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Nurse-Driven Protocol to Reduce Catheter Associated Urinary Tract Infections

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A NURSE-DRIVEN PROTOCOL TO REDUCE CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

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

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This project, written by Elva E. Hamilton under direction of Dr. Stefanie Lamanna Project Chair, and approved by members of the project committee, has been presented and accepted in partial fulfillment of requirements for the degree of

DOCTOR OF NURSING PRACTICE

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Certification

We hereby certify that this DNP Project, submitted by Elva E. Hamilton, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the project requirement for the Doctor of Nursing Practice degree.

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Abstract

Background: Catheter-associated urinary tract infections (CAUTIs) are a major source of avoidable hospital-acquired infections. The scientific evidence supports utilization of nurse-driven protocols to reduce CAUTIs.

Purpose: The purpose of this quality improvement project was to update and implement an evidence-based CAUTI prevention protocol for the nursing staff on a medical-surgical unit in an adult acute care hospital to decrease the utilization of indwelling urinary catheters and CAUTIs.

Theoretical Framework: Donabedian's structures, processes, and outcomes (SPO) model was utilized as the framework for this project. Donabedian's SPO model focuses on strong healthcare structures and processes to improve nurse, patient, and organizational outcomes.

Methods: This project utilized a quantitative design. A convenience sample of 28 nurses from the medical-surgical unit of a South Florida hospital participated in the project. An educational intervention was delivered on CAUTI prevention based on guidelines from regulatory agencies, and the hospital existing protocol was updated and revised to reflect the guidelines. The sample was administered a short demographic survey, and 10-item pretests and posttests on CAUTI prevention before and after implementation of the standardized evidence-based protocol. To determine possible differences in nurses' knowledge and perceptions of indwelling urinary catheters before and after the implementation, paired *t* tests were conducted. To determine if the proportions of days with urinary catheters were statistically significantly different 30 days before and after

implementation of the standardized evidence-based guideline, a 2-proportion *z*-test was conducted.

Results: On analysis of the pretests and posttests, a statistically significant difference was found in 6 of the 10 questions, indicating that nurses' knowledge and perceptions of CAUTIs improved after the intervention ($p < .001$ to $p < .043$). After the intervention, urinary catheter days relative to patient days also decreased significantly ($z = 5.562$, $p < 0.001$).

Conclusion: Implementation of an evidence-based nurse-driven protocol in a hospital in South Florida improved nurses' knowledge and perceptions of CAUTI prevention. Nursing practice and healthcare delivery can benefit from development of such guidelines and educational interventions to empower nurses to better manage patients' indwelling urinary catheters, and decrease the incidence of CAUTIs in hospitals.

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Chapter 1

Nature of the Project and Problem Identification

Medical errors in the Unites States (US) account for over 400,000 fatalities annually (Makary & Daniel, 2016). Many of the deaths result from conditions which are largely preventable (Makary & Daniel, 2016**)** and result from hospital-acquired infections (HAIs). Urinary tract infections (UTIs) are the fourth leading cause of nosocomial infections in the US, accounting for 93,000 cases in acute care hospitals in 2011, with an associated death toll of approximately 13,000 annually (Centers for Disease Control and Prevention [CDC], 2017).

Of all HAIs, 40% are UTIs, and 80% of the UTIs are associated with indwelling urinary catheters (Institute for Healthcare Improvement [IHI], (2017). Appropriate uses of indwelling urinary catheters include insertion in patients with acute urinary retention or obstruction, measurement of output in critically ill patients, assistance with healing of stage 111 and 1V pressure ulcers, and in surgical cases, among other uses (Agency for Healthcare Research and Quality [AHRQ], 2015). Catheter-associated urinary tract infections (CAUTIs) are one of the most common of UTIs, affecting over 560,000 patients annually (American Nurses Association [ANA], 2017). In addition to the cost of lives and human suffering associated with UTIs, an enormous financial burden of approximately $40 billion from such infections is placed on the US healthcare industry annually (AHRQ, 2015). These statistics support the need for healthcare providers to prioritize management of this issue to improve patient outcomes.

A consensus exists among professional healthcare associations that the prevalence of CAUTIs is a patient safety issue that needs to be addressed (Mohajer & Darouiche, 2016; Mori, 2014; Smith, 2015). Healthcare leaders are challenged to implement practice to bridge the gap between evidence and practice that has been identified within the US healthcare system (Carr, Lacambra, Naessens, Monteau, & Park, 2017; Olson-Sitki, Kirkbride, & Forbes, 2015). Although evidence exists to support the implementation of-based measures to improve patient outcomes, the problem of hospital-acquired CAUTIs persists (Carr et al., 2017; Quinn, 2015).

CAUTIs are a major source of hospital-acquired infections in the US, according to the AHRQ (2015), and utilization of evidence-based strategies can result in prevention of up to 70% of CAUTIs. Practice guidelines outlined strategies that nurses can employ in their practice to decrease CAUTIs. These strategies include decrease of the use of indwelling urinary catheters, catheter care, and timely removal of the catheters when indicated (AHRQ, 2015; ANA, 2017; CDC 2017).

Prolonged use of an indwelling urinary catheter is a major risk factor for CAUTIs (Mohajer & Darouiche, 2013). Indwelling urinary catheters should therefore be utilized only with appropriate indications and should be discontinued as soon as they are no longer indicated (Centers for Disease Control and Prevention [CDC], 2018a). The use of indwelling catheter in US acute care hospitals is often inappropriately monitored. According to the established scientific evidence, decrease of the use of indwelling catheters can play a key role in reducing CAUTIs in the acute care facilities (Lo et al. 2014; Mohajer & Darouiche, 2013). Nurse-driven protocols have been shown to decrease

the incidence and periods (dwell times) of indwelling urinary catheters, thus improving patient outcomes.

Mori (2014) implemented a nurse-driven indwelling urinary catheter protocol at an acute care facility to determine the prevalence of urinary catheters, dwell times, and infection rates. From preintervention to postintervention, the prevalence of indwelling urinary catheters, catheter days, and incidence of CAUTIs decreased. A similar nurse-driven-protocol was implemented across a multihospital healthcare system by Dy, Major-Joynes, Pegues, and Bradway (2016). The authors reported a significant decline in CAUTIs postintervention of the nurse-driven protocol in the hospital with the highest baseline rate and varied results in the facilities with the two lowest baseline rates.

Like these studies, many other studies exist to support reduction of the use of urinary catheters to decrease the incidence of CAUTIs in the US. Patients in acute care hospitals have benefitted from a decrease in indwelling urinary catheter utilization. Furthermore, the evidence supports utilization of nurse-driven protocols to decrease CAUTIs (AHRQ, 2015; ANA, 2017; Olson-Sitki et al., 2015; Sublett, 2016).

Problem Statement

Currently, the medical-surgical unit at an acute adult care hospital in South Florida does not utilize an effective standardized nurse-driven-protocol for CAUTI prevention and reduction, as indicated by scientific evidence and regulatory agencies. This ineffectiveness results in overuse of indwelling urinary catheters and increases incidences of preventable CAUTIs.

Purpose of the Project

The purpose of this quality improvement project was to update the CAUTI policies and guidelines in an acute care hospital and implement an evidence-based CAUTI prevention protocol for the nursing/provider staff of the adult medical-surgical unit to decrease the utilization of indwelling urinary catheters and to decrease and prevent CAUTIs.

Project Objectives

1. Identify evidence-based practice guidelines relating to CAUTI prevention from peer-reviewed journal articles and professional organizations, such as CDC, ANA, and AHRQ, and complete a gap analysis of the hospital's current CAUTI policies and guidelines. Obtain Nova Southeastern University Institutional Review Board (IRB) approval and the site approval and support by November 2017.
2. Complete demographic and pretest questionnaires to determine background, and level of knowledge of CAUTI prevention; and collect aggregated data from patient charts on CAUTIs, patient days, and catheter days 30 days before implementation of the new protocol.
3. Develop an updated, evidence-based nurse-driven protocol for the indication, maintenance, and removal of indwelling urinary catheters congruent with established guidelines and other scientific evidence by January 2018.
4. Educate staff on new nurse-driven CAUTI prevention protocol in the medical-surgical units, conduct posttest, and implement the protocol by March 2018.

5. Evaluate the effectiveness of the project 30 days after protocol implementation

Theoretical Framework

The theoretical framework guiding this Doctor of Nursing Practice (DNP) quality improvement project was Donabedian's (1966) structures, processes, and outcomes (SPO) model for the evaluation of healthcare quality. The SPO theory, according to Huddleston (2014), addresses healthcare structures and processes, which lead to optimal nurse, patient, and organizational outcomes. The SPO theory suggests that optimal structures lead to optimal processes that will then lead to optimal outcomes. Utilization of this framework to assess current policies as well as to implement protocols for indwelling urinary catheter use should improve patient outcomes (Mori, 2014).

Structures

The relevant structures in this project included the environment of practice which was examined for the cleanliness of the practice area as it relates to infection control. Adequate staffing is another element of structure which was considered as well as the availability of supplies for the insertion and maintenance of indwelling urinary catheters. The availability of adequate lighting at nights plays a role and was also considered when assessing the structure for healthcare interventions. The policies and protocols for indwelling urinary catheter utilization within the facility were reviewed to ensure that they meet the standards of the ANA, and other professional healthcare organizations. The staff compliance with established policies and protocols were examined for areas to be improved to drive the desired outcomes.

Processes

The processes in this project refer to the indwelling catheter related procedures that are completed by the nurses. These processes are guided by the CAUTI prevention protocol within the structure. The protocol provides a resource for nurses to utilize in assessing for indications for indwelling urinary catheters, and maintenance of catheters when indicated for use.

Outcomes

The data on indwelling urinary catheter utilization and CAUTIs 30 days prior to the intervention and 30 days thereafter was examined. The desired outcome in this project was to decrease in the utilization of indwelling urinary catheters and CAUTIs after the intervention when compared to the facility's preintervention data.

Significance of the Project

Nursing Practice

This quality improvement project was designed to address the need for reduction of indwelling urinary catheter use and CAUTIs. Nurses play a significant role in the healthcare professional team, and this project may increase their knowledge and expertise toward reduction of CAUTIs. The project will contribute to the existing scientific body of knowledge available to guide future nursing practice and will provide a foundation for other nursing projects to utilize nurse-driven protocols to improve patient outcomes. Nurses in the facility will be empowered to take the lead against CAUTIs and will be able to disseminate their knowledge throughout other facilities where they are employed as well as to educate new nurses.

