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Simulation-based Education to Decrease CAUTI Rates in the Intensive Care

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This is to certify that the doctoral study by

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Abstract

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MS, Walden University, 2014

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Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Catheter-associated urinary tract infections (CAUTIs) occur frequently in Intensive Care Unit (ICU) patients, who are hospitals' most vulnerable population. This quality improvement project is the evaluation of 2 interventions used in one acute care facility's ICU to decrease CAUTI rates over a 3-year timeline. The 2 interventions used for the project were 1) an evidence-based guideline developed from the Comprehensive Unit-based Safety Program and 2) simulation-based education for teaching the guideline. Using the Iowa model and Havelock's theory of planned change as a framework, the 2 interventions were evaluated over a 3-year timeline: 2014 pre- intervention, 2015 intervention, and 2016 post-intervention. The results were compared quarterly for the 3 years using the standardized infection rate (SIR) and standard utilization ratio (SUR), which show the effectiveness of preventative activities. Data were obtained from the National Healthcare Safety Network and the results from the project showed an 82.46% decrease in SIR from 2014 through 2016 in Baseline 1, and a 71.33% decrease in SIR from 2015 through 2016 in Baseline 2. This is statistically significant for CAUTI reduction over a 3-year period ($p < 0.001$). For the SUR there was a 14.29% decrease from 2014 to 2016 in Baseline 1 and no statistically significant difference from 2015-16 in Baseline 2. It can be concluded that an evidence-based guideline taught through simulation significantly reduces SIR and has a positive effect on catheter use. This study contributes to positive social change because it promotes decreased patient length of stay and cost of care and decreases morbidity and mortality for patients. It also has a positive effect on health behavior-related outcomes for the ICU nurses for CAUTI prevention.

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Dedication

I dedicate my doctorate scholarly project to my family: my husband, James C. Bell whose patience, encouragement and love was always present for me during this journey; My children Sandy Bell and Dirk Bell who were my inspiration and motivation to “Never Give Up”. I also dedicate this doctoral scholarly project to my mother Virginia Belanger, who worked so I could go to nursing school 35 years ago and posthumously to my father, Raoul Belanger whose experience inspired my subject choice.

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Section 1: Nature of the Project

Introduction

Hospital acquired infections (HAIs) are infections that occur 48 hours after a hospital admission and are not present or incubating at the time of admission (Hensley, 2015). In the United States, one in 25 hospitalized patients suffer from an HAI (Laetsch, 2017). HAIs are linked to 100,000 deaths annually in the United States (Klevens et al., 2007) (Laetsch, 2017) and have an economic impact as high as $45 billion (Krein et al., 2012). The U.S. Government, through agencies such as the Department of Health and Human Services, has made HAI prevention a priority as a public health and safety concern (CDC, 2009). Centers for Medicare and Medicaid (CMS) have also tied reimbursements to quality by aligning financial incentives with improved outcomes (Palmer et al., 2013). The linking of outcomes and adverse events with CMS's new policies for reimbursement has incentivized hospitals to focus on HAI prevention.

There are multiple types of HAIs. They are classified according to their origin, including skin and surgical site infections, and infections from medical devices such as catheters or ventilators (Hensley, 2015). One type of HAI resulting from the use of a medical device is a catheter-associated urinary tract infection (CAUTI). Urinary tract infections (UTIs) make up nearly 40% nosocomial infections, with approximately 80% of those attributed to the use of an indwelling urinary catheter (IUC; Underwood, 2015). The cost of a UTI caused by an IUC is more than $400 million annually, which is passed down to the healthcare consumer (Apostolopoulou et al., 2015). It is estimated that 25% of hospital patients will have an IUC during their hospitalization (Janzen et al., 2013),

and each day that it stays in place the chances of getting a CAUTI increases by 7% (Underwood, 2015). A CAUTI can lead to prolonged lengths of stay, increased costs, patient discomfort, and increased rates of morbidity and mortality (Galiczewski, et al, 2017).

In the hospital setting, roughly 76 % of all IUCs (Gray et al., 2010), are used in the intensive care unit (ICU) due to the prevalence of high acuity patients with complex diseases (Foxley, 2011). This vulnerable patient population requires accurate monitoring of fluid balance, or the daily sum of all intakes and outputs (Shepherd, 2011). Furthermore, many patients in the ICU are unable to micturate due to obstruction (Rothfeld & Stickley, 2010), fluid retention (Andrioli, et al., 2016), and/or sedation issues (Andrioli, et al., 2016).

The IUC poses little risk when appropriately managed (Huang, 2016). Proper management includes aseptic insertion, daily maintenance, and timely discontinuation (Elpern, 2016). However, when the urinary catheter is mismanaged, there is an increased risk for the development of a CAUTI (Huang, 2016).

In 2008, CMS chose to deny reimbursements to hospitals for patients that develop a CAUTI during their stay (Saint et al., 2014). Several efforts to reduce CAUTIs have been developed as a result. One such effort was the National Action Plan, which provided strategies to prevent HAIs in acute care settings and had the goal of reducing CAUTIs by 25% by 2013 (Saint et al., 2014). Despite these efforts, however, the rates of CAUTIs increased by 6% (Saint et al., 2014). To address the issue of CAUTIs, programs and guidelines were developed to improve patient safety through the use of interventions and

new evidence-based practices. It is up to each healthcare organization to educate its staff on these guidelines in order to achieve effective outcomes.

The use of a medical device is paradox in healthcare: the same device used to save a life can be the one that causes morbidity or mortality in a patient (Cantrell, 2014). In the case of an IUC, following a comprehensive, evidence-based guideline that incorporates an effective educational method for teaching its contents will significantly decrease the rising rates of CAUTIs in the ICU population (Fasugba et al, 2016).

Problem Statement

High CAUTI rates in the ICU result from the inappropriate management of IUCs. The etiology is reasoned to result from the lack of evidence-based practice and the absence of professional development programs specific to appropriate IUC management.

Local Context for Gaps in Practice

There were two gaps in practice noted by the project manager at the hospital hosting this DNP project: a) inappropriate management of IUCs, and b) the lack of professional development strategies to teach clinicians how to effectively insert, manage and care for an IUC. Management of the IUC requires a multifaceted approach (Purvis et al., 2014) that includes using appropriate criteria for the use of the catheter, using aseptic technique for insertion, proper maintenance and post-insertion care, prompt removal when the catheter is no longer necessary, and an effective method of staff and patient education.

In hospital settings, as many as 63% of catheter insertions are not indicated by clinical necessity (Knudson, 2014). To address this gap, guidelines for appropriate IUC

use were developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC) and published by the CDC in 2009. The HICPAC determined six indications for IUC placement, including: (a) patient has acute urinary retention or bladder outlet obstruction; (b) a need for accurate measurements of urinary output in critically ill patients; (c) perioperative use for selected surgical procedures; (d) to assist in the healing of open sacral or perineal wounds in incontinent patients; (e) patients who require prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures); or (f) To improve comfort for end of life care (Gould et al., 2011).

Despite the importance of evidence-based criteria for indwelling urinary catheters use, the decision for use at this practice site was based on individual physician judgment and heavy influenced by the opinion of the ICU nurse. Compared to nurses in other departments, ICU nurses are significantly more likely to support the use of an IUC (Drekonja, Kuskowski, & Johnson, 2010).

The method of education, or lack thereof, for CAUTI prevention is another practice gap in the ICU. The present method of education used at the DNP project site is Health Stream, a computer-based learning management program with the ability to schedule, track, deliver, and report on classroom and online learning (Hayes & Heyd, 2015). This method omits the physical, hands-on training and practice needed to learn new clinical skills and lacks real-time witnessed evaluation (Mizerek, 2015), especially in regard to aseptic technique. Skills such as maintaining aseptic technique during IUC insertion can only be performed by properly-trained personnel (Medding et al., 2014).

Competency verification through demonstration is not possible through the computer method. For competency verification for clinical skills, it is important to use an effective educational method (Fonseca et al., 2016).

Local Relevance and Practice Environment

IUC management in clinical practice is varied and lacks evidence-based practice **(**Smith, 2003). The lack of standardization and evidence-based practices for the use, management, and care of an IUC was determined to be the cause of the high use of urinary catheters and high CAUTI rates in the project's setting. The two interventions used to address the gap in nursing practice were an evidence-based guideline and the use of simulation-based education.

There are currently multiple interventions that are used in the ICU settings to address the multifaceted issues of high CAUTI rates (Purvis et al., 2014; Parker et al., 2017; Richard, 2017; Kure et al., 2017), but none evaluate the use of an evidence-based guideline taught through simulation.

Significance and Implications for Nursing Practice

Addressing gaps in practice in the ICU will advance the nursing culture in the unit and have a direct effect on clinical practices. Engaging the staff nurses through an effectively-taught, evidence-based guideline will address the gap in knowledge for CAUTI prevention by eliminating practices based on tradition. Furthermore, the process will encourage nurses to sustain a practice that is research-based (Miller et al., 2016). Clinical nurses are in a unique position to influence a patient's illness and recovery through the care they provide. As the largest group of caregivers in a hospital setting,

nurses have the opportunity to provide evidence-based care that can reduce the potential for harm and poor outcomes (Doody & Doody, 2011). When nurses incorporate evidenced-based practices specific to urinary catheter management, the CAUTI rate can be reduced by almost 70% (Fletcher et al., 2016).

Purpose Statement

Gap in Clinical Practice

The purpose of this DNP project was to evaluate two interventions used in an evidence-based quality improvement program (EB-QIP) to reduce inappropriate IUC use as a strategy to reduce CAUTIs. The two interventions used in this EB-QIP project were the use of an evidence-based CAUTI prevention guideline that specifically addresses the gaps in practice and the educational method of simulation to teach the guideline. Prior to this project, this site had no standard CAUTI prevention programs or guidelines and lacked an effective education method, despite evidence on the benefits of CAUTI preventive programs (Knudson, 2014). The project's objective was to identify interventions that would increase the knowledge and clinical skill for CAUTI prevention in the ICU staff.

