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Prevention and Reduction of Catheter-Associated Urinary Tract Infections (CAUTIs)

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Prevention and Reduction of Catheter-Associated Urinary Tract Infections (CAUTIs)

Abstract

Problem: Fifteen to twenty-five percent of hospitalized patients receive indwelling urinary catheters (IUCs) during their hospital stay and are at high risk for catheter-associated urinary tract infections, according to the Centers for Disease Control and Prevention (CDC, 2015).

Context: A CAUTI Prevention program was implemented in a community hospital surgical unit to address concerns of high rates of CAUTI.

Interventions: Staff training/education, pre-CAUTI and post-CAUTI prevention survey, hand hygiene, bundle care audit, and staff competency for indwelling urinary catheter insertion were implemented to prevent and reduce CAUTI cases in the surgical unit.

Measures: The Standardized Infection Ratio (SIR) formula, pre-CAUTI, and post-CAUTI prevention survey, and annual competency were the process measures used to evaluate the success of this project.

Results: The 2 and 3 Surgical units had no CAUTI cases as of July 2023. Hand hygiene compliance rate and bundle care audit were improved.

Conclusions: The quality improvement project reevaluated the organization's current nurse-driven indwelling urinary catheter protocol and implemented several interventions to prevent and reduce CAUTI. The 5 P's framework used to assess microsystems consists of purpose/policy, patients/participants, professionals, processes, and patterns (Nelson et al., 2007). PDSA cycle (Plan-Do-Study-Act) and Six Sigma were utilized to implement plan of care. Sustainability cycles were created to maintain the quality project plan of care.

Keywords: quality improvement, CAUTI bundle care, catheter-associated urinary tract infections, healthcare-associated infections.

Personal Leadership Statement

My values for nursing leadership are accountability and integrity. I will be accountable for providing high-quality and cost-effective care. I'm able to evaluate client care and implement changes in healthcare practices to improve outcomes within the healthcare system. In addition, integrity value is reflected in professional practice when the nurse leader is honest and provides care based on an ethical framework. I need to document care honestly and accurately, seek to remedy errors, and demonstrate accountability.

As a nurse leader, my vision is to provide high-quality care to everyone regardless of their socio-economic status. The organizational mission is to provide high-quality accessible healthcare and excellent service to all people in the community. Organizational value is to provide excellent and compassionate care respectfully to everyone. To demonstrate integrity by being open, honest, reliable, and dedicated to the organization's mission. To respect the individuals you work with, and the people you serve. Lastly, to value learning and strive for continual improvement based on what you learn, individually and as an organization.

I chose CAUTI as my quality improvement project mainly because as a healthcare professional I can significantly prevent and reduce CAUTI rates to save lives and prevent harm through effective leadership skills. The organization has strong management support from the Quality and Infection Prevention department, bedside nurses, physicians, staff developers/educators, and the leadership team. Interprofessional team collaboration is essential in the prevention and reduction of CAUTI by maintaining the indwelling urinary catheter (IUC) policy. Every nurse is a leader and encourages all nurses to develop and demonstrate effective leadership skills. Nurse leaders must adapt to constantly changing processes such as evidence-based standards in healthcare. Training and education are the foundation of frontline nurses as

one strength in the microsystem. Self-awareness, excellent communication skills, and collaboration are some of the leadership strengths that are useful when working in a team. Overall, these skills help the leader to be more productive and effective to provide exceptional high-quality care to our community.

Problem Description

The microsystem located within the Santa Clara County area, the 2 and 3 Surgical unit, an adult medical surgical specialty unit, is an inpatient hospital unit that provides the highest level of care to a diverse patient population. The microsystem currently has a nurse-driven indwelling urinary catheter protocol but is not achieving the expected outcomes. The protocol includes the list of inclusion criteria to meet the necessities for indwelling urinary catheters. Upon review of patient data, inclusion criteria, and catheter care were not properly documented on the patient chart. The documentation of catheter care and patient urine output was either incomplete or incorrect. Adequate and complete documentation is very crucial in providing proper treatment to patients. Failure to document will result in poor patient outcomes.

According to the CDC, the rate of CAUTI cases continues to rise every year, leading to an increased number of days in the hospital, increased medical costs, and patient mortality and morbidity rate. On the review of data collected and the organization's protocol, the Standardized Infection Ratio (SIR) as of 2021 was 1.45. The SIR was above the national benchmark and organizational goal of 0.75 SIR. The Standardized Infection Ratio goal is less than or equal to 0.75 within a year. This ratio is the benchmark to measure if the project intervention and expected outcome are achievable. The SIR is a summary measure used to track HAIs at a national, local, or state level over time (National Healthcare Safety Network, 2022). According to the National Healthcare Safety Network (NHSN), a SIR greater than 1.0 indicates that more

HAIs were observed than predicted. In contrast, a SIR less than 1.0 indicates that fewer HAIs were observed than predicted.

Specific Project Aim

The aim of this quality improvement project is to prevent and reduce the incidence of CAUTI from 30% to 70% within six months in patients admitted to the 2 and 3 Surgical Department by reinforcing the facility's current protocol to nurses on indwelling urinary catheter (IUC) management.

Available Knowledge

The following PICOT statement was used for the project: "How does staff training improve adherence to the indwelling urinary catheter protocol and reduce CAUTI on the surgical unit within six months?" Five articles were chosen to support the rationale of this project.

A systematic review was conducted using the Cochrane database, AHRQ evidence reports, and PubMed.gov database from 2017 to 2023 publication. The key terms that were searched included: CAUTI, intervention, preventions, inclusion criteria, urinary tract infection, catheters, knowledge, and healthcare personnel. The article type was limited to systematic review and meta-analysis and evaluated using the John Hopkins Nursing Evidence-Based Practice Appraisal Tool (see Appendix A).

A systematic review conducted randomized controlled trials (RCTs) and quasi-experimental organized by Mitchell et al., (2021), to study the effectiveness of meatal cleaning in the prevention of CAUTI (see Evaluation Table). This review covers 18 studies evaluating the use of antiseptic, antibacterial, or non-medicated agents for cleaning the meatal, periurethral, or perineal areas before indwelling catheter insertion or intermittent catheterization, or during

routine meatal care. The results concluded emerging evidence of the role of chlorhexidine antiseptic proper to urinary catheterization in reducing CAUTIs (Mitchell et al., 2021).

A randomized controlled clinical trial regarding the efficacy of bladder irrigation in preventing urinary tract infections associated with short-term catheterization was conducted by Ramezani et al., (2018). The experimental group consists of eligible patients who received daily bladder irrigation with 450 ml sterile normal saline, in 3 150-ml doses, for 3 consecutive days. Findings showed that the risk of CAUTI decreased by 99%, indicating a decrease in axillary body temperature and improvements in urine appearance, urinary red cells, and white cells in the blood following bladder irrigation (Ramezani et al., 2018). The study showed the efficacy of bladder irrigation has a positive effect on urine colony counts, and axillary body temperature and is successful in preventing CAUTI in short-term catheterization.

A systematic review of studies published in the United States since 2006 was performed, following guidelines from the Institute of Medicine (Durant, 2017). The study showed that twenty-nine studies were found eligible for IUC inclusion criteria and all reported reductions in clinical predictors of CAUTI. However, the number of CAUTIs remained unchanged in one study. Another systematic review was conducted by Abubakar et al., (2021) to measure the knowledge of healthcare workers on the prevention of CAUTI. According to the result of the study, there was a need for standardized instruments for the evaluation of CAUTI prevention knowledge so that targeted interventions can address knowledge deficits (Abubakar et al., 2021).

Lastly, another systematic review was performed by McCleskey et al., (2022) regarding the evaluation of quality improvement interventions to prevent CAUTI in the hospital setting. Hospitals have implemented diverse quality improvement (QI) interventions to reduce rates of

CAUTIs. The evaluations showed that QI interventions were associated with a 43% decline in infections and the net costs to hospitals that varied greatly (McCleskey et al., 2022).

Nurse-driven protocols, which provide a medically approved rubric for professional nurses to make autonomous care decisions, can facilitate appropriate catheter use and timely removal (Durant, 2017). Centers for Disease Control and Prevention provided guidelines for IUC inclusion criteria and the CAUTI bundle of care that will help the quality improvement project to reinforce the current microsystem nurse-driven protocol. Adequate knowledge of CAUTI in healthcare workers supports effective prevention and control of infection.

Rationale

The quality improvement project utilized the Six Sigma methodology (see Appendix B). The purpose of Six Sigma is to reduce variation in a system using the five phases: the define, measure, analyze, improve, and control methodology. Quality improvement focuses on a single step in a process to refine and standardize before moving on to other areas of variation. Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects and minimizing variability in processes by using a set of quality management methods (Agency for Healthcare Research and Quality, 2020).

