

Spring 2023

Reducing Catheter-Associated Urinary Tract Infection Rates by Educating Staff on Bundle Interventions

Tirath Kaur
San Jose State University

Follow this and additional works at: https://scholarworks.sjsu.edu/etd_projects



Part of the [Other Nursing Commons](#)

Recommended Citation

Kaur, Tirath, "Reducing Catheter-Associated Urinary Tract Infection Rates by Educating Staff on Bundle Interventions" (2023). *Master's Projects*. 1291.
DOI: <https://doi.org/10.31979/etd.yybn-4bcb>
https://scholarworks.sjsu.edu/etd_projects/1291

This Master's Project is brought to you for free and open access by the Master's Theses and Graduate Research at SJSU ScholarWorks. It has been accepted for inclusion in Master's Projects by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

Reducing Catheter-Associated Urinary Tract Infection

**Reducing Catheter-Associated Urinary Tract Infection
Rates by Educating Staff on Bundle Interventions**

Tirath Kaur RN, BSN

A master project completed in partial fulfillment of the requirements for the degree of Masters Science—Nursing, Family Nurse Practitioner at the Valley Foundation School of Nursing, San José State University

May 1st, 2023

Project Team Members

Lisa Walker-Vischer RN, DNP, CNS, CCRN

Lecturer, San José State University

Masters Project Advisor

Title and Affiliation

Dedication

This project is dedicated to my beloved parents, who educated me and enabled me to reach this level. My father is my primary motivator, and my mother is my faith in accomplishing any goal that I dreamt of. My father always told me, “You can divide property or other materialistic things; however, no one can take your education away from you.” I am lucky that my father taught me to dream big and work hard to achieve my goals.

Acknowledgment

My special gratitude to my professor Dr. Lisa Walker RN, DNP, CNS, CCRN who gave the right direction to my project and advised me throughout this project. My special thanks to my husband, Rajwinder Singh, and my adorable daughter Avnoor Kaur Mann. They supported me and handled my struggles of dedicating my time and energy to this project rather than spending time with them. As I finish this project, I will spend my whole time with my family and try to fulfill the time I missed during this project.

Reducing Catheter-Associated Urinary Tract Infection

Abstract

PURPOSE: Catheter associated urinary tract infection is an undesired burden to the patients and healthcare system. This systematic review explores the published literature and determines the impact of educating nursing staff on the indication of urinary catheter, insertion of foley catheters, maintenance of urinary catheters, and periodical communication between nurses and physicians for changing foley catheters can reduce the CAUTI rates in adult patients in the acute care hospital setting.

METHOD: A systemic review was conducted using CINHALL, Science Direct, PubMed, and MEDLINE within the time period of ten years from 2012 to 2022. Eight published articles are reviewed and used for this systemic review.

RESULTS: There were 62.5 % of studies found a statistically significant reduction in CAUTI rates and 12.5 % of studies found a significant reduction in inpatient catheter days by focusing on multifaceted CAUTI bundle interventions such as educating on the indication for foley catheter, the aseptic technique of urinary catheter insertion, and maintenance of catheter. There were 12.5% of studies that used a single CAUTI intervention such as the aseptic insertion of a foley catheter and there was no significant reduction in CAUTI rates.

CONCLUSION: A significant reduction in CAUTI rates can only happen if nurses use multifaceted CAUTI bundle interventions. The studies that emphasized only on one CAUTI intervention did not significantly reduce CAUTI rates in this systemic review.

Keywords: catheter-associated urinary tract infection, CAUTI rates, decreasing CAUTI, CAUTI bundle interventions, educational interventions, adult patients, and acute care hospital setting

Reducing Catheter-Associated Urinary Tract Infection

Reducing Catheter-Associated Urinary Tract Infection

Rates by Educating Staff on bundle interventions

Background

No one wants to get infected from healthcare-associated infections during their hospital stay. However, according to U.S Centers for Disease Control and Prevention (CDC), about one in 31 hospital patients has at least one healthcare-associated infection on any given day (CDC, 2021). These healthcare-associated infections (HAIs) include central line-associated bloodstream infections, catheter-associated urinary tract infections (CAUTIs), surgical site infections, and ventilator-associated pneumonia (CDC, 2014). According to National Health Safety Network (NHSN) reports, urinary tract infections (UTIs) are the most common type of healthcare-associated infections (CDC, 2015). Mostly healthcare-associated UTIs are caused by the instrumentation of the urinary tract (CDC, 2015).

Between 15% to 25% of hospitalized patients may receive short-term indwelling urinary catheters. Often, healthcare providers are unaware that their patients have foley catheters or catheters that are placed for inappropriate indications, which can lead to prolonged and unnecessary use (CDC, 2015). Approximately 70-80% of UTIs are associated with a urinary catheter, a tube inserted into the bladder through the urethra to drain urine (CDC, 2015). As of October 1, 2008, Medicare was not reimbursing preventable events, which include CAUTIs as well (Calderwood et al., 2018). CAUTIs increase the cost of the hospital due to extended hospital stay and treatment related to CAUTIs. In the United States, each CAUTI is associated with a medical cost of \$758 and a total of over \$340 million each year (National Healthcare Safety Network (NHSN) Catheter-associated Urinary Tract Infection (CAUTI) Outcome Measure 2009). It is estimated that between 17% and 69% of CAUTI can be prevented through

Reducing Catheter-Associated Urinary Tract Infection

recommended infection control measures, which means that up to 380,000 CAUTI-related infections and 9,000 deaths can be prevented each year (CDC, 2015).

The first line of defense against CAUTI is not inserting the indwelling urinary catheter or removing it as soon as possible as per evidence-based guidelines (Greene, 2020). Insertion of a urinary catheter is not without risk as any line or device such as a urinary catheter, central line catheter, and surgical implants inserted into the human body can form a biofilm which means microorganisms can attach to that inserted device which can eventually cause infection (Pelling et al., 2019). Nurses play a crucial role in managing indwelling urinary catheters and can effectively implement core strategies recommended by the CDC to prevent CAUTIs. Nurses can start by reviewing patients' charts daily, and the CDC's prevention criteria for the appropriate use of an indwelling urethral catheter (IUC) to evaluate if the patient still needs IUC or not. In addition, Nurses can receive continuing education and training, emphasizing procedures for insertion and removal of IUC by following the aseptic technique.