The United States health sector is complex for both care providers and recipients. The sector can benefit from scientists and clinicians continually exploring new ways to bring research evidence into practice while considering patient preferences and clinical judgment (Chan, 2007). This is what evidence-based practice means: an essential strategy to achieve quality improvement and better patient outcomes (Makic et al, 2013). By continually evaluating our present practices and translating research into new, evolving

practices, our present health care system can develop into one that is built on an evidence-based foundation (Makic et al, 2013).

Evidence-based nursing practice requires that nursing professionals understand and use relevant practices based on evidence-based research in specific situations to deliver high-quality care and improve patient outcomes (Haeok, 2013). For this project, the best method was based on the PICOT question. The PICOT question guides nurses in defining a clinical problem, organizing the facts into a clear and concise problem statement, identifying the best research evidence, and evaluating the evidence for implementation into practice (Melnyk et al., 2011).My PICOT question is: Will the use of an evidence-based guideline taught through simulation decrease CAUTI rates and catheter use over three years in a 28-bed ICU?

Response to the Gap in Clinical Practice

The purpose of this EB-QIP, was to emphasize the importance of using evidence-based interventions to reduce CAUTI rates and catheter use in this practice setting. Prior to the use of these interventions, CAUTI rates were consistently above national benchmarks. The high rates prompted the clinical practice leader (CPL) to search for evidence-based clinical practices proven to decrease CAUTIs, leading to the involvement in the Comprehensive Unit-Based Safety Program (CUSP). The CPL is responsible for clinical education in their assigned unit. The CUSP provided the opportunity to collaborate with other professionals seeking evidence-based CAUTI strategies. I developed one of this project's two interventions, an evidence-based guideline, from the accumulation of all proven strategies used in the CUSP. I based the second intervention

on the DNP project site's lack of an effective education method for CAUTI prevention. The CPL chose the educational method of simulation-based education (SBE) because it was effective in reinforcing all the strategies used in the evidence-based guideline, it addressed and eliminated both the knowledge and clinical skill deficits associated with IUC use, and the CPL could complete the education in one short 90-minute simulation lab.

Nature of the Doctoral Project

Project Sources of Evidence

The nature of this project was to evaluate an EB-QIP for decreasing CAUTI rates and catheter use in the ICU setting. This DNP project's sources of evidence were secondary data from National Healthcare Safety Network, the most widely-used healthcare-associated infection tracking system in the United States (NHSN/CDC, 2016). This system provides hospital organizations with data to identify infections and measure prevention efforts (NHSN/CDC, 2016).

Project Method

This was an evaluation of a retrospective EB-QIP that will compare CAUTI rates and catheter use before, during, and after the use of two interventions. The evidence-based guideline was implemented in the first quarter of 2015 and simulation-based education (SBE) for all ICU staff members began in the second quarter of 2015. Attendance was mandatory for all ICU staff members, including RNs and practice clinical technicians (PCTs) who care for patients with IUCs to ensure standardized care, adherence to guidelines, and collaboration within the unit. Mandatory attendance was

supported by the ICU director, who held each staff member accountable for attendance. Attendance was validated by a sign-in attendance record. 100% of the ICU staff had completed the SBE by the end of the second quarter of 2015.

The education for the two interventions was ongoing until the end of 2016 to ensure that all ICU staff and PCTs, travelers, agency, and float pool nurses who took care of patients with IUCs used the guideline and attended SBE. Flexible educational schedules were used to ensure 100% attendance could be provided.

Project Pathway

The primary purpose of this DNP project was to evaluate two interventions used to decrease CAUTI rates and catheter use. The CPL could directly address the knowledge and skill deficit in nursing practice by using the two interventions, an evidence-based guideline and simulation-based education for CAUTI prevention.

Significance to Practice

Of all HAIs, CAUTIs are the most common in the vulnerable ICU population (Galiczewski, 2017). They are responsible for poor patient outcomes and are financial burdens for both the facility and the patient (Schuller et al., 2014). The implementation of an effective CAUTI prevention project can improve patient safety and quality outcomes, such as reduced morbidity and mortality, decreased length of hospital stay, reduction in overall cost per stay, and increased revenue through full payment for services. This project is clinically significant to nursing practice for vulnerable ICU patients (Galiczewski, 2016).

This project also highlights the necessity for additional research on clinical practices, including the use of perineal care, the use of CHG directly on skin and foley catheters, the presence of two trained staff members when inserting an IUC to ensure aseptic technique, and the BARD's method of "double clean" prior to insertion of the IUC. The double clean method is recommended by Bards to ensure that heavy debris is removed prior to inserting a sterile Foley catheter.

Stakeholders Analysis

The stakeholders' analysis in this EB-QIP provides identification of those individuals who were affected or would be affected by the project interventions and its outcome. The corporate division of the healthcare organization where the project took place chose the topic of this project. Other stakeholders include: all ICU patients who had a IUC during the time of this project, the patients' family members, the ICU staff (RNs and PCTs) who took care of patients with IUC, the ICU physician and nurse director, and the organization where this project took place.

The stakeholders' analysis showed that improving clinical practice through evidence-based guidelines taught through simulation results in benefits for all stakeholders. The patients receive services resulting in better clinical outcomes and shorter stays. Families become part of the healing process and participate in the care of their love ones. Nurses learn the value of incorporating research into their nursing practice and gain the ability to have more autonomy over the care they provide. The organization benefits by receiving full reimbursements for the services they provided,

reducing hospital stays, and seeing improvements in quality and safety measurements for public reporting and required benchmark measures.

Contributions to Nursing Practice

The evaluation of this project's success advanced the translation of research into nursing practice for the prevention of CAUTIs in the vulnerable ICU population. It demonstrated the benefits of hands-on education through the use of simulation to ensure competency in clinical skills and showed the benefits of employing a clinical expert as the leader for improving quality and safety in clinical settings.

In hospital settings, in high risk departments such as the emergency department (ED) and ICU, it is the nurse who has the most control over the patient's IUC and can influence the physician as to its use and length of stay (Mulcare et al., 2015; Mizerek, 2014). In some cases, IUCs are used for nurse's convenience or requested by the family (Mulcare et al., 2015; Mizerek, 2014). This project's evaluation provides evidence-based information that addresses the knowledge and clinical skill deficits that exist in the ICU setting.

Transferability of Knowledge

The evaluation of this project's two interventions, the evidence-based guideline and the use of SBE, is not limited to just CAUTI and the ICU setting, but can be used successfully for other HAIs and practice areas in the hospital as well. Using evidence-based guidelines whose foundations are based on the CUSP have been shown to be effective with other HAIs, such as the central-line associated blood stream infection (CLABSI; Mauger et al., 2014). Using an evidence-based guideline in combination with

simulation has the potential to produce greater results because it fills the gaps in practice for both the knowledge and clinical skills deficit in nursing practice. This project is easily transferable to other patient populations and organizations who want to reduce infection rates.

Implications for Social Change

Improving patient care by advancing nursing practice is another way to look at social change (Lamprecht, 2014). The interventions used in this project changed both the knowledge base and the clinical skills used in CAUTI prevention. This progress demonstrated the interventions had a positive effect on health behavior-related outcomes for the ICU nurses. Consequently, this project has advanced nursing practices for CAUTI prevention, resulting in improved care for ICU patients who have IUCs. This study is also the first of its kind to use an evidence-based guideline taught through simulation-based education to effectively reduce CAUTI rates in an ICU.

Summary

This section illustrated that high CAUTI rates continue to be a serious problem both nationally and locally for ICUs. Misuse of IUCs has resulted in serious consequences for both the patient and healthcare organization. I also discussed the gaps in practice occurring at this practice site and the two interventions that were used to address the gaps in nursing practice significant in CAUTI prevention. The use of an evidence-based guideline combined with an effective education method is proven to have positive outcomes for ICU patients (Fletcher et al., 2016).

Section 2 will provide the background and the context for this project by describing the theory and model used in this project, along with a literature review of the two interventions proposed in this project for CAUTI prevention. This section will also explore the local background of the project and the role the DNP student played in it.

Section 2: Background and Context

Introduction

Currently, the ICU has the highest rates of CAUTIs in the hospital setting (Gray et al., 2010). The high presence of IUCs in the ICU is due to several factors, including the need for strict monitoring of fluid balance. Many patients are unable to micturate due to obstruction, fluid retention, and/or sedation issues (Foxley, 2011). Although the catheter is an important medical device for use in this population, an IUC is the primary cause of catheter-associated urinary tract infections (CAUTI) and is associated with consequences that have significant safety and quality issues for the patient and organization.

This evaluation involved a retrospective, evidence-based quality improvement project (EB-QIP) in which the CPL used two interventions to reduce CAUTI rates and use of an IUC in one hospital's 28 beds ICU over a three-year period. The success of the project was determined by comparing the data results from pre-intervention, intervention and post-intervention timelines.

Concepts, Models, and Theories

I used a theory to follow an organized pattern of processes that were central to the development, implementation, and evaluation of this project. The theoretical framework for this project was the Iowa model, which guided the use of research-based practice to promote quality care. This model is focusing on two main triggers: the problem-focused trigger and the knowledge-focused trigger. These triggers allow the stakeholders to question their own current practices and knowledge base as they relate to the high rates of CAUTIs in their practice area (White, and Spruce, 2015). This project focuses on a

clinical and cultural problem, financial and benchmarking data, and current research; both the practice-focus triggers and knowledge-focus triggers were used.

The Iowa model has three decision points that guide the project forward or directs it backward if gaps are identified. In order to move forward, the project must address the three-decision points.

The first of the three decision questions is: Is the topic a priority for the organization? For this organization, it is a top priority due to high CAUTI rates that have a negative financial impact on reimbursements, a negative impact on quality scores, and contribute to poor outcomes for patients. Due to these factors, a CAUTI Prevention Team was formed and backed by leadership in order to reduce this pervasive infection.