The promotion of infection control is a major focus at all levels of nursing, including nursing education (Hassan, 2018). With an evidence-based protocol, nursing schools could incorporate urinary catheter competencies for nursing students. Snidjers (2014) observed that involving nursing students in projects such as CAUTI prevention will assist in bridging the evidence-practice gap. Nursing curricula could include the implementation of evidence- based nurse-driven protocols, such as that developed in this project. More extensive training in nursing schools could be delivered as it relates to the insertion, maintenance, and removal of indwelling urinary catheters.

Healthcare Outcomes

Partnership for patients focuses on maximizing health outcomes while reducing costs through the collaboration of healthcare providers, patients, hospitals, the government, and other stakeholders (Arizona Nurse, 2015). This project may further highlight the need for more collaboration between physicians and nurses in the effort to improve patient outcomes regarding CAUTIs. This project was undertaken to address improved patient outcomes in the use of CAUTIs.

A plethora of evidence suggests that CAUTIs are preventable (AHRQ, 2015; CDC, 2017; Makary & Daniel, 2016**).** The statistics on CAUTIs make it imperative for healthcare providers to focus on the issue, with the goals of improving quality of care and decreasing healthcare spending. Implementation of this quality improvement project should help improve patient outcomes regarding CAUTIs, increase interprofessional collaboration, and benefit all stakeholders. The instruction of nurses in the prevention of hospital-acquired conditions such as CAUTIs will decrease patient mortality and illness and benefit all other healthcare stakeholders. This project also added to the existing

evidence-based knowledge of CAUTIs and helped fill the evidence-practice gap. The project also may provide a basis for future research on CAUTIs.

Healthcare Delivery

This project may impact healthcare delivery by increasing the utilization of nurse-driven protocols in hospitals and other healthcare facilities. The prevention of nosocomial infections is a major focus and a paradigm shift in healthcare. As such, prevention should be addressed at all levels of nursing.

The project was intended to foster nurses' independent decisions in the delivery of patient care, specifically the use of CAUTIs, thus increasing nurses' empowerment. Through the implementation of the evidence-based nurse-driven protocol, this project helped to bridge the evidence-practice gap. In utilizing the nurse-driven protocol, nurses will be called upon to assume increased responsibility and therefore accountability in providing direct patient care on the use and duration of CAUTIs.

Healthcare Policy

Prevention of hospital-acquired conditions is a focus of regulatory agencies. The awareness of the positive impact of nurse-driven protocols such as that developed for this project could potentially impact the scope of nursing practice in different states throughout the US. This project could impact healthcare policy by standardizing CAUTI prevention protocols across hospital units and systems. Hospital policies could be instituted to ensure that recommendations from relevant professional organizations, and the nurse-driven protocol for CAUTIs are implemented in hospitals and other healthcare settings.

Summary

Improvement of patient outcomes is one of the most important responsibilities of nursing. Achievement of the best healthcare outcomes include the assessment of current healthcare delivery to identify evidence-practice gaps and the utilization of best practices to bridge those gaps. An abundance of evidence exists suggesting that CAUTIs cause needless patient deaths and are preventable. At an acute care hospital in South Florida, this project addressed the decrease and prevention of CAUTIs through a quality improvement project.

Approaches to CAUTI prevention in the acute care setting include the implementation of best practices for indwelling urinary catheter relative to insertion, maintenance, and timely removal of catheters. Professional organizations such as the ANA established evidence-based guidelines for the utilization of indwelling urinary catheters within the acute care environment. In addition, studies have shown that nurse-driven protocols are effective in addressing infection control issues such as CAUTIs. This project utilized evidence-based guidelines in the development of a nurse-driven protocol to improve the outcome of patients with indwelling urinary catheters in the acute care environment.

Donabedian's (1966) SPO theoretical framework was used to assess the existing structures and processes within the organization relating to indwelling urinary catheters and provide the basis for improvement to facilitate optimal patient outcomes. The project is significant in the application of CAUTI information to nursing school curricula, partnerships for prevention of CAUTIs among all healthcare stakeholders, and implementation of hospital policies regarding CAUTIs at institutions nationwide. The

project also adds to the existing scientific knowledge and provides a basis for future research on CAUTIs. Most importantly, nurses will be empowered through the use of a nurse-driven protocol to improve patient outcomes.

Chapter 2

Review of the Literature

The continuous evolution in healthcare is largely focused on improving patient outcomes while lowering costs (Ryan, Brown, Glazier, & Hutchinson, 2016). The reduction of hospital-acquired infections is a major focus of healthcare professionals, regulatory agencies, and hospitals. Among the leading causes of HAIs are CAUTIs (AHRQ, 2015; CDC, 2017). The ANA, CDC, Centers for Medicare and Medicaid Services (CMS), and many other professional healthcare organizations have established guidelines to address the issue of CAUTIs. Despite the guidelines, CAUTIs continue to be a major source of HAIs, affecting more than 560,000 patients annually (ANA, 2017).

As a major part of the healthcare team, nurses can make a measurable impact on the reduction of CAUTIs in hospitals. The scientific evidence supports the utilization of evidence-based nurse-driven protocols to enhance nurses' role in CAUTI prevention (AHRQ, 2015; Mori, 2014**).** This project was undertaken to provide an appropriate protocol for nurses in the prevention of CAUTIs.

Literature Search

The literature search for this project was conducted through web searches of professional healthcare organizations and governmental organizations as well as databases such as EBSCO host and Cumulative Index to Allied Health Literature

(CINAHL). The database searches focused on articles published between 2013 and 2018, and were limited to scholarly peer-reviewed, full-text, evidence-based journal articles in English. Search terms utilized included *Donabedian's model, nurse-driven protocol for CAUTI prevention, nurse-driven protocol for urinary catheter removal*, *and urinary catheter infections*. Internet searches included *CAUTI prevention toolkit* and *CAUTI prevention guidelines.*

Urinary Tract Infections

Urinary tract infections (UTIs) constitute one of the most prevalent forms of HAIs, and CAUTIs account for approximately 75% of all UTIs (Centers for Disease Control and Prevention [CDC], 2015). CAUTIs are the leading cause of avoidable HAIs in the US (ANA, 2017; CDC, 2015). The use of indwelling urinary catheters represents the correct mode of treatment for many hospitalized patients. However, in many instances, indwelling urinary catheters are not indicated for many patients' conditions, posing avoidable risks for patients (Moultona, Lachiewiczb, Liuc, & Goje, 2018; Purvis et al., 2014).

A CAUTI is a urinary tract infection that develops when a patient has an indwelling urinary catheter for more than 2 days from the date of the insertion, and the catheter is in place on the day of the UTI or the preceding day. In instances where the catheter has been discontinued, it had to be in use for more than 2 days. In addition, the UTI must be evident on the date of removal or the following day for it to be classified as a CAUTI (CDC, 2017).

According to the Centers for Disease Control and Prevention (CDC, 2018b), a CAUTI exists (a) in the presence of a positive urine culture that is collected at 48 hours

or more after admission to a facility, (b) in the presence of an indwelling catheter at the time of or 48 hours prior to the collection of the specimen for urine culture, and (c) with a elevated temperature of 38 degrees Celsius or greater, with no other assessed causes for the fever. In addition, the patient must have developed either tenderness or pain either of the costovertebral angle or suprapubic area; alternatively, a positive blood culture must be found with the same organism as in the urine (CDC, 2017). These criteria for CAUTIs were adopted for this quality improvement project.

Guidelines for Use of Indwelling Urinary Catheters

Guidelines have been established for the indication, maintenance, and removal of indwelling urinary catheters. These guidelines are largely focused on the elimination of improper usage and improvement of patient outcomes when the treatment is indicated. According to the AHRQ (2015), up to 70 % of CAUTIs can be prevented with the use of established evidence-based practice guidelines. This estimation supports the argument that CAUTI reduction needs to be a focus for healthcare providers to improve patient outcomes.

ANA CAUTI Prevention Tool

The ANA in collaboration with the CDC created an evidence-based tool for nurses to utilize in the treatment of patients with indwelling urinary catheters. The goal of the tool was to prevent CAUTIs through several means. These are reduced utilization of indwelling urinary catheters, timely removal of indwelling urinary catheters, and adequate assessment of the catheters while in use (ANA, 2017).

The ANA (2015) CAUTI tool addresses the indication for an indwelling urinary catheter by adopting the CDC's (2016) guideline for indwelling urinary catheter

insertion. Indications include urinary retention, comfort for end-of-life care, accurate measurement of intake and output in critically ill patients, some surgical procedures, immobilization in some patients, sacral ulcers, and perineal wounds. The ANA (2017) specified that patients who do not meet the indications for indwelling urinary catheter should not receive one, and patients indicated for use must be assessed daily for continued use and appropriate maintenance of the catheter. Further, the ANA collaborated with CMS in a project called *Partnership for Patients* to reduce avoidable hospital-acquired conditions, with CAUTIs as a major focus (Arizona Nurse, 2015).

CDC Guidelines for CAUTI Prevention

In 2016, the Centers for Disease Control and Prevention (CDC, 2016) updated its 2009 guideline for CAUTI prevention. This update was based on new scientific evidence and provided recommendations for implementation of use, measurement, and surveillance of indwelling urinary catheters. The CDC (2016) guideline suggests that indwelling urinary catheters should be used only for patients with specified conditions. These are bladder outlet obstruction; for intake and output for critically ill patients; selected perioperative patients; patients with open sacral or perineal wounds; patients requiring long periods of immobilization, such as those with some neurological conditions; and patients with end-of-life comfort care needs. The guideline discourages use of indwelling catheters in patients whose conditions do not fall within one of these categories (CDC, 2016).

In patients who meet the indications, the CDC (2017) recommends that the catheter be inserted by trained professionals using aseptic technique and sterile equipment. The catheter system should remain closed, and the flow of the urine should be

unobstructed. In addition, the catheters should be maintained by trained individuals, with an emphasis on precautions for infection prevention. The catheter should be removed as soon as the indication for use is no longer appropriate (CDC, 2017).

Agency for Healthcare Research and Quality Guidelines

The AHRQ (2015) published guidelines for healthcare providers to utilize for the prevention of CAUTIs. The major recommendations address strategies for catheter avoidance, product selection and care, timely removal, surveillance, and education for healthcare providers. The recommendations of the AHRQ are similar to those of the ANA and that of the CDC, with additional recommendations for comprehensive unit-based safety programs (AHRQ, 2015).