According to the 2020 National and State healthcare-associated infections progress report, there is a 10% increase of CAUTI observed in the ICU, apart from that there was no significant change in CAUTI between 2019 and 2020 (CDC, 2021). There are CAUTI bundle interventions guidelines by CDC, however, CAUTI rates are still high. There remains a gap in the implementation of CAUTI bundle interventions. Nurses play an essential role in implementing evidence-based practice interventions. Nurses should frequently get training and education on CAUTI bundle interventions such as step-to-step insertion of foley catheters and maintenance of indwelling urinary catheter.

Reducing Catheter-Associated Urinary Tract Infection

Methods

Study Purpose & Design

The purpose of this systematic review is to examine published literature and determine the impact of educating nursing staff on the indication of urinary catheter, insertion of foley catheters, maintenance of urinary catheters, and periodical communication between nurses and physicians for changing foley catheters can reduce the CAUTI rates in adult patients in the acute care hospital setting.

Search Strategy

The PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines were used to conduct systematic review (Liberati et al., 2009). The research articles were obtained by searching on Google Scholar, PubMed, CINAHL, and MEDLINE within the time period of ten years from 2012 to 2022. The search terms used in the process includes keyword such as catheter-associated urinary tract infection, CAUTI rates, decreasing CAUTI, CAUTI bundle interventions, educational interventions, adult patients, and acute care hospital setting. The search was performed across the databases, and a broad range of articles was found on the above-mentioned search engines. The search was then narrowed down by using a filter for full-text articles, peer-reviewed articles, open access articles, and articles only in English within ten years from 2012 to 2022. The articles not relevant to the research question were removed based on title, abstract review, and duplicity. In the end, eight articles were selected based on inclusive and exclusive criteria (Figure 1).

Inclusion & Exclusion Criteria

The sample characteristics for the research articles included the adult patient population > 18 years old, the patient admitted to the acute care hospital and males and females of all ethnicities,

Reducing Catheter-Associated Urinary Tract Infection

the time frame of a study conducted, educational interventions, and results of CAUTI rates in response to CAUTI bundle educational interventions. Data were extracted based on study design, patient population, types of educational interventions, the target group for intervention, and post interventions follow-up. Most of the selected articles used pre and post-study designs for educational interventions and evaluated the reduction of CAUTI rates after implementing the educational program. One of the selected study articles used a direct observation design for step-to-step insertion of foley catheter and its impact on reducing CAUTI rates (Galiczewski & Shurpina, 2017).

Data Extraction and Analysis

The data from each article was extracted using the literature review matrix template, including author/ date, research question, dependent and independent variable, study design, participant, educational interventions, analysis and results, and conclusion (Table 1). In addition, Google Docs used to organize articles and RefWorks for citing the research articles.

Quality Appraisal

The selected articles are reviewed based on their relevance to the research question and conclusion. The article quality was analyzed by Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals Research Evidence Appraisal Tool (Johns Hopkins Nursing Evidence-based practice: Johns Hopkins Nursing EBP Toolkit, 2022). The primary outcome of this project was to evaluate the impact of CAUTI bundle educational interventions on the reduction of CAUTI rates. The outcome is analyzed by evaluating knowledge on CAUTI bundle interventions before and after the educational program in each article. The secondary outcome was analyzed by reviewing the number of CAUTI rates reduced in each article based on CAUTI bundle educational interventions provided to nursing staff. The Johns Hopkins Evidence-

Reducing Catheter-Associated Urinary Tract Infection

Based Practice Model for Nursing and Healthcare Professionals tool used to analyze the level of study and the quality of each article. The level of study was based on the study design, such as randomized control trial (RCT), the quasi-experimental design, nonexperimental study, and the combination of RCT, quasi-experimental study, and non-experimental study. The quality of each article was based on the consistent, generalizable results, sufficient sample size for the study design, adequate control, definitive conclusions, etc. The quality of each article categorized as high, good, and low quality.

Synopsis of articles

Andrioli et al. (2015) implemented a multifaceted intervention in the cardiac ICU unit and assessed its impact on CAUTI rate, urinary catheter utilization (UCU) ratio, and adherence to recommendations for using indwelling urinary catheters among nurses. The prospective, before, and after intervention study was conducted in three 6-month phases: preintervention (phase 1), intervention (phase 2), and postintervention (phase 3) between April 2011 to September 2012. Phase 1 observed the IUC insertion technique, maintenance care, and removal/non-removal practices. Phase 2 conducted 45 minutes training session on the CAUTI prevention measures, which included avoidance of unnecessary urinary catheters, the aseptic technique of insertion of a urinary catheter, maintenance of urinary catheter, and review of the indication of urinary catheter daily. Phase 3 included evaluating nurses' knowledge using a questionnaire, providing feedback based on observation and evaluation, and posting the incidence of CAUTI rates at the nursing station. The results showed that CAUTI incidence decreased from 11.42 to 4.40 cases/1000 catheter days from phase 1 to phase 3, and nurses' knowledge of indwelling urinary catheter protocol management also significantly increased. However, the UCU ratio remained constant.

Reducing Catheter-Associated Urinary Tract Infection

Bell et al. (2016) did a quality improvement project from September 2013 through March 2015 in Scottsdale Osborn Medical Center intensive care unit. The Alliance of Independent Academic Medical Centers (AIAMC) team was developed which included the family medicine residency director, 2 residents, the chief academic officer, the vice president of quality and safety, the chief medical officer, and an academic project coordinator. AIAMC team developed CAUTI bundle interventions based on evidence-based guidelines. The CAUTI bundle interventions focused on indications for urinary catheters, sterile insertion and appropriate catheter care, and introduced the Stat Lock device to secure catheters and to prevent unwanted movement. Continuing medical education conference was conducted to educate nursing staff, attending physicians, residents, and quality improvement staff on indications for urinary catheters, and strategies to reduce catheter use. Electronic initiation and stop order with the indication of urinary catheter and reason for continued catheter was introduced in the electronic medical record (EMR). The catheter days were reduced from 2697 in 2013 to 1589 in 2015 in medical ICU. The CAUTI rate per 1000 catheter days was 5 in the beginning of 2013 and peaked to 8 in 2014 and then dropped down to 0 CAUTI rate per 1000 catheter days in 2015.

Blondal et al. (2017) did a prospective cohort study in 17 medical-surgical wards at a university hospital with pre and post-design conducted from 2010 to 2012. They evaluated the effect of short educational interventions on nursing personnel on the use of urinary catheters. The interventions included two elements 1) knowledge of approved indications for using a catheter in nurses and doctors 2) three 30-45 minutes of educational sessions including the evidence-based practice of catheter usage for nursing personnel. The educational session focused on four components; to avoid the unnecessary use of a urinary catheter, the aseptic technique of catheter insertion, maintenance of urinary catheter, and daily assessment of unnecessary urinary catheter

Reducing Catheter-Associated Urinary Tract Infection

use and removal. The data were collected from patient records before the educational interventions and 12 months after the educational interventions. The CAUTIs rate reduction was 1.5 infections per 1000 catheter days which was not statistically significant. However, there was a significant reduction in inpatient days with the catheter from 4.5 days to 3.7 days. There is still a need of focusing on the hands-on practice of nursing personnel in the aseptic insertion of foley catheters as this study more focused on the early removal of catheters and assessment of unnecessary catheters rather than on insertion techniques.

