort to restore homeostasis (Sterling & Eyer, 1988).

Allostasis can be viewed as a natural defense mechanism that initiates a dynamic and complex cascade of chemical changes that are intended to be adaptive in nature. When these mechanisms do not "turn-off" a high allostatic load (HAL) or allostatic burden is said to exist. A HAL is maladaptive due to the cumulative and multisystem toll exacted from the over activity and dysregulation that occurs. The ultimate result of allostatic burden is dispersed cellular damage (multi-system/organ dysfunctions) and unabated inflammation (McEwen, 1998).

Multiorgan dysfunction- CCIS revealed.

According to Van den Berghe (2002), there was an assumption that regulatory response mechanisms were identical with acute and chronic critical illnesses. Studies have revealed that changes in the adaptive mechanisms during the acute phase (first hours to days) are dissimilar to

those in the chronic phase (from 7-10 days onward) of critical illness (Van den Bergh, G., de Zegher, F., & Bouillion, R., 1998). Therefore, it is estimated that survival (not recovery) from an acute illness may be revealed as CCI somewhere between 5 to 12 days (Carson, 2012; Van den Berghe et al., 1998) or from 7-10 days onward (Van den Berghe et al., 1998). While the precise mechanism of CCI is uncertain, the hyperinflammatory response that leads to inflammation is a hallmark physiologic feature of CCI. What seems apparent is that CCI is the result of high allostatic loads that presents a "clinical constellation" of features. Due to the multi-system and multi-organ impact, the term chronic critical illness syndrome (CCIS) is frequently used.

The physiology and care needs for CCI patients and families are complex, challenging and distinctly different than those with an acute critical illness. Key features of CCI are related to ongoing and overlapping multi-system multi-organ dysfunctions such as- endocrine exhaustion, loss of glycemic control, hypothyroidism, catabolism, malnutrition, cachexia, immune exhaustion, increased susceptibility to infections and wounds, bone loss, anemia, critical illness polyneuropathy, delirium, depression and a high burden of suffering (Bellar, Kunkler & Burkett, 2009). Managing these patients requires an interdisciplinary approach that is equipped to deal with a myriad of physical, emotional, ethical and psychosocial issues. Statistics associated with CCI prevalence and outcomes are not clear. It has been estimated that 5%-10% of adult patients with a critical illness will develop CCI (Carson & Bach, 2002). It stands to reason that the prevalence of CCI will continue to increase as a result of continued advancement in medical technology and an increase in our aging demographics. Hospital mortality has been reported to range from 37%-60% (Wiencek & Winkelman, 2010) whereas post discharge mortality rates were > 50% at six months (Carson & Bach,

2002). While additional CCI studies are needed, it is evident that this population presents a unique spectrum of challenges and is extremely vulnerable to CAUTIs.

Long term acute care hospitals.

Catheter associated urinary tract infections are problematic in the LTACH venue. According to NHSN's report available at the onset of this project from, which included data reported to NHSN January through December 2012 and to the CDC by July 1, 2013, LTACHs had a higher rate than almost all other locations for CAUTI pooled mean rates and urinary catheter device utilization ratios (Dudeck, et al., 2013). The most recent NHSN that included data reported from January through December 2013, the CAUTI pooled mean remained the same. Table 1 depicts LTACH device associated data specific to CAUTI rates from three data periods, 2011, 2012, and 2013.

Table 1 Device-associated data from NHSN

Data for Long-Term Acute Care Hospitals (Adult Ward)

Urinary catheter-associated UTI rate (CAUTI)				**Percentile**				
No. of locations	No. of CAUTI	Urinary catheter days	Pooled mean (Benchmark)	10	25	50	75	90
166 (165)	1407	652,175	2.2	0.00	0.90	1.80	3.10	4.80
*588 (580)	2,537	1,282,295	2.0	0.00	0.00	1.60	3.00	4.90
**628 (625)	4830	2,461,736	2.0	0.00	0.60	1.60	2.80	4.20