The second decisions question is: Is there a sufficient research base for the project? There is a plethora of current research on prevention programs, strategies and the use of advance practice nurses to decrease CAUTI rates in the ICU. The next step in the Iowa model pertains to this project's two interventions, the development of evidence-based guidelines taught through simulation-based education for evaluation at the project's site. The ICU's CAUTI rates and catheter use data were collected by me at the 2014 pre-intervention, 2015 intervention, and 2016 post-intervention time points. I made a comparison to show the difference the interventions made at this site.

The third decision point is to determine if this change is appropriate for adaption into practice. Due to continual high rates of CAUTI and catheter use in the ICU, both interventions were timely and appropriate and can be used with other HAIs and in other departments.

Another model I used for this project was Havelock's theory of planned change. This theory enables a change agent to make changes and to sustain the change by building relationships and gaining acceptance with the stakeholder (White & Dudley, 2012). This change theory consists of three phases: unfreezing, moving, and refreezing (Oates, 1997). The three phases involve building a relationship with the client, choosing a solution that gains acceptance from the participants, and integrating and stabilizing the new change (Oates, 1997). This change theory is helpful when presenting and implementing the change with the ICU nurses, especially since the change agent is the clinical practice leader (CPL), who has an established relationship with the nurses.

Terms

Catheter-Associated Urinary Tract Infections (CAUTI): A subcategory of the larger group of Hospital Acquired Infections and is an infection of the urinary tract that is directly related to the use of an indwelling urinary catheter (Huang, 2016).

CCRN: A specialty certification for critical care nurses, ensuring nursing practice is consistent with standards of excellence (Moneke, et al., 2014).

Clinical Practice Leader (CPL): A job title used in this DNP project site for a master-prepared registered nurse who is considered the clinical practice expert in a specific patient population. The CPL is responsible for determining education for the staff and for the quality and safety of patient outcomes in a designated patient population (Trident Hospital Job Description for Clinical Practice Leader, 2016).

Comprehensive Unit-Based Safety Program (CUSP): A program that was developed by the Agency for Healthcare Research and Quality in a national effort to

prevent hospital-acquired infections by improving quality, reducing errors and increasing patient safety in hospital settings (Agency for Healthcare Research and Quality [AHRQ], 2011).

Hospital-Acquired Infections or Hospital-Associated Infections (HAIs): Infections that occur within 48 hours of admission that were not present on admission to the hospital or occur while receiving treatment for another condition in any type of healthcare facility (Booth, 2016).

Intensive Care Unit (ICU): A unit in hospital settings where the most seriously ill patients are closely monitored and cared for by specially trained staff, including doctors, nurses, respiratory therapists, clinical nurse specialists, pharmacists, physical therapists, nurse practitioners, physician assistants, dietitians, social workers, and chaplains (Bishop, 2014).

Indwelling Urinary Catheter (IUC): A catheter that is inserted into the bladder from the meatus and allows urine to pass externally (Scott et al., 2014).

Simulation-Based Education (SBE): The use of an artificial environment or manikins provides safe opportunities in multiple areas of medical education to shape the development of clinical skills (Issenberg et al., 1999).

Relevance to Nursing Practice

In 2017, CAUTI rates are estimated to reach two million cases a year, which would cost $400 million annually (Galiczewski et al., 2017). This is significant for the ICU population, in which 76% of IUCs in a hospital setting are administered (Gray et al., 2010). The evaluation of the two interventions used in this project addresses the multiple

variations in nursing practice, the effectiveness of the education, and the accountability of leaders to ensure success.

Looking at the broader problem of CAUTI prevention in the ICU setting, it is important to understand how other departments affect ICU CAUTI rates. In the hospital setting, the decision to insert an IUC begins in the emergency department (ED) or the operating room (OR). The ED has a key role in CAUTI prevention, because this is the first stop that most patients make prior to being admitted to the ICU or other nursing departments. The ED places three million IUCs annually, accounting for the majority of hospital IUC placements, and, therefore, the majority of catheter-associated infections (Scott, 2014). This has a direct relationship to CAUTI rates and use of IUCs in the ICU, because data used for CAUTI rates and use are only tracked to the hospital's inpatient departments. The ICU assumes the responsibility of IUCs inserted in a patient in the ED who is subsequently admitted to ICU.

Mizerek (2015), examined perceptions and environmental factors that would influence clinical decisions for nurses to place and maintain an IUC in the ED. Mizerek (2015) noted variation in practices and revealed that, in almost every case, the insertion of the catheter was the lone decision of the nurse and was done with less-than-desirable techniques (Mizerek, 2015). In related study, Hu et al. (2015), determined that most indwelling urinary catheters, over one million annually, are placed inappropriately. When questioned about this problem, nurses and doctors stated that "convenience of care" was the rationale for inappropriate IUC insertion (Hu et al., 2015).

Like the ED, the OR is not considered an inpatient unit, so all catheter insertions in the OR that then progress to CAUTIs are counted against the department that the patient is transferred to. The OR is a sterile environment in which the OR staff wear caps, gowns, and gloves, ensuring the practice of strict sterile technique for foley insertion is used. The use of timeout in this practice setting suggests that all breaks to aseptic technique observed during insertions are stopped prior to patient contamination. This validates that lower CAUTI rates are associated with catheter insertions in the OR than inpatient units (Gary, 2010). For patients that come to the ICU with an IUC, the focus should be on questioning its necessity daily and removing the catheter as soon as possible, because each day it remains the chances of getting a CAUTI increases by 7% (Underwood, 2015).

The nursing profession is inundated with basing practice decisions on clinical and historical experiences rather than objective scientific evidence (Abrahamson et al., 2012). New nurses do what they see experienced nurses do and learn from the culture within which they work. Practices, whether good or bad, repeat themselves. The practice of inserting a urinary catheter and keeping it in has become a common practice in some settings. Until CAUTI preventative interventions are used, this practice will continue. Using an evidence-base guideline taught routinely through simulation by a trained professional will address variations that continue to occur in nursing practices by basing CAUTI prevention and education on the evidence that is founded in research.

The literature for CAUTI prevention and the use of guidelines, interventions, and education is extensive. Many different interventions and combinations of interventions have been used to address the many facets of CAUTI preventions. Now, there is limited literature that evaluates the use of an evidence-based guideline taught by simulation-based education for CAUTI prevention in the ICU setting. This DNP project addressed the gap in nursing practice for clinical skills and the knowledge deficit for CAUTI prevention. It also invites the possibilities for future research on the use of IUC in other areas of the healthcare population such as the ED and OR.

Search Strategy

I conducted a comprehensive literature search for CAUTI prevention. This search resulted in over 300 peer-reviewed research articles. A total of 81 articles met the inclusion criteria for the prevention of CAUTIs this project is based on. All 81 articles presented the best evidence-based practices in CAUTI prevention, revealed that prevention is multifaceted, and suggested multiple interventions that can be used to decrease the use of IUCs. Furthermore, these studies also support the use of guidelines and using an effective method of education on CAUTI prevention

I performed the research for this project electronically using several multidisciplinary databases such as PubMed, Medline, CINAHL, CINTHAL PLUS with Full Text, Ovid Nursing Journals, Cochrane Library, Science Direct, Science Citation Index, and Google Scholar. The list of search phases, terminology and key search words includes: *indwelling urinary catheters, CAUTI, CAUTI prevention, ICU, Intensive care unit, strategies, barriers, interventions, guidelines, tools, simulation, education, nursing,*

knowledge, critical care infection and observation, and *catheter-associated urinary tract infections.* Truncated root words, such as CAUTI and CAUTIs, were incorporated into the search, as was the use of Boolean to search for two concepts and add a synonymous term to the search. The filter was set to search articles published from January 2010 to January 2017 to ensure up to date information was used. Any article with an earlier date was excluded, unless deemed a seminal article for this project. The filter was set to include peer-reviewed, full text articles written in the English language. The inclusion criteria consisted of articles related to prevention of CAUTIs, catheter utilization, catheter care and maintenance, the use of simulation as a means of effective education, barriers to CAUTI prevention, nursing perceptions, reimbursement and penalties, financial impact of CAUTIs, and the use of simulation in ICU settings.

Literature Review

CAUTI Prevention

Several researchers concluded that the reduction of CAUTIs requires a multifaceted intervention (Andrioli et al., 2016; Bell et al., 2016). The authors showed CAUTI rates are reduced when strategies are implemented together in an evidence-based guideline and used consistently. When strategies are used together they are more effective than when they are used individually (Fonseca et al., 2016).

Abrahamson et al. (2012) reviewed how guidelines were developed to fill the gap that exists between the evidence for best practice and the care that patients receives. The authors indicated that the evidence-based guideline is a proven strategy for CAUTI

prevention. The guideline offers the bedside clinicians structural guidance for decision-making and care planning that is consistent and effective.

The multifaceted CAUTI prevention strategies of reducing CAUTI rates and use are varied. A study by Underwood (2015) recommends two interventions for CAUTI prevention, the use of a nurse-led daily assessment system for appropriate urinary catheter use and removal when no longer necessary, and supplemental education for proper catheter insertion techniques and proper care and maintenance of the catheter. By using these two interventions, there was a 15 % reduction in catheter use in a neurosurgical and neurological intensive care unit (NNICU). This study demonstrated the importance of developing a catheter care guideline that is properly used and understood by the staff through an educational method for catheter care and insertion techniques.

In a similar study using multiple interventions, Andrioli et al. (2016) examined the impact of multifaceted interventions in the cardiovascular (CV) intensive care unit on CAUTI rates, utilization, and adherence to IUC guidelines during three phases: pre-intervention, intervention, and post-intervention. This study used face-to-face training of the CV nurses on four interventions: appropriate use, sterile insertion technique, maintenance and care, and removal and non-removal practices during the interventional phase. The authors concluded there is a reduction in CAUTI rates, and improvements in the quality of catheter insertions and maintenance and care of the catheter.