Nurse-Driven Protocols

Many scientific studies support the use of nurse-driven protocols to improve patient outcomes. The ANA toolkit (ANA, 2017) was developed for the support of nurse-driven protocols as well as support of nurses in the overall effort to reduce CAUTIs (ANA, 2017). The AHRQ (2015) suggested the utilization of nurse-driven protocols for indwelling urinary catheter removal. Overall, nurse-driven protocols in CAUTI prevention have been widely utilized in hospitals with great success (Mori 2013; Olson-Sitki et al., 2015; Sublett, 2016).

Many studies attest the success of nurse-driven protocols; three recent studies are reviewed next. Mori (2014) implemented a nurse-driven indwelling urinary catheter protocol at a 150-bed acute care hospital. The study targeted admitted patients with the exception of the obstetrics patients. The intervention was created in collaboration with physicians and other healthcare professionals for the development of practice standards,

which included use and removal criteria for an indwelling urinary catheter. The indication criteria were used to develop a nurse-driven protocol for nurses to independently discontinue the urinary catheter when the indications were no longer met (Mori, 2014).

A decision tree was created for nurses to utilize as an easy source of reference. All healthcare providers, including physicians at the facility, were educated on the protocol. The protocol also addressed maintenance of the catheter by securing the catheter tubing to the bed sheet, avoidance of dependent looping, and maintaining the catheter system closed (Mori, 2014).

Before and after implementation of the nurse-driven protocol, retrospective chart reviews of 389 and 282 patients, respectively were conducted to determine dwell time, prevalence, and CAUTI rates 3 months preintervention and 3 months postintervention. Comparison of these factors showed a reduction in dwell time from 1,280 days preintervention to 1,025 days postintervention, a decrease in prevalence of catheters from 37.6% to 27.7%, and a decrease in CAUTIs from 0.77% to 0.35% (Mori, 2014). These results support the development and utilization of a nurse-driven protocol for CAUTI reduction.

The Mori (2014) study had some limitations. It was conducted over a short time and included a small sample size. A longer study time and larger sample size may have rendered this study more generalizable to other healthcare facilities.

Quinn (2015) studied CAUTIs at a regional community hospital with 301 beds. A nurse-driven process for CAUTI prevention was implemented with an 8-point protocol for indication, physician collaboration, education, and monitoring. This intervention did

not allow for nurses to independently discontinue utilization of the urinary catheters; nevertheless, the intervention provided an algorithm to guide nurses on whether to seek physicians' orders to continue or discontinue the catheter on a daily basis (Quinn, 2015).

CAUTI rates were measured from 2008 to 2013 via the electronic medical record (EMR) prior to and following the intervention. Quinn (2015) reported that CAUTI rates decreased from 4.9/1000 catheter days in 2008 to 3.9/1000 catheter days in 2009. Catheter days declined from 22,212 in 2008 to 13,249 in 2012. The facility continued to see a decline in CAUTIs to 0.2/1000 in 2013. These results indicated a direct relationship between the utilization of a nurse-driven protocol, and catheter utilization, dwell time, and CAUTI rates (Quinn, 2015).

The Quinn (2015) study, however, had limitations. It was conducted within a single acute care facility, which limits generalization to other facilities. Nevertheless, the impact of the nurse-driven protocol could be studied on a larger scale and in various geographical location.

Dy et al. (2016) implemented a nurse-driven removal protocol for indwelling urinary catheters across three acute care hospitals within an academic healthcare system. The average patient days for these hospitals were 789, 354, and 496 respectively. The nurse-driven protocol was intended to reduce the indwelling catheter utilization and CAUTIs in the intensive care units of all three hospitals.

The nurse-driven protocol was to be ordered by physicians with criteria for specific times or conditions for removal. There was also an option for physicians themselves to monitor these catheters daily. However, for patients who were ordered the

nurse-driven protocol, nurses would be able to remove the indwelling catheters when indicated without consulting the physicians for orders (Dy et al., 2016).

The protocol was implemented for 12 months from June 2014 to May 2015. CAUTI rates and indwelling urinary catheter utilization rates for the implementation period were compared with the 12-month preintervention period from May 2013 to April 2014. The results indicated there was no significant differences across the system in the utilization rate of indwelling urinary catheters. However, a significant reduction (19%) was found in CAUTIs ($p = 0.13$) when compared to the preintervention period (Dy et al., 2016).

The limitations of the Dy et al. (2016) project include the sample of only ICU patients in a single healthcare system. This sample renders the results ineligible for generalization. Further, no assessment was made of patient characteristics regarding the decision to remove or retain the catheters. Finally, the preimplementation phase addressed the education of the protocol and not providers' barriers to implementation. Nonetheless, the results of the Dy et al. (2016) project indicate that the utilization of nurse-driven protocols is effective in CAUTI reduction.

The Role of Information Technology

Health information technology (HIT) has been a major contributor to quality improvement in healthcare (Liu et al., 2016; Santana et al., 2018). In New York, White Plains Hospital utilized HIT in its successful CAUTI prevention initiative for customized reports that identified patients with indwelling urinary catheters. HIT was used also to capture the maintenance of the catheters by the nursing staff (Quinn, 2015).

A study conducted at a 150-bed community hospital in the northern United States by Mori (2014) showed that information technology was utilized successfully to collect data relative to patient demographics, as well as to collect data prevalence of indwelling urinary catheters and dwell times. The successful collection of data utilizing information technology is essential in quality improvement projects such as those previously discussed.

HIT has other uses. It can be utilized to remind nursing staff to reassess urinary catheter use, as well as to provide data on the utilization of the catheters (Mori, 2014**)**. In the current project, the EMR was utilized for chart reviews and data collection. The nurse-driven protocol was not implemented immediately by electronic means because of characteristics of the study facility, which is part of a large healthcare system. Changes will have to be implemented throughout the system and regions for the most effective use of the EMR. However, future plans include implementation with the EMR for greater expediency of the nursing staff.

Summary

An abundance of evidence exists in the established literature that supports the fact that CAUTIs are a national healthcare issue in the US. This issue is important to address, as it is a major contributor to nationwide mortality and morbidity.

Studies have shown reduction of CAUTIs with the utilization of evidence-based interventions relating to the indications for indwelling catheters and the care, assessment, and prompt discontinuation of catheters at many healthcare facilities. Utilization of evidence-based nurse-driven protocols has proven to be an effective strategy in the effort to reduce CAUTIs nationally. Implementation of an evidence-based guideline to reduce

CAUTIs in the current project helps bridge the evidence-practice gap, adds to the scientific knowledge of CAUTI prevention, and improves patient outcomes.

Chapter 3

Methods

Catheter-associated urinary tract infections are a major source of hospital-acquired infection in the US, affecting over 560,000 patients annually (ANA, 2017). CAUTIs are associated with prolonged hospitalization and increased mortality and morbidity (Smith, 2015). However, CAUTIs can be avoided with evidence-based interventions (AHRQ, 2015). As a major segment of healthcare, nurses are in a unique position to improve patient outcomes. Protocols for the prevention of CAUTIs have been utilized with success, and have become models for intervention decreasing CAUTIs (Dy et al., 2016; Mori, 2014; Quinn, 2015).

Evidence-based practice guidelines for the prevention of CAUTIs have been established by ANA, CDC, CMS, AHRQ, and many other professional healthcare organizations. These guidelines have been accepted by many hospitals and address the insertion criteria, timely removal of catheters, and catheter maintenance, in addition to many other catheter-related facets of intervention. The intervention implemented in the current project was based on the guidelines by major professional organizations.

Project Design

This project utilized a quantitative design. Preintervention and postintervention data were collected: for nurses, a preintervention demographic questionnaire and survey questionnaires on CAUTIs; and for patients, data on CAUTIs. Aggregated data on

CAUTIs, patient days, and catheter days within the facility's medical-surgical units 30 days prior to the intervention were utilized as a baseline. The nurse-driven CAUTI prevention protocol was developed and implemented on the medical-surgical units for 1 week. Thirty days postintervention, the aggregated data on CAUTIs, patient days, and catheter days were collected. At this time, the preintervention data were compared with the postintervention data by descriptive statistics, frequencies and percentages; and inferential statistics, paired *t* tests for possible significant differences and 2-proportion *z* tests.

Problem Statement

Currently, the medical-surgical unit at an acute adult care hospital in South Florida does not utilize an effective standardized nurse-driven-protocol for CAUTI prevention and reduction, as indicated by scientific evidence and regulatory agencies. This ineffectiveness results overuse of indwelling urinary catheters and increases incidences of preventable CAUTIs.

Purpose of the Project

The purpose of this quality improvement project was to update the CAUTI policies and guidelines in an acute care hospital and implement an evidence-based CAUTI prevention protocol for the nursing/provider staff of the adult medical-surgical unit to decrease the utilization of indwelling urinary catheters and to decrease and prevent CAUTIs.

Setting

The project took place at a 357-bed acute care hospital, part of a large healthcare system, in South Florida. The hospital has one building: Tower 1 and Oncology are

connected and form the medical-surgical unit; Tower 3, Signature Suites, Towers 2 and 4 are Telemetry units. The hospital includes three intensive care units.

The services provided at the hospital include emergency room, women services, new-born intensive care unit (ICU), adult ICUs, behavioral health, surgeries, oncology, telemetry, medical-surgical services, and many outpatient services. Indwelling urinary catheters are utilized in all the inpatient nursing units upon orders by physicians. The catheters are inserted primarily by registered nurses (RNs) and are maintained by RNs. This setting was chosen because of its high incidence of CAUTIs and the potential benefits of improvement to patients and the community.

Sample

The participants were recruited by convenience sampling of the 20 nurses who worked on the medical-surgical unit at the time of intervention. All participants were required to speak and read English. Participation was voluntary, and participants were able to withdraw at any time. There was no incentive for participation.

Inclusion Criteria

The inclusion criteria for this project included registered nurses from the medical-surgical unit of the hospital; these nurses provided direct patient care. Part-time staff who consistently worked more than 2 days per week were also included**.**

Exclusion Criteria

Exclusion criteria included nurses who were not RNs, who did not speak and read English, and who worked on the unit sporadically from other units within the hospital. Agency nurses were excluded, as were per diem nurses who worked less than 2 days per week and staff who refused to participate.

Ethical Considerations

Approval to conduct the project was sought from the Nova Southeastern University Institutional Review Board (IRB). The IRB determined that the project was exempt from further review. This approval was based on the minimal risk to human subjects (Appendix A).

