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Implementing a CAUTI Bundle in the Adult Hospitalized Trauma Population

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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MSN, MHA, University of Phoenix, 2015

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Project Submitted in Partial Fulfillment

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Doctor of Nursing Practice

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Abstract

The use of an indwelling catheter is a common occurrence in the hospital setting. Careful evaluation of the initial indication for catheterization and need for continued catheterization is necessary to mitigate the complications of catheter insertion, which includes urinary tract infection. Catheter associated urinary tract infections (CAUTI) are the most common healthcare-associated infection in the United States, with > 30% of these infections reported. More than 560,000 hospital acquired urinary tract infections occur annually. CAUTI and its complications increase morbidity and mortality, hospital length of stay, readmission rates, cost, and the use of antimicrobial medication. CAUTI was identified as an outlier infection in the adult hospitalized trauma population at the practicum site. The purpose of this quality project was to reduce the use of indwelling catheter device/days by implementing a CAUTI care bundle in the adult trauma patient. The project used the plan-do-study-act framework and focused on (a) use of an indwelling urinary catheter assessment to determine the need for insertion and (b) following a nurse driven urinary catheter removal protocol. Nursing staff were instructed through virtual education on the bundle components. Pre and post bundle implementation data were collected and compared on the number of infections, catheter days, patient days, and infection rates. Analysis used a CAUTI audit tool reviewing assessment, care, maintenance, and removal. Results reflected a zero-infection incidence and decrease in use of indwelling catheters for 3 months. This project may contribute to social change by changing the care pathway. The use of the CAUTI bundle decreased infection rates in the adult trauma patient, thereby impacting the overall quality of patient care.

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Dedication

I dedicate this paper to my wonderful husband, Robert, and my children, Nicole and Logan, whose love is unconditional, and whose support and encouragement have made it possible for me to make this journey in the next steps of my career. Thank you to my family, with all my heart and love. You have helped me to prove to myself that all things are possible.

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Section 1: Nature of the Project

Introduction

The earliest recording of indwelling catheters was in 1500 BC by the Egyptians who used papyrus fashioned into a long tube for the treatment of urinary retention. Prior to 1930, the urinary catheter was mostly used in male patients due to its design (Feneley et al., 2015). The modern balloon-based catheter was developed in 1929 by Bard for use by both men and women. While the design has changed over many years, the concept remains the same, which is the need for continuous bladder drainage. Patients need catheters for bladder drainage for many reasons, including a blockage in the urethra, injury to the urethra, an enlarged prostate, bladder weakness, nerve damage, and hygienic care for a bedridden or unconscious patient. However, this treatment is now the fourth leading cause of healthcare-associated infections in acute care hospital settings in the United States (Ferguson, 2018).

Catheter associated urinary tract infection (CAUTI) is defined as an infection that occurs in the urinary tract at least 2 days after the insertion of an indwelling urinary catheter (National Healthcare Safety Network, 2020). Trauma patients are particularly at risk for this type of infection due to many factors such as an immunocompromised state, breaks in skin and tissues, required invasive devices and procedures, unconsciousness, and the possibility of immobility. Additionally, urinary catheters may be inserted in trauma patients under emergent conditions in the field or the trauma bay where there is difficulty adhering to aseptic standards. Common symptoms associated with CAUTI

include dysuria, urinary urgency and frequency, abdominal or flank pain, fever, and burning with urination.

Patients impacted by such complications could experience increased mortality, increased length of stay, and increased cost associated with their care and treatment (Elkbuli et al., 2018). Many of these infections are preventable with proper infection prevention measures. There is ample evidence to support evidence-based practice surrounding appropriate use, insertion, maintenance, and removal to prevent infection. According to Panchisin (2016), this type of hospital infection can be reduced by 70% by just improving existing prevention strategies.

Problem Statement

The clinical practice site demonstrated consistent opportunities for improvement related to CAUTI rates in the trauma population. The use of a catheter for drainage of urine from the bladder through the urethra is a common procedure among hospitalized patients. However, this procedure can result in a urinary tract infection (UTI). Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter. CAUTI is one of the most common hospital associated infections, accounting for more than 30% of acute care hospital infections and 13,000 deaths each year in the United States. There are estimated to be 560,000 CAUTI events per year (Panchisin, 2016). Each CAUTI is associated with a medical cost of $758 for a total of over $340 million attributable to the incidence of CAUTI in the United States each year (Ferguson, 2018).

Despite much research on this topic as well as evidence-based recommendations on the use of bundles and prevention tool kits, hospitals continue to struggle to reduce

CAUTI rates. The most important risk factor for developing a CAUTI is prolonged use of the urinary catheter. CAUTI impacts the patient's value-based care related to outcomes such as length of stay, readmission rates, morbidity, and mortality (Monaghan et al, 2011; Stovall et al., 2013). At the clinical practice site, these infections were validated and reported to NHSN. NHSN categorizes infections as occurring in two clinical areas: intensive care units and medical surgical care units. These are then publicly reported by the CDC. The standardized infection ratio (SIR) is used to determine the rate of infection based on the collected data. This rate is calculated using the number of observed infections divided by the expected number of infections for a specified time. The SIR is a more accurate rate for the entire hospital compared to the NHSN rate, which only counts the intensive care and medical-surgical units. At the current clinical site for the first two quarters of 2019 (January-June), there was a total of 18 infections. The first quarter demonstrated 10 total infections, with seven meeting the NHSN reportable criteria. The second quarter demonstrated eight total infections, with four meeting the NHSN reportable criteria. The trauma service line accounted for 10 out of the 18 CAUTIs (60%). See Table 1.

Table 1

2019 Pre-CAUTI Data

Unit	Quarter 1	Quarter 2
SIR rate#	2.156	1.549
Trauma ICU*	5	3
Medical ICU*	0	1
Surgical ICU*	0	1
Medical surgical unit*	2	1
Cardiovascular unit	1	1
Trauma progressive unit	1	1
Oncology unit	1	0

Note. #SIR = Standardized infection ratio. *Reportable to National Healthcare Safety Network.

The clinical site had set a goal of 0.412 in 2019, and a goal even lower in 2020 at 0.373. The rate for 2019 Quarter 2 was 1.549. Although this was a decrease from the first quarter rate of 2.156, did not meet the set goal of 0.412 (infection control nurse, personal communication, December 16, 2019). To meet this goal and reduce and prevent these infections, a CAUTI care bundle needed to be implemented.

Purpose

The purpose of this quality improvement project was to implement evidence-based strategies to reduce the indwelling catheter device utilization/days, thereby decreasing risk for CAUTI. Decreasing the CAUTI rate in the hospitalized trauma patient is the goal of the trauma program at the practicum site for this study. A gap exists as this program is not meeting the hospital goal for CAUTI rates and the trauma patient population because this facility has the highest infection rates in their division. Current nursing practices surrounding CAUTI were evaluated and data were analyzed in relation to those practices. An evidence-based practice bundle, which includes a nurse-driven

protocol for removal, will be implemented. Goals for care include improved patient safety, reduction of avoidable harm, and aiming for zero healthcare acquired infections.