Ferguson (2018) evaluated the prevention of CAUTI among hospitalized patients by enhancing the nurse's knowledge of indwelling urinary catheter care with an interactive CAUTI prevention educational program. The two units with the highest CAUTI rates were selected, and a total of 59 nurses participated in the educational program. Pre and post-design were used to evaluate nurses' knowledge of indwelling catheter care and CAUTI rates in the unit before and after the educational interventions. The nurse's knowledge was assessed with fourteen items self-report survey, which included knowledge of institutional policies, indications for foley catheter use, and methods to prevent catheter-associated infections. The educational program included face-to-face instructions with a PowerPoint presentation and video clips. The nurses were evaluated by a post-assessment test and demonstrated skill competency in inserting a foley catheter. There was a reduction in CAUTI rates from the mean of 4.12 to 1.56 per 1000 catheter days and 7.79 to 0 per 1000 catheter days in the telemetry unit and neurotrauma unit respectively. The limitation of this study is that it does not measure the skill competency of proper insertion of foley catheter with aseptic techniques before the educational program as it is an important component in the prevention of CAUTI.

Reducing Catheter-Associated Urinary Tract Infection

Fletcher-Gutowski & Cecil (2019) analyzed the impact of the two-person urinary catheter insertions protocol (UCIP) on reducing CAUTI from 2016 to 2017 in the progressive and pulmonary care units. The checklist for compliance was completed by either two registered nurses or one registered nurse and staff trained in sterile technique and urinary catheterization. The four E's of the Pronovost process was used to engage, educate, execute, and evaluate. The leadership team was engaged by proposing a checklist and two-people UCIP; then, the staff was educated on foley catheter insertion techniques. One RN inserted a foley catheter in the execute phase, and the second RN observed any compromise in sterile techniques and completed the checklist. In the evaluation phase, CAUTI rates were compared before and after the implementation of UCIP, and the results showed a moderately significant ($p= 0.305$) decrease in CAUTI rates.

Gonçalves et al. (2019) performed quasi- experiment study in the ICU of a Hospital in Southeast Brazil. This study was conducted for 12 years, from January 1, 2005- December 31, 2016. The study was conducted in 4 phases, and the first phase (2005-2006) focused on using preventive measures rather than implementing protocol procedures. The second phase was a Bi-annual training (2007-2010). They used CDC guidelines for training which included criteria for indication of Indwelling Catheter, Aseptic techniques for catheter insertion, and measures of preventing CAUTI. The third phase included a denominated checklist and Biannual training (2011-2014). During daily rounds, staff evaluated whether each patient needed a catheter and also monitored the maintenance of the catheter. In the final phase (2015-2016), Bi-annual training for the entire staff was substituted by mandatory training for newly hired personnel along with a daily checklist. The result showed that the rate of urinary catheter utilization decreased from phase 1 to phase 4 (73.1%, 74.1, 54.9% & 45.6%, respectively). Also, the

Reducing Catheter-Associated Urinary Tract Infection

incidence of CAUTI decreased from Phase 1 to Phase 4 (14.9,7.3,3.8 & 1.1 per 1000 catheter days, respectively).

Martínez-Reséndez et al. (2014) aimed to evaluate the impact of chlorhexidine bathing and hand hygiene on reducing nosocomial infection in the acute care setting. They did six months of each three-phase study for a total of eighteen months period from January 2012 to June 2013 on 1007 patients. Three phases included the pre-intervention phase (PIP) (soap and water bathing), intervention 6 phase (IP) (bathing with chlorhexidine wipes and hand hygiene), and post-intervention phase (PoIP) (soap and water bathing). Two weeks prior to the interventional phase, instructions and step-by-step bathing techniques with chlorhexidine wipes were provided. The rates of CAUTI per 1000 catheter days were decreased in the interventional phase compared to the pre and post-interventional phase (PIP16.68, IP-12.62, PoIP-20.32). Nosocomial infection rate per 100 discharges was higher in pre and post interventions than in the interventional phase.

Potugari et al., (2020) aimed to evaluate the Standardized infection rate (SIR) for catheter-associated urinary tract infections (CAUTI) before and after the implementation of a multimodal intervention approach in a rural tertiary hospital from 2015 to 2017. The multimodal interventions included physician and nurse education, daily provider reminders for the clinical necessity of catheters, advocating for alternative toileting options, and emphasis on aseptic techniques for insertion and removal of catheters. After a one-year timeframe of intervention, the Standardized infection rate for CAUTI was significantly reduced from 1.524 to 0.607 (60%), and urinary catheter days were also significantly reduced from 16,195 in 2015 to 13,348 in 2017.

Results

Total 1048 number of articles identified through database searching CINHALL, Cochrane library, PubMed, Google scholar. The duplicate articles were removed which resulted 816

Reducing Catheter-Associated Urinary Tract Infection

articles. Out of 816 articles, 789 articles were eliminated based on title, abstract review, inclusion and exclusion criteria. Out of 27 selected articles, 19 articles were excluded as those were not available for free. The eight study articles are included in the final analysis (Figure 1).

Theme 1: Population & setting

Five of the eight studies were conducted in the United States, and three were conducted in Iceland, Brazil, and Mexico. Six studies focused on educational training to the nursing staff, while two focused on educational training for the physicians and nursing staff.

Theme 2: Study design and sample size

The sample of the patient population with catheter range from 108 to 1007 patients. Five of the eight studies (62.5 %) used pre and post-study designs, while the other three (37.5%) used prospective cohort study and quasi-experimental study designs. One study used 59 nursing staff as participants in CAUTI bundle educational training (Ferguson, 2018).

Theme 3: Multifaceted CAUTI bundle intervention

Six of eight studies (75%) used multifaceted CAUTI bundle intervention to reduce CAUTI rates. These studies focused on educational training that includes an indication for catheter use, the aseptic technique of catheter insertion, and maintenance of the catheter. There were 62.5 % of studies found a statistically significant reduction in CAUTI rates by focusing on multifaceted CAUTI bundle interventions. In 12.5% of the studies, CAUTI rate reduction was not statistically significant with the implementation of CAUTI bundle interventions. However, there was a significant reduction in inpatient days with the catheter (Blondal et al., 2017).