A quality improvement model such as the Plan-Do-Study-Act (PDSA) cycle and Six Sigma provided a framework and guidance throughout this project. The PDSA cycle will be run to revise and adapt the tools for change and assess their effectiveness. The data was collected using the number of observed HAIs and predicted HAIs to calculate the SIR. The microsystem/organization used the Standardized Infection Ratio (SIR) with a benchmark of 0.79 to see if the desired goal for improvement is achievable.

Context

The demographic data were obtained from 2 and 3 Surgical units from the leadership team. The age distribution varies based on the census, but the majority of the population is elderly. Approximately 75% of the population are men and 25% are women with indwelling urinary catheters. Patients on the unit within the indwelling urinary catheter inclusion criteria include a chronic catheter, acute urinary retention/obstruction, and the critically ill. The purpose of the catheter is to obtain accurate measurements of intake and output while in the unit.

People can acquire catheter-associated urinary tract infections (CAUTIs) when receiving care in a hospital or healthcare facility for a different condition. Urinary tract infections (UTIs) are any kind of infection involving the ureters, bladder, kidney, urethra, or any part of the urinary system (Centers for Disease Control and Prevention, 2015). The most common cause of UTI is prolonged use of indwelling urinary catheters. CAUTI increases medical costs, mortality and morbidity rate, hospital readmissions, and hospital length of stay (Agency for Healthcare Research & Quality, 2017). Catheter-associated urinary tract infection (CAUTI) is a highly preventable healthcare-associated infection (HAI) that continues to be an economic burden in the United States (Centers for Disease Control and Prevention, 2015).

A SWOT analysis (strengths, weaknesses, opportunities, and threats) was done to understand how to develop a sustainable QI project surrounding CAUTI prevention and reduction and nurses' understanding of the facility's protocol. The organization has strong management support from the Quality and Infection Prevention department, bedside nurses, physicians, staff developers/educators, and leadership teams. Interprofessional team collaboration is essential in the prevention and reduction of CAUTI by maintaining the IUC policy. Training and education are the foundation of frontline nurses as one strength in the

microsystem. However, the microsystem is a teaching facility with a residency program and is considered a potential weakness. In addition, the microsystem has higher acuity patients that contribute to the staffing ratio. It was identified that lack of documentation for removal, catheter care, and indication of indwelling urinary catheters contributes to a higher rate of CAUTI. Moreover, patient refusal of catheter care is one of the causes of recurrent urinary tract infection that progresses to CAUTI.

The organization's external opportunities include increasing patient and staff satisfaction, decreasing patient harm, and learning best practices from outside the microsystem. External threats to the microsystem project include financial support for the CAUTI champion, environmental factors such as cold and flu season, and consistent staff training and education. The internal weakness and external threats have a negative impact and significant role in sustaining the project. SWOT analysis helps to identify factors that maintain the competitive advantage of the project (see Appendix C).

The financial analysis of the improvement project was based on the data gathered from evidence-based research. According to AHRQ, the additional cost of one CAUTI event is \$13,793. The 3 Surgical units had 1 CAUTI event and no cases in 2 Surgical units according to data provided by the Infection Department. The CAUTI cases from January 2022 to December 2022 data (see Appendix D). The implementation cost of \$8,228 includes the major expenses of providing training and education to 15 frontline/bedside nurses (see Appendix E). Staff and education training is relevant to this improvement project to improve quality and patient safety. This project will generate savings for the hospital, provide patient-staff satisfaction and increase the quality of care and patient safety.

Intervention

The CAUTI prevention and reduction quality improvement project consists of four main interventions: 1) staff education regarding CAUTI prevention and reduction through email or at a staff meeting/huddle; 2) staff will participate in a pre-CAUTI and post-CAUTI prevention survey to assess for learning needs and improvement in practice; 3) staff will be observed and checked off for competency with the CAUTI bundle procedure two times over one month by the Charge Nurse, or designated Unit Champions; 4) handwashing protocol following hospital policy will be assessed during each staff assessment and immediate feedback will be provided for correction, when appropriate.

Staff education was provided during huddles, staff meetings, and through email. The clinical nurse leader, staff developer, or educator provided staff education and training. Training and education covered the insertion of a catheter using an aseptic technique, maintaining IUC based on recommended guidelines, adherence to hand hygiene, proper documentation, and review of IUC necessity daily, and removal of the catheter when not needed. The physician must include the inclusion criteria for catheterization when placing an order for IUC. The weekly patient chart audit was sent via email to the Quality Improvement department head. The audit result served as a reminder to correct the nurse's documentation and to add the proper inclusion criteria. The staff should document catheter care every shift which includes the correct inclusion criteria and patient refusal. Catheter care includes the assessment for catheter prompt removal when it is not needed. This will help to reduce dwell time and prevent CAUTI. The leadership team will conduct an audit on all patients with IUC at least once or twice a week. The unit has one designated CAUTI champion and plans to add another CAUTI champion who will implement and foresee that the intervention and current guidelines are being followed by nurses.

The second intervention assessed the staff's knowledge and attitude toward CAUTI prevention. Staff participated in a pre-CAUTI and post-CAUTI prevention survey to assess learning needs and improvement in practice. The survey consists of three categories: 1) indication for catheterization; 2) preventive measures; 3) attitudes of nurses towards CAUTI prevention. The questions regarding the indication for catheterization or inclusion criteria and CAUTI preventive measures were taken as per Centers for Disease Control (CDC) guidelines. There were 9 questions regarding the indication for catheter insertion that were assessed by asking the respondents to answer whether it is indicated or not indicated. Knowledge regarding the methods to prevent CAUTI included 10 methods and the respondents had to answer whether this method is effective or non-effective. There were 6 questions to assess the attitude and the answers had to be given as to whether they agreed or disagreed with the statements. The CAUTI prevention survey was sent through email to 2 and 3 Surgical units.

The third intervention was to reinforce current CAUTI bundle care to prevent and reduce infection with competency verification. During skills day, the charge nurse or designated champions observed and documented the competency of the indwelling urinary catheter insertion and maintenance performed by direct staff. Using the IUC checklist to prevent CAUTI in the unit will assess the competency of direct staff (see Appendix F).

Lastly, staff were assessed on proper hand washing during the skills day assessment and immediate feedback will be provided for correction. Handwashing has a vital role in CAUTI prevention and reduction. The most common way that germs are spread is through poor hygiene. Washing hands before using the catheter is essential to avoid infection.

The additional cost of one CAUTI event is \$13,793 (Agency for Healthcare Research & Quality, 2017). The 3 Surgical units had 1 CAUTI event and no cases in 2 Surgical units

according to data provided by the Infection Department (see Appendix D). The avoidance cost of one CAUTI event was \$13,793 (see Appendix E). This cost will be avoided if CAUTI has been prevented and no occurrences will happen. Lastly, it will improve patient outcomes and employee satisfaction.

Study of the Intervention

The quality project improvement conducted a pre-prospective and post-prospective questionnaire-based survey where it can measure and assess the knowledge of nurses in 2 and 3 surgical units on CAUTI prevention (see Appendix G). The survey consists of three categories which include the indication of catheterization, preventive measures, and attitudes of nurses toward CAUTI prevention. The indication of catheterization includes the recommended inclusion criteria. The pre-CAUTI prevention survey accumulated 10 responses from the nurses in the Surgical unit with experience of between 1 to 20 years. The survey shows that 10% of the respondents identified urine output monitoring in a mobile patient or even obtaining a urine sample for culture sensitivity as a valid indication for catheterization (see Appendix G, Table 1). Most respondents could not correctly identify noneffective measures such as twice daily meatal care (30%) and isolation of patients known to have UTI from other non-infected patients (60%). Furthermore, 30% of the respondents agreed that catheters should be removed whenever it is convenient for healthcare providers, and 20% agreed that proper documentation of insertion indications and removal is not necessary. However, 100% of the respondents felt that education, renewal reminders, and proper hand hygiene would help in preventing CAUTI. The data collected from January 2023 to March 2023 in the surgical unit shows that 30% of patients had IUC due to chronic catheter, and acute urinary retention/obstruction (see Appendix H). These patients recommended reassessment for catheter removal and void trial if indicated.