Nature of Doctoral Project

The evidence-based practices used in this project were placed into a care bundle to assist the clinical staff in preventing catheter associated UTIs in the trauma patient. The CAUTI bundle includes (a) indwelling catheter assessment, (b) ongoing maintenance, (c) a nurse driven catheter removal, and (d) specimen collection protocol.

Indwelling Catheter Assessment

When assessing an indwelling catheter, the nurse will determine the appropriate voiding strategy as either independent toileting, straight catheter, external urinary device, or use of indwelling urinary catheter.

Independent toileting is used when a patient can void on their own. The patient can ambulate to the toilet or bedside commode or use a bed pan or urinal. A straight catheter is used with the patient who can void independently but who has urinary retention confirmed using a bladder scanner. Patients may use a straight catheter for various neurological issues. This can be used by a nurse or by patients who have used this practice at home. Straight catheterization requires a provider's order. An external device (for example, a Pure Wick device or condom catheter) is used when a patient can void independently but is incontinent and does not have an indication for an indwelling urinary catheter. This device is not used in patients who have skin breakdown or wounds or who develop skin issues while using this type of device.

Indications for the use of an indwelling catheter are as follows:

- There is a need for accurate input and output in the critically ill and unconscious patients for fluid balance.
- There is presence of acute urinary retention with failure from voiding strategies. A provider's order is necessary.
- To assist with skin healing.
- In the presence of gross hematuria with an order for continuous bladder irrigation.
- Palliative/Hospice care.
- Perioperative procedures.
- Prolonged immobilization.
- Postoperative pelvic or abdominal surgery repair of the urological systems or surrounding structures.
- Catheters placed by urologist or another specialist.

Insertion Bundle

When inserting an indwelling catheter, indications for its use must be assessed before placement occurs to identify appropriate voiding strategy and criteria. If it is determined that a catheter insertion is necessary, the nurse will follow these steps:

1. Perform hand hygiene.
2. Conduct a standard bladder scan and conduct a straight (in/out) catheterization prior to insertion of indwelling catheter. If the patient is retaining >350 ml determined by the bladder scanner or if the patient is experiencing discomfort, then a straight catheter will be used, documentation of the procedure will be

completed, and a rescan in 8 hours will be conducted. If straight catheterization is needed more than twice, the provider will be called for further orders.

3. Select the appropriate catheter type. These include standard bladder scanning and a straight (in/out) catheterization process, use of the standard all-inclusive urinary catheter tray/insertion kit, or an external device.
4. Have two people insert the catheter to promote visualization and maintain the aseptic technique. A catheter securement device will be used after insertion is completed.

Maintenance

Following insertion, the catheter will be maintained, and steps will be taken to prevent infection. Steps to prevent infection include

1. Hand hygiene.
2. Daily assessment and documentation of the indication for the device, beginning 24 hours after insertion. The nurse driven removal protocol is used when the catheter is no longer indicated.
3. Emptying the drainage bag regularly and prior to the patient leaving the unit for any reason by using a single patient dedicated measuring device.
4. Maintaining an unobstructed urine flow with prevention of looping or dependent loops.
5. Maintaining the bag lower than the level of the hips and bladder.
6. Securing the bag to the bed or chair and preventing tubing and bag from touching the floor.

7. Maintaining a closed, aseptic, drainage system. Each nursing shift will assess to verify the system and replace the system if there is breaks, leakage from bag, or disconnection of tubing.
    a. Do not disconnect the closed system. This system should avoid irrigation unless ordered or needed; disinfection of the catheter tubing junction should occur before irrigation.
    b. Disinfect the sampling port when sampling urine.
    c. Change catheter if it becomes contaminated.
8. Daily bathing and perineal hygiene using single bathing wipes when possible. Do not reuse basins.
9. Considering the use of a fecal device when incontinence of stool is present.
10. Remembering that urine cultures can only be collected when ordered and suspicion of infection is confirmed by a provider. This is not based on appearance or odor of urine.
11. Remembering that maintenance includes the daily assessment for documentation and documentation of indication.

Nurse Driven Removal and Specimen Collection Protocol

This protocol begins 24 hours post insertion of an indwelling catheter. Optimal timing for catheter removal is early AM. This allows time for interval catheterization and obtaining an order for reinsertion of an indwelling urinary catheter, if required, during active hours and to prevent the disruption of a required rest. See Figure 1. If the patient has an indwelling catheter > 24 hours, then the removal criteria should be concurrently

reviewed and documented on every shift. It is necessary to determine if the patient meets any of the criteria for continuation of the indwelling catheter. The catheter should not be removed if any of the criteria are met. If none of the exclusionary criteria are met, the indwelling urinary catheter can be removed by the registered nurse without an order if the patient meets all the following:

- The patient is awake, alert, oriented, and verbally expresses no trouble voiding prior to the catheter insertion.
- The patient can resume their usual voiding position or at least one that is presently comfortable.
- The patient can cooperate with strict intake and output monitoring if ordered by the provider.
- The epidural catheter has been removed.

If patient does not void, or voids < 250ml within 4 hours, the following post catheter removal assessment will be initiated:

