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Catheter Associated Urinary Tract Infection

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Catheter Associated Urinary Tract Infections: A Benchmark Study

A Paper Submitted in Partial Fulfillment of the Requirements

For NURS 5382: Capstone

In the School of Nursing

The University of Texas at Tyler

by

Latrina Martin

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Contents

Acknowledgments

I want to extend the warmest thank you to my husband Samuel for all the support, love, encouragement, and for believing I could any goal I set. You are my backbone, best friend, and biggest cheerleader. Thank you to my grandmother for helping cultivate a family of nursing. Without her love for nursing, I would not have come into the profession. Thank you to my sons for keeping me motivated to do better and be better than I was yesterday. Thanks to all the instructors throughout this journey who encouraged, supported, and lifted me up along this trek.

Executive Summary

Catheter associated urinary tract infections (CAUTI) are a common preventable occurrence in healthcare. With many conditions requiring catheterization for numerous reasons, catheter use is unavoidable in many circumstances. According to Sun et al., (2020), catheters account for up to 80% of hospital-acquired infections. This paper discusses how proper catheter selection in addition to a series of nursing interventions can decrease CAUTI. The benchmark project will address the steps of data analysis, protocol approval, staff education, implementation, and post implementation data analysis. The previous 12 months of data on CAUTI rate, CAUTI mortality rate, number of catheter days, current protocols in place for catheter insertion/discontinuation, and catheter selection will be carefully reviewed. The data analysis will be presented to Administration for review and approval of a new protocol to decrease CAUTI rate. Once approved, nursing staff and physicians will be educated on the new protocol for catheterization. The new protocol will consist of using only silver-alloy catheters, allowing the nurse to initiate and discontinue the catheter according to the protocol without having to contact the physician. There will be specific diagnoses that will exclude the patient from this protocol. The nurse will also document the catheter status and bag location, urine quality, quantity, and amount twice per shift. The nurse will also be required to report changes in WBC's (white blood cells) on lab work and report abnormalities in UA's (urinalysis) to the physician. The aim of the new protocol is to decrease CAUTI incidence, improve patient outcomes, decrease CAUTI mortality, decrease the number of catheter days, increase revenue, prevent loss of revenue from negative outcomes, and to maintain and elevate facility quality measures. The new protocol will be implemented for 12 months before the data is reanalyzed for the results, which will likely show improved CAUTI rates and improved patient outcomes.

Catheter Associated Urinary Tract Infections: A Benchmark Study

Foley catheters are a common nursing intervention for a variety of diagnoses. Catheter-associated urinary tract infections (CAUTI) are a common complication of patients with indwelling catheters and a leading cause of hospital acquired infections (Sun et al., 2020). This paper discusses how CAUTI incidence can be decreased by catheter selection and a series of nursing interventions. In (P) patients requiring catheterization, (I) do silver containing catheters (C) compared to non-silver containing catheters (O) decrease catheter associated infections over a (T) 12-month period?

Rationale for the Project

This benchmark project will evaluate how the use of antimicrobial urinary catheters along with certain nursing interventions decrease catheter associated urinary tract infection (CAUTI). Catheters are a common occurrence in many aspects of nursing. In the home setting, nurses most commonly see Foley catheters used for a variety of reasons. Urinary tract infection prevention is a crucial part of every patient who requires catheterization on a long- or short-term basis. Catheter-associated urinary tract infection (CAUTI) represents one of the most common causes of morbidity and mortality. Prolonged catheterization is an important risk factor associated with CAUTI, and the formation of biofilm plays a central role in the pathogenesis of CAUTIs. Silver-coated catheters show promise toward reducing CAUTI (Cooper et al., 2016). Healthcare professionals have a major responsibility to do the right thing for the patient and present the best treatment options as applicable. The goal of ascertaining whether silver-alloy catheters are superior to standard latex catheters is to ensure care provided is the best available and driven by the evidence. Currently, the protocol for indwelling catheters is to use standard silicone-elastomer latex Foley catheters unless there is a contraindication to latex, and in that case a

silicone catheter would be used. In the home setting, catheters are changed every 4 weeks and as needed for leakage, dislodgement, or blockage. Catheter bags are to be emptied every 12 hours unless more frequent emptying is necessary. Patients and families are instructed on catheter care including daily cleansing of the meatus, maintaining bag position below the bladder- but not on the floor, and signs and symptoms of infection to report such as fever, chills, sweating, foul odor, or changes in mental status. Current practice is to collect a urinalysis only after contacting the physician and obtaining a verbal order. There are currently no alternatives to catheterization as the Foley catheter is the only viable option for short term and long-term needs (Feneley et al., 2015), so preventing CAUTI is an important issue.