Theme 4: CAUTI intervention focusing only on aseptic insertion of foley catheter

One study focused only on one element of CAUTI bundle intervention (Fletcher-Gutowski & Cecil, 2019). This study focused on the insertion of the foley catheter with sterile technique,

Reducing Catheter-Associated Urinary Tract Infection

However, the reduction of the CAUTI rates were not statistically significant (Fletcher-Gutowski & Cecil, 2019).

Theme 5: CAUTI intervention focusing on hand hygiene and daily chlorhexidine bath

One study emphasized only on hand hygiene and daily chlorhexidine bathing (Martínez-Reséndez et al., 2014). This study noted a significant reduction in CAUTIs rate (Martínez-Reséndez et al., 2014).

Discussion

The nursing staff's educational training and implementation of CAUTI bundle interventions, such as daily assessment for indication of catheter use, an aseptic technique of inserting a urinary catheter, and maintenance of urinary catheter, have a positive impact on the reduction of CAUTI rates as well as the reduction in catheter days. Majority of the studies used all elements of CAUTI bundle interventions which reduced CAUTI rates significantly. One study used daily chlorhexidine baths and hand hygiene as intervention, and surprisingly there was a significant reduction in CAUTI rates (Martínez-Reséndez et al., 2014). In one study by Blondal et al., the short educational interventions significantly reduced inpatient days with the catheter. However, the educational interventions did not affect the decision to urinary catheter insertion in the first place, which ironically impacted the reduction of CAUTI rates (Blondal et al., 2017). Furthermore, the lack of qualified champions in the wards to implement new changes also affected the CAUTI rates in this study (Blondal et al., 2017).

Fletcher-Gutowski & Cecil, 2019, emphasized their study on aseptic insertion of urinary catheters only. However, there was no significant reduction in CAUTI rates, meaning only sterile insertion of the urinary catheter cannot prevent CAUTI rates. It is essential to implement all

Reducing Catheter-Associated Urinary Tract Infection

elements of CAUTI bundle interventions and, most importantly, early removal of a urinary catheter, daily assessment of indication for urinary catheter, and maintenance of urinary catheter.

Limitations and Gaps

Some of the articles were not explored in this systematic review due to a lack of free access, which can impact the results of the systemic review. In addition, this systematic review was limited to a period between 2012 to 2022 and was limited to English language articles only which can also impact the conclusion of this systematic study. Furthermore, there is a risk of bias, such as inadequate blinding, attrition bias, and selective outcome reporting, as the writer of this systematic review is a novice and the only single reviewer in analyzing published literature results.

Most studies used all elements of CAUTI bundle interventions, and it is hard to decide which intervention is most effective in reducing the CAUTI rates. Some studies used all elements of CAUTI bundle intervention, yet there was no significant reduction in CAUTI rates based on the educational method they used in the study (Blondal et al., 2017). In the study done by Bell et al. (2016), CAUTI rates also decreased due to a change in the national definition of CAUTI. There was a 25-30% reduction in reported CAUTI cases based on the new CAUTI definition. It was complicated to determine if the CAUTI rates decreased due to educational interventions or the change in the definition of CAUTI rates. There should be further research on each CAUTI intervention and their relationship to a reduction in CAUTI rates individually. Furthermore, there should be further research on methods of implementing educational training for the nursing staff to assess which training method is effective.

Reducing Catheter-Associated Urinary Tract Infection

Conclusions and Practice Implications

The impact of CAUTI on patients and the health care system include sepsis, morbidity, mortality, and increased hospital length of stay, which increases the cost of the stay. It is vital to prevent CAUTI rates as they affect patients and the health care system. Providing training about CAUTI bundle intervention is economically less costly than treating CAUTI. In this systematic literature review, most of the study articles used CAUTI interventions in a bundle, which significantly reduced the CAUTI rates in hospital settings. Few studies focused on only one or two interventions, such as hand hygiene, daily chlorhexidine bath, and aseptic catheter insertion technique. The studies that emphasized only on one intervention did not significantly reduce CAUTI rates. A significant reduction in CAUTI rates can only happen if nurses use multifaceted CAUTI bundle interventions.

References

- Andrioli, E. R., Furtado, G. H. C., & Medeiros, E. A. (2015, November 14). *Catheter-associated urinary tract infection after cardiovascular surgery: Impact of a multifaceted intervention*. American journal of infection control. Retrieved December 2, 2022, from <https://pubmed.ncbi.nlm.nih.gov/26585248/>
- Bell, M. M., Alaestante, G., & Finch, C. (2016). *A multidisciplinary intervention to prevent catheter-associated urinary tract infections using education, continuum of care, and systemwide buy-in*. The Ochsner journal. Retrieved February 3, 2023, from <https://pubmed.ncbi.nlm.nih.gov/27046414/>
- Blondal, K., Ingadottir, B., Einarsdottir, H., Bergs, D., Steingrimsdottir, I., Steindorsdottir, S., Gudmundsdottir, G., & Hafsteinsdottir, E. (2017). *The effect of a short educational intervention on the use of urinary catheters: A prospective cohort study*. International journal for quality in health care : journal of the International Society for Quality in Health Care. Retrieved March 29, 2022, from <https://pubmed.ncbi.nlm.nih.gov/27664821/>
- Calderwood, M. S., Kawai, A. T., Jin, R., & Lee, G. M. (2018, June 28). *Centers for Medicare and Medicaid Services Hospital-acquired conditions policy for Central line-associated bloodstream infection (CLABSI) and Catheter-associated urinary tract infection (CAUTI) shows minimal impact on hospital reimbursement: Infection Control & Hospital Epidemiology*. Cambridge Core. Retrieved March 2, 2022, from <https://www.cambridge.org/core/journals/infection-control-and-hospital->

Reducing Catheter-Associated Urinary Tract Infection

epidemiology/article/abs/centers-for-medicare-and-medicaid-services-hospitalacquired-conditions-policy-for-central-lineassociated-bloodstream-infection-clabsi-and-catherassociated-urinary-tract-infection-cauti-shows-minimal-impact-on-hospital-reimbursement/945EB1EDE41BB4248A4C37D90D15168A

Centers for Disease Control and Prevention. (2014, March 26). *Types of healthcare-associated infections*. Centers for Disease Control and Prevention. Retrieved March 29, 2023, from <https://www.cdc.gov/hai/infectiontypes.html>

Centers for Disease Control and Prevention. (2015a, November 5). *Background*. Centers for Disease Control and Prevention.