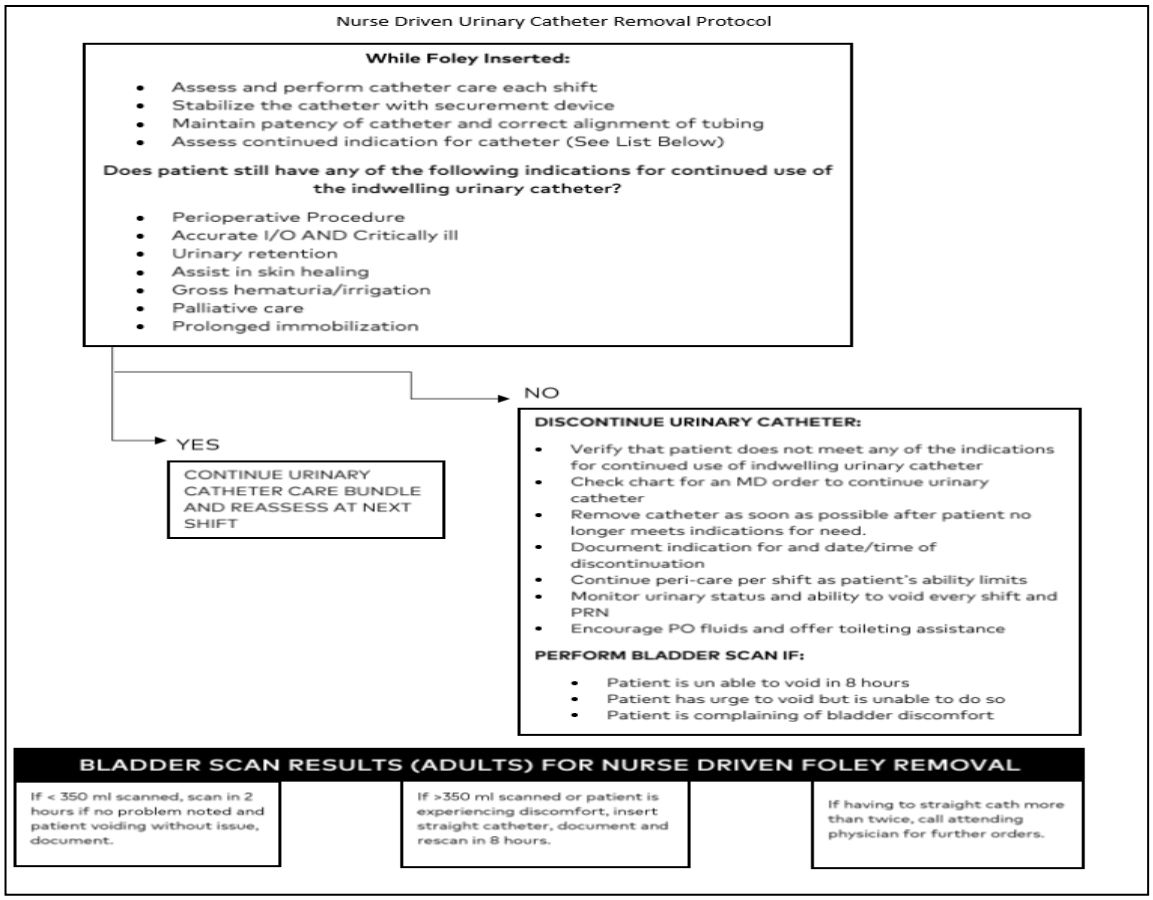
- Perform bladder scan every 4 hours until spontaneous voiding resumes.
- If bladder volume ≥ 350 ml, perform straight catheterization. An order is required.
- If bladder volume < 350, rescan in 2 hours if patient has not voided; catheterization when volume is > 350ml. An order is required.
- If straight catheterization is required twice, the attending physician should be called for further orders.
- The attending physician should be called if urinary output < 250 ml over 8

hours.

- If bladder volume <250 ml and patient is voiding, continue to monitor intake and output.

Figure 1

Nurse Driven Urinary Catheter Removal Protocol



Specimen Collection

A urine sample from an indwelling catheter should only be collected if the catheter has been in place less than 48 hours. If the catheter has been in place 48 hours or longer, the nurse must obtain an order from the provider to change the catheter prior to specimen collection. The steps include the following:

1. Perform hand hygiene and apply clean gloves.
2. Disinfect the sample port with alcohol and aspirate urine using a sterile syringe.
3. Discard the initial 10 mL of urine obtained.
4. Remember that urine from the drainage bag is never an appropriate specimen for the urine culture.
5. Obtain larger volumes of urine for special analysis (such as 24-hour urine creatinine) using clean technique from the drainage bag.

Using the above bundle protocol, the focused question for this project was as follows: Does implementation of a CAUTI bundle decrease the incidence of CAUTI SIR in the adult trauma population? De-identified data were obtained from the facility trauma registry to identify patients who have been diagnosed with CAUTI.

Significance

According to the CDC 15 to 20% of hospitalized patients use urinary catheters during their course of treatment. In 2015, the Centers for Medicare and Medicaid Services started imposing financial penalties on hospitals for patients diagnosed with a CAUTI. This was done because there was a 5-year prevention target to decrease use by 25%. Notably, the CDC (2012) reported that > 50% of hospitals did not monitor who

patients were catheterized, and 75% did not monitor the length of time in which an indwelling catheter was in place.

Using evidence-based strategies can reduce catheter associated UTIs by (65% to 70%). The average cost of such infections is an estimate of $758 per/infection. The median annual cost for a hospital is roughly $594,683(Pyrek, 2012). The impact financially comes from various medical costs associated with care, length of stay, antimicrobial resistance, and mortality rates. Despite financial incentives since 2008, there have been very little progress made in reducing these rates (Pyrek, 2012).

CAUTI efforts have been implemented in many healthcare facilities and often fail due to protocols lacking evidence-based strategies or lack of consistent compliance with the protocol. Nurses are important in implementing these measures to decrease catheter days, improve aseptic techniques during insertion, improve the selection of the most appropriate toileting strategy, and review daily indications for current indwelling catheters. Due to their role as the primary care giver, nurses have the power to positively impact and decrease CAUTI rates through a standardized approach and clinical pathway that can improve outcomes while maintaining patient safety (Galiczewski, 2016).

Summary

Patients commonly have indications that require an indwelling urinary catheter, so it is imperative for nurses to recognize and establish protocols to combat CAUTI in the hospital setting to prevent patient harm. This quality improvement project can help to determine if interventions such as the CAUTI bundle, which includes a nurse-driven protocol for catheter removal, will have a positive impact on the trauma patient, their

length of stay, and the burden of infection (see Davies et al., 2018). This population of patients has been determined to have the highest CAUTI rate in the practicum facility.

Following review and instruction on the bundle, the nurse will use this CAUTI bundle for guidance in selecting the appropriate interventions and pathway of care. The nurse will be required to assess for the appropriate voiding strategy, determine catheter necessity, and then follow the bundle. This quality improvement initiative will allow the nurse to utilize evidence-based practice as a guideline to prevent catheter associated UTIs in the adult trauma patient.

Section 2: Background and Context

Background and Context

In 2009, the Healthcare Infection Control Practices Advisory Committee, a federal advisory committee was appointed to provide advice and guidance to Department of Health and Human Services and the CDC regarding the practice of infection control, published guidelines for the prevention of catheter associated UTIs, and made strong recommendations for a change in practice as it relates to the use, insertion, maintenance, and removal of an indwelling catheter to prevent undue harm to patients. This clinical knowledge had not been updated since 1981. Although the guidance is now dated, it is still relevant to the topic and is being used as evidence-based practice (see CDC, 2012). Despite this published guidance, CAUTI continues to be the fourth most common hospital associated infection (see Davies et al., 2018). The infection is often related to the indwelling urinary catheter. With the implementation of evidenced-based strategies, reduction rates can occur.

The current clinical site is a 200-bed facility located in Southeast Florida. The hospital offers quality and award-winning services that include bariatric surgery, orthopedic care and joint replacement, robotic surgery, cardiac and vascular services including open heart surgery, cardiac interventional procedures, emergency services, neurological services, and rehabilitation services. This facility offers high acuity services as a Level II Trauma Center and Comprehensive Stroke Center with a large volume of patients admitted through the emergency department (ED). Approximately 86% of patients are admitted through the ED.