Informed Consent

For adherence to ethical considerations, a letter of participation and consent was provided to all participants prior to their participation in the project (Appendix B). The letter described the purpose of the project, nature of the information requested, time for participation, and the risks and benefits of participation for nurses' informed decisions regarding participation. There was no coercion, participation was voluntary, and participants were informed they could withdraw at any time with no penalty. All questionnaires completed by participants were anonymous to ensure protection of identities and possible repercussions from employers.

Confidentiality

Participants' identities were confidential, known only to the principle investigator and representatives of Nova Southeastern University. This project did not utilize protected health information as all data were aggregated and deidentified. All documents relative to this project were maintained in a locked cabinet accessible only to the principal investigator. Documents will be retained for 36 months and then destroyed by paper shredding and deletion of electronic files.

Project Phases/Objectives

This project took place in several phases to meet each objective.

Objective 1

Identify evidence-based practice guidelines relating to CAUTI prevention from peer-reviewed journal articles and professional organizations, such as CDC, ANA, and AHRQ, and complete a gap analysis of the hospital's current CAUTI policies and guidelines. Obtain Nova Southeastern University Institutional Review Board (IRB) approval, and the site approval and support by November 2017.

This objective was accomplished by examination of current evidence-based practice guidelines for CAUTI prevention by healthcare organizations and regulatory agencies. Current evidence-based peer-reviewed journal articles were utilized for recommendations for CAUTI prevention and nurse-driven protocols. The hospital's current policy for CAUTI prevention was obtained from the hospital electronic policy database and compared to the scientific recommendations to determine how the policy could be modified and utilized in the revised evidence-based nurse-driven protocol. IRB exemption was granted (Appendix A), and the hospital provided approval and support (Appendix B).

Objective 2

Complete demographic and pretest questionnaires to determine background, and level of knowledge of CAUTI prevention; and collect aggregated data from patient charts on CAUTIs, patient days, and catheter days 30 days before implementation of the new protocol.

To recruit nurses for this project, flyers were circulated throughout the unit to introduce the project and request participation (Appendix C). For those who responded, the letters of participation and consent were provided in hard copy (Appendix B). The demographic survey of 10 items (Appendix D), and pretest of 10 items (Appendix E) were developed by the principal investigator based on the scientific evidence and then administered electronically via SurveyMonkey**.** The pre- and posttests were designed to test nurses' perceptions and knowledge of basic CAUTI prevention. Data from patient charts of CAUTIs, patient days (each day that a patient utilized the services at the hospital), and catheter days (each patient day with an indwelling catheter in use) were obtained from the infection prevention department of the hospital. This information was aggregated by the principal investigator to protect patients' confidentiality.

Objective 3

Develop an updated, evidence-based nurse-driven protocol for the indication, maintenance, and removal of indwelling urinary catheters congruent with established guidelines and other scientific evidence by January 2018.

Evidence-based recommendations identified for implementation were extracted from the guidelines of regulatory agencies and the literature. These recommendations were integrated into the current policy to form a new nurse-driven protocol utilizing an algorithm congruent with the hospital's medical staff protocols, and nursing scope of practice. The new protocol was developed and presented to the nursing director of the implementation unit, the director of infection control for approval. Approval was granted.

Objective 4

Educate staff on new nurse-driven CAUTI prevention protocol in the medical-surgical units, conduct posttest, and implement the protocol by March 2018.

Educational sessions for the nursing staff on the new protocol were conducted by the principal investigator during 1 week. at a staff meeting to ensure that as many members as possible were receiving the same training. Additional educational sessions were scheduled and completed to facilitate participants who were not present at the staff meeting. All sessions were 60 minutes in length, and four sessions were conducted to accommodate all nurses. Three days after the training was completed, the posttest survey of 10 items was administered electronically via SurveyMonkey (Appendix G). The new protocol was implemented on the medical-surgical unit 1 week following the posttest survey (Appendix H).

Objective 5

Evaluate the effectiveness of the project 30 days after protocol implementation.

Evaluation of the project effectiveness was conducted with data analysis of the CAUTI-related data in the medical-surgical units 30 days preintervention and 30 days postintervention. Results of the SurveyMonkey pretest and posttest were compared, as well as aggregated data on CAUTIs, patient days, and catheter days. These data were obtained from the infection prevention department from patient records and aggregated by the principal investigator.

Timeline

Adherence to the projected timeline was essential for completion of the project, requiring concentrated focus on the objectives. The time allocated for the project was

limited to one university semester. Objective 1, which identified evidence-based practice guidelines relative to CAUTI prevention; and Objective 2, which included recruitment and pretest survey data collection from nurses and the infection prevention department, were completed within 8 weeks. Objective 3, development of the nurse-driven protocol and approval; and Objective 4, which included education of the nurses, administration of posttest surveys, and utilization of the protocol, was completed within 8 weeks. Objective 5 addressed the evaluation of the project, including data analysis, and was completed after 30 days postintervention required for evaluation.

Resources/Budget

The project relied heavily on the support of the facility nursing director of the implementation unit and staff nurses. Technology was employed to develop materials for education, review the scientific body of evidence, collect data from the nurses, and record aggregated data from chart reviews. Access to a reliable computer with Microsoft office or compatible software was required. Table 1 shows the costs associated with the project.

Outcome Measures

All of the project outcomes were measured as described below:

Objective 1: Identify evidence-based practice guidelines relating to CAUTI prevention from peer-reviewed journal articles and professional organizations, such as CDC, ANA, and AHRQ, and complete a gap analysis of the hospital's current CAUTI policies and guidelines. Obtain Nova Southeastern University Institutional Review Board (IRB) approval and the site approval and support by November 2017.

Table 1

Project Budget

Item	Cost	Description
Printing	$25.00	Printing of letters of participation in black and white and education material in color.
Announcements	$25.00	Posters: 5 posters @ $5 per poster.
Staff lunch	$150.00	For staff appreciation: 30 staff @ $5 per member.
SPSS software	$35.00	For data analysis: 3-month subscription to software package.
Disk	$15.00	For electronic storage of data: 1 disk.
Total	$250.00	

Objective 1 addressed the scientific evidence and was measured by the utilization of guidelines recommended by regulatory healthcare agencies, such as the ANA, AHRQ, and CDC. A detailed review of the evidence provided the measurement for this objective. Approval was granted from the Nova IRB and facility (Appendices A and B).

Objective 2: Complete demographic and pretest questionnaires to determine background, and level of knowledge of CAUTI prevention; and collect aggregated data from the infection prevention department on CAUTIs, patient days, and catheter days 30 days before implementation of the new protocol.

This objective was measured by the successful recruitment of nurses ($N = 20$) and collection of data from the pretest (Appendix F) and patient charts of CAUTI-related information.

Objective 3: Develop an updated, evidence-based nurse-driven protocol for the indication, maintenance, and removal of indwelling urinary catheters congruent with established guidelines and other scientific evidence by January 2018.

This objective was measured by comparison of the hospital's current CAUTI policy with the scientific evidence, development of the protocol, and approval by the directors of the implementation unit and infection control.

Objective 4: Educate staff on new nurse-driven CAUTI prevention protocol in the medical-surgical units, conduct posttest, and implement the protocol by March 2018.

This objective was measured by education of the staff with four 60-minute sessions and implementation of the new nurse-driven CAUTI prevention protocol (Appendix H) in the medical-surgical unit for 1 week. Measurement included participants' completion of the posttest survey (Appendix G).

Objective 5: Evaluate the effectiveness of the project 30 days after protocol implementation.

This objective was measured by statistical analyses of reviews of patients' CAUTI-related records before and after the intervention, and participants' pretest and posttest survey results. The results showed that after the implementation the prevalence of indwelling urinary catheters decreased significantly. The pretest-posttest results indicated that 6 out of 10 questions showed a statistically significant improvement in nurses' perceptions and knowledge of CAUTI prevention.

Summary

Nurses need to address CAUTIs in healthcare as it is necessary for the improvement of patient outcomes, as well as for the fiscal viability of the healthcare

organizations. This capstone project utilized a quantitative design to implement an evidence-based nurse-driven protocol to address CAUTIs at an acute-care hospital in South Florida. The project was exempted from review by the Nova IRB, as it presented minimal risk to human subjects. The project was completed with five phases during one university semester. The project objectives were measured by examination of scientific literature, reviews of aggregated patient data, surveys of participants, and data analysis of CAUTI-related issues 30 days prior to and 30 days following implementation of an education session and introduction of new nurse-driven protocol. Data analysis included descriptive statistics, paired *t* tests, and 2-proportion *z t*ests.

Chapter 4

Results and Discussion

An abundance of scientific evidence exists recommending the utilization of nurse-driven CAUTI prevention protocols to decrease the utilization of urinary catheters in hospitals as a means of reducing CAUTIs (AHRQ, 2015; CDC, 2017; Mori, 2014). A nurse-driven CAUTI prevention protocol was developed and implemented at a hospital in South Florida to reduce indwelling urinary catheter utilization congruent with scientific recommendations. This protocol utilized an algorithm (Appendix H) as a guide for nurses when caring for patients with indwelling urinary catheters. For development of this algorithm, scientific evidence and professional practice guidelines were utilized from regulatory agencies relating to the utilization of indwelling urinary catheters in acute care settings.

The problem identified was that the medical-surgical unit at an adult acute care hospital in South Florida did not utilize an effective standardized nurse-driven protocol for CAUTI prevention and reduction, as indicated by scientific evidence and regulatory agencies. The purpose of this quality improvement project was to update and implement an evidence-based CAUTI prevention protocol for the nursing staff at the unit to decrease the utilization of indwelling urinary catheters and CAUTIs.

This project evaluated the effectiveness of the CAUTI prevention protocol 30 days after implementation. A 10-question demographic questionnaire (Appendix E) was

administered to obtain information on the participants, followed by Likert-type 10-question pretest and posttest surveys on 5-point scales (Appendices F and G) to determine participants' knowledge and perceptions of CAUTI prevention before and after an educational intervention. Aggregated data on indwelling urinary catheter utilization 30 days preintervention and 30 days postintervention were compared to evaluate for the project effectiveness.

Data analysis evaluated the effectiveness of the CAUTI prevention protocol 30 days after implementation. A 10-question demographic questionnaire (Appendix E) was administered to obtain information on the participants, followed by Likert-type 10-question pretest and posttest questionnaires on 5-point scales (Appendices F and G) to determine participants' knowledge and perceptions of CAUTI prevention before and after an educational intervention. Data on indwelling urinary catheter utilization 30 days pre- and postintervention were compared to evaluate for the project effectiveness.