<https://www.cdc.gov/infectioncontrol/guidelines/cauti/background.html>

Centers for Disease Control and Prevention. (2015b, November 5). *Evidence review*. Centers for Disease Control and Prevention.

<https://www.cdc.gov/infectioncontrol/guidelines/cauti/evidence-review.html>

Centers for Disease Control and Prevention. (2019). CAUTI guidelines - CDC.

<https://www.cdc.gov/infectioncontrol/pdf/guidelines/cauti-guidelines-H.pdf>

Centers for Disease Control and Prevention. (2019, December 24). National Healthcare Safety Network (NHSN) Catheter-associated Urinary Tract Infection (CAUTI) Outcome Measure.

Retrieved March 29, 2023, from <https://www.cdc.gov/nhsn/psc/uti/index.html>

Reducing Catheter-Associated Urinary Tract Infection

Centers for Disease Control and Prevention. (2021, November 10). *Healthcare-associated infections (HAIS)*. Centers for Disease Control and Prevention. Retrieved March 29, 2023, from <https://www.cdc.gov/hai/index.html>

Centers for Disease Control and Prevention. (2022, November 4). *Current hai progress report*. Centers for Disease Control and Prevention. Retrieved March 29, 2023, from <https://www.cdc.gov/hai/data/portal/progress-report.html>

Ferguson, A. (2018). *Implementing A CAUTI prevention program in an acute care hospital setting*. The Free Library. Retrieved March 28, 2022, from <https://www.thefreelibrary.com/Implementing+a+CAUTI+Prevention+Program+in+an+Acute+Care+Hospital...-a0568974209>

Fletcher-Gutowski, S., & Cecil, J. (2019, July 16). *Is 2-person urinary catheter insertion effective in reducing CAUTI?* American Journal of Infection Control. Retrieved March 26, 2022, from <https://www.sciencedirect.com/science/article/pii/S0196655319305759#tbl0001>

Galiczewski, J. M., & Shurpina, K. M. (2017, June). *Dr. Martin Luther King Jr.. library*. San Jose State University Library. Retrieved April 19, 2022, from <https://www-sciencedirect-com.libaccess.sjlibrary.org/science/article/pii/S096433971630180X>

Gonçalves, M. M., Marcia, C., Fernando, B. R., Auxiliadora, M. M., & Gambero, aspar G. (2019, February). *Long term prevention of catheter associated - downloaded from journals.lww/md-journal by. StuDocu*. Retrieved December 2, 2022, from

Reducing Catheter-Associated Urinary Tract Infection

<https://www.studocu.com/en-us/document/university-of-georgia/seminar-med-and-surg/long-term-prevention-of-catheter-associated/13665779>

Greene, L. R. (2020, April 1). *CAUTI prevention and urinary catheter maintenance*. American Nurse. Retrieved March 7, 2022, from <https://www.myamericannurse.com/cauti-prevention-and-urinary-catheter-maintenance/>

Johns Hopkins Nursing Evidence-based practice: Johns Hopkins Nursing EBP Toolkit. Subject Guides. (2022, March 19). Retrieved April 19, 2022, from <https://guides.upstate.edu/c.php?g=1023176&p=7411265>

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009, July 21). *The prisma statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration*. The BMJ. Retrieved April 19, 2022, from <https://www.bmj.com/content/339/bmj.b2700>

Martínez-Reséndez, M. F., Garza-González, E., Mendoza-Olazarán, S., Herrera-Guerra, A., Rodríguez-López, J. M., Pérez-Rodríguez, E., Mercado-Longoria, R., & Camacho-Ortiz, A. (2014, May 13). *Impact of daily chlorhexidine baths and hand hygiene compliance on nosocomial infection rates in critically ill patients*. American Journal of Infection Control. Retrieved March 26, 2022, from <https://www.sciencedirect.com/science/article/pii/S0196655314005859>

Reducing Catheter-Associated Urinary Tract Infection

National Healthcare Safety Network (NHSN) catheter-associated urinary ... (2009).

<https://www.hospitalsafetygrade.org/media/file/CAUTI.pdf>

Pelling, H., Nzakizwanayo, J., Milo, S., Denhem, E. L., MacFarlane, W. N., Bock, L. J., Sutton, J. M., & Jones, B. V. (2019, April 1). *Bacterial biofilm formation on indwelling urethral catheters*. *Letters in applied microbiology*. Retrieved March 3, 2022, from

<https://pubmed.ncbi.nlm.nih.gov/30811615/>

Potugari, B. R., Umukoro, P. E., & Vedre, J. G. (2020, April 27). *Multimodal intervention approach reduces catheter-associated urinary tract infections in a rural tertiary care center*. *Clinical medicine & research*. Retrieved February 3, 2023, from

<https://pubmed.ncbi.nlm.nih.gov/32340983/>

Reducing Catheter-Associated Urinary Tract Infection

Table 1.

Methodologic Matrix for Recording Key Methodologic Features of Studies for a Literature Review

Author s	Pu b Yr	Co un try	Depen dent Variab les	Independent Variables	Stud y Desig n	Sampl e Size	Sampl ing Method	Data Collection	Analysis & Results	Implications for practice	Level/ Quality
Andrioli et al.	2016	U.S.A.	CAUTI rates, urinary catheter utilization ratio, Knowledge of nursing staff	CAUTI bundle interventions (avoid unnecessary urinary catheters, insert urinary catheters using aseptic technique, maintain urinary catheters based on recommended guidelines, and review the need for urinary catheterization daily and remove catheters promptly when indicated), Training of nursing staff	Prospective, before and after interventional study	Patients with catheters = 108	voluntary and anonymous.	Observation, questionnaire	The results showed that CAUTI incidence decreased from 11.42 to 4.40 cases/1000 catheter days from phase 1 to phase 3, and nurses' knowledge of indwelling urinary catheter protocol management also significantly increased. However, the UCU ratio remained constant.	A multifaceted intervention composed of IUC insertion, maintenance and training of nursing staff can help with reduction in CAUTI rates	II/ Good quality