The organization continues to grow, and the trauma department is no exception. The trauma department grew 17.5% in 2019 and treated 3625 patients in that year. Mortality in the trauma patient population was 2.9% in 2019. Trauma is classified through the mechanism of injury and is based on two types of injury: penetrating and blunt injury. Blunt injury accounts for 90.5% of patients being treated at this facility and 9.5% of patients experience a penetrating injury.

The largest population of trauma patients admitted to this Level II Trauma Center are over the age of 65 years. The top three most-common traumatic injuries among patients are

1. Ground level (low) falls,
2. Motor vehicle accidents, and
3. Intentional injury (gunshot wounds, stabbings, etc.)

The injury severity score (ISS) is used to determine the severity of injury for trauma patients. The ISS is an established medical score to assess anatomical trauma severity. It uses a systematic approach and correlates with mortality, morbidity, and hospitalization time after trauma. The average ISS in this group is (9 to 15), which indicates severe injury. For example, a patient with a score of 9 could have an isolated fractured femur, while someone with a severely lacerated spleen might have a score of (9 to 16) depending upon the extent of organ injury. A major trauma will have an ISS greater than 15. For example, a patient with a flail chest (score of 16) and a fractured femur (score of 9) would have a combined ISS of 25. A high percentage of patients at the practicum site fall into the category of severe injury. This is in part due to the facility's status as the

only Level II trauma center in the region. The population is also significantly older and more medically frail, with a frequent need for surgery that often results in a determination of the need for an indwelling urinary catheter. Consequently, they are a high-risk group for development of a CAUTI.

Three units have been chosen to participate in this project. The selected units were chosen based on the number of catheter-associated infections in this population. The target population was the adult trauma patient >17 years old admitted to the trauma intensive care unit (TICU), 4-Trauma Progressive Care Unit (TPU), and 4 North (4N). The TICU is a 34-bed unit and is a combined trauma, medical, and surgical intensive care for patients. The TICU overflow units include the six bed Medical Intensive Care Unit and ED holding patients awaiting a critical care bed. Nursing care in the intensive care unit is provided at a 1:2 nurse-patient ratio, except when medically indicated for a lower ratio. The TPU is a 24-bed unit where the nursing care is provided at a 1:4 nurse-patient ratio. The 4N unit is a trauma medical unit with 29 beds. Nursing care is provided at a 1:6 nurse-patient ratio. The CAUTI rates for this group of units are presented in Table 1.

Relevance to Nursing Practice

Nurses can prevent CAUTI by minimizing or eliminating the use of an indwelling catheter. Other devices may be selected if there is an option for the delivery of treatment and returning the patient to ambulatory toileting practices as soon as possible to promote functional recovery. The CAUTI bundle can be used by the bedside nurse, nurse leaders, and other team members for the direction of care.

Conflict often arises when reimbursement comes into play; however, the bottom line is to improve the quality of care and prevent harm and complications from occurring to patients. The nursing process will be followed for the assessment, execution, and evaluation of the urinary care strategy. The first step is to use appropriate indications and to use alternatives when possible. Nurses must be trained to assess for the appropriate voiding strategy, and after careful evaluation insert the catheter if the patient meets the established criteria and remove when the patient meets removal criteria. The synergistical approach gives the nurse the ability to lead the patients' care using evidence-based practice, and the bundle of care provided is the foundation for prevention (Davies et al., 2018).

This change can impact the infection rate by decreasing overuse of the indwelling catheter. By implementing evidence-based strategies such as these in the clinical setting, nurses will have the knowledge and increased awareness that will promote the management of patients with bladder management needs. This project will be implementing the CAUTI bundle that will test the new practices and their corresponding results. These results will then be used in the corroboration of the idea or refuting the CAUTI bundle of care.

Role of the DNP Student

My role as the DNP student in this quality improvement project was to look at current practices in the clinical setting and use evidence-based practices to produce a change. I used the Academic Center for Evidence-Based Practice's star model of knowledge transformation. I used five steps in this process (see White et al., 2016):

- Step 1: Discovered staff knowledge gaps about CAUTI.
- Step 2: Completed evidence summary with significant systematic literature searches on this topic to determine best practices.
- Step 3: Translated into practice. The creation of change within the organization using a CAUTI bundle and nurse driven removal protocol in the trauma patient population.
- Step 4: Integrated into practice. Use of the CAUTI bundle and nurse driven removal protocol in the identified practice areas.
- Step 5: Evaluated the use of the pathway and protocol to determine if the desired outcome in reducing harm related to indwelling urinary catheters has been achieved.

This project was introduced to the clinical practicum facility and approved. A policy was created and approved following the steps of the CAUTI bundle and nurse driven removal protocol. The formal proposal was approved by Walden University IRB.

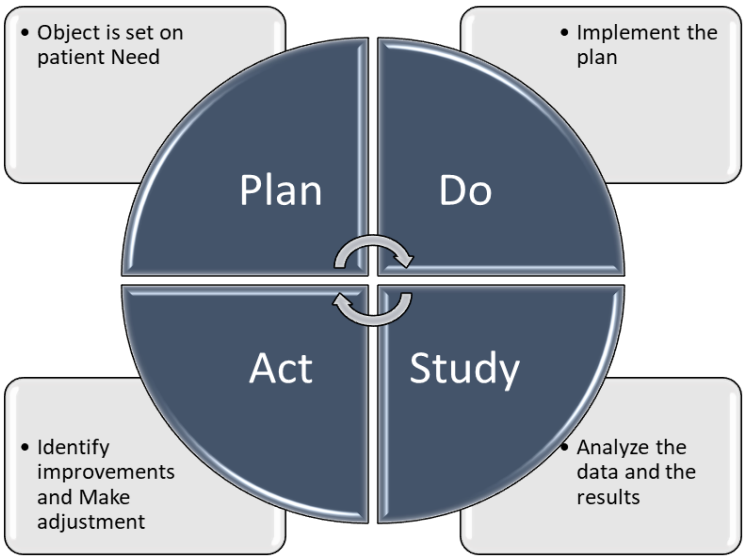
Section 3: Collection and Analysis of Evidence

Introduction

The framework and method for improvement that was used in this proposal is the plan-do-study-act (PDSA) process for improvement; this is also known as the effective change management model. The PDSA cycle can be used for improvement and can support the adjustments and refinement of the final plan (White et al., 2016). According to Langley et al. (2009), the PDSA cycle is a short and easy way to implement and test change. In using this model, one can plan to test the change (plan), carry out the testing (do), observe and monitor the changes that have been implemented and look at the impacts of those changes (study), and determine next steps and identified improvements that need to be adjusted to the plan (act). This model is a way to accelerate improvement and to reduce population-based harm in the areas of CAUTI with a reduction in the number of device days leading to a reduction in the risk of infections. The effective change management model PDSA cycle is shown in Figure 2 (see Gao & Gurd, 2019).