Literature Synthesis.

Collectively, the research suggests that silver containing catheters do decrease CAUTI, but this alone is not always effective. Chung et al. (2017) concluded that a 31% reduction was seen in patients with the silver and hydrogel catheters. A study by Aljohi et al., (2016) demonstrated a 90% decrease in CAUTI using noble metal alloy catheters in the ICU. Clarke et al. (2012) concluded that bundling interventions can provide cost savings, decreased CAUTI rate, and better patient outcomes. Ackam et al., (2019) state that a small number of patients with antimicrobial catheters have demonstrated a decrease in CAUTI. Magnusson et al., (2019) reported a decrease in the frequency of recurrent UTI with noble metal alloy catheters. According to Johnson et al., (2016), a 28% reduction in CAUTI was seen postimplementation of an eight-month long trial of a nurse driven catheter protocol. Lederer et al., (2014) conducted a multicenter, before-after cohort study of patients with CAUTI yielded a 41-58% reduction. The study compared the infection rates while using standard catheters for 3 months and silver-alloy catheters for 3 months. Lederer et al. (2014) concluded with a 95 percent confidence interval that

the infection rate decreased with the use of silver-alloy catheters. Beattie & Taylor (2011) conducted a systematic review (SR) of 97 studies that showed likelihood that silver alloy catheters decrease CAUTI. Cooper et al., (2016) tested the antimicrobial ability of photo-deposited silver on urinary catheters and the results suggest that silver is antimicrobial. Sun et al., (2020) concluded with their systematic review that bacteremia was reduced with the use of silver-alloy catheters. These studies are the "gold standard" level 1 evidence (Fineout-Overholt & Stillwell, 2019). Johnson et al., (2016) estimate that 30-40% of patients do not receive care based on the best available evidence. The evidence is clear suggesting that the use of silver-alloy catheters in addition to certain nursing interventions can have a substantial decrease on CAUTI.

Project Stakeholders

. The stakeholders impacted by the change will be patients, nurses, physicians, facility administrators, financial shareholders, and Centers for Medicare and Medicaid (CMS). Each stakeholder will be impacted by the change because of the role infection rate in all aspects of care including comparative ratings and reimbursement. CMS adjusts payment to involved entities-hospitals, skilled nursing facilities, home health agencies-when readmissions occur for the same diagnosis within set time frames (CMS, 2020). Stakeholders all want to have lower infection rate, lower costs, and fewer complications related to Foley catheter use. The ethical considerations are autonomy and beneficence. Patients have a legal right to choose treatment and must be provided with all options available and be able to weigh the pros and cons to make an informed decision. Nurses should inform patients of the new protocol in place to reassure patients that they are receiving the most current treatment with the least amount of complications. Most patients elect treatment that is aligned with their own values and beliefs and nurses have the responsibility to facilitate this autonomy (American Nurses Association, 2015).