The microsystem has a goal to achieve 0.75 SIR within a year. This ratio is the benchmark to measure if the project intervention and expected outcome are achievable. The SIR is a summary measure used to track HAIs at a national, local, or state level over time (National Healthcare Safety Network, 2022). According to the National Healthcare Safety Network (2022), a SIR greater than 1.0 indicates that more HAIs were observed than predicted. In contrast, a SIR less than 1.0 indicates that fewer HAIs were observed than predicted. The formula for the Standardized Infection Ratio is as follows (National Healthcare Safety Network, 2022):

$$\text{SIR} = \frac{\text{Observed (O) HAIs}}{\text{Predicted (P) HAIs}}$$

The organization is conducting quality cycles using Plan-Do-Check-Act (PDCA) or the same as Plan-Do-Study-Act (PDSA) cycle to discover what is an effective and efficient way to improve a process (see Appendix B). PDCA/PDSA is an iterative, four-step process that is a way to test a change that is implemented and used for action-oriented learning (Institute for Healthcare Improvement, n.d.). The project should have an appropriate timeline for the PDSA test cycle. Setting an end date for the PDSA cycle is important.

The project suggested having a CAUTI champion every shift, reevaluating the CAUTI bundle of care, staff training and education, and regular audit for completion of documentation. The CAUTI champion nurse is the one able to engage other nursing staff and oversees the prevention of CAUTI. The champion nurse communicates and conducts patient and staff feedback. Lastly, the annual in-service for CAUTI prevention will be implemented in the unit for all direct care staff with competency verification.

Ethical Considerations

The CAUTI project was approved by the director of nursing, the quality improvement manager, and the unit leadership team. Staff education, proper documentation, and timely removal of IUC will promote safety and increase patient outcomes. Provision 5 of the code of ethics for nursing states, “The nurse owes the same duties to self as to others, including the responsibility to promote health and safety, preserve wholeness of character and integrity, maintain competence, and continue personal and professional growth” (American Nurses Association, 2015). Lastly, this project has been approved as a quality improvement project by faculty using QI review guidelines and does not require Institutional Review Board approval.

Outcome Measure Results

Catheter-associated urinary tract infection has many process measures to evaluate the quality improvement project. The main process measures used to evaluate the success of the project’s outcome metrics were the results of the pre-CAUTI and post-CAUTI prevention survey, bundle care, patient chart audit, and SIR. The data collected and audited/reviewed was from January 2023 through July 2023 from 2 and 3 Surgical units.

The post-CAUTI prevention survey showed significant improvements in the IUC inclusion criteria. The preventive measures on a post-CAUTI survey regarding twice daily meatal care and nurses' attitudes on documentation have been decreased (see Appendix I).

The SIR is also considered to measure the results of the quality improvement project; however, the ratio was based on the overall microsystem SIR CAUTI report. Since the project started in January 2023 up to July 2023, the 2 and 3 surgical units have no case of CAUTI. The hand hygiene audit results improved from 39% to 77% based on the data collected from February to April 2023 (see Appendix J, Table 1).

The CAUTI bundle care audit completed from February 2023 and March 2023 showed that peri care performed per policy improved from 89% to 97% and tubing free of independent loop improved from 68% to 75%. In contrast, the bag hanging free without touching the floor bundle care decreased from 100% to 97% during the audit (see Appendix J, Table 2).

The patient chart/audit was performed every week from January 2023 to July 2023 in 2 and 3 Surgical units on patients with indwelling urinary catheters. The audit was conducted to review the nurse's documentation for catheter care and indication for catheterization. The nurse's documentation for indications for catheterization improved from 86% to 100% after the implementation of interventions. The catheter care documentation had significantly improved from 52% to 100% (see Appendix J, Table 3). The data shows the importance of patient chart audits in reminding the nurses to complete their documentation.

Summary

The project implemented the pre-CAUTI and post-CAUTI prevention survey, patient chart audit/review, bundle care, compliance to hand hygiene, and a proposal of staff education with skills competency. The pre-CAUTI prevention survey assessed the knowledge of nurses on how to prevent CAUTI. The survey was utilized to create interventions to prevent CAUTI. The post-CAUTI prevention survey showed improvement after the implementation of interventions such as patient chart audits, hand hygiene compliance, and reinforcing bundle care. The comparison data for the pre-CAUTI and post-CAUTI prevention survey were summarized in Appendix J, table 4.

The 2 and 3 Surgical units had one CAUTI case based on the data collected from 2022. In 2023 up to this date, the unit has no CAUTI reported. The nurse's catheter care documentation had significantly increased to 100% after the weekly audit conducted from January 2023 to July

2023. The results of the audit show the importance of how to prevent CAUTI and provide excellent quality care to all patients in 2 and 3 Surgical units. The staff education plan with skills competency has been completed and distributed via email to the leadership team.

Conclusions

The primary objective of the quality improvement project was to implement interventions to prevent and reduce CAUTIs in the microsystem located in the Bay Area. CAUTIs are the most common cause of healthcare-associated infections that cost \$13,793 per event. The organization has established a nurse-driven protocol for indwelling urethral catheters, but the target SIR has not achieved. The proposed project will help to meet the SIR national benchmark and sustain these improvements. In addition, the project will not only generate revenue of more than 50% of the cost per CAUTI but also promote staff-patient satisfaction and increase the quality of care and patient safety. Adherence and consistency to nurse-driven indwelling catheter protocol, educational training, and evaluation and audits promoted the success and sustainability of the project. The project will utilize the Plan-Do-Study-Act cycle to test a change and Six Sigma methodology for quality improvement.

The introduction of pre-CAUTI and post-CAUTI prevention surveys helped to assess the knowledge of nurses on CAUTI prevention and reduction and to create interventions. Post-CAUTI prevention was utilized to assess the results after implementing the interventions. The unit had one CAUTI in 2022, but no reported cases as of July 2023. The introduction of reinforcing bundle care, patient chart audit, hand hygiene compliance, catheterization inclusion criteria guidelines, IUC guidelines, patient void trial, staff education, and overall increased unit awareness all contributed to an improvement in 2 and 3 Surgical units. The unit has a staff education plan with skill competency in place.

Sustainability of improvement work is crucial in the healthcare setting to prevent and maintain CAUTI zero cases. The new hire staff, unit leadership turnover, and continued physician education are all factors to consider sustaining the project. The project sustainability plan cycle was created and distributed to the leadership team for review. The quality plan cycle helps to maintain the quality improvement project. As a leader, patient advocate, and educator, the introduction of a clinical nurse leader into the healthcare setting would have an impact on the sustainability of the CAUTI prevention state.

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Appendices

Appendix A

Evaluation Table

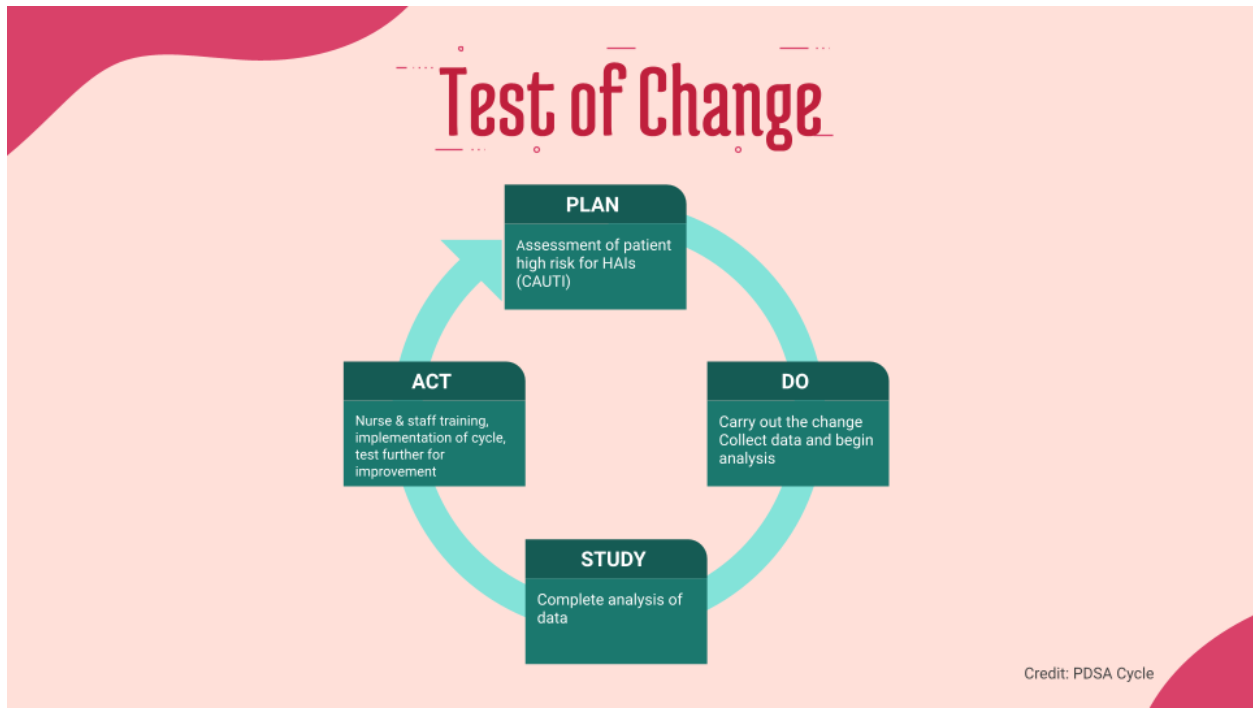
Study	Design	Sample	Outcome/Feasibility	Evidence rating
<p>Abubakar, S., Boehnke, J. R., Burnett, E., & Smith, K. (2021). Examining instruments used to measure knowledge of catheter-associated urinary tract infection prevention in health care workers: A systematic review. <i>American journal of infection control</i>, 49(2), 255–264. https://doi.org/10.1016/j.ajic.2020.07.025</p>	Systematic Review	15 studies for inclusion criteria 13 instruments for review	Most of the instruments did not address all knowledge components essential for CAUTI prevention as defined by the catheter lifecycle model. The psychometric quality of the instruments was not sufficiently evaluated.	Level 1 B
<p>Atkins, L., Sallis, A., Chadborn, T., Shaw, K., Schneider, A., Hopkins, S., Bunten, A., Michie, S., & Lorencatto, F. (2020). <i>Reducing catheter-associated urinary tract infections: a systematic review of barriers and facilitators and strategic behavioral analysis of interventions</i>. https://doi.org/10.1186/s13012-020-01001-2</p>	Systematic Review	<p>A mixed methods, three-phased study:</p> <ol style="list-style-type: none"> 1. systematic review of 25 studies to identify behaviors and barriers to and facilitators of CAUTI-related behaviors 2. Content analysis of nationally adopted CAUTI interventions 3. Linking of findings from 1 and 2 	The most frequently reported barriers to and facilitators of CAUTI-related behaviors related to ‘environmental context and resources’; ‘knowledge’; ‘beliefs about consequences’; ‘social influences’; ‘memory, attention and decision processes’; and ‘social professional role and identity.’	Level III B