Figure 2

PDSA



The PDSA process for this project includes the following:

1. Plan: Reduce the number of device days in the trauma patient through use of a CAUTI bundle.
    a. Review current bundle and make changes related to evidence-based practice.
    b. Determine if the patient meets the criteria for inserting or keeping the indwelling catheter.
    c. Review that nurses have the knowledge and skill necessary to use the bundle and protocol criteria.
    d. Establish a plan for concurrent review to ensure the proper policy was followed and removal criteria are is assessed each day.
2. Do: Follow up when indicated

   a. When patient meets criteria for removal, follow the nurse driven protocol and obtain any necessary provider orders.
   b. Collect and trend data.

3. Study: Validate accurate and consistency in practice through a review of the documentation and data on trauma patient infection rates. Point prevalence will be established at this phase. Infection rates on the selected trauma units will be compared using first and second quarter 2019 and 2020. Data will be displayed using tables and figures as appropriate. Review will consist of beside bundle validation and documentation.
4. Act: Review compliance and gaps in practice and adjust. Integrate review process into the shared governance process and target areas of opportunities.

Practice-Focused Question

This was a quality improvement project with a goal to reduce the indwelling catheter device utilization/days, therefore decreasing the risk for CAUTI in the adult trauma patient. The aim was to answer the following question: What is the impact of implementing a CAUTI bundle on UTIs in the adult trauma population? The following PICOT was used to develop the above question:

Population/Patient Problem: Adult trauma hospitalized patient

Intervention: (CAUTI) bundle

Comparison: Usual care

Outcome: Decrease the rate of occurrence, decrease catheter days

Time: Comparison review of 2019 data vs 2020.

I evaluated existing nursing practices in the prevention of CAUTI, analyzing data related to those practices and applying evidence-based practices found that might assist in reducing this hospital acquired infection. The overall project objective was to decrease the rate of infections related to indwelling urinary catheters by using a CAUTI bundle. The bundle includes

1. Careful assessment of the use of an indwelling catheter meeting an insertion criterion.
2. Evidence-based practice on the maintenance of the indwelling device.
3. Nurse driven indwelling urinary catheter removal and specimen collection protocol.
4. Post catheter removal assessment.
5. Daily documentation of device monitoring and reason for insertion.

Sources of Evidence

To identify the body of evidence surrounding the impact of indwelling catheterization on rates of infection among adult trauma patients, the NHSN validated measure (observed/expected) over a specified period of time of CAUTI were used and compared pre- and post-implementation of a CAUTI bundle. A literature search was conducted to determine why rates of CAUTI are higher in adult trauma patients. Key words used in the search were *catheter associated urinary tract infection, CAUTI, cultures, Foley catheters, community acquired UTI, CAUTI and urine cultures, reflex testing, ICU and non-ICU indwelling urinary catheters,* and *adult trauma patient*. Databases searched included MEDLine/PubMed, Cochrane and Joanna Briggs Library of

systematic reviews, Cumulative Index to Nursing and Allied health Literature (CINAHL), and MedNAR/Google Scholar. Articles that were considered were full text and published in English after 2006. Articles of particular importance were those related to evidence-based indications for the appropriate use of the urinary bladder catheter, recommendations on insertions, appropriate clinical indications when ordering urine cultures, guidelines and recommendations on sterile closed drainage systems, nurse removal protocols, and NHSN criteria. Notably, organizational barriers, obstacles, incidence, and vulnerability of trauma patients experiencing CAUTI were explored.

Analysis and Synthesis

CAUTI was defined by the NHSN, and rates were tracked and determined in the NHSN database. The clinical site will implement an evidence-based CAUTI bundle; the site quality assurance staff will oversee the implementation, and I will analyze the data on the infection rates for the adult trauma patient population 3 months after the implementation of the bundle. An anticipated outcome of this project is a change in nursing practice standard by promoting appropriate use and removal of indwelling devices by nursing staff.

The approach had three parts. First, I presented the CAUTI bundle components to the clinical practicum site. Second, nursing staff were instructed on the bundle components and then after one month an evaluation. Third, a retrospective data review on CAUTI rates was be conducted. Data from 2019 was compared to the same time in 2020. Results were displayed using descriptive statistics and tables/figures as appropriate.

Data collection will focus on the infections that were NHSN reportable (as these were validated measures) and rates were expressed as a ratio or SIR (standardized infection ratio) for the measuring period. The CAUTI infections that occurred were investigated to identify any trends, and opportunities for improvement. An attempt then was made to resolve fluctuations in practice.

Data was obtained from the daily hospital census to identify and ensure that all trauma patients were included in the study, as well as the reported infection rates from the NHSN data base for the clinical site. Data variables reviewed were demographic characteristics such as age, sex, mechanism of injury, number of trauma patients with a diagnosed CAUTI, the average injury severity score, mortality rates, where the insertion of the indwelling catheter took place, present on admission, and the length of time the indwelling catheter had been in place when an infection diagnosed. Accurate device days were collected daily. These were documented in the patient record. The project will have the following processes:

- The site provided the aggregated deidentified data and a retrospective review of the CAUTI infections for 2019 and noted any trends. This is connected to Essential VII: Clinical prevention and population health for improving the nation's health by analyzing the enviornment, and evaluating care delivery models (ANCC, 2006).
- Reviewed existing CAUTI prevention strategies and compared to evidence-based practices that needed change. This is connected to Essential VII: Clinical

prevention and population health for improving the nation's health by analyzing the enviornment, and evaluating care delivery models (ANCC, 2006).

- Update and reviewed the bundle criterion for insertion, maintaining and removal of the indwelling catheter. Used this bundle to improve consistency in nursing practice, and improved care given to each patient with an indwelling urinary catheter. Then established a point prevalence process that enabled each area to be evaluated timely. This is connected to essential VIII: Advanced nursing practice (ANCC, 2006).
- Established a daily concurrent review process for appropriate utilization and removal of indwelling devices. Then a multidisciplinary and unit-based team approach was used to identify root causes of each identified CAUTI infection. This is connected to Essential VI: Interprofessional collaboration for improving patient and population health outcomes (ANCC, 2006).

Key stakeholders' involvement was vital to the successful outcome. Since this project is concerned with an infection control process, I developed a multidisciplinary team to assist with the data analysis to determine the success of the bundle. Although many departments are involved in resolving an infection control issue, the primary stakeholders to be included in this project as part of a clinical workgroup committee were representatives from the trauma program, infection control, medical staff, nursing, education, and executive leadership. The workgroup was involved in the development of the bundle and analysis of data. According to Hodges and Videto, (2011) getting people involved will be the key to success of a program.