Reducing Catheter-Associated Urinary Tract Infection

Bell et al.	2016	U.S.A	Inpatient catheter days, CAUTI rates	Education on CAUTI bundle interventions: indications for urinary catheters, sterile insertion and appropriate catheter care, and the Stat Lock device to secure catheters; electronic stop order reminder to the physicians	Quality improvement project	N/A	Convenience	Track the daily patient census, EMR	The catheter days were reduced from 2697 in 2013 to 1589 in 2015 in medical ICU. The CAUTI rate per 1000 catheter days was 5 in the beginning of 2013 and peaked to 8 in 2014 and then dropped down to 0 CAUTI rate per 1000 catheter days in 2015.	The combination of education, electronic reminders, and daily tracking can help to reduce CAUTI rates.	II/ Low quality
Blondal et al.	2017	Iceland	Number of inpatient days with the catheter, Number of catheter days without appropriate indications,	Aligning doctors and nurses' knowledge of approved indications for use of catheters, Educational training on the indication of use of catheters.	Prospective Cohort study	Patient with catheter= 244 (pre), patient with catheter = 255 (post)	Convenience	Data collection form, Observation	The CAUTIs rate reduction was 1.5 infections per 1000 catheter days which was not statistically significant. However, there was a significant reduction in inpatient days with the catheter from 4.5 days to 3.7 days	Short educational sessions for nursing personnel can increase the knowledge and awareness of CAUTI which can eventually help with CAUTI reduction.	II/ Good quality

Reducing Catheter-Associated Urinary Tract Infection

			CAUTI rates,								
Ferguson, A.	2018	U.S.A.	Nurse's knowledge on appropriate indwelling urinary catheter care, CAUTI rates,	Educational training to nurses on Indications for Foley catheter use, methods to prevent catheter-related infections	Pre and post-survey design	59 nurses from 2 units within 393-bed acute care hospital	Convenience/voluntary	A 14- item self-report questionnaire, Observation	A reduction in CAUTI rates from the mean of 4.12 to 1.56 per 1000 catheter days and 7.79 to 0 per 1000 catheter days in the telemetry unit and neurotrauma unit respectively. There was a 22% increase in nurse knowledge on guidelines of when to insert or remove a foley catheter.	This CAUTI prevention educational program can be easily used in clinical practice to reduce CAUTI rates	II/ Good quality
Fletcher-Gutowski & Cecil	2019	U.S.A.	CAUTI rates	Educational training of nursing staff on sterile technique and urinary catheter insertion, 2- person urinary catheter insertion	Pre and post-study design	692 patients	Convenience	Checklist, observation	Results showed a decrease in CAUTI rates in the pulmonary and progressive care units. However, the results were not statistically significant.	The emphasis on proper aseptic insertion techniques can help to prevent CAUTI rates in a patient who needs intermittent catheterization or indwelling catheter due to a neurogenic bladder	II/ Good quality

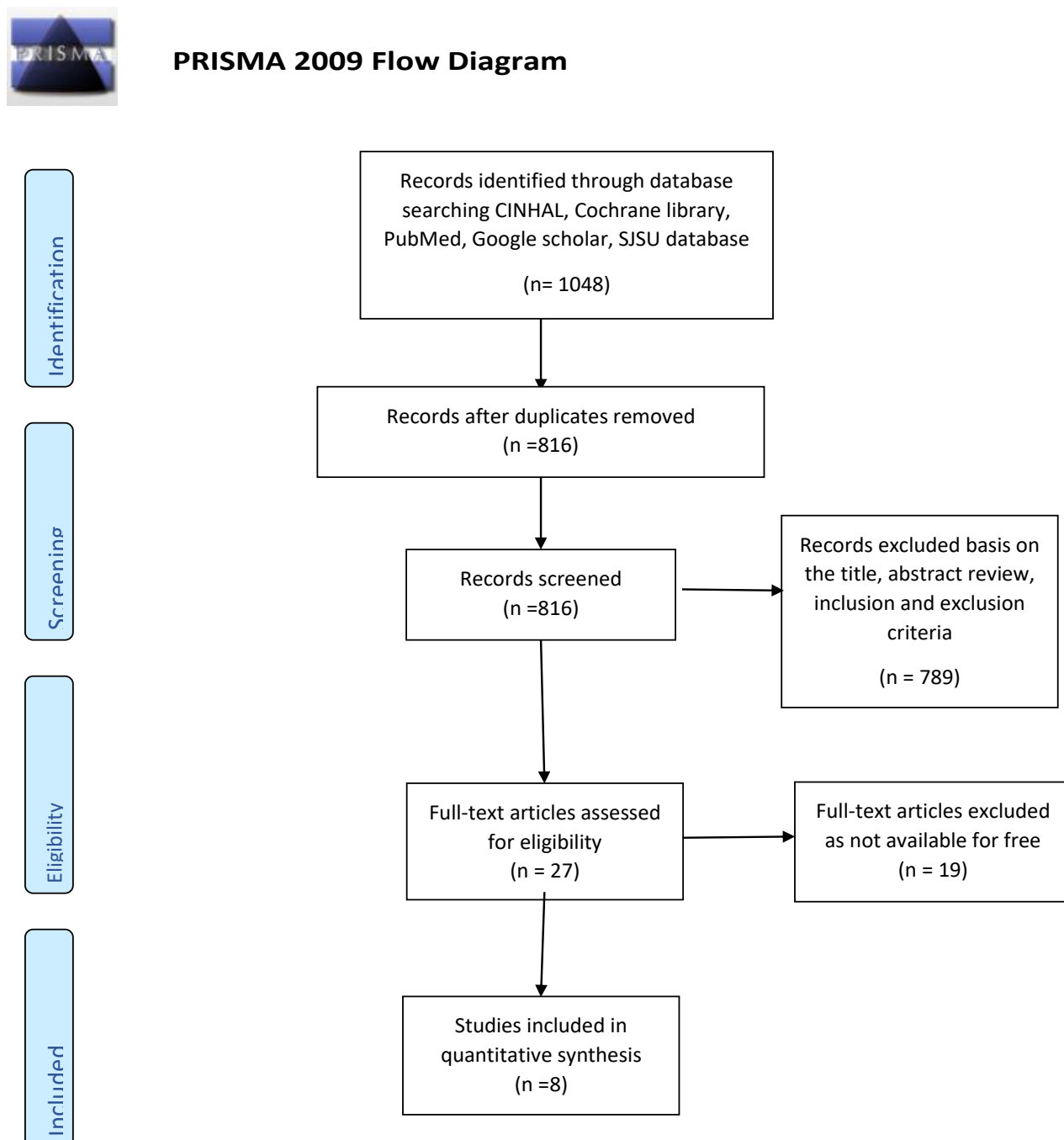
Reducing Catheter-Associated Urinary Tract Infection