In another study involving the use of multiple CAUTI prevention interventions, Bell et al. (2016) evaluated current best-practice guidelines to reduce CAUTIs in ICU and non-ICU floors. They used six interventions to reduce the use of unnecessary urinary

catheters: education, mandatory prompts and reminders in the electronic medical record, daily patient tracking, a resident quality champion, and a urine retention protocol. The results showed the greatest achievement in the emergency department (ED), where there was a significant drop in the number of catheters inserted. Bell et al. credited this to the intense education provided at the beginning of the project on these strategies. Important reductions in the targeted ICU and other non-ICU units for catheter utilization and CAUTI reduction were also noted.

As noted in the preceding articles, CAUTI prevention is multifaceted, which can lead to variations in strategies used. Saint et al. (2016) found that, in a survey of Infection Control Preventionists (IP), there was no single or widely-used strategy for CAUTI prevention in the acute care Veterans Affairs (VA) hospitals with > 50 beds. According to this study, only 30% used portable bladder ultrasound, 14% used alternatives devices such as condom catheters, and only 9% used any form of catheter reminders or stop orders.

Guidelines for CAUTI prevention need to be standardized and adhered to in order to achieve a reduction in catheter use and decrease CAUTI rates. An evidence-based guideline for CAUTI prevention assists nurses in making the appropriate decision for clinical care of the urinary catheter and promotes a consistency of care, which reduces mistakes (Woolf et al., 1999).

This highlights the need for implementation of, and adherence to, evidence-based practices related to CAUTI prevention. Lack of standardization and adherence to evidence-based guidelines could account for high CAUTI rates and catheter use. All of

the articles pertaining to CAUTI prevention in the literature review demonstrate the widespread lack of compliance of healthcare providers to guidelines or education on implementation. Knudson (2014) reported that 27 to 68 percent of 1,653 ICUs had CAUTI prevention policies and that only 6 to 27 percent of those ICUS adhered to those policies.

Conway et al. (2012) conducted a study to determine if present polices described in CAUTI prevention guidelines were being adhered to in ICU settings, identify variation in policies based on the organizations characteristics, and establish whether or not policies had an effect on CAUTI rates. Data was collected from 250 hospitals that provided information from 415 ICUs. Results showed that only a small portion of ICUs had policies that supported bladder scanning, condom catheters, catheter removal reminders, or a nurse-driven protocol for catheter removal. Hospital with > 500 beds were half as likely to have at least one policy for CAUTI prevention and IP directors who had access to key leadership had a policy adapted. Hospitals with > 500 beds had 1.5 times higher CAUTI rates than smaller hospitals. The conclusion of this study verified that little attention is placed on CAUTI prevention in ICUs and further research needs to be conducted on the relationship between adherence to CAUTI prevention recommendations and CAUTI rates.

Purvis et al. (2014) conducted a study to determine if education, clinical practice changes and the use of an evidence-based protocol was effective in reducing the use and duration of IUCs. Findings showed that a lack of adherence to protocol for nurse-driven catheter removal was due to a knowledge deficit and nurse and patient convenience. Two

interventions were used in this study, education and the standardization of evidence-based strategies. In the ICUs where this study was conducted, the results showed a reduction in CAUTI rates from 4.2 in 2011 to 2.4 in 2013.

Fonseca et al. (2016), performed a systematic review focused on strategies for implementing guidelines by healthcare providers. They brought up important points for reducing CAUTI rates and IUC use including: strategies implemented together produced better results than implementing them individually, strategies are dispersed throughout literature and need to be gathered for effective access, and the use of effective education was seen as a starting point for all practice changes. They concluded that just having strategies is not enough to prevent CAUTIs and catheter use, but that change can occur when healthcare professionals become aware of and are motivated by the change that they can help cause.

Simulation-based Education

For CAUTI prevention to be successful there needs to be a way to effectively educate the nurse to use the guidelines appropriately and to practice the skills needed to correctly use the interventions in the guideline. Educating nurses on the use, care, and maintenance of IUCs can have a large impact on the rate of CAUTIs and can reduce the risk of CAUTIs (CDC, 2011). Jansson et al. (2016) reported on a single-center, prospective, controlled cohort study that demonstrated that simulation education resulted in improvement in participants' cognitive, behavioral, and psychomotor skills. They also reported that simulation education was effective in improving clinical outcomes, such as

incidence of intensive care unit acquired infections and medical errors. They emphasized that education needs to be periodically repeated and that further research is needed.

The method of simulation-based education is not new in ICUs. Eisold et al. (2015) state that simulation has been used in ICU settings for over 10 years as an effective educational tool for all healthcare professionals. Present day simulators are a far cry from the first version, known as Resusci Annie, used for CPR training. Simulators vary in features, expense and levels of fidelity, but there are many teaching curriculums published that have proven their effectiveness. Depending on learning objectives, partial simulator manikins can defray expense, are portable, and can vary in fidelity.

The use of simulation can have many benefits for both the nurse and the patient. Fort (2010) noted that simulation offers the opportunity to train without risk or pain to the patient and to perform procedures that are infrequently used in practice. For the nurse, it offers hands-on training and allows the educator to observe whether or not correct techniques are being used. If a mistake is made the nurse can learn from it and repeat the simulation. Simulation improves communication and teamwork, reduces anxiety, and allows medical personal to work more efficiently when real events do occur.

Simulation not only increases technical skills, it also has proven to improve clinical knowledge and increase confidence and self-efficiency. In a systematic review by Boling (2016) all 17 papers showed an increase in nurse technical skill and 13 of those studies demonstrated improvements in knowledge and confidence of nurses after using the simulation-based education method. The use of simulation for education will become more critical as our experienced nurses in critical care leave the workforce. Studies have

shown that there is a direct correlation between provider experience and patient outcomes in the ICU. This article promotes the use of high fidelity simulation for critical care education.

There are a variety of innovative methods that can be used to educate nurses on CAUTI prevention that are effective and are unique to each organization. In a one such study by Dols, et al. (2016) the simulation-based education for CAUTI prevention was used in an interdisciplinary CAUTI educational fair for the transplant critical care unit and for the ICU. The use of a fair provided an environment that was non-threatening, a place to unlearn exiting behaviors, and to become competent in new evidence-based practices. Using simulation-based education and an evidence-based CAUTI prevention guideline, the students had the opportunity to practice their skills and techniques and then had their competency validated via a checklist. Mandatory attendance of all ICU staff for competency validation was required and provided by the support of nursing leadership. Competency was tested for insertion techniques, perineal care, appropriate use and timely removal of catheter, and documentation through hands-on return demonstration. Results showed that the transplant unit's CAUTI rate went from 3.54 to 1.50 per 1,000 patient device days, and from 4.71 to 1.29 per 1,000 patient device days in the ICU. This pilot was so successful that it was used in the rest of the facility for CAUTI prevention.

Evidence to Address the Gaps-in-Practice

The gaps in practice for CAUTI prevention for this DNP projects site were similar to the gaps noted in the literature. At this practice site, gaps in practice were observed in both experienced and novice nurses including: knowledge deficit for appropriate criteria

for an IUC, lack of knowledge on aseptic insertion techniques, variations in maintenance and care of an IUC, long dwelling times, absence of daily questioning for IUC use, knowledge deficit for use of alternatives and bladder scanning, absence of bladder algorithm and documentation of IUC, lack of education for skills and competency, and no accountability for adherence to interventions or guidelines. Theses gaps continue despite evidence showing that interventions used in national and state CAUTI Prevention programs have worked in ICU settings (Fasugba et al., 2016).

Local Background and Context

Evidence to Justify the Problem

This DNP project was based in a hospital that is part of one of the largest hospital health systems in the United States. The CAUTI rates in the ICU were the highest in the organization's Southeast Division, which is above the benchmarks set by the National Healthcare Safety Network (NHSN). Leadership for this organization was tasked with reducing the CAUTI rates in the ICU.

This project's two interventions advanced the knowledge base and clinical skills of the ICU staff, contributed to a better method of education for nursing practices, and decreased the CAUTI rate and IUC use in the ICU, resulting in improvements for patient care and safety.

Institutional Context

I based this evaluation on a retrospective, quality improvement project in a single, high-acuity, 28-bed multi-specialty ICU. The patient population is composed of a variety of medical-surgical, level 2 trauma, renal, cardiac and cardiovascular open-heart

patients with the mean age of 65. The ICU is situated in a for-profit, 313-bed community hospital that services low- to middle-income residents in North Charleston, South Carolina. As part of one of the largest hospital health systems in the United States, a number of quality improvement projects were mandated across different divisions, including CAUTI reduction.

The hospital enrolled in CUSP, sponsored by the South Carolina's Hospital Association in an effort to learn strategies to decrease CAUTI rates in the ICU setting. In response to this effort, a CAUTI prevention team was established that would align these strategies with the hospital's mission statement, "We create a caring environment where healing occurs" (Hospital A's Mission Statement, 2017).

State and Federal Context

The quality department at the project site looked at several national and state programs that have been successful in reducing CAUTI rates. CUSP was chosen as a framework to use for CAUTI prevention and approved by leadership at this site. CUSP builds a culture of patient safety and improves the quality of care through teamwork, communication, data transparency, and identification of safety issues in the ICU (AHRQ, 2011). CUSP is based on a five-step process: (A) Educate on the science of safety; (B) identify defects and patient safety hazards; (C) partner senior executive with a unit; (D) learn from defects; and (E) implement teamwork and communication tools (AHRQ, 2011).

Role of the DNP Student

Professional Relationship to the Project

As a DNP student, it is a requirement to meet the foundational elements outlined in the American Association of Colleges of Nursing (AACN) (2006) that define the roles and responsibilities for graduates in the Doctor of Nursing program (DNP). The DNP program at Walden University has prepared me to meet the standards set forth by AACN. The final requirement of my DNP program requires that an evidence-based practice project in their chosen practice settings be developed prior to graduation. This project allowed this DNP student to fulfill the requirements.

Professional Role in the Project

My role was both as a professional, the CPL in the ICU, and as a DNP student during the time of this project. My responsibilities for both included identifying a clinical problem specific to my practice area and developing a project that would address the problem, thus fulfilling my responsibility both professionally and as a student. As the lead on the CAUTI committee, the hospital's representative for CUSP, and being in need of a clinical project for school, I was uniquely positioned to accomplish both.