<p>Durant D. J. (2017). Nurse-driven protocols and the prevention of catheter-associated urinary tract infections: A systematic review. <i>American journal of infection control</i>, 45(12), 1331–1341. 10.1016/j.ajic.2017.07.020 https://pubmed.ncbi.nlm.nih.gov/28982611/</p>	Systematic Review		<p>29 studies were found eligible for IUC inclusion</p> <p>All used a case-control approach, and all reported reductions in clinical predictors of CAUTI</p> <p>1 study showed the number of CAUTI is remained unchanged</p>	Level III B
<p>McCleskey, S. G., Shek, L., Grein, J., Gotanda, H., Anderson, L., Shekelle, P. G., Keeler, E., Morton, S., & Nuckols, T. K. (2022). Economic evaluation of quality improvement interventions to prevent catheter-associated urinary tract infections in the hospital setting: a systematic review. <i>BMJ quality & safety</i>, 31(4), 308–321. https://doi.org/10.1136/bmjqs-2021-013839</p>	Systematic Review	None	QI interventions with 43% decline in infections	Level III B
<p>Mitchell, B., Curryer, C., Holliday, E., Rickard, C. M., & Fasugba, O. (2021). <i>Effectiveness of meatal cleaning in the prevention of catheter-associated urinary tract infections and bacteriuria: an updated systematic review and meta-analysis.</i> https://doi.org/10.1136/bmjopen-2020-046817</p>	Systematic Review RCTs	Sample: 18 studies using antiseptics compared with non-antiseptics for meatal cleaning	Antiseptics (Chlorhexidine or povidone-iodine) may be of value for meatal cleaning	Level I B

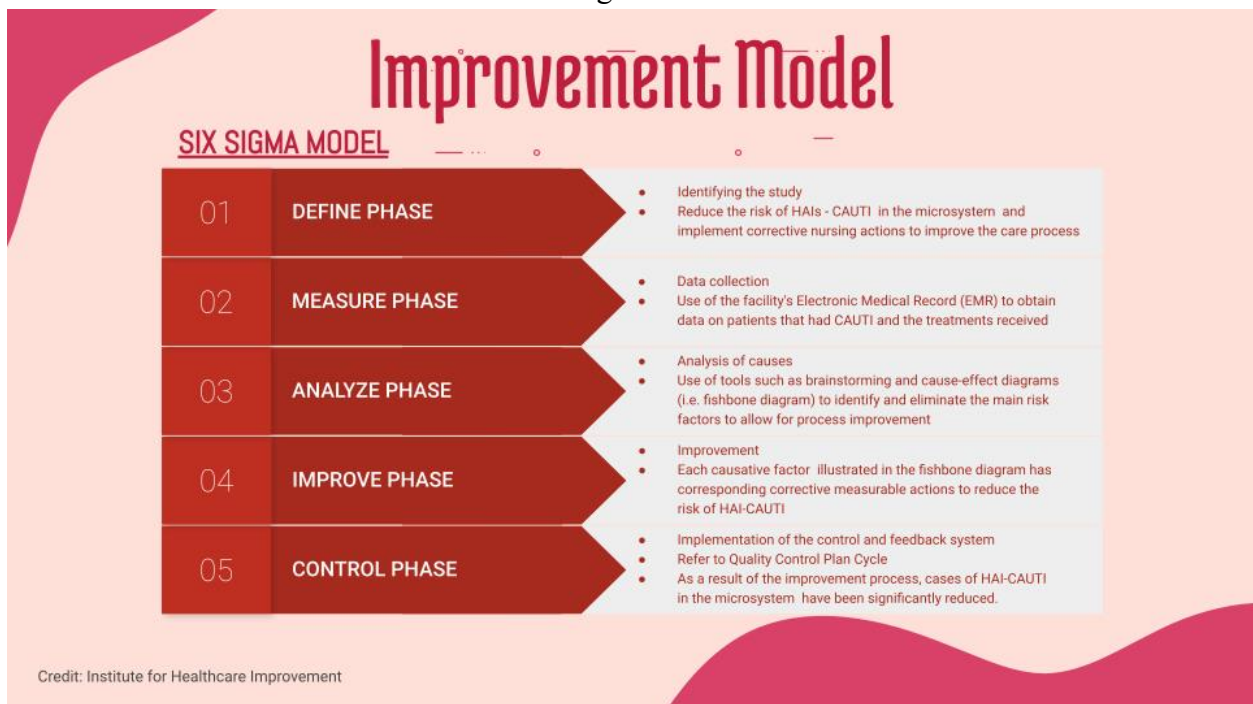
<p>Ramezani, F., Khatiban, M., Rahimbashar, F., & Soltanian, A. R. (2018). Efficacy of bladder irrigation in preventing urinary tract infections associated with short-term catheterization in comatose patients: A randomized controlled clinical trial. <i>American journal of infection control</i>, 46(10), e45–e50. https://doi.org/10.1016/j.ajic.2018.05.009</p>	RCTs	<p>Experimental group: daily bladder irrigation with 450cc sterile NS for 3 consecutive days</p>	<p>Daily bladder irrigation with normal saline during 3 days demonstrated efficacy in preventing CAUTI in comatose patients.</p> <p>CAUTI decreased by 99% in the experimental group</p>	Level I B

Appendix B

Plan-Do-Study-Act (PDSA) Cycle



Six Sigma Model



Appendix C

SWOT Analysis

	Favorable/Helpful	Unfavorable/Harmful
Internal (attributes of the organization)	Strengths <ul style="list-style-type: none"> ● Staff training ● Indwelling catheter algorithm policy in place and implemented ● Management and staff leadership support ● Support from Quality Department and Infection Prevention Department 	Weaknesses <ul style="list-style-type: none"> ● Higher acuity patient ● Lack of documentation ● No existing CAUTI core team in the unit ● Teaching facility with new residents
External (attributes of the organization)	Opportunities <ul style="list-style-type: none"> ● Learn best practice from other hospital ● Decrease patient harm and increase patient outcomes ● Increase in revenue ● Increase staff and patient satisfaction 	Threats <ul style="list-style-type: none"> ● Patient medical diagnosis with recurrent UTI ● Increase cost of supplies ● Lack of staff education and training ● Environmental factors that affect the increase of CAUTI outside the microsystem