The Statistical Package for the Social Sciences (SPSS), version 23 for Windows (IBM, 2015), was used to conduct data analysis. Descriptive statistics, primarily frequency tables, were used to summarize the survey data for the demographics and the pre- and posttest questionnaire responses. Paired *t* tests were conducted for significant differences from pretest to posttest. To determine the difference in the proportions of patients with indwelling urinary catheters before and after the implementation, a 2-proportion z-test was utilized. Microsoft Excel was used to create the bar chart of the 30 days pre- and postimplementation data. A *p* value of less than 0.05 indicated significant differences.

Results per Objective

Objective 1

Identify evidence-based practice guidelines relating to CAUTI prevention from peer-reviewed journal articles and professional organizations, such as CDC, ANA, and AHRQ, and complete a gap analysis of the hospital's current CAUTI policies and guidelines. Obtain Nova Southeastern University Institutional Review Board (IRB) approval and the site approval and support by November 2017.

This objective was achieved through a comprehensive review of clinical practice guidelines from ANA, AHRQ, and CDC. A review of peer-reviewed journal articles was also conducted to determine current evidence-based practices from other organizations. The facility's CAUTI prevention policy was reviewed, and evidence-practice gaps were identified to be addressed in the new protocol. IRB approval was obtained (Appendix A), and evidence of support from the organization (Appendix C) was obtained prior to commencement of the project.

Objective 2

Complete demographic and pretest questionnaires to determine background, and level of knowledge of CAUTI prevention; and collect aggregated data from the infection prevention department on CAUTIs, patient days, and catheter days 30 days before implementation of the new protocol.

This objective was met by nurses' completion of the demographic questionnaire (Appendix E) and the pretest questionnaire (Appendix F). Aggregated data were collected by the principal investigator from the infection prevention department of the hospital

from patient charts for CAUTIs, patient days (each day that a patient utilized the services at the hospital), and catheter days (each patient day with an indwelling catheter in use).

The demographic questionnaire (Appendix E) was developed by the principal investigator to obtain descriptive information about the nurses. The questionnaire consisted of 10 items, four multiple choice and six fill-ins, requesting nurses' characteristics. The data were collected electronically via SurveyMonkey, and all participating nurses were required to respond to the survey for participation in the project.

Eligible nurses were those who were employed in the medical-surgical unit of the hospital, who worked in the unit at least 2 days per week, and who provided direct patient care. All medical-surgical nurses *(N* = 48) were invited to participate in the project through a recruitment flyer (Appendix D), and 28 nurses responded. All participants received a letter of participation and consent (Appendix B) prior to participation. Descriptive statistics were used to summarize the data.

As Table 2 shows, all participants were registered nurses (*N* = 28). A total of 85.7% (*n* = 24) indicated English as their primary language, 50% *(n* = 14) achieved a bachelor's degree, and 17.9 % (*n* = 5) a graduate degree. In terms of gender, 89.3% *(n* = 25) were female, and 10.7% (*n* = 3) were male. Regarding age, 53.6% (*n* = 15) were between the ages of 36 to 50, and 35.7% (*n* = 10) were over 50 years of age. In terms of current nursing unit, 35.7*% (n* = 10) worked at Tower 1, 14.3% *(n* = 4) worked at Tower 3, 25.0% (*n* = 7) worked at the medical-surgical unit, 17.9% *(n* = 5) worked at the medical-surgical oncology unit, and 7.1% (*n* = 2) worked at Signature Suites.

Table 3 shows that the average years of experience working in the current unit was 5.63 (*SD* = 5.55). The minimum was slightly over half a year and the maximum was

25 years for working at the current unit and the facility. The average years of experience working at the current unit was 5.63 (*SD* = 5.55) and at the facility was 6.17 (*SD* = 5.59).

Table 2

Demographics (N = 28)

Characteristic		Frequency (%)
Job title	Auxiliary nurse midwife	1 (3.6)
	Registered nurse	27 (96.4)
Primary language	English	24 (85.7)
	Other	4 (14.3)
Gender	Female	25 (89.3)
	Male	3 (10.7)
Highest level of education	Associate degree	9 (32.1)
	Bachelor's degree	14 (50.0)
	Graduate degree	5 (17.9)
Age	18-25	1 (3.6)
	26-35	2 (7.1)
	36-50	15 (53.6)
	50+	10 (35.7)
Certifications	ACLS, BLS	10 (47.6)
	BLS	7 (33.3)
	BLS, ACLS, ONS	1 (4.8)
	Chemotherapy	1 (4.8)
	ONC, BLS	1 (4.8)
	Oncology	1 (4.8)
Licenses	Registered nurse license	28 (100.0)
Current nursing unit	Tower 1	10 (35.7)
	Tower 3	4 (14.3)
	Medical-surgical unit	7 (25.0)
	Medical-surgical oncology	5 (17.9)
	Signature suite	2 (7.1)

Note. ACLS = advanced cardiac life support, BLS = basic life support, ONS = Oncology Nursing Society, ONC = Oncology nursing certification.

Table 3

Years of Experience Working in Current Unit and at Facility (N = 28)

	M (SD)	*Min*	*Max*
Current unit	5.63 (5.55)	0.58	25
Facility	6.17 (5.59)	0.58	25

The pretest questionnaire (Appendix F) consisted of 10 items on a 5-point Likert scale, ranging from *1 = Strongly Disagree to 5 = Strongly Agree* and administered via SurveyMonkey to determine participant's knowledge prior to the intervention. A total of 20 participants completed the pretest. Participants' responses to the 10 questions are summarized in Table 4.

For the pretest survey data in Table 4, two items (Q6 and Q8) had mean responses of (M = 2., SD = 1.45 for Q6; M = 2.30, SD = 1.45 for Q8). These scores indicated that participants in general disagreed with both statements. The mean response scores for the remaining eight items ranged from 3.15 (Q5) to 3.95 (Q9), indicating that before implementation of the evidence-based protocol participants agreed with these statements regarding indwelling urinary catheters.

Aggregated data were obtained from the infection prevention department for CAUTIs, patient days, and catheter days 30 days before guideline implementation. These preimplementation data were collected from January 26, 2018, to February 24, 2018. For this 30-day data collection period there were 502 patient days, of which there were 13.15% (n = 66) indwelling urinary catheter days.

Table 4

Survey Responses for Pretest (N = 20)

	Frequency (%) of Survey Responses						
Item	1	2	3	4	5	*M (SD)*	*SW*
1	2 (10)	7 (35)	1 (5)	5 (25)	5 (25)	3.20 (1.44)	0.006
2	1 (5)	6 (30)	1 (5)	6 (30)	6 (30)	3.50 (1.36)	0.004
3	2 (10)	5 (25)	1 (5)	4 (20)	8 (40)	3.55 (1.50)	0.002
4	2 (10)	7 (35)	0	2 (10)	9 (45)	3.45 (1.61)	>0.001
5	1 (5)	8 (40)	3 (15)	3 (15)	5 (25)	3.15 (1.35)	0.005
6	8 (40)	6 (30)	0	4 (20)	2 (10)	2.30 (1.45)	0.001
7	0	4 (20)	2 (10)	8 (40)	6 (30)	3.80 (1.11)	0.002
8	8 (40)	6 (30)	0	4 (20)	2 (10)	2.30 (1.45)	0.001
9	0	5 (25)	1 (5)	4 (20)	10 (50)	3.95 (1.28)	<0.001
10	0	7 (35)	1 (5)	3 (15)	9 (45)	3.70 (1.38)	<0.001

Note. 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree. *SW* = *p* value of the Shapiro-Wilk test.

Objective 3

Develop an updated, evidence-based nurse-driven protocol for the indication, maintenance, and removal of indwelling urinary catheters congruent with established guidelines and other scientific evidence by January 2018.

The evidence-based nurse-driven CAUTI prevention guideline was updated by comparison of the facility's current protocol with scientific evidence and guidelines from regulatory agencies. The nurse-driven protocol was developed in the form of an algorithm (Appendix H) for nurses to utilize daily in the care of patients with indwelling urinary catheters. The guideline included assessment criteria for continuation of an indwelling urinary catheter, maintenance requirement, and post-catheter removal

assessment. After development, the guideline was approved by both nursing and the infection prevention directors for utilization on the medical-surgical unit.

Objective 4

Educate staff on new nurse-driven CAUTI prevention protocol in the medical-surgical units, conduct posttest, and implement the protocol by March 2018.

Four educational sessions were developed and conducted by the principal investigator for the nurses for 1 week. The educational sessions were developed from scientific evidence and guidelines from regulatory agencies.

The posttest questionnaire, which was identical to the pretest questionnaire, was administered electronically to the nurses via SurveyMonkey 3 days following the educational sessions. The guideline was implemented on the medical-surgical unit for 7 days from February 25, 2018, to March 3, 2018. Hard copies of the protocol/algorithm (Appendix H) were placed at different locations in the medical-surgical nursing units for easy accessibility to the nurses. The nursing director conducted surveillance to determine compliance with the protocol. The number of algorithms utilized for the 7 days of implementation were collected by the primary investigator to determine the percentage of utilization.

Table 5 summarizes the results for the posttest questionnaires. Two items (Q6 and Q8) had mean response scores as follows: $M = 1.35$, $SD = 0.50$ for Q6; $M = 1.45$, $SD = 0.51$ for Q8. These results indicated that participants in general disagreed with both statements. The mean response scores for the remaining eight items ranged from 3.50 (Q5) to 4.60 (Q2), indicating that after implementation nurses agreed with these questions.

Table 5

Survey Responses for Posttest (N = 20)

	Frequency (%) of Survey Responses						
Item	1	2	3	4	5	*M (SD)*	*SW*
1	0	0	0	10 (50)	10 (50)	4.50 (0.51)	<0.001
2	0	0	0	8 (40)	12 (60)	4.60 (0.50)	<0.001
3	0	0	0	9 (45)	11 (55)	4.55 (0.51)	<0.001
4	2 (10)	0	0	9 (45)	9 (45)	4.15 (1.18)	<0.001
5	3 (15)	3 (15)	0	9 (45)	5 (25)	3.50 (1.43)	0.001
6	13 (65)	7 (35)	0	0	0	1.35 (0.50)	<0.001
7	1 (5)	3 (15)	3 (15)	6 (30)	7 (35)	3.75 (1.25)	0.008
8	11 (55)	9 (45)	0	0	0	1.45 (0.51)	<0.001
9	0	1 (5)	0	6 (30)	13 (65)	4.55 (0.76)	<0.001
10	0	0	0	10 (50)	10 (50)	4.50 (0.51)	<0.001

Note. 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree. *SW* = *p* value of the Shapiro-Wilk test.