Implementation Plan

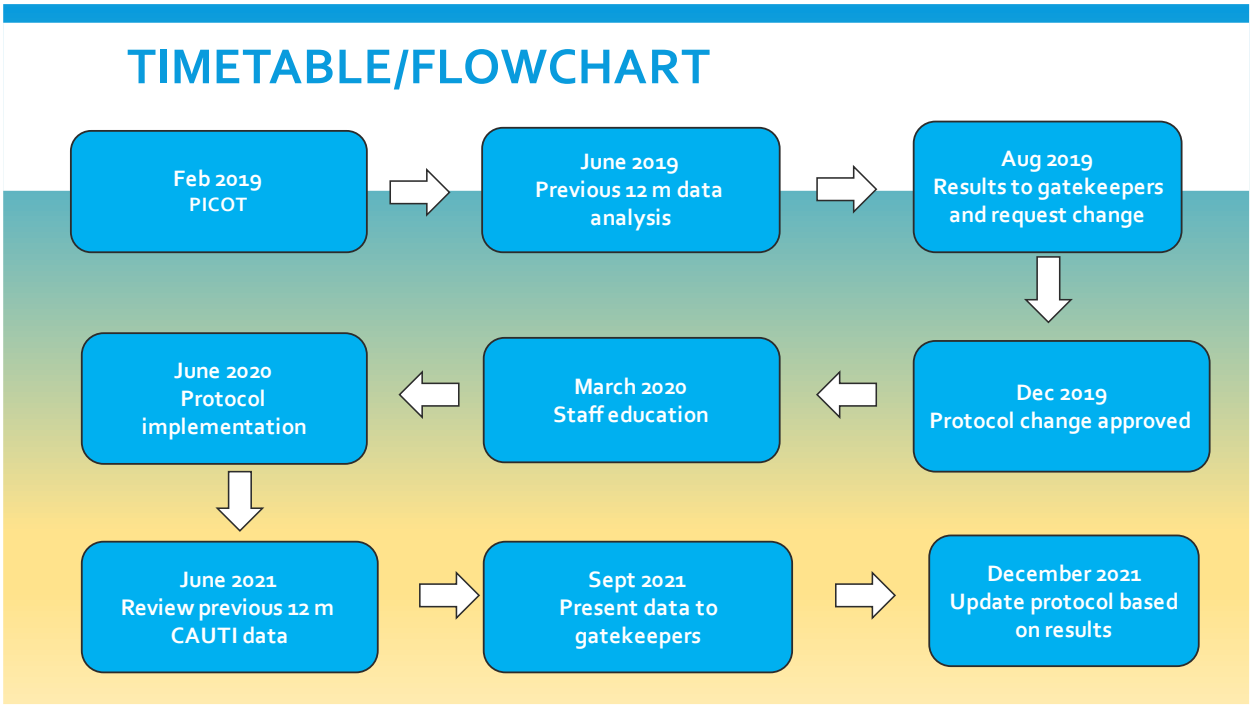
Most processes of change are met with resistance from one source or another. The challenge will be to overcome nurse resistance. Many people are used to doing things a certain way and respond best to change when the "why" is provided. Nursing staff will be provided with education regarding catheter selection, insertion and removal timing, and monitoring interventions all in effort to reduce CAUTI according to the evidence. Johnson et al. (2016), state that evidence-based education makes nursing more caring because care is based on the evidence resulting in better care and outcomes. Most nurses will support change if they believe it will benefit their patients, so this will be the most important part of having this change embraced. To evaluate the success of the change, the previous 12 months of data will be examined and compared to the infection rates of the implementation period. The goal of the change project is to decrease CAUTI. The project will involve a series of interventions by nursing staff implemented at designated times such as immediately prior to surgical procedures, or as indicated by certain diagnoses that result in urinary retention. The nurse will initiate the silver-alloy catheter as indicated and discontinue it when no longer indicated. The nurse will also document the location of the drainage bag and catheter, urine characteristics, & amount in addition to monitoring and reporting any elevation in white blood cells on lab work and any abnormal findings on urinalysis and documenting vital signs twice per shift. These interventions will allow each nurse to take ownership for preventing CAUTI. CAUTI is an important part of nursing no matter the setting, so to find an evidence-based solution for preventing them could change healthcare.

Timetable/Flowchart

The timetable for the project is listed in Figure 1. The benchmark project will take place over a 2-year period. The project began with the formulation if the PICOT (population,

intervention, comparison, outcome, time) question. The previous 12 months of data will be analyzed for CAUTI infection rates, CAUTI mortality rates, number of catheter days, current protocols in place for catheterization, and process for catheter selection. Once the data is analyzed, the results will be presented to administration. During the results presentation, the request for a change in protocol will be presented for approval. This process takes 2-3 months and once approval is obtained, an implementation plan will be presented. Once approval is obtained within 90 days, the education process will start. Nurses and physicians will be educated on the new protocol for initiating and discontinuing catheters. The new protocol will be implemented.

Figure 1



Data Collection Methods

The pre-implementation data will be comprehensively evaluated for the previous 12 months' CAUTI rates. The results review will be comprehensive to include all patients on the

unit who had a catheter during the timeframe. The researchers will evaluate the outcomes for each patient to determine if there were complications from the catheterization such as rehospitalization, sepsis, or mortality. The researchers will evaluate the additional costs of treatment for any complications related to CAUTI. Any negative ramification to the facility from CAUTI will be analyzed including any decreases in quality ratings, negative reporting, or loss in reimbursement. The cost of care for patients with CAUTI will be evaluated to identify cost savings or elevations because of the implementation. The researchers will calculate the number of catheter days during the 12-month period to establish a baseline prior to the new protocol implementation. The data will be examined to determine the CAUTI rate per 365 days. Once the protocol is implemented for 12 months, the same data for the implementation period will evaluated and compared.