Gonçalves et al	2019	South east Brazil	Urinary catheter utilization rate, the incidence density of CAUTI	Biannual educational training of clinical team on criteria for indication of use of an indwelling urinary catheter, aseptic techniques for catheter insertion, and measures for preventing CAUTI; daily checklist to evaluate the indication of urinary catheter.	quasi-experiment study	250 patients/month for 12 years	Convenience	Self-report questionnaire	The result showed that the rate of urinary catheter utilization decreased from phase 1 to phase 4 (73.1%, 74.1, 54.9% & 45.6%, respectively). Also, the incidence of CAUTI decreased from Phase 1 to Phase 4 (14.9,7.3,3.8 & 1.1 per 1000 catheter days, respectively).	Health Care Workers education and daily evaluation of indwelling urinary catheter indications can be highly effective in the long-term reduction of catheter utilization rates as well as the incidence density of CAUTI.	II/ Good quality
Martínez-Reséndez et al.	2014	Mexico	CAUTI rates,	Daily chlorohexidine bath, hand hygiene	Pre and post-study design	1007 patients.	Convenience	Nosocomial infection surveillance	The rates of CAUTI per 1000 catheter days were decreased in the interventional phase compared to the pre and postinterventional phase (IP-12.62, PIP-16.68, PoIP20.32).	CHG bath and hand hygiene can easily be implemented in practice to reduce nosocomial infection	II/ Good quality

Reducing Catheter-Associated Urinary Tract Infection

Potugari et al.	2020	U.S.A	The Standardized infection rate for CAUTI, and the number of urinary catheter days.	A multimodal educational intervention to physicians and nursing staff, daily provider reminders for the clinical necessity of catheters, Aseptic technique of insertion of the catheter, and appropriate usage of urinary catheter	Pre and post study design	504-bed hospital	convenience	monthly monitoring of CAUTI incidence and surveillance	Significant reduction in Standardized infection rate for CAUTI from 1.524 to 0.607 (60%), and urinary catheter days were also significantly reduced from 16,195 in 2015 to 13,348 in 2017.	The multi model educational interventions composed of provider education, proper insertion of catheter, and monthly surveillance can help to reduce the CAUTI rates in the hospital setting.	II/ Good quality
-----------------	------	-------	---	--	---------------------------	------------------	-------------	--	--	--	---------------------

Figure 1.



Appendix

Annotated bibliography

Andrioli, E. R., Furtado, G. H. C., & Medeiros, E. A. (2015, November 14). *Catheter-associated urinary tract infection after cardiovascular surgery: Impact of a multifaceted intervention*. American journal of infection control. Retrieved December 2, 2022, from <https://pubmed.ncbi.nlm.nih.gov/26585248/>

In this article, Andrioli et al. implemented a multifaceted intervention in the cardiac ICU unit and assessed its impact on CAUTI rate, urinary catheter utilization (UCU) ratio, and adherence to recommendations for using indwelling urinary catheters among nurses. The prospective, before, and after intervention study was conducted in three 6-month phases: preintervention (phase 1), intervention (phase 2), and postintervention (phase 3) between April 2011 to September 2012. Phase 1 observed the IUC insertion technique, maintenance care, and removal/non-removal practices. Phase 2 conducted 45 minutes training session on the CAUTI prevention measures, which included avoidance of unnecessary urinary catheters, the aseptic technique of insertion of a urinary catheter, maintenance of urinary catheter, and review of the indication of urinary catheter daily. Phase 3 included evaluating nurses' knowledge using a questionnaire, providing feedback based on observation and evaluation, and posting the incidence of CAUTI rates at the nursing station. The results showed that CAUTI incidence decreased from 11.42 to 4.40 cases/1000 catheter days from phase 1 to phase 3, and nurses' knowledge of indwelling urinary catheter protocol management also significantly increased. However, the UCU ratio remained constant.

Reducing Catheter-Associated Urinary Tract Infection

Bell, M. M., Alaestante, G., & Finch, C. (2016). *A multidisciplinary intervention to prevent catheter-associated urinary tract infections using education, continuum of care, and systemwide buy-in*. *The Ochsner journal*. Retrieved February 3, 2023, from <https://pubmed.ncbi.nlm.nih.gov/27046414/>

Bell et al. (2016) did a quality improvement project from September 2013 through March 2015 in Scottsdale Osborn Medical Center intensive care unit. The Alliance of Independent Academic Medical Centers (AIAMC) team was developed which included the family medicine residency director, 2 residents, the chief academic officer, the vice president of quality and safety, the chief medical officer, and an academic project coordinator. AIAMC team developed CAUTI bundle interventions based on evidence-based guidelines. The CAUTI bundle interventions focused on indications for urinary catheters, sterile insertion and appropriate catheter care, and introduced the Stat Lock device to secure catheters and to prevent unwanted movement. Continuing medical education conference was conducted to educate nursing staff, attending physicians, residents, and quality improvement staff on indications for urinary catheters, and strategies to reduce catheter use. Electronic initiation and stop order with the indication of urinary catheter and reason for continued catheter was introduced in the electronic medical record (EMR). The catheter days were reduced from 2697 in 2013 to 1589 in 2015 in medical ICU. The CAUTI rate per 1000 catheter days was 5 in the beginning of 2013 and peaked to 8 in 2014 and then dropped down to 0 CAUTI rate per 1000 catheter days in 2015

Blondal, K., Ingadottir, B., Einarsdottir, H., Bergs, D., Steingrimsdottir, I., Steindorsdottir, S., Gudmundsdottir, G., & Hafsteinsdottir, E. (2017). *The effect of a short educational*

Reducing Catheter-Associated Urinary Tract Infection

intervention on the use of urinary catheters: A prospective cohort study. International journal for quality in health care : journal of the International Society for Quality in Health Care. Retrieved November 28, 2022, from <https://pubmed.ncbi.nlm.nih.gov/27664821/>

In this article, Blondal et al. (2017) did a prospective cohort study in 17 medical-surgical wards at a university hospital with pre and post-design conducted from 2010 to 2012. They evaluated the effect of short educational interventions on nursing personnel on the use of urinary catheters. The interventions included two elements 1) knowledge of approved indications for using a catheter in nurses and doctors 2) three 30-45 minutes of educational sessions including the evidence-based practice of catheter usage for nursing personnel. The educational session focused on four components; to avoid the unnecessary use of a urinary catheter, the aseptic technique of catheter insertion, maintenance of urinary catheter, and daily assessment of unnecessary urinary catheter use and removal. The data were collected from patient records before the educational interventions and 12 months after the educational interventions. The CAUTIs rate reduction was 1.5 infections per 1000 catheter days which was not statistically significant. However, there was a significant reduction in inpatient days with the catheter from 4.5 days to 3.7 days. There is still a need of focusing on the hands-on practice of nursing personnel in the aseptic insertion of foley catheters as this study more focused on the early removal of catheters and assessment of unnecessary catheters rather than on insertion techniques.