Objective 5

Evaluate the effectiveness of the project 30 days after protocol implementation.

This objective was achieved by comparison of the pretest and the posttest questionnaire scores. The number of algorithms utilized by the nurses was compared to the number of patient days. Urinary catheter and patient days 30 days preimplementation and 30 days postimplementation were also compared.

To determine if there were differences in nurses' knowledge and perceptions of indwelling urinary catheters before and after the educational sessions, paired *t* tests were utilized (Field, 2013). The results summarized in Table 6 show that after the educational sessions significant changes resulted from the mean pretest to mean posttest scores for

Questions 1, 2, 3, 6, 8, and 10 (60% of the questions). However, no significant changes were evident from the mean pretest scores to mean posttest scores for questions 4, 5, 7, and 9 (40% of the questions).

Table 6

Results of Paired t Tests

	Paired Differences (Pre-Post)							
				95% *CI* of the Difference				
Item	*M*	*SD*	*SE*	Lower	Upper	*t*	*df*	*p*
1	-1.30	1.53	0.34	-2.01	-0.59	-3.812	19	0.001*
2	-1.10	1.37	0.31	-1.74	-0.46	-3.584	19	0.002*
3	-1.00	1.59	0.36	-1.74	-0.26	-2.814	19	0.011*
4	-0.70	2.30	0.51	-1.77	0.37	-1.363	19	0.189
5	-0.35	1.84	0.41	-1.21	0.51	-0.849	19	0.406
6	0.95	1.67	0.37	0.17	1.73	2.545	19	0.020*
7	0.05	1.64	0.37	-0.72	0.82	0.137	19	0.893
8	0.85	1.76	0.39	0.03	1.67	2.165	19	0.043*
9	-0.60	1.64	0.37	-1.37	0.17	-1.641	19	0.117
10	-0.80	1.61	0.36	-1.55	-0.05	-2.223	19	0.039*

Note. * indicates significance at the 0.05 level.

The aggregated data collected by the principal investigator for CAUTIs, patient days, and catheter days on the medical-surgical unit pre- and postimplementation of the

protocol were analyzed. The preintervention period took place from January 26, 2018, to February 24, 2018; the postintervention period took place from March 4, 2018, to April 2, 2018.

At both timeframes, the number of CAUTIs, patient days, and catheter days were measured to determine if there were statistically significant differences before and after the implementation of the evidence-based nurse-driven protocol. The principal investigator determined the items for data collection, and the aggregated data were obtained from the infection prevention department of the hospital. During this period, on 14 urinary catheter days 71.4% (n = 10) of the nurses utilized the guideline.

Figure 1 shows the total number of patient days and number of urinary catheter days by month. For the 30 days of data collected prior to utilization of the evidence-based protocol, there were 502 patient days, of which 13.15% (n = 66) were indwelling urinary catheter days. For the 30 days postimplementation of the evidence-based protocol, there were 742 patient days, of which 4.45% (n = 33) were indwelling urinary catheter days.

No CAUTIs were reported for either the 30 days before or after use of the guideline. To determine if the proportions of days with urinary catheters were statistically significantly different before and after implementation of the evidence-based nurse-driven guideline, a 2-proportion z test was conducted. The results indicated a statistically significant difference in the proportions of days with urinary catheters before and after implementation of the standardized evidence-based guideline ($z = 5.562$, $p < 0.001$). As Figure 1 shows, the proportion of days with urinary catheters after the implementation of the standardized evidence-based guideline (4.45%) was significantly lower than the

proportion of days with urinary catheters before implementation of the standardized evidence-based guideline (13.15%).

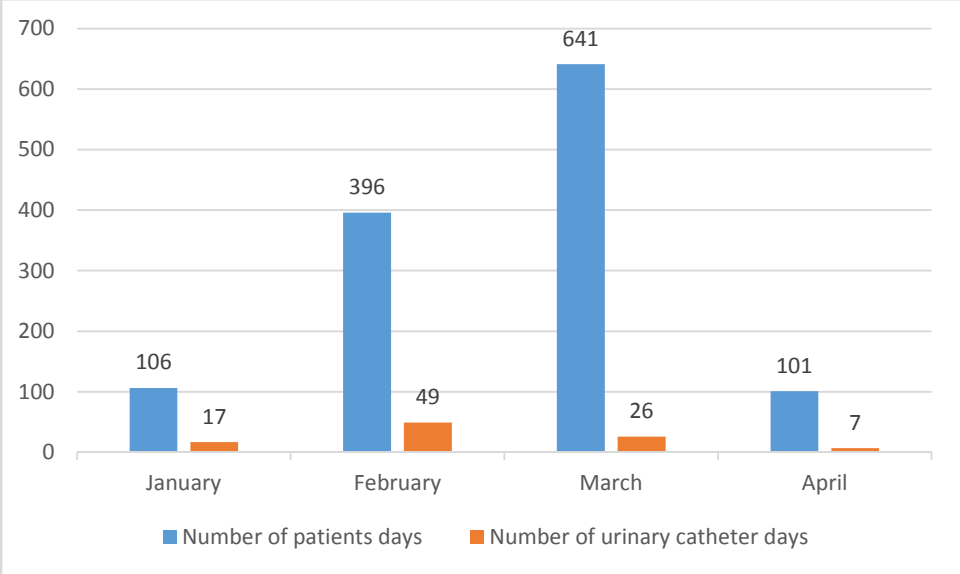

Figure 1. Total number of patient days and urinary catheters days, by month.

Note: Blue = number of days; orange = number of catheter days.

Discussion of Findings

Objective 1

The evidence supports the utilization of nurse-driven protocols to reduce urinary catheter incidences and catheter days. Professional healthcare organizations, such as the ANA, and regulatory agencies such as CMS and AHRQ, have completed extensive research on CAUTI prevention and have utilized the scientific evidence to formulate practice guidelines for healthcare providers utilization. The primary goal of these guidelines is the reduction of CAUTIs. In this project, regulatory agencies' comprehensive guidelines were used to identify evidence-practice gaps in the implementation facility's CAUTI prevention policy.

Objective 2

The demographic questionnaire was completed by 28 participants, but only 20 completed the pretest because some participants met the exclusion criteria. All participants were registered nurses, and most were above 36 years old (89.3%) and indicated English as the primary language (85.7%). Half of the participants (50.0%) had a bachelor's degree (BSN), and nearly half (47.6%) held certifications in ACLS and BLS. The average years of experience working in the current unit was 5.63 (*SD* = 5.55), and the average years of experience working at the facility was 6.17 (*SD* = 5.59).

Although all participants were English-speaking, only 85.7% indicated English as their primary language. Those whose primary language was not English (14.3%) could have perceived the survey questionnaires and educational intervention as difficult and so they did not respond. A total of 50% of the participants were BSN-prepared. This is significant because higher levels of nursing education translate into better patient outcomes (Blegen, Goode, Park, Vaughn, & Spetz, 2013). The relatively high percentage could have contributed to the decrease in proportions of urinary catheter utilization 30 days after the guideline was implemented. Regarding the aggregated data collected, the facility's infection prevention department personnel were cooperative in supplying the data for CAUTIs, patient days, and catheter days.

Pretest scores showed that participants generally disagreed with Question 6 ("There is no need for handwashing prior to indwelling urinary catheter care as this is not a sterile procedure"; *M* = 2.30, *SD* = 1.45) and Question 8 ("A family's request is a good reason to utilize an indwelling urinary catheter"; *M* = 2.30, *SD* = 1.45). These scores indicated some knowledge of good nursing practice regarding indwelling catheter care.

This prior knowledge from participants could also have contributed to the significant decrease in catheter utilization after the implementation of the guideline.

For the remaining eight questions, participants' scores ranged from 3.15 for Question 5 to 3.95 for Question 9. These results further indicated that nurses were familiar with the current CAUTI prevention protocol within the facility.

Objective 3

The facility's CAUTI prevention policy was updated to reflect the current evidence-based standards. The gap that was addressed by the new nurse-driven protocol was significant for the reduction of indwelling urinary catheter days as well as for the incidences of indwelling urinary catheters. According to AHRQ (2015), providers should be knowledgeable in the appropriate indications for urinary catheter utilization. The implemented guideline provided this information in an algorithm format, which was made easily accessible to nurses to foster compliance.

Objective 4

The educational sessions were perceived well by stakeholders. Of the four sessions, an average of eight nurses participated in each session. Informal feedback following the sessions indicated that participants were enthusiastic about the project. After the implementation of the standardized evidence-based guideline, the posttest revealed several important changes in nurses' knowledge and perception of CAUTI-related care. The scores contrasted with those of the pretest. Posttest results showed that participants agreed more that (a) there is a need for handwashing prior to indwelling urinary catheter care (Q6; $M = 1.35$, $SD = 0.50$); and (b) a family's request is not a good reason to utilize an indwelling urinary catheter (Q8; $M = 1.45$, $SD = 0.51$).

Responses to several other items showed scores close to *Strongly agree*, the highest score of agreement. These were as follows: (c) the hospital's current catheter-associated urinary tract infection protocol is easy for nurses to utilize (Q1; $M = 4.50$, $SD = 0.51$); (d) nurses were adequately educated on the hospital's current catheter-associated urinary tract infection protocol (Q2; $M = 4.60$, $SD = 0.50$; (e) nurses provided catheter care to all patients with indwelling urinary catheters in every shift (Q3; $M = 4.55$, $SD = 0.51$; (f) nurses are key players in the reduction of indwelling urinary catheter use in hospitals (Q9; $M = 4.55$; $SD = 0.76$); and (g) during handoff indwelling urinary catheters were routinely addressed (Q10; $M = 4.50$, $SD = 0.51$). These results indicated that the educational intervention was successful in increasing nurses' knowledge and perceptions regarding CAUTI prevention.

The new protocol was utilized in the medical-surgical unit for 7 days. The protocol was disseminated throughout the medical-surgical unit at points convenient for the nurses to access, and the nursing director oversaw protocol use to monitor nurses' compliance. Nurses were enthusiastic about the new protocol, and it was perceived well by stakeholders.

Objective 5

Evaluate the effectiveness of the project 30 days after protocol implementation.