From "National Healthcare Safety Network report, data summary for 2011, device-associated module." by M. A. Dudeck, et al, 2013. American Journal of Infection Control, v. 41(4), p 286-300
*From "National Healthcare Safety Network report (NHSN), data summary for 2012, device-associated module." by M. A. Dudeck, et al, 2013. American Journal of Infection Control, v. 41(12), p 1148-1166
**From "National Healthcare Safety Network report, data summary for 2013, device-associated module." by M. A. Dudeck, et al, 2015. American Journal of Infection Control, v. 43(3), p 206-221

The CAUTI challenge in the LTACH population is multifaceted. From a physiological standpoint, the immune exhaustion experienced by these patients leave them significantly vulnerable and with little reserve to fight off infections. A large percentage of LTACH admissions come from intensive care units with indwelling catheters already in place. Data are not available with regards to what percent of patients have these devices upon admission. As in acute care venues, urinary catheters are prevalent in LTACHs without just cause- physicians forget they are present, nurses are reluctant to remove them and/or they choose not to collaborate with physicians to obtain orders to remove them.

Regulations, healthcare transparency and public access to data require health care organizations (HCO) to embrace a culture of safety and accountability. Hospital acquired infections are on the "radar" of multiple media sources. With the availability of quality metrics at the public's fingertips, consumers and insurers are in the position to shop for quality care. LTACH's are **100%** referral based. Therefore, outcomes associated with CAUTI can have a devastating impact with regards to reimbursement, image and hospital viability.

Statistics associated with CCI outcomes are not clear. Data specific to mortality due to CAUTI in LTACH are not available but it seems logical that CAUTIs can complicate the potential for recovery and contribute to LTACH mortality rates. Therefore, a quality improvement project was warranted in an effort to identify if an admission nursing urinary catheter removal protocol actually reduces CAUTIs in this very fragile population. The risk of CAUTI increases daily so even 1 less day with a catheter should be considered significant.

Evidence Synthesis.

Prevention of CAUTIs has become an international initiative. In an effort to improve the quality of healthcare, numerous U.S. based organizations such as the IOM, Centers for Medicare & Medicaid Services (CMS), The Joint Commission (TJC), Center for Disease Control and Prevention (CDC), Association for Professionals in Infection Control and Epidemiology (APIC), Society for Healthcare Epidemiology of America (SHEA), and Infectious Diseases Society of America (IDSA) have partnered in an effort to eliminate CAUTIs. These organizations have provided a plethora of information to assist organizations in their quest to eliminate CAUTIs.

The incidence, cost and preventability of CAUTI prompted CMS to eliminate payment for this condition. As of October 2008, CMS does not pay for CAUTIs that are contracted while hospitalized. CMS has taken the stance as an active purchaser of quality care and other payers are sure to follow suit. The financial incentive to eliminate CAUTI is clear but there are also nonfinancial incentives. As healthcare becomes more transparent, healthcare organizations must be accountable to those they serve and those who pay for services rendered. Publicizing performance data will impact consumer and payer choice as well as increase competition for market share. Thus, the use of indwelling catheters do not pose a risk to just the patient, they are a business risk.

In 2009 the Healthcare Infection Control Practices Advisory Committee (HICPAC) via CDC, published indications for indwelling urethral catheters recommendations- (1) Patient has acute urinary retention or bladder outlet obstruction (2) Need for accurate measurements of urinary output in critically ill patients, (3) Perioperative use for selected surgical procedures, (4) To assist in healing of open sacral or perineal wounds in incontinent patients, (5) Patient requires prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such

as pelvic fractures), and (6) To improve comfort for end of life care if needed (Gould, Umscheid, Agarwal, Kuntz, & Pegues, 2009).