Summary

The role of the nurse is very important in decreasing or eliminating CAUTI in the hospital setting. CAUTI is one of the greatest opportunities for improving patient safety in the hospital. CAUTI prevention requires the facility to give the nurse a clear and consistent practice bundle which includes a daily process for identifying patients at risk for developing infections and taking actions that will assist in minimizing those risk. The development and implementation of a CAUTI bundle using evidence-based practices will help nurses to improve their knowledge, skill and apply the new practices to improve patient safety by decreasing preventable hospital acquired infections.

Section 4: Findings and Recommendations

Introduction

CAUTIs are the fourth most common hospital acquired infections in the United States, with many of these types of infections related to an indwelling urinary catheter (Ferguson, 2018). Approximately 65 to 75% of these types of infections could be prevented with following evidence-based practice strategies. The Centers for Medicare and Medicaid Services (2017) now impose penalties for such infections using the value-based purchasing model. Despite evidence-based practice strategies and imposing financial penalties, organizations continue to struggle with the rise in CAUTI incidence. CAUTI continues to be one of the most common nosocomial infections (see Davies et al., 2018).

The study site had the second highest CAUTI rate compared to 189 facilities. The hospital's goal was to improve patient safety, reduce avoidable harm, and have zero healthcare acquired CAUTI infections. The purpose of the quality improvement project was to focus on the nursing process to decrease the use of urinary catheters and decrease the CAUTI rates in the hospitalized trauma patient. This was done through the implementation and use of a CAUTI bundle and nurse-driven protocol for removal and then through an evaluation of the effectiveness on CAUTI rates. The results of this project serve as a platform to improve CAUTI rates through the remainder of the facility as well as their health system. The project can furthermore serve as a platform to improve the CAUTI rates regionally. The project question was as follows: What is the impact of implementing a CAUTI bundle on UTIs in the adult trauma population?

Sources of Evidence

The study site's trauma quality improvement coordinator provided de-identified data from the trauma registry for 2019 and up to the current year 2020 to include all data variables: age, sex, mechanism of injury, number of patients meeting the NHSN definition of CAUTI, average severity score, mortality rates, where the catheter was inserted, if catheter was present on admission, the length of time the indwelling urinary catheter was in place when the infection was diagnosed, and accurate device day counts. All information was collected through the MEDITECH computer system. The CAUTI infection data were compared with CAUTI national rates of infections. Figures were also collected from the HealthStream education system to determine the total number of nursing staff who received education and skills check off on periurethral preparation and septic insertion, proper maintenance, and removal techniques per the established bundle criterion.

Findings

The CAUTI bundle components were shared, approved, and adopted with the clinical practicum site. The site had an existing CAUTI prevention policy that only included a nurse driven foley catheter removal protocol algorithm and had not been updated since 2016. A new policy was created and updated in the policy stat system so that the nursing and medical staff had easy access. The nursing staff in the trauma departments were educated on the bundle components and nurse driven removal protocol and underwent competency for insertion and removal techniques to ensure they could follow the requirements of the study. One hundred seventy-five nurses were educated,

along with 22 patent care technicians in the three units being evaluated to include TICU, TPU, and 4N. A total of 6,088 patients were identified in the trauma registry and were included in the analysis during the study period, with 5,172 patients being admitted before intervention and 916 patients after implementation. The baseline characteristics did not differ greatly between pre- and post-groups that included age, sex, mortality rate, mechanism of injury, and the injury severity score. See Table 2.

Table 2

Baseline Trauma Characteristics

Baseline Characteristics	Pre (*n* = 5,172)	Post (*n* = 916)	*P* value
Age (y)	61±22	59±23	0.14
Sex: Male	2866 (169/month)	521 (173/month)	0.65
Sex: Female	2308 (136/month)	395 (132/month)	0.74
Mortality	2.6%	2.8%	0.74
Mechanism of	Ground level fall	Ground level fall	<.01
injury	MVA	MVA	<.01
	Blunt injury	Blunt injury	<.01
ISS 1-8	459±32	485±2	0.01
ISS 9-15	297±15	366±13	0.01
ISS 16-24	76±30	59±7	0.38
ISS 25-75	41±10	33±18	0.41

The CAUTI data on number of infections, number of catheter days, number of patient day, percent of use of an indwelling catheter, and infection rates were calculated and given before and after the CAUTI bundle implementation by the director of infection prevention. De-identified data was provided for patients with infections to identify any data trends pre and post study.

Data trends were identified in the pre-study period through root cause analysis. Patients', both male and females, average age of infection was 79 years old with a commonality of a traumatic brain injury, a subdural hematoma, or spinal injury. Higher infections rates were found in the male patients who had an average ISS of 9 to 15 and were infected on Day 9 of patient stay, while the female average ISS was 16 to 24 and the infection day was an average of Day 14. Male and female indwelling catheters were often placed in the ED in the trauma bay upon initial activation of trauma alert. Common organisms were found in both male and female patients, with P. Aeruginosa being the most common in male patients and Citrobacter being the most common in female patients, through pan culturing due to a fever or increased white blood cells. See Table 3.

Table 3

Data Trends Pre-study Period

Patient Characteristic Trends	Male patients	Female patients
Average age	79	79
Average ISS	9-15	16-24
Common diagnosis	TBI, SDH, spinal injury	TBI, SDH, spinal injury
Insertion site	ED	ED
Average infection day	Day 9	Day 14
Common organism	P. Aeruginosa	Citrobacter
Culture/reason	Pan culturing: fever/wbc	Pan culturing: fever

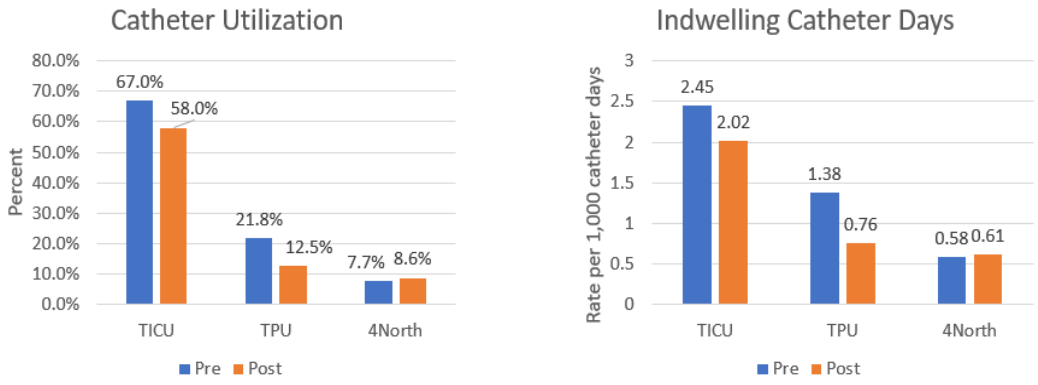
Note. TBI = traumatic brain injury. SDH = subdural hematoma. WBC = white blood cells.