Cost/Benefit Discussion

UTI's are a common occurrence in health care. Catheter coating and specific nursing interventions have been shown to decrease the rate of CAUTI. The most basic methods of preventing CAUTI using catheters only when necessary, for the shortest amount of time, and with the best aseptic technique. The cost of treating CAUTI is about $400 million/year. Lederer et al., (2011) reports a $3,800 increase per patient with CAUTI. The implementation cost will average around $6,500 to implement. The new protocol pays for itself by preventing two patients from getting CAUTI. With rising health care costs, CAUTI can be prevented. Along with pain, CAUTIs can extend hospital stays and increase use of antibiotics, increasing the likelihood of resistant strains of bacteria. Some common complications are cystitis, pyelonephritis, sepsis, shock, and possibly death. Septic shock has an extremely high mortality rate, making early treatment and prevention of CAUTI crucial (Aljohi et al., 2016).

Discussion of Results

The project is an anticipated success as the data analysis post implementation is expected to show a decrease in CAUTI rate, decreased mortality rates, improved patient outcomes, lower costs, and decreased catheter days. Decreasing the days patients have a catheter inserted will also decrease the likelihood that they develop an infection. Consequently, patients return and recommend facilities that provided excellent service, care, and less complications. This will result in better satisfaction scores and outcome ratings, which also will result in higher reimbursement and revenue. CMS decreases payment to facilities that do not provide minimum standards of care. Once the project can be implemented in a time post the novel Coronavirus 2019, one will be able to analyze real data and show with high certainty that silver catheters and a series of nursing interventions do decrease CAUTI.

Conclusions/Recommendations

Based on the conclusions from the research, silver catheters should be implemented with the nursing interventions to decrease CAUTI on a widescale basis. Patient outcomes will improve, costs will be lowered, and less revenue will be recuperated as a result. The next step for the project is implementation. For those who require an indwelling catheter, whether short- or long-term, the Foley catheter is and has been the standard of care, despite the ability to cause bacterial colonization, recurrent and chronic infections, a host of other complications and contribute to antibiotic resistance (Feneley, et al., 2015). Clinicians must continue to challenge the status quo and seek the best evidence for patient care.

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Appendix A

Synthesis Table

Citation: (i.e., author(s), date of publication, & title)	Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence (i.e., level of evidence + quality [study strengths and weaknesses])
Author, Year, Title	**Theoretical basis for study Qualitative Tradition**		**Number, Characteristics, Attrition rate & why?**	**Independent variables (e.g., IV1 = IV2 =)** **Dependent variables (e.g., DV =) Do not need to put IV & DV in Legend**	**What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])**	**What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)**	**Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)**	• **Strengths and limitations of the study** • **Risk or harm if study intervention or findings implemented** • **Feasibility of use in your practice** • **Remember: level of evidence (See PICOT handout) + quality of evidence = strength of evidence & confidence to act** • **Use the USPSTF grading schema http://www.ahrq.gov/clinic/3rduspstf/ratings.htm**
Bonfill et al, (2017). Efficacy and safety of urinary catheters with silver alloy coating in patients with spinal cord injury: a multicentric pragmatic randomized controlled trial. The ESCALE trial.	None Stated	Open label, multicenter RCT	N=489 14 hospitals Age 18+ Cath 7+ days Traumatic or medical SCI	IV=SAH catheter DV=symptomatic UTI DV2=Bacteremia & adverse events	Positive urine culture Fever >38.0 C CV pain, tenderness, foul smelling odor, sweating, AD, dysuria	Symptomatic UTI-OR 0.96 (0.49-1.87) Experimental group adverse events OR 0.03 (0.00-0.06) 95% CI	More research needed to support SAH effectiveness in SCI's	Strengths: Level 2 RCT, decreased CAUTI in hospitalized pt's less than 7 day cath, assessor blinded to intervention, clear inclusion/exclusion criteria. Weaknesses: Specific to SCI, not as specific to hospitalized patients, clinicians not blinded to intervention, participants allowed to be randomized more than once, only some received prophylactic abx, premature termination of study. Feasibility: Yes Grade C, Moderate Level of Certainty, Level 2 RCT
Clarke et al., (2012). Reduction in catheter-associated urinary tract infections by bundling interventions.	None Stated	Retrospective cohort	N=2228 Indwelling Cath in post intervention period WGMC	IV1=exclusive SAH use IV2=CSD IV3=Cath bag off floor DV=CAUTI rate DV2=CAUTI cost rate	CDC NHSN Definition of CAUTI	GEE regression analysis	Suggests SAH decreases CAUTI Decreases costs	Strengths: adequate effect size to be generalized, study can be reproduced in other facilities, 1st study to add 4 interventions, includes decreased CAUTI rate & true cost reduction, IV's Category 1B recommendations Weaknesses: Not a Level 1 SR of RCT, study from only one facility, each intervention effect not studied individually Feasibility: Yes Grade A, High Level of Certainty, Level 4 Cohort
Beattie & Taylor, (2011). Silver alloy vs. uncoated urinary catheters: A systematic review of the literature.	None Stated	Systematic Review	N=17 Adult Requires short term urinary catheterization Outcome measures SAH vs non SAH	IV=SAH vs non SAH or teflon catheter DV=CAUTI decreased	CASP-SRT CASP-RCTT Rigorous bias detection methods	Fischer's Exact test, Chi Square, Kaplan-Meier & Student's t-test	Suggests SAH decreases CAUTI	Strengths: Level 1 SR, rigorous bias detection, reproducible database searches, includes PICO question, 10% of papers had 2nd review, inclusion/exclusion predetermined Weaknesses: moderate evidence and significant heterogeneity of some studies, no ethical considerations, numerical filtering tool not designed for SR's, small samples from some studies, none measured symptomatic CAUTI Feasibility: Yes Grade A, High Level of Certainty, Level 1 SR