In 2014, the Society for Healthcare Epidemiology of America (SHEA) sponsored a collaborative effort with multiple organizations (Infectious Diseases Society of America (IDSA), American Hospital Association (AHA), Association for Professionals in Infection Control and Epidemiology (APIC), The Joint Commission (TJC)) and updated their 2008 practice recommendations to prevent CAUTs in acute care hospitals. Three key practice strategies included:

(1) Provide and implement written guidelines for catheter use, insertion, and maintenance,

(2) Develop and implement facility criteria for acceptable indications for indwelling urinary catheter use, and

(3) Limit criteria to those appropriate for indwelling catheters such as-

a. Perioperative use for selected surgical procedures, such as urologic surgery or surgery on contiguous structures of the genitourinary tract; prolonged surgery; large volume infusions or diuretics during surgery; intraoperative monitoring of urine output needed,

b. Hourly assessment of urine output in patients in an ICU,

c. Management of acute urinary retention and urinary obstruction,

d. Assistance in healing of open pressure ulcers or skin grafts for selected patients with urinary incontinence,

e. As an exception, at patient request to improve comfort (e.g., end-of-life care)

(Lo, et al., 2014 p 467-468).

Criteria for urinary catheters for this DNP student's organization were recently reviewed and re- developed based on the above recommendations and the specific patient population served. The Chief Medical Officer, Chief Quality Officer, Senior Vice President/CNO, and Corporate CAUT Task Force approved the criteria. The criteria became a part of the admission process in the form of a formalized UCP followed by an evaluation period.

There is a growing body of evidence that supports the use of checklists with catheter criteria. The primary modifiable risk factors for CAUTIs is avoiding unnecessary catheter placement and minimizing the duration of use (Lo, et al., 2014; Gould, 2010). IHI's "How-to guide" specifically addresses the need to, "modify routine admission assessment to include check for presence of a urinary catheter and verification of necessity if present; this should occur on arrival to nursing unit. Catheters that do not meet criteria should be removed." (IHI 2011, p 11). This IHI recommendation was the impetus for this project in that a previously implemented regional protocol within the health care delivery system of interest (LTACHs) needed revisioned. This provided a unique opportunity for a quality improvement project evaluation and optimization, in advance of the roll-out of a large-scale initiative.

Chen et al. (2013) conducted a randomized control trial in two respiratory care intensive care units. Two hundred seventy eight patients with urinary catheters in place for greater than two days were randomly assigned to either an intervention group (daily reminder to physician to remove catheter if criteria were not met) or the control group (no reminder). The reminder protocol decreased catheter utilization rates by 22%, reduced the median duration of catheterizations, and decreased the CAUTI rate by 48%.

Mori (2014) conducted a quality improvement project in a 150-bed community hospital. A nurse driven protocol that included criteria for catheter use was developed. A retrospective chart review for prevalence of catheter usage and dwell time was measured 3 consecutive months before (n=389) and after (n=282) protocol implementation. Urinary catheter incidence went from 37.6% pre-intervention to 27.7% post-intervention. CAUTI rates were also reduced from 0.77% pre-intervention to 0.35% post-intervention.

Magers (2013) conducted a quality improvement initiative using a seven-step EBP approach. This study was conducted in a 25-bed LTACH setting. A nurse driven protocol-containing criteria for urinary catheters was implemented. CAUTI rates declined by 33% (although not statistically significant) and the mean number of catheter days dropped from 13.12 to 9.69.

Practice Recommendation.

The literature supports best practice recommendations to remove urinary catheters as soon as possible. Utilizing a urinary catheter protocol provides nurses within LTACH facilities a standardized guideline for urinary catheter use. Implementing the protocol was essential to reduce the incidence of CAUTI rates associated with having a urinary catheter.

Chapter Three: Methods

Project Design

This was a quality improvement project intended to decrease CAUTI rates for a chronically critically ill population within two LTACH facilities following the implementation of an evidence-based best practice protocol. Pre-existing quality metrics revealed CAUTIs were above the acceptable standards of care for this chronic critically ill population. The Senior Vice President/Chief Nursing Officer (CNO) in collaboration with the Director of Education acknowledged the need to reduce CAUTI rates and supported the initiation of this quality improvement project. A (QI) CAUTI Reduction Task Force was initiated prior to project implementation. Official members of the QI team included the Director of Education, Director of Research/Quality, two Divisional CNOs and Divisional Director Quality Management (DQM). Other stakeholders involved included the Chief Medical Officer, Chief Quality Officer, and Senior Vice President/CNO.