The number of patients that had an indwelling urinary catheter were reduced when the CAUTI bundle intervention was utilized. TICU started with a utilization rate of 67% and dropped to 58% post implementation, which revealed a 9% improvement. Catheter days for this area, also followed the same pattern with dropping indwelling catheter days from 2.45 down to 2.02.and 0.43 days in use. TPU saw similar results with a drop in catheter utilization moving from 21.8% down to 12.5%, which yielded a 9.3% improvement. Indwelling catheter days dropped from 1.38 to 0.76, showing a 0.62 days of improvement in use. 4N increased utilization from 7.7% up to 8.6%, which is 0.9%

increase and same pattern with indwelling catheter days increasing slightly from 0.58 to 0.61. See Figure 3.

Figure 3:

Catheter Utilization and Indwelling Catheter Days



Both pre-study and post-study focus were placed on appropriate documentation. A review of key indicators was looked at and addressed real time by nursing leadership on the reasons to insert the indwelling catheter using criteria, daily device monitoring, and daily documentation of a reason to retain indwelling catheter. Then each unit was given a total compliance score. The combined outcomes pre and post study were as follows (See Table 4).

Table 4

Nursing Documentation

CAUTI review: (Units included: TICU, TPU, 4N)	Pre-study	Post-study
% Total care compliance	98%	99%
% Documentation reason to insert indwelling catheter	100%	100%
% Documentation of device monitoring	98%	99%
% Daily documentation of reason to retain indwelling catheter	98%	99%

Note. TICU = trauma intensive care unit. TPU = trauma progressive care unit. 4N = 4 north

Opportunities identified included

- Same patient on multiple occasions continued to be missed.
- Nursing leaders were not looking at their data and did not have timely follow up.
- Gaps on weekends and holiday documentation.
- TICU did not de-escalate the catheter prior to leaving the ICU.
- TICU had de-escalated the catheter but failed to document causing a care compliance issue in the receiving unit.
- The operating room inserted indwelling catheters during perioperative period and not documenting appropriately, and in the Post Anesthesia Unit the catheter was removed and not documented.

- Suprapubic catheters were often documented in correctly and placed in the wrong area.

Charge nurse were trained to do a shift audit via CAUTI Tool (Figure 4). This audit was to ensure that there were appropriate indications for insertion, or removal protocol was initiated. A visual observance to check to see if drainage bag was not overfilled, it was below the hips and urine flow was unobstructed with no dependent loops observed. The tubing was straight and not touching the floor. Cultures were closely monitored by the infection prevention team, and when inappropriately orders were addressed immediately with physician. Weekly rounds with the chief medical officer, chief nursing officer, and infection preventionist were made a priority in all study areas to make staff aware of importance of reducing infection rates.

Figure 4

CAUTI Audit Tool

Indwelling Urinary Catheter (IUC) Necessity/Maintenance/Removal Audit Tool

Date: ____________ Shift: ________ Department: ____________ Audit Performed by: ________________

		Indication for Medical Necessity									Indwelling Urinary Catheter Use Assessment							
Room #	Patient Name	Urology Surgery or ICU placed by Urology	Urinary Obstruction Retention after 3 Straight Caths	Gross Hematuria /CBI	Immediate Post-Op or Peri-Op Use (Remove POD1)	Strict I/O (Requires hourly I&O) **ICU ONLY**	Epidural Catheter in place	Stage III or IV Decubitus	Comfort Care/ Palliative Care	How many days has the patient had an IUC?	IUC secured to patient with a STAT-Lock	Drainage tubing looped or kinked (Dependent Loop Observed)	Drain tubing and bag below the bladder	Bag/Meter touching the floor	Separate clean container for each patient (urine drainage container)	Label with time & date of catheter insertion (Bag and/or chart)	Device Insertion Location	**NO INDICATION MET (REMOVE IUC)**
											Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	ER OR CC MS OTH CPOA	Yes / No
											Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	ER OR CC MS OTH CPOA	Yes / No
											Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	ER OR CC MS OTH CPOA	Yes / No
											Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	ER OR CC MS OTH CPOA	Yes / No
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											Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	ER OR CC MS OTH CPOA	Yes / No

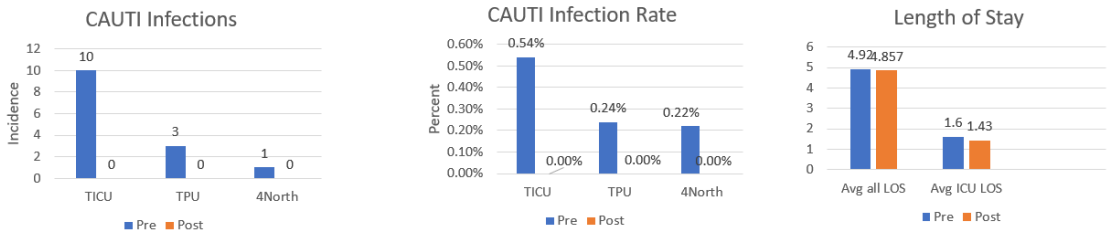
Notes: ________________________________

Insertion Location Legend: ER: Emergency Dept. OR: Operating Room CC: Critical Care MS: Med-Surg OTH: Other in-house Dept CPOA: Catheter Present On

The combined efforts of the nurses, physicians, nursing leaders, and administrative teams the CAUTI bundle showed significant improvement. All areas in the post study period had zero infections and dropping the infection rate to zero. Length of stay also showed a small decrease. Hospital goal was reached during the post evaluation period. See Figure 5.

Figure 5

CAUTI Infection Numbers, Rates and LOS



Implications

The Centers of Medicare and Medicaid Services report more than two million cases of CAUTI each year, and limits government funded reimbursement (Galiczewski, 2016). Implementation of a CAUTI bundle involves a nurse focused assessment and used for optimal patient selection, technique, care and maintenance and timely removal. The CAUTI bundle intervention was beneficial to a subgroup of high-risk patients and can have a large financial impact. Pyrek (2012), reports the average hospital acquired catheter-associated urinary tract infection to be an estimate of $758, thus averaging for three units above in *Figure 6* to be estimated $10, 612 during the pre-study period. The bundle not only improved patient outcome but can decrease the financial burden on the patient and facility.

Implementing this bundle may decrease length of stay and cost associated with CAUTI. The business impact can be bigger than just the day to day financials. Length of stay can impact several hospital charges as well as socioeconomic cost associated with hospital acquired infections. These charges can range from direct medical costs, indirect

cost related to productivity, and intangible patient cost. Adjustments can be made for length of stay, severity of illness, and underlying co-morbid conditions to determine attributable cost related to CAUTI (see Pyrek, 2012). Although length of stay decreased slightly the contributable cost could be very large.