Evaluation of the pretest and posttest results showed significant differences in nurses' responses on their knowledge and perceptions of CAUTI-related care for 60% of the questions (1, 2, 3, 6, 8, 10) and no significant changes for 40% (4, 5, 7, 9). The significant changes were important in terms of care delivered and indicated that nurses learned from the intervention. For questions that showed no significant changes, the

results were largely due to participants' moderate knowledge of CAUTI prevention prior to the intervention. The increased knowledge that was evident from questions showing significant results could be applied in the delivery of patient care, a positive step for the facility for prevention of HAIs and especially CAUTIs.

During the 7-day period for utilization and monitoring of the guideline, 14 urinary catheter days were reported. A total of 10 algorithms were collected from the nurses, indicating use by 71.4%. This percentage indicates that the guideline was well received and implemented by most of the nursing staff.

Regarding CAUTI-related information, aggregated data were collected 30 days postimplementation of the protocol and compared with the data collected 30 days preimplementation. There were no CAUTIs either before or after the utilization of the new guideline. Indwelling urinary catheter utilization decreased significantly (13.15% [66] of total patient days preprotocol to 4.45% [33] postprotocol ($p < 0.001$). These findings support the use of evidence-based nurse-driven protocols to reduce catheter incidences, which will ultimately improve patient outcomes.

Expected and Unexpected Findings

Expected findings included improvement in nurses' knowledge and perceptions of CAUTI prevention after the educational intervention and use of the protocol. The reduction in indwelling urinary catheter utilization after the implementation was also an expected finding. A third expected finding was the nurses' support of the protocol.

An unexpected finding was that not all the eligible participants who completed the demographic survey completed the pretests and posttests. Although 28 participants completed the demographic survey, only 20 participants completed the pretests and

posttests. The question relevant to the importance of discontinuation of urinary catheters by nurses when no longer indicated addressed (Q4) a nursing priority task, yet the data analysis did not show a statistically significant improvement after the intervention. Further, this question pertained to one of the major nursing responsibilities in CAUTI prevention. The ANA (2015) CAUTI prevention initiative referred to the timely removal of indwelling urinary catheters when no longer indicated as essential to CAUTI prevention.

Strengths and Limitations

The strengths of the project included provision of a structured approach for nurses to easily identify interventions to prevent catheter use and improve the outcome of patients utilizing indwelling urinary catheters in the acute care healthcare setting. The development and implementation of the protocol was necessary for upgrade of the existing institutional protocol for better patient care. The project was well received by the nursing staff, and the results showed significant increases in nurses' knowledge and perceptions surrounding indwelling urinary catheter use, and nurses' roles in prevention of CAUTIs.

The limitations of the project included the small sample size of nurses from the medical-surgical department. This small sample ($N = 20$) was not representative of the general population of nurses, and therefore the results of the pretests and posttests cannot be generalized to other facilities. In addition, the actual number of patients with indwelling catheters was not obtained; these data could have added more value to the project. The timeframe for conducting the study was also limited and may not have adequately reflected a trend in the facility's indwelling catheter utilization.

Implications

Practice

The implementation of guidelines to reduce CAUTIs is essential to patient outcomes and should be taken seriously by nurse leaders and other healthcare professionals. A nurse-driven protocol that is easy for nurses to utilize constitutes one method for bridging the evidence-practice gap relative to indwelling urinary catheter use in hospitals. This project adds to the existing evidence supporting nurse-driven protocols as a means of nurse empowerment and improvement of patient outcomes. CMS (2018) recently began to apply reimbursement penalties, including penalties for hospital-acquired conditions such as CAUTIs. These penalties indicate the seriousness of CAUTIs and urgency of prevention.

Healthcare leaders need to be able to align cost with quality of care through implementation of quality improvement projects (Mori, 2014). Nurses as a major force in healthcare can lead initiatives to reduce costs while improving quality of care. Nurses' ages, levels of experience, certification, and years of experience should also be considered in implementation of projects such as the current one. Most participants were mature, with advanced credentials and years of experience. Practice improvement with CAUTI-related issues may be effective especially with such nurses, who may be able to draw on their education and experience to apply their increased knowledge and perceptions for maximum patient benefits.

Healthcare Outcomes

The implementation of an evidence-based nurse-driven protocol can improve healthcare outcomes by providing a standardized process for nurses to utilize when caring for patients with indwelling urinary catheters. The utilization of a CAUTI prevention guideline, as in this project, is essential to ensure that all patients with indwelling urinary catheters receive the same quality of care with equal opportunities for the best quality outcomes. The new protocol helped ensure an equal quality of care. According to AHRQ (2015), the addressing of clinical practice is a major strategy to achieve and sustain CAUTI reduction. Guidelines such as that developed and implemented in this project address clinical practice concerns observed by AHRQ and other agencies.

Healthcare Delivery

The implementation of this nurse-driven CAUTI reduction protocol can assist with the fostering of positive change in healthcare facilities to bridge the existing evidence-practice gap. The protocol developed can be utilized to encourage and increase collaboration between physicians and nurses to improve patient outcomes. A standardized process for nurses to follow can increase and sustain compliance by improving the structure for healthcare delivery.

This project can become a model for additional independent nursing interventions in acute care hospitals. With such interventions, the US healthcare delivery system can be positively impacted. The increased responsibilities for nurses through such protocols as the current one can promote greater nursing responsibilities and informed decisions in care delivered.

Healthcare Policy

A nurse-driven CAUTI prevention protocol can be instrumental in policy development as it relates to nursing scope of practice, with lessened dependence on physician orders. The implementation of a nurse-driven CAUTI prevention protocol provides information relevant to policy development within healthcare facilities to improve care delivery consistent with evidence-based guidelines advocated by organizations such as AHRQ, ANA, and CDC. This project could impact national healthcare policy development by providing a rationale and background for arguments to standardize care and decrease CAUTIs throughout the US to reflect evidence-based practices, as promoted by AHRQ (2015) and ANA (2017).

Future Research

This project focused on an intervention and protocol development to decrease the incidence of CAUTIs in acute care hospital settings. Implementation of this project provides a basis for future research in several areas, such as additional qualitative studies to examine nurses' perceptions of their roles in CAUTI prevention at healthcare facilities of different sizes in varying locations. The findings from this DNP project can lead to future quantitative studies on a larger scale, with more diverse samples and over longer periods of time. Follow-up studies can also be conducted at 60 and 120 days postintervention and protocol implementation to measure the consistency of nurses' adherence to CAUTI prevention practices. Additional quantitative studies could be conducted with patients who have received indwelling catheters for assessment of their satisfaction with their nursing care.

Qualitative studies could also be conducted with nurses and other hospital staff, such as directors of nursing and infection prevention department members, on their views

and recommendations about the CAUTI prevention protocol. Patients and patients' family members could become the participants in studies of their perceptions of the care delivered and received based on the evidence-based nurse-driven protocol. In such qualitative studies, these participants could also be asked for their care recommendations.

Summary

An overwhelming amount of scientific evidence exists that supports the implementation of evidence-based nurse-driven protocols to reduce CAUTIs and subsequently improve patient outcomes in hospitals. In this project, a demographic survey provided descriptive information about the participants (e.g., gender, age, highest level of education). Participants were primarily female, the majority were between 36 and 50 years old, and over 50% had bachelor's degrees or higher. The literature indicated a positive correlation between patient outcomes and higher educated nurses (Blegen et al., 2013).

Pretest questionnaires were conducted to evaluate the participants' knowledge and perceptions of their roles in CAUTI prevention, as well as participants' general knowledge on interventions to prevent CAUTIs. After participant education on CAUTI prevention and the development and implementation of a new protocol, nurses' knowledge and perceptions of CAUTI prevention were reassessed with a posttest questionnaire. Data analysis comparing the pretest and posttest scores showed statistically significant improvement for 60% of the survey questions.

Analysis of catheter utilization 30 days before and 30 days after protocol implementation showed a statistically significant decrease in indwelling urinary catheter use on the medical-surgical unit. Continued utilization of the protocol could significantly

empower nurses to take additional responsibility for patients' welfare regarding catheter use. Patient outcomes could also be improved, with lessened risk of CAUTI incidents.

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Appendix A

Nova Southeastern University Institutional Review Board Exemption Letter

NOVA SOUTHEASTERN UNIVERSITY
Institutional Review Board

MEMORANDUM

To: **Elva Hamilton**

From: **Vanessa Johnson,**
Center Representative, Institutional Review Board

Date: **January 4, 2018**

Re: **IRB #: 2018-8; Title, "A Nurse-Driven Protocol to Reduce Catheter Associated Urinary Tract Infections"**

I have reviewed the above-referenced research protocol at the center level. Based on the information provided, I have determined that this study is exempt from further IRB review under **45 CFR 46.101(b) (Exempt Category 2)**. You may proceed with your study as described to the IRB. As principal investigator, you must adhere to the following requirements:

1) CONSENT: If recruitment procedures include consent forms, they must be obtained in such a manner that they are clearly understood by the subjects and the process affords subjects the opportunity to ask questions, obtain detailed answers from those directly involved in the research, and have sufficient time to consider their participation after they have been provided this information. The subjects must be given a copy of the signed consent document, and a copy must be placed in a secure file separate from de-identified participant information. Record of informed consent must be retained for a minimum of three years from the conclusion of the study.

2) ADVERSE EVENTS/UNANTICIPATED PROBLEMS: The principal investigator is required to notify the IRB chair and me (954-262-5369 and Vanessa Johnson, respectively) of any adverse reactions or unanticipated events that may develop as a result of this study. Reactions or events may include, but are not limited to, injury, depression as a result of participation in the study, life-threatening situation, death, or loss of confidentiality/anonymity of subject. Approval may be withdrawn if the problem is serious.

3) AMENDMENTS: Any changes in the study (e.g., procedures, number or types of subjects, consent forms, investigators, etc.) must be approved by the IRB prior to implementation. Please be advised that changes in a study may require further review depending on the nature of the change. Please contact me with any questions regarding amendments or changes to your study.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Stefanie La Manna
Vanessa Johnson

Appendix B

Letter of Participation and Consent

Participation Letter for Project Entitled:

A Nurse-Driven Protocol to Reduce Catheter Associated Urinary Tract Infections

Date: _____

Dear _____

Description of the Study: My name is Elva E Hamilton, a Doctoral Nursing student at Nova Southeastern University. As part of the requirement for degree completion I am required to complete a capstone project. I will be assisted by Dr. Stefanie La Manna.