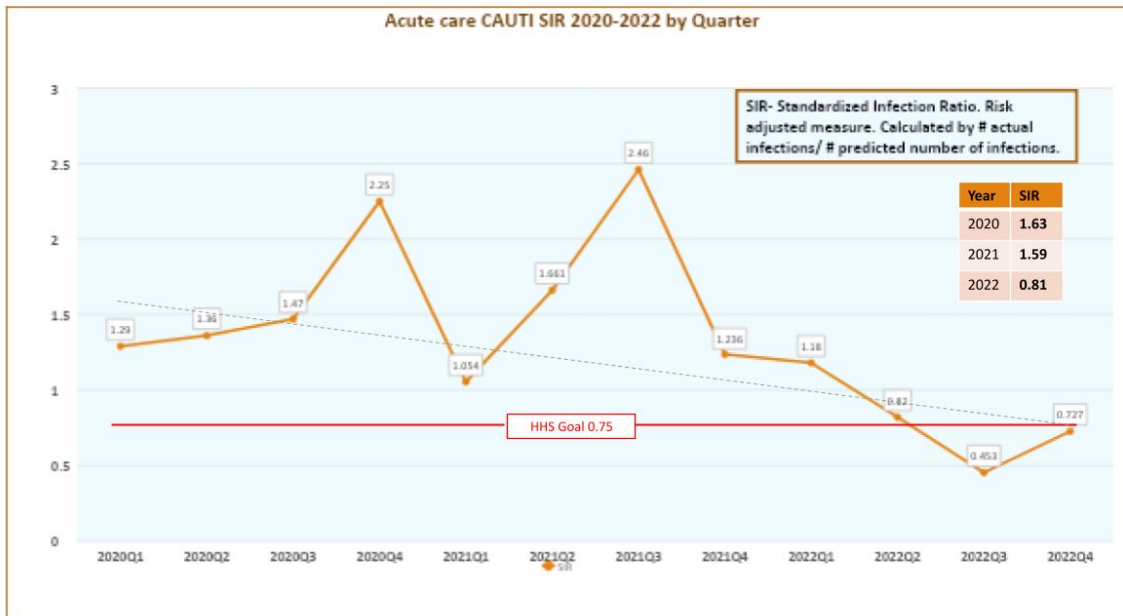
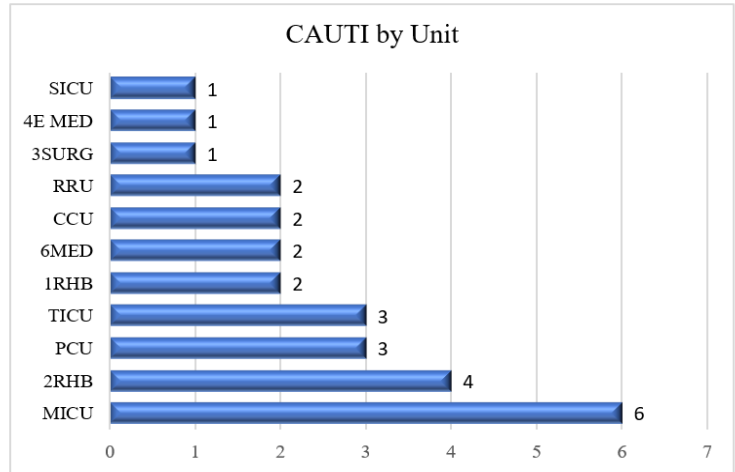
Adopted from: SWOT en.svg. (2020, November 5). *Wikimedia Commons, the free media repository*. Retrieved 23:09, August 13, 2021

from https://commons.wikimedia.org/w/index.php?title=File:SWOT_en.svg&oldid=510267924.

Appendix D

CAUTI Cases by Unit

CAUTI Rate from January 2022 – December 2022



Appendix E

Budget Analysis

COST AVOIDANCE				
COST DESCRIPTION	QUANTITY	COST OF CAUTI (AHRQ, 2017)		ANNUAL COST
CAUTI cases @ 2 and 3 Surgical (2022)	1 CAUTI cases for 2022	\$13,793		\$13,793
IMPLEMENTATION COST				
COST DESCRIPTION	QUANTITY	HOURS	AVERAGE HOURLY RATE WITH 30% BENEFITS (RNPA, 2021)	ANNUAL COST
CAUTI Champions/shift. Training 2 times/year with total hours = 8 hours	1 CAUTI Champion	8	\$92	\$736
Semiannual Staff Training & Education	1 Nurse Educator or Staff Developer	8	\$92	\$736
Bedside RN training 2x/year with 2 hours/training (Total of 4 hours/year/RN)	15 total bedside RN/unit for all shifts	4	\$92	\$5,520
Healthlink Superuser	1 Superuser	8	\$92	\$736
Supplies				\$500

TOTAL COST	\$8,228
NET SAVINGS OR REVENUE GENERATED	
COST AVOIDANCE	\$13,793
COST IMPLEMENTATION	\$8,228
NET SAVINGS OR REVENUE GENERATED	
	\$5,565

Note: Average hourly rate of Santa Clara County base on RNPA (Registered Nurse Professional Association) contract effective Nov. 1, 2021 (CN I to CN III step 3 rate coded position)

References:

Agency for Healthcare Research & Quality (AHRQ). (2017). *Estimating the additional hospital inpatient cost and mortality associated with selected hospital-acquired conditions.*

<https://www.ahrq.gov/hai/pfp/haccost2017-results.html>

National Healthcare Safety Network (NHSN). (2022). *Standard infection ratio.*

<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

Registered Nurses Professional Association (RNPA). (2021). *2020-2023 Final RNPA contract.*

https://www.rnpa.net/docs/contracts/Final_RNPA_contract_January_27th_2020_October_29th_2023.pdf

Appendix F

Competency Assessment for Urinary Indwelling Catheter

Indwelling Urinary Catheter (IUC) Insertion <u>Checklist</u> to Prevent CAUTI in the Adult Hospitalized Patient: Important Evidence-Based Steps.	Yes	Yes with Reminder	Comments
Before IUC insertion:			
1) Determine if IUC is appropriate per the CDC Guidelines (CDC, 2009) (See page 1, Box 1).			
2) Select smallest appropriate IUC (14 Fr., 5ml or 10 ml balloon is usually appropriate unless ordered otherwise).			
3) Obtain assistance PRN (e.g., 2-person insertion, mechanical aids) to facilitate appropriate visualization/insertion technique.			
4) Perform hand hygiene.			
Patient Preparation/Insertion of IUC:			
1) Perform peri-care, then, re-perform hand hygiene.			
2) Maintain strict aseptic technique throughout the actual IUC insertion procedure, re-perform hand hygiene upon completion. <ul style="list-style-type: none"> • Use <u>sterile gloves and equipment</u> and establish/maintain sterile field. • Do not pre-inflate the balloon to test it, as this is not recommended. 			
3) Insert IUC to appropriate length and check urine flow <u>before</u> balloon inflation to prevent urethral trauma. <ul style="list-style-type: none"> • In males, insert fully to the IUC “y” connection, or in females, advance ~1 inch or 2.5 cm beyond point of urine flow. 			
4) Inflate IUC balloon correctly: Inflate to 10 ml for catheters labeled 5 ml or 10 ml per manufacturer’s instructions.			
After IUC insertion completion:			
1) Perform Triple Action for IUC/Drainage System: <ul style="list-style-type: none"> • Secure IUC to prevent urethral irritation. • Position drainage bag below the bladder (but not resting on the floor). • Check system for closed connections and no obstructions/kinks. 			

Reference: American Nurses Association (ANA)

Appendix G

Pre-Prospective Questionnaire-Based Survey

Total Responses: 10

Nurse Experience: 1-20 years (5 & 8 years=20%)

Table 1: Inclusion criteria or indication for indwelling urinary catheter based on CDC guidelines and microsystem protocol

INDICATION FOR CATHETERIZATION (INCLUSION CRITERIA)	INDICATED/ NOT INDICATED	NURSES (n=10) (100%) - PRE
Urethral stricture causing obstruction to urinary flow	INDICATED	10 (100%)
Neurogenic bladder due to paraplegia or quadriplegia	INDICATED	8 (20%)
Prolonged immobilization due to unstable lumbar spine fracture	INDICATED	7 (70%)
Urine output monitoring in a mobile patient	NOT INDICATED	9 (90%)
Obtaining urine sample for culture and sensitivity testing	NOT INDICATED	9 (10%)
Nursing care for incontinent patient	NOT INDICATED	10 (100%)
Routinely before any kind of surgical procedure in a patient	NOT INDICATED	8 (80%)
Palliative care in terminally ill patient	INDICATED	6 (60%)
During labor and delivery that requires epidural	INDICATED	10 (100%)