Ferguson, A. (2018). *Implementing A CAUTI prevention program in an acute care hospital setting*. The Free Library. Retrieved November 28, 2022, from

Reducing Catheter-Associated Urinary Tract Infection

<https://www.thefreelibrary.com/Implementing+a+CAUTI+Prevention+Program+in+an+Acute+Care+Hospital...-a0568974209>

Ferguson (2018) evaluated the prevention of CAUTI among hospitalized patients by enhancing the nurse's knowledge of indwelling urinary catheter care with an interactive CAUTI prevention educational program. The two units with the highest CAUTI rates were selected, and a total of 59 nurses participated in the educational program. Pre and post-design were used to evaluate nurses' knowledge of indwelling catheter care and CAUTI rates in the unit before and after the educational interventions. The nurse's knowledge was assessed with fourteen items self-report survey, which included knowledge of institutional policies, indications for foley catheter use, and methods to prevent catheter-associated infections. The educational program included face-to-face instructions with a PowerPoint presentation and video clips. The nurses were evaluated by a post-assessment test and demonstrated skill competency in inserting a foley catheter. There was a reduction in CAUTI rates from the mean of 4.12 to 1.56 per 1000 catheter days and 7.79 to 0 per 1000 catheter days in the telemetry unit and neurotrauma unit respectively. The limitation of this study is that it does not measure the skill competency of proper insertion of foley catheter with aseptic techniques before the educational program as it is an important component in the prevention of CAUTI.

Fletcher-Gutowski, S., & Cecil, J. (2019, July 16). *Is 2-person urinary catheter insertion effective in reducing CAUTI?* American Journal of Infection Control. Retrieved November 26, 2022, from <https://www.sciencedirect.com/science/article/pii/S0196655319305759#tbl0001>

Reducing Catheter-Associated Urinary Tract Infection

Fletcher-Gutowski & Cecil (2019) analyzed the impact of the two-person urinary catheter insertions protocol (UCIP) on reducing CAUTI from 2016 to 2017 in the progressive and pulmonary care units. The checklist for compliance was completed by either two registered nurses or one registered nurse and staff trained in sterile technique and urinary catheterization. The four E's of the Pronovost process was used to engage, educate, execute, and evaluate. The leadership team was engaged by proposing a checklist and two-people UCIP; then, the staff was educated on foley catheter insertion techniques. One RN inserted a foley catheter in the execute phase, and the second RN observed any compromise in sterile techniques and completed the checklist. In the evaluation phase, CAUTI rates were compared before and after the implementation of UCIP, and the results showed a moderately significant ($p= 0.305$) decrease in CAUTI rates.

Gonçalves, M. M., Marcia, C., Fernando, B. R., Auxiliadora, M. M., & Gambero, aspar G. (2019, February). *Long term prevention of catheter associated* - downloaded from *journals.lww/md-journal* by. StuDocu. Retrieved December 2, 2022, from <https://www.studocu.com/en-us/document/university-of-georgia/seminar-med-and-surg/long-term-prevention-of-catheter-associated/13665779>

In this article, Gonçalves et al performed quasi- experiment study in the ICU of a Hospital in Southeast Brazil. This study was conducted for 12 years, from January 1, 2005- December 31, 2016. The study was conducted in 4 phases, and the first phase (2005-2006) focused on using preventive measures rather than implementing protocol procedures. The second phase was a Bi-annual training (2007-2010). They used CDC guidelines for training which included criteria for

Reducing Catheter-Associated Urinary Tract Infection

indication of Indwelling Catheter, Aseptic techniques for catheter insertion, and measures of preventing CAUTI. The third phase included a denominated checklist and Biannual training (2011-2014). During daily rounds, staff evaluated whether each patient needed a catheter and also monitored the maintenance of the catheter. In the final phase (2015-2016), Bi-annual training for the entire staff was substituted by mandatory training for newly hired personnel along with a daily checklist. The result showed that the rate of urinary catheter utilization decreased from phase 1 to phase 4 (73.1%, 74.1, 54.9% & 45.6%, respectively). Also, the incidence of CAUTI decreased from Phase 1 to Phase 4 (14.9,7.3,3.8 & 1.1 per 1000 catheter days, respectively).

Martínez-Reséndez, M. F., Garza-González, E., Mendoza-Olazarán, S., Herrera-Guerra, A., Rodríguez-López, J. M., Pérez-Rodríguez, E., Mercado-Longoria, R., & Camacho-Ortiz, A. (2014, May 13). *Impact of daily chlorhexidine baths and hand hygiene compliance on nosocomial infection rates in critically ill patients*. *American Journal of Infection Control*. Retrieved November 28, 2022, from <https://www.sciencedirect.com/science/article/pii/S0196655314005859>

Martínez-Reséndez et al. (2014) aimed to evaluate the impact of chlorhexidine bathing and hand hygiene on reducing nosocomial infection in the acute care setting. They did six months of each three-phase study for a total of eighteen months period from January 2012 to June 2013 on 1007 patients. Three phases included the pre-intervention phase (PIP) (soap and water bathing), intervention 6 phase (IP) (bathing with chlorhexidine wipes and hand hygiene), and post-intervention phase (PoIP) (soap and water bathing). Two weeks prior to the interventional phase,

Reducing Catheter-Associated Urinary Tract Infection

instructions and step-by-step bathing techniques with chlorhexidine wipes were provided. The rates of CAUTI per 1000 catheter days were decreased in the interventional phase compared to the pre and post-interventional phase (PIP16.68, IP-12.62, PoIP-20.32). Nosocomial infection rate per 100 discharges was higher in pre and post interventions than in the interventional phase.

Potugari , B. R., Umukoro , P. E., & Vedre , J. G. (2020, April 27). *Multimodal intervention approach reduces catheter-associated urinary tract infections in a rural tertiary care center*. Clinical medicine & research. Retrieved February 3, 2023, from <https://pubmed.ncbi.nlm.nih.gov/32340983/>

Potugari et al., (2020) aimed to evaluate the Standardized infection rate (SIR) for catheter-associated urinary tract infections (CAUTI) before and after the implementation of a multimodal intervention approach in a rural tertiary hospital from 2015 to 2017. The multimodal interventions included physician and nurse education, daily provider reminders for the clinical necessity of catheters, advocating for alternative toileting options, and emphasis on aseptic techniques for insertion and removal of catheters. After a one-year timeframe of intervention, the Standardized infection rate for CAUTI was significantly reduced from 1.524 to 0.607 (60%), and urinary catheter days were also significantly reduced from 16,195 in 2015 to 13,348 in 2017.