Motivation for Completing the Project

My motivation for completing the project is both personal and professional. While I was working as a new graduate nurse in another ICU, my father required open heart surgery and died from complications of an infection. His death was traced to a preventable infection that was brought to the surgeon's attention, but was dismissed, prior to his surgery.

My professional motivation to use CAUTI prevention as my DNP project came about after conducting an initial assessment of project site practices. After observing

significant gaps in the knowledge and competency skills of ICU nurses and correlating poor patient outcomes with this preventable hospital infection, I chose to use CAUTI prevention as my DNP project. This choice allowed me to change nursing practices, introduce an effective educational method, develop new policies, and introduce new innovations that have significant effects on patient outcomes.

Potential Biases

Some members of the ICU staff were not happy with all the changes that were being implemented and were very vocal about it. Change can cause stress, anxiety and burnout for nurses (Koppel et al., 2015). This was misconstrued for nurse apathy by the project lead, but could be due to other reasons, such as a time constraints or understaffing for the new processes. Potential for any conscience or unconscious bias was discussed and checked by my preceptor throughout the project who agreed to advise and redirect me. It is important to identify any potential bias and find ways to alleviate these in one's own research study (Weisskopf et al., 2015).

Summary

In this section I explained the problem and how clinical practices relate to it. I explained the Iowa model and Havelock's theory of planned change as the frameworks used to guide the project's planning, development, implementation, and evaluation. I demonstrated the project's relevance to nursing practice in the literature review, which showed the extent of the problem, gave a general review of CAUTI prevention, and focused on the specific interventions used in this project. Finally, I demonstrated the role of the DNP student and how it relates to the AACN's eight essentials of a DNP project.

In Section 3 I describe the collection of data, the source of evidence used and why this method is appropriate for the project's problem.

Section 3: Collection and Analysis of Evidence

Introduction

In this project, I focused on the problem of inappropriate management of IUCs and the lack of professional development programs in managing IUCs that have resulted in high CAUTI rates in the ICU setting. The purpose of this project was to evaluate two interventions used to achieve CAUTI reduction in this setting. In Section 2, through a review of the literature, I discovered that CAUTI prevention is a multi-faceted interventional process based on nursing practices and that using an evidence-based guideline that is taught through an effective educational method can reduce CAUTI rates. Although the literature search revealed that the use of a guideline, combined with education, is an effective way to address the growing problem of high CAUTI rates, the use of a guideline taught through simulation had never been evaluated in this population.

I determined an appropriate method for data collection in order to evaluate the effectiveness of the two interventions used in this population. LoBiondo-Wood et al. (2010) emphasized that the success of a study often depends on the data method used. The method used ensured that the evaluation was accurate and reliable. In this section I highlight the methods for collecting the data, the population the data was derived from, the tools and measuring instruments, and describe the validity and reliability of the data.

Practice-Focus Question

There are two gaps in practice that were noted for the hospital hosting this DNP project: A) Inappropriate management of IUCs, and B) The lack of professional development strategies to teach clinicians how to effectively manage and care for an IUC.

The management of the IUC is multifaceted (Purvis et al., 2014) and involves nursing practices for the appropriate use of the catheter, aseptic insertion, proper care and maintenance, alternatives, documentation, bladder scanning, and prompt removal when the catheter is no longer appropriate. The present heterogeneity in nursing practices and the lack of training and education has a critical effect on CAUTI prevention (Fink et al., 2012). The two interventions in this evaluation directly addressed both the nursing practices and the education used in the prevention of CAUTIs in this practice site. Evidence-based nursing practices and robust education is the key to CAUTI prevention (Fink et al., 2012). The practice-focused question for this project was: How will an evidence-based CAUTI prevention guideline taught through the use of simulation-based education, impact the CAUTI rates and catheter use in the ICU?

Project Purpose and Method Alignment

The purpose of this EB-QIP was to evaluate two interventions used in the ICU to decrease CAUTI rates and catheter use in the ICU population. The secondary data used for the evaluation of this retrospective project provided validation for the two interventions used in this project. According to Galiczewski et al. (2013), direct observation provides an immediate measure of guideline compliance, provides immediate feedback, improves practice, and is considered the “gold standard” for surveillance. The statistical data compared pre-intervention, during intervention, and post-intervention, proving that addressing the gaps in nursing practice and nursing education in the ICU is the key to CAUTI prevention (Fink et al., 2012).

Key Operational Definitions

Analysis of variance (ANOVA): The use of statistic that tests whether group means differ from each other and considers the variation among all groups (LoBiondo-Wood, et, al., 2010).

National Healthcare Safety Network (NHSN): A department of the CDC and our nation's most widely-used healthcare-associated infection (HAI) tracking system (NHSN/CDC, 2016).

Standardized Infection Ratio (SIR): Calculated by dividing the number of observed infections by the number of predicted infections. The number of predicted infections is calculated using probabilities from negative binomial models constructed from 2015 NHSN data, which represents a standard population (NHSN/CDC, 2016).

Statistical Package for the Social Science (SPSS): Method by which to explain related statistical analysis that creates reports in tables and charts (Bliss-Holtz, 2008).

Standard Utilization Rate (SUR): The number of observed device days divided by the predicted device days. The predicted number of device days is calculated based on multivariable logistic regression models determined by the (NHSN/CDC, 2016).

T-tests: The use of statistic that tests whether two group means are more different than if by chance (LoBiondo-Wood et al., 2010).

Sources of Evidence

I acquired the sources of information for this DNP project from AHRQ's CUSP and CDC guidelines, statistical data from National Health Safety Network (NHSN), the literature review, existing hospital policies/procedures, and stakeholders input. The use of

these sources proved helpful in identifying the gaps in nursing practice and competency for IUCs, lack of evidence-based practice used for CAUTI prevention, and absence of an effective method of education to teach CAUTI prevention to the ICU staff.

Archival and Operational Data

All information used for this doctoral project is from the analysis of the organizational operational data routinely collected for quality improvement measurements. For this project, all information was collected and provided by the infection preventionist at this site.

Currently, hospitals collect the data for possible CAUTI rates and catheter use that meet the criteria established by the CDC's NHSN. The NHSN calculates CAUTI rates and catheter use using a predetermined algorithm and reports the results to the organization's infection prevention (IP) department. IP reports these results to departments involved and to senior leadership.

Description of Data Collection

I collected the data used for this project from NHSN's database and patients' electronic medical records for all catheter use and CAUTI rates in this practice site's ICU for years 2014, 2015, and 2016. The data was confidential and treated in accordance with the hospital confidentially policy.

Participants

This project took place in an adult, 28-bed intensive care unit that cares for medical, surgical, neuro, trauma, and open heart cardiovascular patients. The patient population of interest I identified in this project includes all adult ICU patients $\geq$ 18 years

old who have an IUC at any time during their stay in the ICU unit. No preference was given regarding gender, race, or age as long as the patients were ≥ 18 years old and had an IUC.

The other participants in this project were the ICU staff members, including the ICU staff of RNs and practice care technicians (PCTs) who provide direct care to adult ICU patients with indwelling urinary catheters while in the ICU. It is this population that has the greatest effect on CAUTI prevention due to the direct link of care between the nurse and the patient. This population of participants was expanded to all agency, travelers and float pool nurses, and PCTs who were pulled to the ICU in times of staffing shortages during the project's timeline.

Procedure

The procedure for data collection for CAUTI rates and catheter use was the monthly responsibility of the IP, in accordance with the NHSN methodology and the CDC's definition of CAUTIs. The IP monitored all positive urine cultures and investigated each to determine if they met the CDC's NHSN criteria for CAUTI. I pulled this information from a number of sources in the patient's electronic medical record and loaded into the organization's software program called TheraDoc. This program provided the IP with all the information needed to make valid identifications of CAUTI infections that were timely and accurate. TheraDoc had the added ability to create automated reports for the NHSN. As a division of the CDC, the NHSN has been identified as the most reliable source for tracking healthcare-associated infections and possesses the ability to identify problem areas and measure prevention efforts (NHSN/CDC, 2016). To be

compliant with state and federal regulations, the NHSN benchmarks healthcare organizations for preventable infections such as CAUTIs (NHSN/CDC, 2016). All data sources used for catheter use and CAUTI rates during this project were in accordance with the NHSN.

For the DNP program, Walden University requires that an Institutional Review Board (IRB) application be completed for all student projects that are designed to address a knowledge gap, the collection and analysis of data concerning a living person, and all doctorate projects (Walden University, 2016). The IRB approval ensured that each research student conducted their applied research ethically, obtained informed consent, and were absent of any coercions to the participants in the project. Permission for the operational and archival data used in this project was through the organization's IRB Committee and the secondary approval was determined by Walden University's IRB preceding this project. The Walden University IRB approval number is 10-09-17-0388874. No patient or organizational identifiers were used in this project.

Analysis and Synthesis

Data Systems and Procedures

The organizations where this doctoral project took place uses a commercially purchased infection prevention surveillance software program called TheraDoc. TheraDoc provides a robust data collection system pulling data from the patient's EMR including lab reports, admission and transfer data, vital signs, and physician documentation. The use of TheraDoc provides the IP with all the information needed to make valid identifications of CAUTI infections that is timely and accurate.

Additional needed information such as nursing documentation is reviewed by the IP using the hospital's Meditech system for the patient record. TheraDoc has the added ability to create automated reports for the NHSN. I identified no outliners or missing data during the time this project took place. As a division of the CDC, the NHSN has been identified as the most reliable source for tracking healthcare-associated infections and possesses the ability to identify problem areas and measure prevention efforts (NHSN/CDC, 2016). To be compliant with state and federal regulations, the NHSN benchmarks healthcare organizations for preventable infections such as CAUTIs (NHSN/CDC, 2016). All data source used for catheter utilization and CAUTI rates during this project was in accordance with the NHSN.

Data Integrity

To verify the data, the IP conducted quarterly validation of the system by comparing manually collected data on devices to the electronic system. Data must have agreed to within $\pm$5%. I identified no issues during this period of the project.