Practice Change

No urinary catheter protocol was in use in the pilot hospitals prior to this project.. This project included the development and implementation of a urinary catheter protocol that provided guidelines for nurses to use upon admission. Specifically, the protocol was initiated when patients with urinary catheters were assessed upon admission. Following the protocol the nurses determined whether to maintain or remove the catheter.

Setting

The setting for this project was two LTACH facilities. LTACH's are highly regulated and are required to have an overall average length of stay of twenty-five days. The patient population

served in this setting is commonly referred to the "chronic critically ill." The project setting serves adult patients (18 years of age and older) and typically includes a larger percentage of adults aged 65 or older. All required organization and Institutional Review Board (IRB) approvals were obtained. Based on the study design, the project was determined to be exempt as non-human subjects research by The Ohio State University Office of Responsible Research Practices.

Sample

It was estimated that there would be 155 admissions during the study period. Prior to the project it was estimated that up to 95% of the patients admitted within the two systems had a urinary catheter. Thus, it was estimated that 147 patients would be eligible for protocol implementation upon admission during the study period.

Procedure

This project began following The Ohio State University IRB approval with an exempt status. The DNP student utilized best practice and recommendations from the evidence to develop the UCP. The Director of Research provided a copy of the UCP to the participating hospital's executive team. The executive team was responsible for presenting the UCP to the local Medical Staff Director and obtained approval.

The procedure for utilizing the UCP (see Figure 1) was as follows:

1. The admitting nurse placed the UCP in the medical record for any patient who had a urinary catheter in place upon admission.

2. The nurse assessed the patient to determine if criteria for a urinary catheter were met. The criteria for a urinary catheter included the need for accurate intake & output (hemodynamic

instability, renal insufficiency); end of life care to improve comfort, if requested by patient; would assist healing large/significant sacral/perineal wounds in incontinent patients; neurogenic bladder (diagnosed by physician/LIP) until bladder program could be established; acute urinary retention, obstruction or bleeding; urinary catheter placed by urologist or recent surgery (urological or involving contiguous structures), and; patient required prolonged immobilization (unstable thoracic or lumbar spine, multiple traumatic injuries such as a pelvic fracture).

3. If none of the criteria for a urinary catheter were met, the nurse removed it.

Prior to implementing the UCP information sessions were provided by the DNP student, and Co-chair/Director of Research via synchronous e-learning sessions. Steps in this process included the following:

1. The DNP student contacted the Director of Research to arrange dates for information sessions to key stakeholders within the organization.

2. The Director of Research e-mailed the dates and times of the synchronous information sessions to the executive team which included the Chief Executive Officers (CEO), CNO and, DQM. Any additional stakeholders identified by the executive team were invited to attend the information sessions.

3. Two information sessions were offered the week of November 10, 2014 at 1200 EST and 1400 EST. The UCP was reviewed. The student and Director of Research conducted the sessions via electronic format to accommodate travel and budget.

4. The executive team provided information sessions for Charge Nurse's, staff nurses, and interested physicians during the weeks of November 17 and 24, 2014.

5. The UCP was implemented December 1, 2014.

Data were collected by the onsite Directors of Quality Management, both whom were certified as Infection Control Practitioners. There were no changes to the surveillance protocol over the pre and post protocol period except that the NHSN criteria changed January 1, 2015. Following the implementation of the protocol the DNP student requested (via email) the quality metrics report from the corporate Director of Research. Data was de-identified and stored hardcopy in a locked drawer. The primary source of data for this project was pre-existing and currently monitored by the Quality Management Department and reported to the Corporate Quality Improvement Department. CAUTI Rates and urinary catheter device days were included in the quality metric reports. The quality metrics report included data for the three-month retrospective period prior to protocol implementation (September-November 2014) and a three-month prospective period post protocol implementation (December 2014-February 2015). CDC/NHSN definitions that were in effect at the time of protocol implementation were utilized. A pre and post protocol implementation analysis was completed.