Table 2: Preventive measures

PREVENTIVE MEASURES	EFFECTIVE/ NON-EFFECTIVE	NURSES (n=10) (100%) - PRE
Hand washing should be done immediately before and after any manipulation of catheter site or apparatus	EFFECTIVE	10 (100%)
It should be inserted only when necessary and removed as soon as possible	EFFECTIVE	10 (100%)
Avoid kinking of the catheter to maintain an obstructed flow of urine	EFFECTIVE	10 (100%)
Collecting bag should be emptied regularly	EFFECTIVE	10 (100%)
Twice daily meatal care with antiseptic solution	NON-EFFECTIVE	7 (70%)
Isolation of patients known to have UTI from other non-infected patients	NON-EFFECTIVE	6 (60%)
Prophylactic antimicrobials should be given for 3 days when catheter is inserted	NON-EFFECTIVE	9 (90%)
Regular educational training regarding basic urinary catheter care	EFFECTIVE	10 (100%)
Collecting bags should be kept below the level of the bladder	EFFECTIVE	10 (100%)
Catheter should be inserted only by personnel proficient in technique of aseptic insertion	EFFECTIVE	9 (90%)

Table 3: Attitudes of nurses towards indwelling urinary catheter

ATTITUDES	AGREE/ DISAGREE	NURSES (n=10) (100%) - PRE
Renewal reminders for catheters prevents CAUTI	AGREE	10 (100%)
Catheter can be inserted for nursing staff convenience	DISAGREE	10 (100%)
CAUTI not a very serious illness	DISAGREE	10 (100%)
Education regarding basic catheter care helps prevent CAUTI	AGREE	10 (100%)
Catheter should be removed whenever it is convenience for healthcare provider	DISAGREE	7 (70%)
Documentation of the following in the patient record is not necessary: indications for catheter insertion, date and time of insertion and removal	DISAGREE	8 (80%)

Appendix H

2 and 3 Surgical Unit Patients with IUC from January 2023 to March 2023

Male - n=15 (75%) Female n=5 (25%)

INCLUSION CRITERIA	n=20	
	n	%
Critically ill, need for accurate measurement for I&Os	4	20%
Acute urinary retention/obstruction	6	30%
Chronic catheter	6	30%
Post operative genitourinary/renal invasive procedures surgeries	1	5%
No documentation for inclusion criteria	3	15%

DURATION OF CATHETER	n=20	
	n	%
0 - 7 days	12	60%
7 - 14 days	5	25%
>14 days	3	15%

Appendix I

Post-Prospective Questionnaire-Based Survey

Total Responses: 7

Nurse Experience: <10 years=71% (<=10 years years=29%)

Table 1: Inclusion criteria or indication for indwelling urinary catheter based on CDC guidelines and microsystem protocol

INDICATION FOR CATHETERIZATION (INCLUSION CRITERIA)	INDICATED/ NOT INDICATED	NURSES (n=7) (100%) - POST
Urethral stricture causing obstruction to urinary flow	INDICATED	7 (100%)
Neurogenic bladder due to paraplegia or quadriplegia	INDICATED	7 (100%)
Prolonged immobilization due to unstable lumbar spine fracture	INDICATED	7 (100%)
Urine output monitoring in a mobile patient	NOT INDICATED	7 (100%)
Obtaining urine sample for culture and sensitivity testing	NOT INDICATED	6 (86%)
Nursing care for incontinent patient	NOT INDICATED	7 (100%)
Routinely before any kind of surgical procedure in a patient	NOT INDICATED	6 (86%)
Palliative care in terminally ill patient	INDICATED	6 (86%)
During labor and delivery that requires epidural	INDICATED	7 (100%)

Table 2: Preventive measures

PREVENTIVE MEASURES	EFFECTIVE/ NON-EFFECTIVE	NURSES (n=7) (100%)
Hand washing should be done immediately before and after any manipulation of catheter site or apparatus	EFFECTIVE	7 (100%)
It should be inserted only when necessary and removed as soon as possible	EFFECTIVE	7 (100%)
Avoid kinking of the catheter to maintain an obstructed flow of urine	EFFECTIVE	7 (100%)
Collecting bag should be emptied regularly	EFFECTIVE	7 (100%)
Twice daily meatal care with antiseptic solution	NON-EFFECTIVE	2 (29%)
Isolation of patients known to have UTI from other non-infected patients	NON-EFFECTIVE	6 (86%)
Prophylactic antimicrobials should be given for 3 days when catheter is inserted	NON-EFFECTIVE	7 (100%)
Regular educational training regarding basic urinary catheter care	EFFECTIVE	7 (100%)
Collecting bags should be kept below the level of the bladder	EFFECTIVE	7 (100%)
Catheter should be inserted only by personnel proficient in technique of aseptic insertion	EFFECTIVE	7 (100%)

Table 3: Attitudes of nurses towards indwelling urinary catheter

ATTITUDES	AGREE/ DISAGREE	NURSES (n=10) (100%) - POST
Renewal reminders for catheters prevents CAUTI	AGREE	7 (100%)
Catheter can be inserted for nursing staff convenience	DISAGREE	7 (100%)
CAUTI not a very serious illness	DISAGREE	7 (100%)
Education regarding basic catheter care helps prevent CAUTI	AGREE	7 (100%)
Catheter should be removed whenever it is convenience for healthcare provider	DISAGREE	7 (100%)
Documentation of the following in the patient record is not necessary: indications for catheter insertion, date and time of insertion and removal	DISAGREE	7 (71%)

Appendix J

Outcome Measure Data

Table 1: Hand Hygiene in 2 and 3 Surgical Units

Month/Unit	2 Surgical Unit	3 Surgical Unit
February 2023	56%	62%
March 2023	39%	57%
April 2023	68%	77%

Table 2: CAUTI Bundle Care Audit

CAUTI Bundle Care	February 2023	March 2023
Peri care performed per policy	89%	97%
Secured device present	95%	100%
Collection bag below patient bladder	100%	100%
Tubing free of dependent loop	68%	75%
Bag/tubing secured to bed/chair/foley stand	100%	100%
Bag is hanging free not touching the floor	100%	97%
Documented reason of UC & met criteria	100%	100%

Table 3: Nurses Documentation Audit

Patient Chart Audit	Jan-April 2023	June-July 2023
Indication for catheterization	68%	100%
Catheter care	52%	100%

Table 4: Pre-Prospective and Post-Prospective Questionnaire-Based Survey

Table 4.1: Inclusion criteria or indication for indwelling urinary catheter based on CDC guidelines and microsystem protocol

INDICATION FOR CATHETERIZATION (INCLUSION CRITERIA)	INDICATED/ NOT INDICATED	PRE	POST
Urethral stricture causing obstruction to urinary flow	INDICATED	100%	100%
Neurogenic bladder due to paraplegia or quadriplegia	INDICATED	20%	100%
Prolonged immobilization due to unstable lumbar spine fracture	INDICATED	70%	100%
Urine output monitoring in a mobile patient	NOT INDICATED	90%	100%
Obtaining urine sample for culture and sensitivity testing	NOT INDICATED	10%	86%
Nursing care for incontinent patient	NOT INDICATED	100%	100%
Routinely before any kind of surgical procedure in a patient	NOT INDICATED	80%	86%
Palliative care in terminally ill patient	INDICATED	60%	86%
During labor and delivery that requires epidural	INDICATED	100%	100%
Overall Average Percentage		70%	95%

Table 4.2: Preventive measures

PREVENTIVE MEASURES	EFFECTIVE/ NON-EFFECTIVE	PRE	POST
Hand washing should be done immediately before and after any manipulation of catheter site or apparatus	EFFECTIVE	100%	100%
It should be inserted only when necessary and removed as soon as possible	EFFECTIVE	100%	100%
Avoid kinking of the catheter to maintain an obstructed flow of urine	EFFECTIVE	100%	100%
Collecting bag should be emptied regularly	EFFECTIVE	100%	100%
Twice daily meatal care with antiseptic solution	NON-EFFECTIVE	70%	29%
Isolation of patients known to have UTI from other non-infected patients	NON-EFFECTIVE	60%	100%
Prophylactic antimicrobials should be given for 3 days when catheter is inserted	NON-EFFECTIVE	90%	100%
Regular educational training regarding basic urinary catheter care	EFFECTIVE	100%	100%
Collecting bags should be kept below the level of the bladder	EFFECTIVE	100%	100%
Catheter should be inserted only by personnel proficient in technique of aseptic insertion	EFFECTIVE	90%	100%
Overall Average Percentage		91%	93%

Table 4.3: Attitudes of nurses towards indwelling urinary catheter

ATTITUDES	AGREE/ DISAGREE	PRE	POST
Renewal reminders for catheters prevents CAUTI	AGREE	100%	100%
Catheter can be inserted for nursing staff convenience	DISAGREE	100%	100%
CAUTI not a very serious illness	DISAGREE	100%	100%
Education regarding basic catheter care helps prevent CAUTI	AGREE	100%	100%
Catheter should be removed whenever it is convenience for healthcare provider	DISAGREE	70%	100%
Documentation of the following in the patient record is not necessary: indications for catheter insertion, date and time of insertion and removal	DISAGREE	80%	71%
Overall Average Percentage		92%	95%

Appendix K

GAP Analysis

Gap Analysis		
<p>Area under consideration: Adherence to indwelling catheter algorithm, proper hygiene and decreasing the dwell time of the catheters, CAUTIs will be prevented and reduced by 70% within one year period in the microsystem.</p>		
Desired State	Current State	Action Steps
<p>1. All staff will comply with facility indwelling catheter care protocol and proper hygiene to prevent and reduce CAUTIs.</p>	<p>1. The facility has an indwelling Catheter policy in place and implemented.</p>	<p>1. Staff training</p> <ul style="list-style-type: none"> a. Pre-implementation: Provide staff training and education annually b. Post implementation: Review staff knowledge and effectiveness of policy c. Evaluation: Decreased dwell time. Removal of indwelling Catheter in timely manner as per order Reduced incidence of CAUTI All staff practiced proper hygiene Routine catheter care

Appendix L

Project Charter

Project Charter:

Prevention and reduction of healthcare-associated infection: Catheter-associated urinary tract infection (CAUTI) in the microsystem.