You are being asked to take part in this research study because you are a registered nurse could be involved in direct patient care of patients with indwelling urinary catheters.

The purpose of this study is to revise and implement an evidence-based catheter associated urinary tract infection (CAUTI) protocol for the nursing staff in an adult medical-surgical unit in an acute care hospital to decrease the utilization of indwelling urinary catheters and CAUTIs after the intervention.

If you agree to participate you will be required to do the following: (1) complete a demographic form; (2) completion of two sets of online surveys via survey monkey (a pre-test and a post-tests) consisting of 10 questions each to evaluate your knowledge regarding indwelling urinary catheter utilization and maintenance. These tests should take approximately 15 minutes each to complete. The data obtained from the pre-test will identify the participants' educational needs as it relates to indwelling urinary catheter care and maintenance, and the data from the post-test will determine the effectiveness of the education provided to the participants; (3) participate in one 60-minute educational session on the new CAUTI protocol. There will be no recording of the educational sessions; and (4) utilize the new nurse-driven CAUTI protocol with all indicated patients in your care on the implementing unit.

Risks and Discomfort to the Participant: This research study involves minimal risk to you. To the best of our knowledge, the things you will be doing have no more risk of harm than you would have in everyday life.

Participant's Right to Withdraw from the Study: You can decide not to participate in this research and it will not be held against you. You can exit the study at any time without penalty.

Costs and Payment to the Participant: There is no cost for participation in this study. Participation is voluntary and no payment will be provided.

Confidentiality: Your responses are anonymous. Information we learn about you in this research study will be handled in a confidential manner, within the limits of the law. This data will be available to the researcher, the Institutional Review Board and other representatives of this institution, and any granting agencies (if applicable). All electronic data will be stored in an encrypted file and will require a secure password for retrieval. All confidential paper form data will be kept securely in a locked container. All data will be kept for 36 months and destroyed after that time by shredding of paper or deleting of electronic file.

Funding Source: None

Contacts: If you have questions, you can contact Elva Hamilton at (786) 417-9563 or
Dr. Stefanie La Manna at (561) 805-2263.

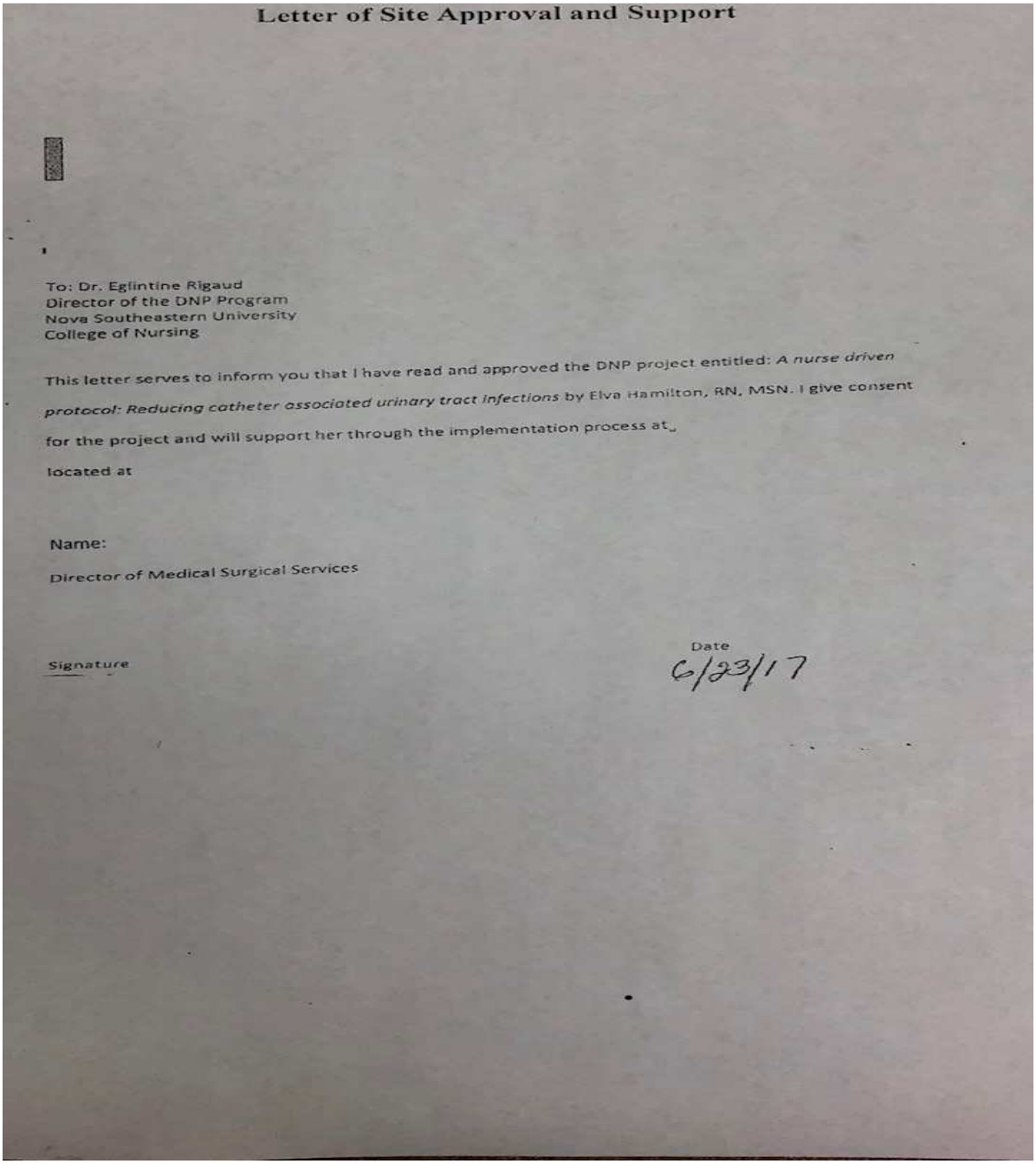
If you have questions about the study but want to talk to someone else who is not a part of the study, you can call the Nova Southeastern University Institutional Review Board (IRB) at
(954) 262-5369 or toll free at 1-866-499-0790 or email at IRB@nova.edu.

I have read this letter, fully understand the content, and wish to participate in the study.

Respectfully,

Appendix C

Letter of Site Approval and Support



Letter of Site Approval and Support

[redacted]

To: Dr. Eglintine Rigaud
Director of the DNP Program
Nova Southeastern University
College of Nursing

This letter serves to inform you that I have read and approved the DNP project entitled: *A nurse driven protocol: Reducing catheter associated urinary tract infections* by Elva Hamilton, RN, MSN. I give consent for the project and will support her through the implementation process at

located at

Name:

Director of Medical Surgical Services

Signature

Date
6/23/17

Appendix D

Recruitment Flyer

NSU NOVA SOUTHEASTERN UNIVERSITY

DOCTOR OF NURSING PRACTICE PROJECT

YOU ARE INVITED TO PARTICIPATE IN A SURVEY FOR A PROPOSED NURSE-DRIVEN CATHETER ASSOCIATED URINARY TRACT INFECTION PREVENTION PROTOCOL

FOR RNS' UTILIZATION

For more Information please contact DNP Student:
Elva Hamilton, RN, MSN, at (786) 417-9563
By January 31, 2018

Appendix E

Demographic Form

1. What is your job title?
   a. Registered Nurse
   b. Patient Care Technician

2. What is your gender?
   a. Male
   b. Female

3. What is your highest level of education achieved?
   a. Associate Degree
   b. Bachelor's Degree
   c. Graduate degree
   d. High School Diploma

4. What is your age?
   a. 18-25
   b. 26-35
   c. 36-50
   d. Over 50

5. What certifications do you hold? _____

6. What licenses do you hold? _____

7. How long have you worked at North Shore Medical Center?
   _____

8. How long have you worked in your current unit? _____

9. Which nursing unit are you currently employed to? _____

10. What is your primary language? _____

Appendix F

SurveyMonkey Pretest Questionnaire

Please answer the following questions on a 5-point scale:

1 = Strongly Disagree; 2 = Disagree; 3 = Neither; 4 = Agree; 5 = Strongly Agree

1. **The hospital's current catheter associated urinary tract infection protocol is easy for nurses to utilize.**

   1 2 3 4 5

2. **I was adequately educated on the hospital's current catheter associated urinary tract infection protocol**.

   1 2 3 4 5

3. **I provide catheter care to all patients with indwelling urinary catheters in my care every shift**

   1 2 3 4 5

4. **Discontinuing indwelling urinary catheters when no longer indicated is one of my daily priorities**

   1 2 3 4 5

5. **Renal failure is an indication for an indwelling urinary catheter.**

   1 2 3 4 5

6. **There is no need for handwashing prior to indwelling urinary catheter care as this is not a sterile procedure.**

   1 2 3 4 5

7. **Acute urinary retention is an indication for an indwelling urinary catheter.**

   1 2 3 4 5

8. **A family's request is a good reason to utilize an indwelling urinary catheter.**

   1 2 3 4 5

9. Nurses are key players in the reduction of indwelling urinary catheter use in hospitals.

1 2 3 4 5

10. During handoff indwelling urinary catheters are routinely addressed.

1 2 3 4 5

Appendix G

SurveyMonkey Posttest Questionnaire

Please answer the following questions on a 5-point scale:

1 = Strongly Disagree; 2 = Disagree; 3 = Neither; 4 = Agree; 5 = Strongly Agree

3. **The hospital's current catheter associated urinary tract infection protocol is easy for nurses to utilize.**

1 2 3 4 5

4. **I was adequately educated on the hospital's current catheter associated urinary tract infection protocol**.

1 2 3 4 5

3. I provide catheter care to all patients with indwelling urinary catheters in my care every shift

1 2 3 4 5

4. Discontinuing indwelling urinary catheters when no longer indicated is one of my daily priorities

1 2 3 4 5

5. Renal failure is an indication for an indwelling urinary catheter.

1 2 3 4 5

6. There is no need for handwashing prior to indwelling urinary catheter care as this is not a sterile procedure.

1 2 3 4 5

7. Acute urinary retention is an indication for an indwelling urinary catheter.

1 2 3 4 5

8. A family's request is a good reason to utilize an indwelling urinary catheter.

1 2 3 4 5

9. Nurses are key players in the reduction of indwelling urinary catheter use in hospitals.

1 2 3 4 5

10. During handoff indwelling urinary catheters are routinely addressed.

1 2 3 4 5

Appendix H

CAUTI Prevention Protocol/Algorithm