Data Analysis Plan

Data analysis was completed for the project questions as follows:

Question 1: Does implementing a urinary catheter protocol initiated upon admission, affect the overall number of catheter days?

Question 2: Does implementing a urinary catheter protocol initiated upon admission, affect catheter associated urinary tract infection rates? The calculation for catheter associated urinary tract

infection rates was the number of hospital-acquired urinary tract infections/number of urinary catheter device days x 1,000.

Comparison of pre and post protocol implementation data was done using parametric statistics for each facility. Pre and post rate differences using a conditional test that compares the number of post events to the number expected if there is no difference in the pre and post rates was assessed (Rosner, 2000). The absolute risk reduction (ARR) was used to assess the likelihood of reduced risk if the protocol was followed.

Data results will be presented to local staff and leadership, as well as corporate leadership team members by the end of May 2015. This will allow the corporate CAUTI Reduction Task Force to determine future actions/directions prior to system-wide implementation.

Chapter Four: Findings

Results

The primary outcomes measured were number of urinary catheter days and hospital-acquired catheter associated urinary tract infection rates (Table 2 and Figure 8). Data were collected in two LTACH's during a 3 month period before protocol implementation and 3 months after implementation. Overall urinary catheter days decreased from 2846 to 2383 a 463 day reduction. Therefore urinary catheter days were reduced by 16.3%.. The incidence of hospital-acquired CAUTIs decreased from 18 to 6 with an overall reduction of 66%. The hospital-acquired CAUTI rate decreased from 6.32 to 2.52 infections per 1000 catheter days. Therefore the use of the protocol reduced the incidence of CAUTIs per 1,000 patient days by 60%. The absolute risk reduction (ARR) further determined the two group's event rate. The absolute risk reduction was 3.81 infections per 1,000 catheter days. Therefore this suggests the use of a urinary catheter protocol reduced the risk of CAUTI's by 3.81 infections per 1,000 catheter days. Overall the findings were statistically significant ($z= 1.82$, $p<0.03$) between the two groups in relation to catheter associated urinary tract infection rates (Table 2).

Analysis suggests that both catheter days and CAUTI rates were significantly affected by implementation of an evidence based urinary catheter protocol.

Table 2 Pre and Post Protocol Implementation Data

*	Pre Protocol Implementation			
LTACH 0	**Patient Days**	**Catheter Days**	**# of CAUTIs**	**CAUTI Rate**
Month 1 (Sept)	947	686	4	5.83
Month 2 (Oct)	969	604	6	9.93
Month 3 (Nov)	963	472	2	4.24
LTACH 1				
Month 1 (Sept)	631	325	3	9.23
Month 2 (Oct)	682	360	3	8.33
Month 3 (Nov)	641	399	0	0.00
Totals	**4833**	**2846**	**18**	**6.32**
	Post Protocol Implementation			
LTACH 0				
Month 1 (Dec)	843	354	0	0.00
Month 2 (Jan)	918	506	1	1.98
Month 3 (Feb)	877	484	1	2.07
LTACH 1				
Month 1 (Sept)	645	327	3	9.17
Month 2 (Oct)	680	339	1	2.95
Month 3 (Nov)	648	373	0	0.00
Totals	**4611**	**2383**	**6**	**2.52**