Data Analysis

I performed all statistical analyses with SPSS version 20.0. The level of significance was set at .05. Data compared between the years 2014 (Baseline 1 pre-intervention), 2015 (Baseline 1 interventional), 2016 (Baseline 1 post interventional) were analyzed for accurate comparison. In order to compare the rates, I used ANOVA because it compared three rates. I also compared data for 2015 (using Baseline 2) and 2016 (using Baseline 2). I used a *t*-test to compare 2015 and 2016 rates. The 2014 rates were excluded from the Baseline 2 comparison because 2014 cannot be converted in

Baseline 2. I discuss the significance of NHSN Rebase line in Section 4 of this paper. The three timelines selected allowed for the assessment of the largest sample size and to correlate with the pre-intervention, intervention and post-intervention periods.

I also used run charts to examine the data over time. Using run charts is an uncomplicated and objective way to understand the changes made to a process or system improvement without the mathematical complexities associated with other analytical procedures (Perla et al., 2011). Among improvement projects such as the one presented in this paper, the run chart is more effective because traditional aggregated statistics ignore time order (Perla et al., 2011). Run charts can be used as a quick test of system performance, a good way to illustrate and share information with other departments, and can be easily constructed and especially useful for one-time analysis of historical data (Perla et al., 2011).

Summary

In this section, I presented the project question according to population, interventions, observations, and the timeline for this project. I focused on the methods used for the collection and analysis of evidence, named the source of the evidence and the analysis and synthesis used to evaluate the outcomes of the project. In the next section, I present the findings and results for this DNP project.

Section 4: Findings and Recommendations

Introduction

Despite national efforts to reduce preventable infections in the hospital settings, CAUTI rates continue to rise (Saint et al., 2014). This is especially true in the ICU, where most indwelling urinary catheters (IUCs) are used (Gray et al., 2010). The cost of infections caused by medical devices has enormous consequences for both the patient and the facility, including: longer lengths of stay, increase cost of care, increase rates of morbidity and mortality, and lack of Medicare and Medicaid reimbursements (Galiczewski et al., 2017).

CAUTI prevention is multifaceted, and many interventions have been introduced to address the gaps in nursing practices (Purvis et al., 2014). These interventions are bundled together and are often used as guidelines to decrease CAUTI rates. Despite evidence that guidelines work, CAUTI rates remain high.

The literature revealed that the most successful use of guidelines for decreasing CAUTI rates is by pairing the guideline with education (Purvis et al., 2014; Fasugba et al., 2016). At the time of this project, there was a lack of education on CAUTI prevention that addressed the knowledge and clinical skill deficit this practice site was experiencing. As Mizerek (2015) noted, even when guidelines are established, education competency is lacking or is not a priority. To address the knowledge and clinical skill deficits at the site, the use of simulation-based education was selected to teach the evidence-based guideline to all intensive care staff members.

The evidence I collected for the evaluation of this quality improvement project was the comparison of the quarterly standardized infection ratio (SIR) for three consecutive years in the ICU: 2014 pre-intervention, 2015 intervention, and 2016 post-intervention. I obtained this data from the NHSN by the Infection Preventionist (IP). Before I collected the data, I obtained approval from the project site's Research Ethics Board and Walden University's Institutional Review Board.

Findings and Implications

Demographics and Descriptive Data

The project's site was a 28-bed, high acuity ICU caring for medical, surgical, trauma, open heart, cardiovascular, respiratory, and renal patients. The project's participants included all patients who had an IUC during the project's timeline: 2014, 2015, and 2016. There was no distinction made regarding age, race, gender or length of time the IUC was used. Patients with a suprapubic catheter were not excluded.

Ninety-two ICU staff members participated in this quality improvement project. The population included 86 RNs and six PCTs. At the end of the second Quarter of 2015, the population of participants was expanded to include all travelers, agency and float pool RNs and PCTs who worked in the ICU during this timeline.

At the end of the first quarter and the beginning of the second (2015), all ICU RNs and PCTs who cared for patients with IUCs began the mandatory 90-minute SBE to teach the evidence-based guideline. The SBE was located in ICU meeting rooms that were reserved for this project. The only requirement for the ICU staff during training was to sign up in pairs, so that they could demonstrate their clinical competence according to the

guideline. All PCTs had to be accompanied by an RN, because PCTs were not allowed to insert IUCs per hospital policy. Scheduled education allowed for flexibility between day and night shifts. It was the staff members' responsibility to attend; no exceptions were granted. Adjusted times were provided for travelers, agency and float pool nurses, and PCTs who reported to leaders outside the department.

All education training was conducted by the critical care CPL to ensure standardization and that evidence-based practice was performed according to the guideline. All materials used for training were new and unopened (e.g. Foley Kit, male and female alternatives, anchoring devices). Male and female partial manikins were covered for privacy, and cleaned prior to and after each use. The staff was required to demonstrate competency on both male and female manikins. An attendance form was completed after SBE containing date, time, and employees' number and was signed by the employee and CPL. This information was double checked to verify that 100% of the staff completed the required training. A copy was given to the director of critical care, who logged it into the employees' file. The ICU staff was at 100% completion for SBE training by the third quarter of 2015. Training continued throughout 2016 in monthly orientation sessions for new staff nurses, travelers, agency and float pool RN's and PCTs who staffed the ICU.

The necessity for patients' privacy and safety was reviewed throughout the 90-minute SBE. No names of patients were used during this project. All hospital employees are required to complete the HIPAA competency training in hospital orientation and on an annual basis. A summary of simulation training is presented in Appendix A.

Descriptive Data

This project took place over 3 consecutive yearly periods and I labeled data by the year and name of the period the intervention was occurring. I compared the results quarterly for the 3 years using NHSN progress measurements: SIR in Baseline 1 and SUR in Baseline 2 for 2015 and 2016 for a fair and accurate comparison. (Appendix B: Projects Site's Data from NHSN).

It is important to understand why two different baselines were used. In 2015, the CDC's NHSN updated or recalculated the original Baseline 1 to Baseline 2 by changing the source of aggregated data and risk adjustment methodology (NHSN, 2017). The years 2015 and 2016 can be calculated in both baselines, but 2014 can only be calculated in Baseline 1 for SIR. To show fair and accurate data, NHSN requires all comparison to be calculated under the same baseline (NHSN, 2017).

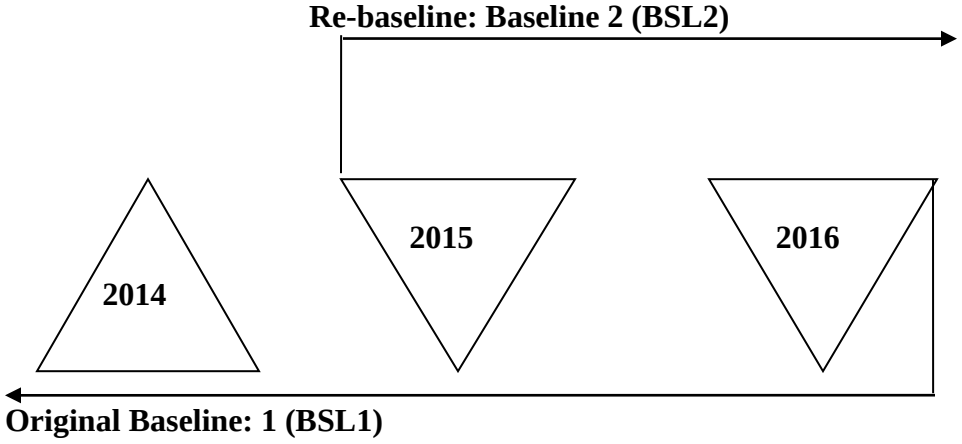

Figure 1. Chart to determine SIRs Baseline to use for comparison.

Results

All statistical analyses were performed with SPSS version 20.0. The level of significance was set at .05. To compare rates, ANOVA was used when comparing more than two groups (as in Baseline 1). When comparing rates of two groups (as in Baseline 2), t-tests were used.

Table 1

Results of Statistical Analysis in Baseline 1

Variable	Pre-intervention (2014)	Intervention (2015)	Post-intervention (2016)	Risk ratio	P value
CAUTIs, n	12	6	2	-	-
Foley days in ICU, n	6311	5889	6002	-	-
Patient-days, n	8238	8658	9058	-	-
DU rate	0.77	0.68	0.66	0.86*	<0.001**
SIR	1.585	0.849	0.278	0.18*	0.001**

*Interventions VS Pre-interventions **Significance at the 0.05-level

The above table in Baseline 1 represents the statistical analysis used to compare the three study periods for incidence of CAUTIs, SIR, and Device Utilization (DU). The results of this comparison showed a significant decrease in CAUTI numbers (2014 *n*=12, 2015 *n*=6, and 2016 *n*=2) and SIR (2014 pre-intervention=1.585, 2015 intervention=0.849, 2016 post-intervention=0.278) showing a decrease of 82.46%. The DU rates (2014=0.77, 2015=0.68, 2016=0.66) were determined by dividing the Foley days by the patient days, and showed a 14.29% reduction over the course of the three-year period.

Table 2

Incidence of CAUTIs, SURs and SIRs in 2015 and 2016 in Baseline 2

Variable	Intervention (2015)	Post-intervention (2016)	Risk ratio	P value
CAUTIs, n	6	2	-	-
Foley days in ICU, n	5889	6002	-	-
Patient-days, n	8658	9058	-	-
SUR	1.088	1.060	0.974	0.613
SIR	1.137	0.326	0.287	0.02**

**Significance at the 0.05-level

The above table in Baseline 2 represents the statistical analysis used to compare two of the study periods; 2015 intervention, and 2016 post-intervention for incidence of CAUTIs, SUR and SIR. The pre-intervention timeline cannot be determined in Baseline 2 for 2014 as noted earlier in this paper.

The results for SUR exhibited a decrease (2015=1.088, 2016=1.060) of 2.57%. These two study periods show a risk ratio of 0.974 and a p-value of 0.613.