Global Aim:

Adherence to the facility's Foley catheter protocol/algorithm, proper hygiene, and decreasing the dwell time of the catheters, CAUTIs will be prevented and reduced by 70% within one year in the microsystem.

Specific Aim:

The project's main purpose is to prevent and reduce CAUTI by 70% (reaching the SIR equal or less than 0.75) within one year in the microsystem.

Background Information/Rationale for Project:

Healthcare-associated infections (HAIs) are one of the economic burdens due to the high direct medical cost of treatment in the US. According to the Centers for Disease Control and Prevention (CDC), on a given day, one in thirty-one U.S. hospitals has HAIs that have direct medical costs of at least \$28.4 billion each year (CDC, 2015). HAIs are infections acquired while being treated for another condition in a medical facility. One of the most common HAIs is catheter-associated urinary tract infections (CAUTIs). Urinary tract infection (UTI) involves any part of the urinary system that includes the urethra, bladder, ureters, and kidney (CDC, 2015). Approximately 75% of this infection is associated with a urinary catheter (CDC, 2015). Indwelling catheters should only be used for medical necessity and should be removed in a timely manner. To achieve CAUTI prevention and reduction, a unit culture and clinical practice are necessary (AHRQ, 2015). The most common cause of UTI is prolonged use of indwelling urinary catheters. The fishbone diagram illustrates the potential causes and effects of the risk of catheter-associated urinary tract infection (see Appendix A).

The Standardized Infection Ratio goal is less than or equal to 0.75 within a year. This ratio is the benchmark to measure if the project intervention and expected outcome are achievable. The SIR is a summary measure used to track HAIs at a national, local, or state level over time (National Healthcare Safety Network, 2022). Several CAUTI measures and formulas in NHSN are listed in Appendix B. Appendix C shows the flowchart on identifying symptomatic urinary tract infection (SUTI) and asymptomatic bacteremia urinary tract infection (ABUTI) to classify as CAUTI. The flowchart adopted from CDC guidelines on CAUTI prevention.

Sponsors:

QI Manager, Prevention & Infection Head, Unit Manager

Goals for the Project:

The project's main purpose is to prevent and reduce CAUTI by 70% (reaching the SIR equal or less than 0.75) within one year in the microsystem. The objective of the project is to achieve the SIR goal by the end of the fiscal year, the Clinical Nurse Leader (CNL), nurse educator, champion nurses, and all bedside nurses should participate and strictly implement the nurse-driven protocol for indwelling catheter insertion and removal, the bundle of care, proper documentation and staff training. With adherence to these interventions and proper hygiene, CAUTI could have been prevented by 70% within one year in the microsystem.

Measures: Outcome and Process Measures

Outcome and Process Measures

OUTCOME MEASURES

% Symptomatic CAUTI rate

- Number of symptomatic CAUTI
- Number of indwelling catheter-days x 1000

Frequency:

- Monthly

PROCESS MEASURES

% Daily review of urinary catheter necessity

- Number of records of patients with indwelling urinary catheter and daily documentation of indication for continued catheter necessity
- Number of records of patients with indwelling urinary catheters reviewed

Frequency

- Monthly

Credit: CDC NHSN Manual

Balancing Measure(s)

- Using external catheter when indicated and necessary but may cause skin breakdown
- No significant change after implementation of intervention

- The fall rate related to CAUTI is defined as the number of patient falls divided by 1000 bed days.
- The proportion of catheters that reinserted within the 48 hours of removal.
- CAUTI SIR calculated by dividing the number of observed infections by the number of predicted infections (NHSN, 2022).

Team Members:

Quality Nurse, CAUTI Champions, Infection & Preventionist, Unit Manager,
MD's, Staff Developer/Educator/Nurse Coordinator,

References

Agency for Healthcare Research and Quality (AHRQ). (2015). *Toolkit for reducing catheter-associated urinary tract infections in the hospital units: Implementation guide*.

<https://www.ahrq.gov/hai/cauti-tools/guides/implguide-pt1.html>

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Institute for Healthcare Improvement (IHI). (n.d.). *Science of improvement: Testing changes*.

<https://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementTestingChanges.aspx>

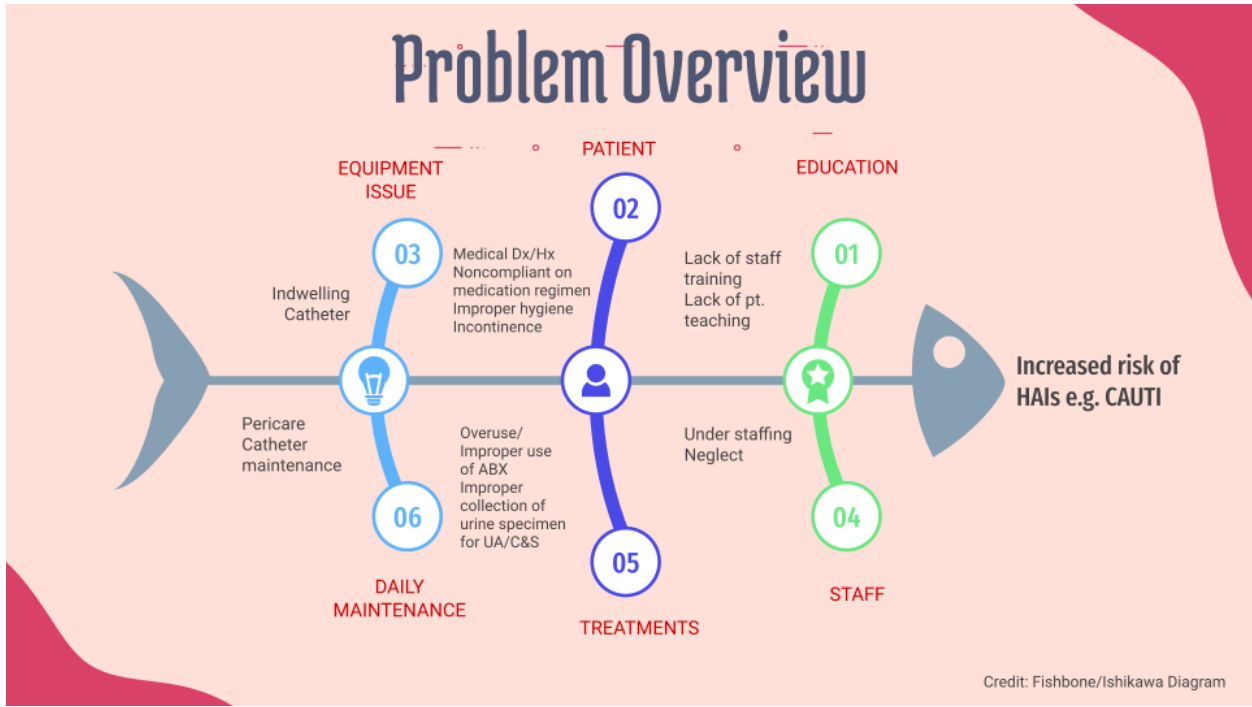
National Healthcare Safety Network (NHSN). (2022). *Urinary tract infection (catheter-associated urinary tract infection) and non catheter associated urinary tract infection events*. <https://www.cdc.gov/nhsn/pdfs/pscmanual/7pscCAUTICurrent.pdf>

National Healthcare Safety Network (NHSN). (2022). *Standard infection ratio*.