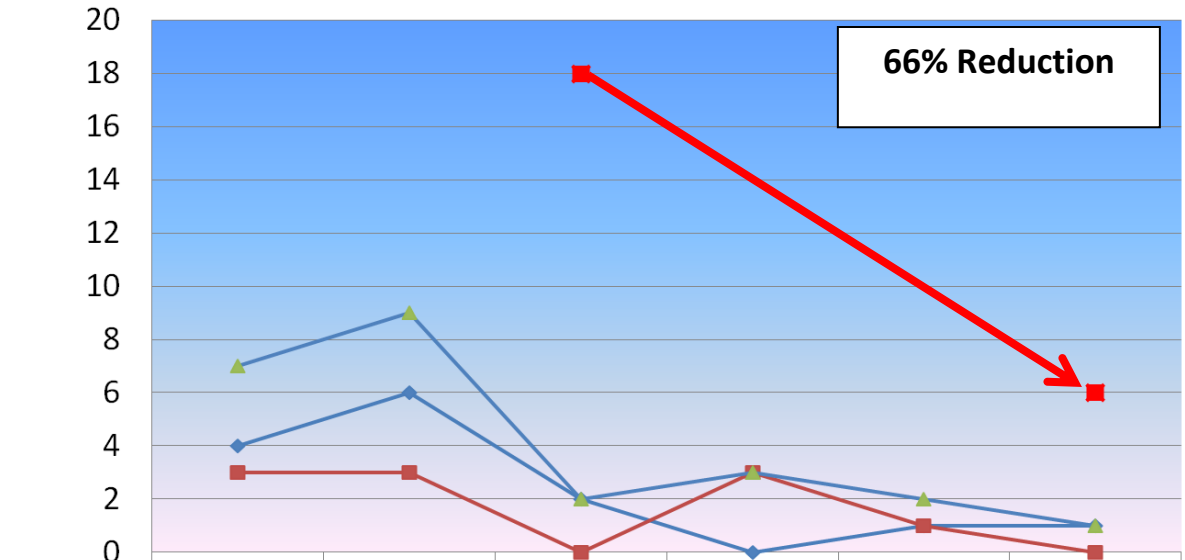
	Patient Days	**Catheter Days**	**# of CAUTIs**	**CAUTI Rate**
Pre protocol	4833	2846	18	6.32
Post protocol	4611	2383	6	2.52
Difference	222	463	12	3.8
Trend	**↓**	**↓**	**↓**	**↓**
Percent Reduction	**4.6**	**16.3**	**66**	**60**

****CAUTI Rate Summary Statistics and Statistical Significance of the Rate Difference**				
Infections per 1000 person days before the protocol	Infections per 1000 person days after the protocol	Absolute Risk Reduction (the rate difference)	z Value of a test of no rate difference	p Value (One sided)
6.32	2.52	3.81	1.82	0.03

**Data provided by Amanda Dawson, PhD, Select Medical (03/02/2015)*

*** Analysis provided by Loraine Sinnott, PhD The Ohio State University College of Nursing (03/05/2015)*

Figure 8 Number (Incidence) of CAUTI



	9/2014	10/2014	11/2014	12/2014	1/2015	2/2015
Hosp 0	4	6	2	0	1	1
Hosp 1	3	3	0	3	1	0
Total	7	9	2	3	2	1
Sum			18			6

Discussion

Reducing CAUTIs enhances quality of care and can reduce medical expenses. One of the key strategies to prevent and/or reduce this hospital-acquired infection is to minimize catheter use. The incidence of CAUTIs can be attributed to numerous factors. However, CAUTIs can be mitigated with the implementation of an evidence based practice protocol such as the one utilized for this project. From a quality perspective, the number of CAUTI's was reduced by 66%, the CAUTI rate was reduced by 60% and the number of catheter days was reduced by 16.3%.

National LTACH quality metric reporting has lagged behind typical hospital venues Regulations, healthcare transparency and public access to data require HCO's to embrace a culture of safety and accountability. HAI's are on the "radar" of multiple media sources- internet, television, newspaper, talk shows, and billboards. With the availability of quality metrics at the public's fingertips (e.g. Hospital Compare) consumers are in the position to shop for quality care. Consistent high quality care requires a collaborative approach. Healthcare professionals can not have an attitude that urinary catheters are the "norm". Ownership, accountability, a culture of safety, and continuous improvement are needed to obtain and sustain quality patient outcomes and control healthcare costs.

According to Umscheid et al. (2011) the hospitals cost per patient with a CAUTI is estimated to be $1200 - $4700. In this study, the number of hospital-acquired CAUTIs went from 18 pre protocol to 6 post protocol thus, there were 12 fewer infections. For the two hospitals involved in this study the estimated cost saving was $14,400 - $56,400 over a three month period. Twelve fewer CAUTIs over a 3 month period for the two hospitals represent an average of 2 less CAUTIs per

hospital per month. From an organizational standpoint, the estimated savings could be $3,283,200 - $12,859,200 (2 less CAUTI/month/hospital x 12 months x 114 hospitals = 2736 less CAUTI x $1200 or $4700).