The results show a huge decrease in SIR (From 1.137 in 2015 to 0.326 in 2016) of 71.33%. These two study periods show a p-value of 0.02 and the risk ratio of 0.287 for SIR.

Both Baseline 1 and 2 report the results of CAUTI rates and catheter use during the 3 years this project took place, but NHSN requires the same baseline be used for consistent and accurate comparison. The evaluation for this project is exclusively based on the results found in Baseline 1.

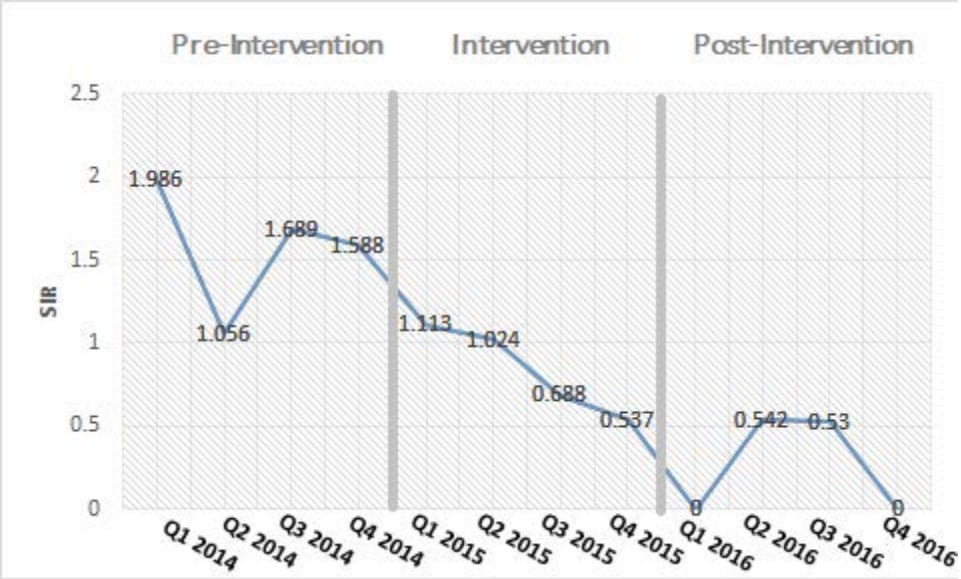

Figure 2. SIR run chart in Baseline 1.

The above run chart based on the SIR baseline shows an accurate picture of the effects the project's two interventions had on CAUTI infections during this project. In the beginning of 2015, the evidence-based guideline was introduced producing a downward trend in quarter one's SIR. In quarter two and into quarter three of 2015, the combination of the evidence-based guideline and SBE began and was 100% completed for the ICU staff by the end of 2015. There is a significant downward trend over this time. The downward trend continues through 2016, when the SBE is used for all new ICU staff, travelers, agency and float pool nurses and PCTs. The run chart shown in Baseline 1 demonstrated the effect the two interventions had in this project.

Unanticipated Limitations or Outcomes and Potential Impact on Findings

This study had several limitations. First, I did not take the opportunity to expand on the educational benefits that simulation had on the ICU staff by conducting a pre- and post-simulation test to show the before and after knowledge and clinical skills of the ICU

staff. Second, I also could have expanded my study to include gender differences for CAUTI rate and use in the ICU. Third, due to the high staff turnover in the hospital, there was a lack of buy in from the other departments' CPLs to use the guidelines and teach SBE in their departments. Patients transferred from their units to the ICU might have directly affected CAUTI rates in the ICU**.** Fourth, data collection for ICU mortality, costs of care, and length of stay limited my ability to determine the effects this project's interventions would have had on their outcomes. Fifth, the CPL was the only person conducting SBE training. It is likely during the project when peaks occurred in patient census, a staff, agency, traveler or float pool nurse or PCT cared for an ICU patient with an IUC without attending training.

Another unanticipated outcome was the lack of accountability from top leadership to continue these interventions once the project was over and had been recognized by the facility's corporate division to be highly successful. This can be attributed to changes in leadership positions or lack thereof towards the end of this project. Leadership engagement and support is paramount to the success of a project (Fakih et al., 2014).

Implications

This project's results have affected many different areas in health care. Prior to this project, almost every patient in the ICU received an IUC, the care was varied, and clinical skills were not evidence-based, with minimal education focused on CAUTI prevention. The evaluation of this project has shown that having an evidence-based guideline that is backed by an effective educational method can result in significant

changes being made in the nursing knowledge, clinical practices, and skills that contribute to CAUTI reduction.

As the only community hospital in this area of the state providing care to low-income patients and members of the armed forces, it is the responsibility of this site's ICU to ensure clinical practices and skills are based on evidence and delivered with respect. A community should feel safe going to their local hospital, one that ensures quality care and safe practices regardless of the ability to pay. This is especially true with a preventable HAI such as a CAUTI.

As a part of the largest health care organization in the country, this institutions CAUTI rate was the highest in the southeast division prior to this project's interventions. After seeing the results from this project, not implementing it in other practice areas or sustaining it in this setting would be negligent on the part of the institution.

A system change involves the collaboration of the whole team to change practices. It starts at the top with support from leadership. There are several examples of this in this project: the manager had to ensure that staffing was covered for mandatory attendance for SBE; the director agreed to the project and provided accountability for its success; and the ICU staff buy- in, demonstrated by changing their current practices to align with the evidence-based guideline, lead them to become the unit champions and ensure the sustainability of the project.

Ethical, Legal, and Economic Implications

Ethically, all health care professionals are obligated to care for their patients by contributing to their health and well-being and avoiding doing harm. The use and training

of evidence-based practices that promotes knowledge and clinical skills for CAUTI prevention ensures that care is of the highest standards, promoting competency among caregivers.

Legally, it is the responsibility of all health care professionals to meets the standard of care. When guidelines are approved by the organization and become part of the organization's policies, they govern the standard of care and therefore have legal implications if not followed.

Using an evidence-based guideline taught by SBE will result in decreasing CAUTI rates and catheter use in the ICU. Economically, this project's interventions will decrease patients' length of stay and allow for full insurance reimbursements. Implementing the evidence-based guideline can be achieved at minimal cost, unlike SBE, which uses both time and resources initially, but ultimately will save money in the long run.

Implication to Positive Social Change

The social implications from this project affect many areas: the ICU, the organization, and the nursing profession itself**.** The results have changed the behaviors, culture and values that challenge, compel and alter previous behaviors, processes and structures.

The results of this project show that the ICU staff possess a better understanding of CAUTI preventions and have demonstrated a shift in attitudes and behavior, causing a cultural change in the unit. This organization and its systems supported changes in CAUTI prevention through the introduction of CAUTI prevention policies and

procedures incorporating evidence-base practices and through the publication of this project on their Knowledge Center Site, so that other facilities and divisions can learn from its findings. The findings from this study will benefit nursing professionals in other organizations to improve patient care for CAUTI prevention and possibly for other HAIs as well.

Recommendations

Through the evaluation of the two interventions used in this project, I addressed the multifaceted issues that healthcare facilities face for CAUTI prevention. The use of a guideline combines all of the evidence-based strategies proven to be successful for decreasing CAUTI rates into one place. The data shows a downward trend in SIR (29.912% decrease) in the first quarter of 2015, but it wasn't the large drop-off demonstrated in quarters 2 and 3, when mandatory SBE began and continued for the ICU staff, (a 51.752%).

As a result of the large decrease in CAUTI rates during this period, it is obvious that SBE was an effectively used to teach evidence-based clinical skills and address the knowledge deficit in this ICU. The use of simulation has been shown to improve participants' cognitive, behavioral, and psychomotor skills leading to better CAUTI outcomes (Jansson et al., 2016).

First, I recommended that undergraduate nursing programs teach evidence-based clinical skills using simulation for all CAUTI prevention interventions. This will ensure knowledge and skill level is at the highest standard prior to entry into the nursing profession, avoiding poor clinical practices from the start. Second, all practicing nurses

should be required to demonstrate annual hands-on competency based on evidence-based practices for foley insertion by a trained observer. Experienced nurses are sometimes thought of as the experts, but even with certification, such as the ICU CCRN, it remains unclear if cognitive knowledge translates to bedside clinical practices (Kendall-Gallagher et al., 2009). Third, an abbreviated annual competency for CAUTI prevention education for other disciplines, such as physicians, transporters, radiology technicians, and physical therapists, should be incorporated to ensure their clinical practices align with CAUTI prevention.

Strengths and Limitations of the Project

There are several strengths and weakness associated with this project. For this DNP project I used two important quality metrics that showed the statistical depth and the NHSN CAUTI surveillance change that occurred in 2015, SIR and SUR. The 2015 Rebaselined change can cause confusion and inaccurate comparisons if not calculated in the same baseline. This project took place over a three-year timeline. The first year, 2014 could only use the original Baseline 1, whereas the next two years of this project could use Baseline 1 or 2. To achieve a fair and accurate comparison, I used Baseline 1 for SIR. The SUR could only be calculated in Baseline 2 for 2015 and 2016, so our project only used Baseline 2 for SUR results. As the project's researcher, leader, and instructor, some may question my bias towards this project, but these roles were all necessary for the success of this project

Strength of this study was the length of time in which the project was conducted. For this study, a three-year timeline was used to evaluate the outcome of two

interventions; 2014 pre-intervention, 2015 intervention, 2016 post-intervention. The length of this project allowed trends to form in the statistics and to prove that interventions were not caused by random chance, but by the interventions used in the project. Also, the use of the same location ensured consistency and control.

The use of evidence-based guidelines and SBE may be beneficial for preventing other infections, such as central line-associated blood stream infections (CLABSI). These interventions will directly address the gaps noted in nurses' clinical skills and knowledge deficits.

Section 5: Dissemination Plan

Dissemination is an integral part of all research projects, by which you promote the visibility of the results and communicate the high standards for clinical practice (Marin-Gonzalez et al., 2017). True dissemination for this project is when the ICU nurses are practicing the knowledge taught in the guidelines and using the knowledge to govern their clinical practices at the bedside.