Lederer, Jarvis, Thomas, & Ritter, (2011). Multicenter cohort study to assess the impact of a silver-alloy and hydrogel-coated urinary catheter on symptomatic catheter-associated urinary tract infections.	None Stated	Retrospective Cohort	N= 1580 Age-18-89 foley cath insertion culture with <2 organism 7 acute care hospitals	IV=silver vs standard cath DV=CAUTI infection rate	Fisher's Exact Wilcoxon's	OR 0.53 P < 0.0001 95% CI 0.45-0.6	SAH decreased CAUTI's by NHSN & clinical criteria	Strengths: Assess both NHSN and clinical criteria definition of CAUTI, captured all cultures in the time period Weaknesses: Not a Level 1 SR of RCT, sponsored by Bard, limited to documentation because of retrospectiveness, device days & patient days show correlation Feasibility: Yes Grade A, High Level of Certainty, Level 4 Cohort
Leuck, et al., (2015). Safety and efficacy of a novel silver-impregnated urinary catheter system for preventing catheter-associated bacteriuria: A pilot randomized clinical trial.	None Stated	Prospective single facility RCT	N=95 12 M study at UMMC Attrition=no post cath ua, no qd ua, or in/exclusion criteria not met	IV= test silver cath DV=time to ABU	Urine dipstick qd & after 48 H post cath dc Monitoring v/s, s/p tenderness, dysuria, itching, redness, swelling, dysuria, or oliguria	P=0.08, log-rank test ABU test group P=0.03 ABU total population	Time to ABU decreased by test catheter	Strengths: Assesses time to ABU for test silver system vs standard silver system, RCT, results warrant more studies, 0 ABU in test group, study design was FDA mandated Weaknesses: small sample size, single facility study, pilot study, results warrant more studies, only 63% completed study per protocol Feasibility: Yes Grade C, Moderate Level of Certainty, Level 2 RCT

Legend: **N**=Number of Participants **OR=**Odds Ratio **P**=Level of Significance **CI**=Confidence Interval **SAH**=Silver Alloy Hydrogel Catheter **IV**=Independent Variable D**V**=Dependent Variable **CAUTI**=Catheter Associated Urinary Tract Infection **NHSN**= National Healthcare Safety Network **RCT**=Randomized Controlled Trial **UMMC**=University of Minnesota Medical Center **M**=Month **ABU**=asymptomatic bacteriuria, **qd**=daily **s/p**=suprapubic **v/s**=vital signs **SR**=Systematic Review **CASP**= Critical Appraisal Skills Programme **SRT**=Systematic Review Tool **RCTT**=Randomized Controlled Trial Tool **CSD**=Catheter Securement Device **WGMC**=West Georgia Medical Center **CDC=** Center for Disease Control **NHSN=**National Safety & Health Network **AD**=Autonomic Dysreflexia, **CV**=costovertebral **SCI**=Spinal Cord Injury **ABX**= Antibiotics **GEE**=General Estimation Equation

***Prompts for each column – **please do not repeat the headings, just provide the data**

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