Conclusions

LTACH patients are frequently admitted with urinary catheters in place. Many of these patients are critically ill therefore vulnerable to many hospital-acquired conditions including CAUTI. This project supported that implementation of a nurse driven protocol to remove urinary catheters can reduce CAUTIs. This quality improvement project provided an evidence-based protocol that had a positive impact on patient outcomes and therefore potentially medical expenses. While the potential cost savings was estimated, the impact of this project was certainly significant from both a clinical and statistical perspective.

The NHSN benchmark for LTACH CAUTI rates is 2.0. There was a 60% overall reduction in the CAUTI rate from 6.32 to 2.5 so there is a need to continuously monitor and improve these results. To provide the best care possible, research, EBP and quality improvement process efforts must continue. The positive results of this evidence-based practice quality improvement project will likely result in the adoption of this urinary catheter protocol for organization wide implementation.

Chapter Five: Summary

Study Summary

The overall goals of this project were to reduce urinary catheter days and CAUTI rates. These results show that implementation of a best practice protocol can influence both thereby improve patient outcomes.

Limitations

The quality improvement design, sample size, and specific population studied (LTACH CCI patients) were study limitations. These limitations affect the generalizability to other patient populations. Additional limitation in this study included the lack of statistical depth and the NHSN CAUTI surveillance changes for 2015 as described in Figure 6. Two important quality metrics, urinary catheter utilization ratios (UCUR) and standardized infection ratios (SIR), were not included in the study design. These metrics are important as they provide hospitals with the ability to see benchmarks and assess the quality of care within their own organization. They are indicative of quality care which regulators (such as TJC and CMS) as well as, insurance companies and consumers have access to.

Lack of onsite oversight of the project may also be considered a limitation of the study. The DNP student provided online education to the hospital leaders for the sites involved. The leaders were responsible for educating and supporting the project. Onsite oversight by the DNP student would have ensured appropriate and accurate education. Although the overall results of the study were positive, it seems logical that the presence of the DNP student would have provided staff with ongoing support, the ability to verify compliance, and improved outcomes.

Implications for Nursing Practice and to the DNP Essentials

Evidence based practice strategies must be rooted in sound scientific evidence to promote safe, efficient, cost effective, and patient centered care. Providing care based on the best scientific evidence provides nurses with the opportunity to innovate and integrate. The scientific underpinnings for practice are the "brain" of nursing while the delivery of compassionate care is the heart and soul/the art of nursing. The artful delivery of evidence based care must remain forefront in nursing practice.

According to Dudeck et al. (2015) the CDC intended use of the 2013 LTACH data may serve as the baseline for new standardized infection ratios. The NHSN is currently collecting additional information on the 2014 NHSN annual LTACH survey to determine if such data can be used for future risk adjustment and to better describe this patient population (Dudeck et al., 2015).

Application and translation of quality patient care by employing evidence-based practice requires leadership. Leaders need to push beyond achieving benchmarks such as a 2.0 CAUTI rate and inspire healthcare providers to achieve and sustain zero CAUTIs. Doctoral prepared nurses along with other interdisciplinary team members can provide organizational and systems leadership to improve patient outcomes and reduce healthcare cost. Translation of knowledge into nursing practice on the appropriate use of urinary catheters remains problematic. Future studies, randomized controlled trials as well as quality improvement studies are needed to identify strategies that will successfully hardwire and sustain the delivery of best practice behaviors to the bedside.

Future Directions

When compared to other HAIs, the morbidity and mortality associated with CAUTI is relatively low (Gould, Umscheid, Agarwal, Kuntz, & Pegues, 2009). However, the prevalence of urinary catheters remains high and can lead to infections and deaths. There is a sound basis for utilization of UCP but further research is needed to identify barriers to protocol implementation in an effort to reduce the prevalence of urinary catheter use and ultimately eliminate CAUTIs.

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