<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

Appendix A

Fishbone Diagram



Sources:

Template by slidesgo. <https://slidesgo.com/>

Appendix B

CAUTI Measures

CAUTI Measures Available in NHSN

<u>Measure</u>	<u>Calculation</u>	<u>Application</u>
CAUTI SIR	Number of Observed CAUTIs Number of Predicted CAUTIs	Both location specific and summarized measure
CAUTI Rates	Number of CAUTIs per location Number of Urinary Catheter Days per location * 1000	Location specific measure only
Urinary Catheter SUR	Number of Observed Catheter Days Number of Predicted Catheter Days	Both location specific and summarized measure
DUR	Number of Catheter Days for a location Number of Patient Days for a location	Location specific measure only

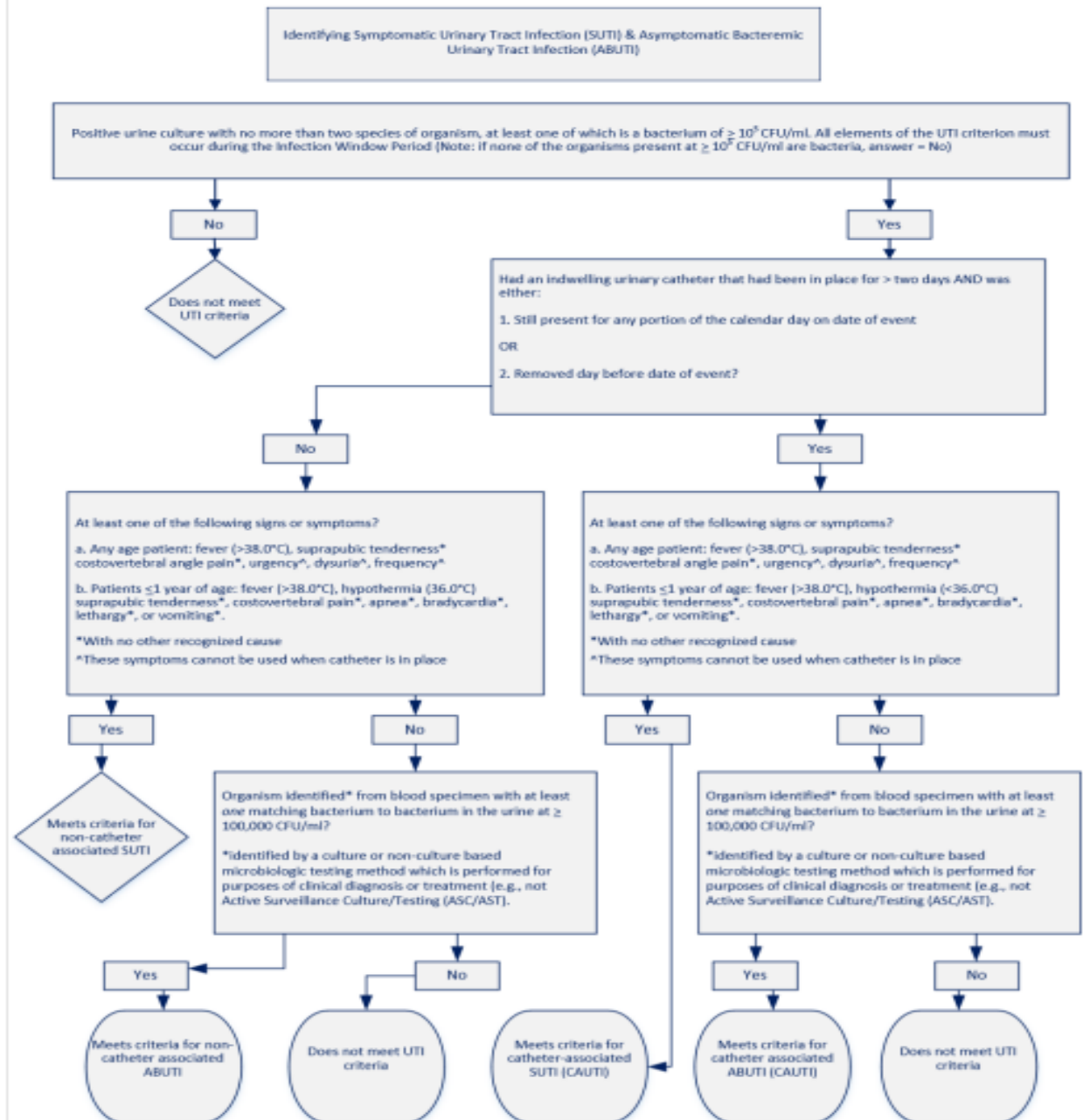
Reference:

National Healthcare Safety Network (NHSN). (2022). *Urinary tract infection (catheter-associated urinary tract infection) and non catheter associated urinary tract infection events*. <https://www.cdc.gov/nhsn/pdfs/pscmanual/7pscCAUTICurrent.pdf>

Appendix C

Identifying SUTI and ABUTI Flowchart from CDC

Figure 2: Identifying SUTI and ABUTI Flowchart



Reference:

National Healthcare Safety Network (NHSN). (2022). *Urinary tract infection (catheter-associated urinary tract infection) and non-catheter associated urinary tract infection events*. <https://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf>

Appendix D

Gantt Chart

Project Timeline

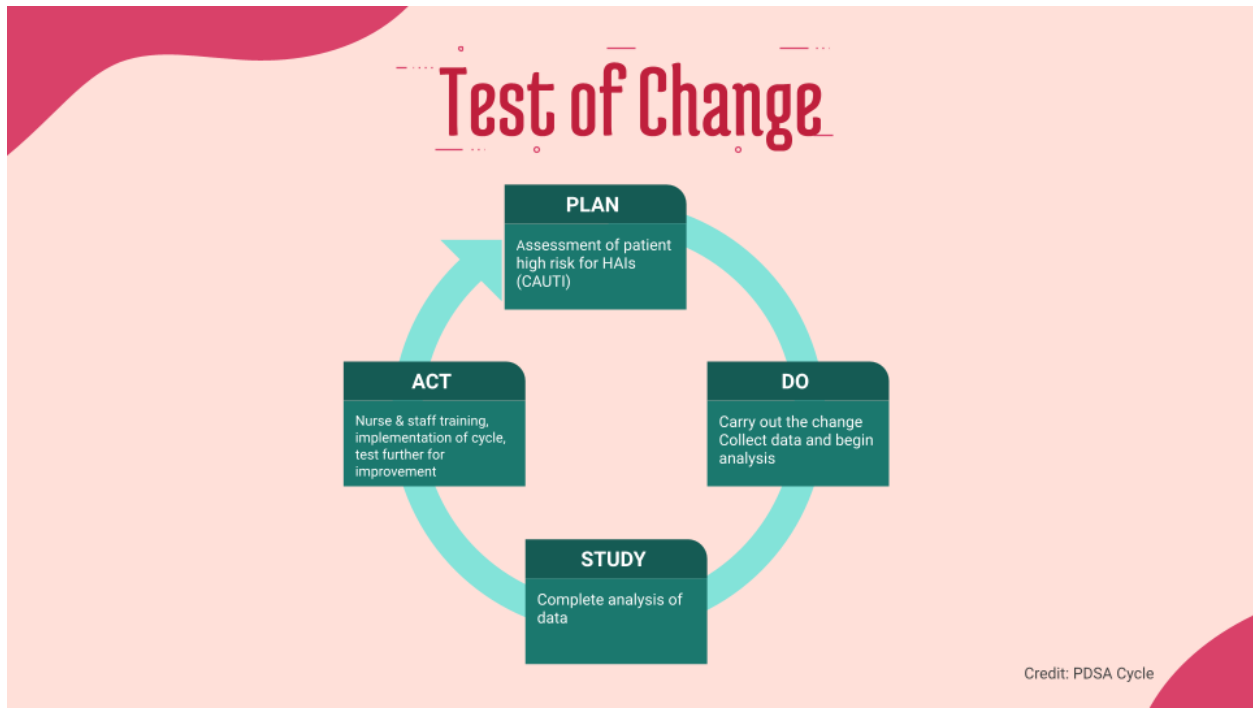
Task	Responsible Person(s)	Oct	Nov	Dec	Jan	Feb	March
Microsystem assessment plan and data collection	CNL						
Project definition, budget & planning	CNL						
Development of task group	CNL						
Review of facility policy	CNL, QAPI						
Staff education and training	Nurse Educator						
Implementation of intervention	CNL, QAPI						
Evaluation & reevaluation	CNL, QAPI						
Plan of Corrections	CNL, QAPI						
Final Project Implementation	CNL, QAPI						

CNL - Clinical Nurse Leader

QAPI - Quality Assurance and Performance Improvement

Appendix E

Plan-Do-Study-Act (PDSA) Cycle



Six Sigma Model