The Infection Control Committee (ICC) presented the findings from this project and the two interventions to the project site's quality improvement department and to the executive leadership during a scheduled monthly executive meeting. In addition, the same presentation was given during a weekly nursing leadership meeting. Attendees included nursing managers, directors, and the organizational development leaders, whose responsibilities included clinical education for employees of the hospital. The ICC also presented in the ICU staff meetings where the project took place. All three presentations included showing the problem the project site was experiencing, the two interventions used to address the problem and how they were implemented, and the statistical results of the project.

To date, two areas for dissemination of this project have occurred. The first was during the annual Corporate Summit Meeting at the end of 2016 where the project was given the Honor Mention for Clinical Excellence and then published in the Knowledge Center site and tagged to the HAI's focus area in the organization's Enterprise Evidence library so other divisions in the organizations can learn from it. The second was an interview conducted by the South Carolina Hospital Association on how the project site's

ICU achieved such a significant decrease in CAUTI rates as a result of this project. The interview was published so other healthcare organizations in the state could gain an understanding of CAUTI preventions. Further dissemination of this DNP project is planned by publishing it in a peer-reviewed journal. This would allow for dissemination to a broader group of nursing professionals who share similar issues in CAUTI prevention and may assist them in implementing a project in their own clinical setting.

Analysis of Self

Analysis as Practitioner

For the last 30 years, my main practice area has been critical care. During this journey, I have had opportunities to advance from a position of staff nurse to the director of critical care, but never felt that I was an expert in my field until my formal education matched my clinical and leadership skills. As I moved through school, from my BSN to completion of my DNP program, a balance in my profession was achieved. This realization of the balance was never as strong as when I designed, implemented, and evaluated this project. This realization has given me confidence for future projects that have the potential to benefit clinical practices and processes in other areas of the nursing profession.

Analysis as Scholar

The journey to obtain my terminal degree of Doctorate of Nursing Practice has been long and hard, yet very rewarding. This degree signifies my competency as an expert in my field and identifies that I am equipped as a leader to expertly move my profession forward for better patient outcomes. The use of my DNP degree was validated

by the success of my project and my plans to use the knowledge gained from it to be used for future clinical issues or new innovative ways to ensure safe and quality care for the critical care patient.

Analysis as Project Manager

The role of project manager at this site provided many valuable challenges and lessons, including: getting the staff's buy-in, scheduling for education while ensuring adequate patient care was in place, and justifying the benefits compared to the financial cost of this project.

As the project manager, I was able to build my leadership skills in areas of communication and collaboration. Listening to staff concerns, along with mentoring staff on their involvement in the project, was instrumental in the project's success. As noted in an article by Fischer, (2017), engaging and empowering your staff will achieve goals for organizational improvements.

Challenges, Solutions, and Insights

The completion of this project brings 3 years of hard work, challenging situations, and great lessons learned to an end. Now, at the end of the project, the pain of the process is diminished by the joy of the achievement. The challenges seem insignificant next to the lessons learned from my project.

My first lesson was realizing how the changes from my project affected the staff at the project's site. Any change can result in stress and anxiety for those experiencing the change. The involvement of the staff in the project from the start eliminated the negative reactions to change and allowed the staff an element of control over their practices.

Consequently, an environment of collaboration occurred and the staff became change agents. This demonstrates that nurses who have direct input into nursing care can affect practice changes at the micro system level for patient care improvements

The second lesson that I learned was that the success of any project can be measured by the support and accountability of the leader with their staff. The critical care director understood the importance of this concept and showed unwavering support by holding the ICU staff accountable for CAUTI prevention. For a culture of safety in an organization to exist, leadership accountability is vital (Sammer, et al., 2010).

Summary

CAUTIs continue to be a significant cause of preventable harm to patients in the ICU (Alexaitis et al., 2014). Literature suggests CAUTI prevention is multifaceted and that the use of a guideline combined with an effective educational method to teach it will decrease CAUTI rates (Andrioli, et al., 2016). The project's purpose was the evaluation of two interventions; an evidence-based guideline and simulation-based education. These two interventions addressed multiple variations being used in clinical practices for CAUTI prevention in the ICU. An evidence-based guideline brought together all of the proven practices in one place, while the use of simulation addressed the knowledge and clinical deficiencies occurring in this project's site.

After comparing the statistical data of CAUTI rates in a 28-bed ICU over a 3-year period, the results showed a significant decrease in CAUTI rates during and after the two interventions were introduced. As a result of these findings, the following recommendations were made.

The first recommendation is for the two interventions to be implemented as a standard practice in this ICU. Second, all new or temporary staff must attend mandatory simulation education prior to taking care of patients in the ICU. Third, all staff must be required to take part in annual simulation education for CAUTI prevention. Fourth, the above recommendations should be used throughout the facility for all nursing departments. Lastly, evidence-based guidelines and simulation should be trialed for other HAIs, such as Central-line Associated Blood Stream Infections (CLASBI).

This DNP project was the evaluation of a quality improvement project addressing deficits and variations in nursing practice for CAUTI prevention in the ICU. The evaluation of the two interventions demonstrated how nursing practice disseminated from research can make a significant difference in patient outcomes and nursing practices.

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Appendix A: Simulation Training for CAUTI Prevention

Simulation Training for CAUTI Prevention	
	Nurses Scope of Practice for Invasive Procedures CDC Reasons for IUC Discuss if a IUC is ever an emergency Only staff trained by this guideline may care for patients with an IUC • This includes all agency, floaters, and travelers who care for patients with an IUC
2. Physician's Order	• Ensure that the patient has an order for an IUC • Does it meet the CDC's criteria? • Follow the Nurse driven protocol for IUC
3. Foley Insertion	• Only trained RN's can insert IUC. • All ICU must be trained prior to care of patient with an IUC • Must have two trained ICU staff to insert IUC (2nd person can be a trained nurse or trained nursing technician. This ensures assistance and accountability • The trained person inserting catheter never touches the patient during the insertion. • The second trained staff aids with positioning of the patient. • Time out for any noted break in sterile procedure. Stop immediately and use a new kit for insertion. • Two-wipe method for Cleaning: • Change gloves and gel hands in between first (Clean) and second cleaning (Sterile). • If meets resistance stop immediately and call physicians. Do not force catheter. • Never break the closed system. Red seal should never be compromised. *Unless patient is a urology patient or GYN patient if red seal is not present-immediately remove IUC. Question need for IUC. If meets CDC requirements insert and get a urinalysis. • All IUC must have a securement device on. • Three places to document: Apply orange sticker with the date of insertion on the drainage bag, write date of insertion on the patient's write board and document in patient's EMR insertion date. • Provide family with the educational card found in every Foley catheter kit and review the contents with them. • Empty drainage bags when half filled. • No loops in the drainage tube and anchored to the bed to prevent pooling and pulling of the tube.

	• All ICU Staff must perform yearly Simulation Competency to care for patients with IUC • All Agency, Travelers and floated RNs and PCTs must go through training prior to taking care of patients with IUC.
	•
4. Pericare	Pericare is done every shift using 2% CHG wipes Follow the pericare guideline for male and female patients in your facility.
5. Alternatives	**Males:** Male condom catheter • Clean patient's penis according to pericare guideline prior to use. • Change every 24 hours, clean area and replace with new condom if needed. Male Urinary Pouches: (use on males who do not have equipment for a condom catheter) • Clean and dry area, measure for appropriate size for opening and use stoma adhesive Male Urinal **Females:** • Female Urinals (Cardboard version) • The female urinal does not go under patients, but up to the patient perineal area New Product (Purewick) • Change every 12 hours or more frequently to prevent skin irritation • Never for internal use Pads (UtraAbsorb Pads) • Use on any patient that is incontinent of urine • Holds up to 1200cc of urine and can be used as a draw sheet for patients up to 375 lbs. • All RNs and PCTs must demonstrate product competency prior to use
6. Bladder Scanning	• Every bladder scanner must have the facilities approved bladder scanning algorithms attached to it • Review Bladder Scanning Algorithm Intermittent catheterization is strictly follows the same requirements as placing an IUC • Using sterile technique • Two people for assistance and accountability • Two cleaning method
7. Nurse	Review Facilities Nurse Driven Protocol

Driven Protocol	
8. Documentation	Review the required hospital's documentation • Three places to document: Apply orange sticker with the date of insertion on the drainage bag, write date of insertion on the patient's write board and document in patient's EMR insertion date.
9. Daily reminders	• Address the presence of the Foley catheter during Multidisciplinary rounds • Put date of insertion on the patient's white board located in patients' room and on the bag so readily seen.
10 New admits with an IUC from another facility	• Remove immediately unless order states to keep in or is a GYN or Urology patient • Access the need according to the CDC 's criteria/ Bladder Scan • If meets the CDC's criteria reinsert following guideline using sterile technique, and get a urinalysis from the new catheter.
11. New admits to ICU and IUC's placed in our hospital	• Check for order- remove if no order • Access for need according to CDC criteria / Bladder scan • If meets requirements of the CDC put date on bag/white board and document in patient's EMR

Appendix B: Projects Site's Data from NHSN

The NHSN results SIR Baseline 1

SIR	Q1	Q2	Q3	Q4	YTD
2014 Baseline 1	1.986	1.056	1.689	1.588	1.585
2015 Baseline 1	1.113	1.024	0.688	0.537	0.849
2016 Baseline 1	0.000	0.542	0.530	0.000	0.278

The NHSN results SIR Baseline 2

SIR	Q1	Q2	Q3	Q4	YTD
2014 Baseline 2	Not available				
2015 Baseline 2	1.491	1.371	0.922	0.719	1.137
2016 Baseline 2	0.000	0.637	0.622	0.000	0.326

The NHSN results for SUR in Quarters in Baseline 2

SUR	Q1	Q2	Q3	Q4	YTD
2014 Baseline 2	Not available				
2015 Baseline 2	1.101	1.201	0.970	1.071	1.088
2016 Baseline 2	1.045	1.050	1.102	1.040	1.060