Trauma patients have a high frequency in use of urinary catheters with an increased risk for developing a urinary tract infection (Elkbuli et al., 2018). The implementation and use of evidence-based protocols and prevention programs such as the CAUTI bundle may lessen the risk of complications in the trauma patients. Information can be found throughout the internet on various public reporting sites on infection rates, and outcomes. Since this is an area that has increased scrutiny and publicity because it is publicly reported it has led to enhance focused on reduction of infection rates.

Publicly reported data can have a very large negative impact. This impact can cause facilities to lose credibility and impacts their reputation publicly. Infections rates are publicly reported via Leapfrog, CMS Star Ratings, and Market comparison. Take leapfrog as an example. Infection control data is comprised of 20.9% of standard weighting. Star Rating is similar and again makes up 22% of this score in the safety care domain. Hospital acquired conditions has the most opportunity in market comparison the southern part of Florida (CMS Hospital Compare, 2019).

Recommendations

The ongoing use and monitoring of the CAUTI bundle should be utilized to continue to drive consistency in nursing practice. A traumatic brain injury CAUTI protocol, and bladder management program should be investigated due to the high

incidence in which CAUTI which occurred in this diagnosis type. Policies should be reviewed for current evidence and updated as needed. Recognition of success and opportunities for improvement can be facilitated through unit based professional practice councils and celebrate those successes. Engaging key stakeholders such as infection prevention, quality, risk, and executive leadership will be key in giving oversite, helping to support and encourage the frontline engagement for sustainability.

Recommendations on providing continuing education to nurses physcians and residents on a continuous basis. Nurses, physcians, and residents should be given CAUTI education on new hire, annually, and just in time. This allows a platform to teach new techniques, share up-dates on practice, as well as share benchmarks, goals, and performance. A special emphasis should be placed on emergency room personnel on sterile insertion techniques. Removal and replacement recommendations should be considered when placing an indwelling urinary catheter in the trauma bay.

Strength and Limitations

The facility will permanently adopt the CAUTI bundle and nurse driven removal protocol and implement it throughout their hospital system. The strengths of this project were the knowledge of and use of evidence-based practices to bedside nursing to decrease and prevent hospital acquired infections. This bundle practice further allowed nurses to easily identify patients that meet criteria for indwelling urinary catheter insertion, consider alternatives, use best practices for insertion, maintenance, and removal of the indwelling urinary catheter. This project also allowed improved practices of ordering urine cultures, reducing pan culturing practices, and standardization of urine

collection practices. Other strengths were the utilization of a multidisciplinary team to determine the root causes of each CAUTI and methods to reduce CAUTI, stainability of interventions, and broadening oversight of the processes in CAUTI prevention.

Limitations of this project was the study only included a single facility. The study was not conducted throughout the facility but limited to the trauma population vs hospital wide. The data was retrieved during a three-month period instead over a longer period. There were multiple interventions implemented as a bundle which created multiple variables which could impact the outcome.

Contribution of the Doctoral Project

The CAUTI prevention bundle and removal protocols were designed to improve care to the hospitalized adult trauma patient when requiring an indwelling urinary catheter following evidence-based practice. The project was to reduce the number of catheters associated infections by implementing the most recent clinical practice guidelines using a framework for the assessment, insertion, maintenance, and removal of the indwelling urinary catheter. Key practice strategies were identified to reduce CAUTI: fewer catheters used, timely removal, insertion, maintenance, documentation, and post removal care. Implementation of a nurse driven assessment protocol was put in place to determine voiding and toileting practice, the use of straight catheterization, and criteria for IUC. Along with nurse driven removal protocol to decrease the utilization of the IUC (Panchisin, 2016). This project was evaluated through data collection. Reduction in CAUTI infections was revealed proving that this evidence-based practices can be effective. There were no ethical implications of this project.

Section 5: Dissemination Plan

The purpose of the project was to understand the relationship of CAUTI prevalence when implementing a CAUTI bundle and removal protocol. Consistent with the literature, this project demonstrated an interactive CAUTI prevention strategy that supports evidence-based interventions that can assist in decreasing CAUTI rates. It is imperative for practitioners to recognize and establish new protocols to battle CAUTI or any other hospital acquired infection in the hospital setting. With the increased complexity of nursing practice, a focused approached on efficiencies with evidence-based practices can improve and impact quality of care.

This project helped me to understand the importance of evidence-based practice guidelines as well as transform that knowledge into practice and lead change through improving patient outcomes. Nurses play a key role in preventing CAUTI and impacting outcomes related to infections in the acute care setting by using evidence-based guidelines (Ferguson, 2018). This project brought to light some the challenges that nurses face on a day-to-day basis. By increasing nursing knowledge on indications and appropriate use and bundle compliance on insertion, maintenance, and removal, nurses are empowered to use evidence-based practice to change behaviors and beliefs, thus changing the culture around indwelling catheter use. Reflecting on the changes that have occurred, I believe this change can be applicable on a much larger scale and successfully change practice at a much larger level.

Project findings were presented to the trauma medical director and administration team and discussed as best practices, with recommendations made to implement practice

throughout all units in the hospital and system wide. The project was then presented to the Trauma Quality and Improvement Committee, Trauma Surgical Advisory Committee, Infection Control Committee, and Quality Committee for the facility. Additionally, the project findings were disseminated to 14 other hospitals in the company. These hospitals will be adopting the policy, bundle, removal protocol, culturing patterns, education, and audit tools.

Analysis of Self

Nursing has evolved over the last 150 years; this is mainly because of their role, education, and perspectives they have gained over the years. Nurses are well positioned to contribute to changes in healthcare and lead that change. During the project, I learned how to be a scholar. I now understand various nursing theories and conceptual frameworks, and I can apply them to practice. As I a scholar, I was able to identify a practice problem in the hospital setting, implement evidence-based practices, and evaluate the practice to improve quality care to many patients.

As I reflect on my strengths and weakness throughout this process, I have developed competencies that will serve me as I continue to develop through my nursing journey. I have gained knowledge, skills, and a different attitude surrounding research to be able to identify needed change, drive change, and mandate practice changes for nursing professionals. As a practitioner, I can identify practice gaps and research to improve those gaps. With the knowledge I have gained, I am able to identify, evaluate, make recommendations to promote preventative measures, and improve patient quality

and safety measures within a healthcare organization. I am comfortable with my skill level to lead a project, set realistic goals and timelines, and work with team dynamics.

Summary

CAUTIs are common in the high-risk trauma population but can be prevented with the use of evidence-based practice guidelines. This quality improvement project yielded a standardized approach for nursing assessment criteria, selection, maintenance, early discontinuation, culturing, and post care. This comprehensive intervention is successful in reducing CAUTI rates in the adult trauma patient and has a positive impact on patient infection rates for the hospital.

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