Daily Rounding to Reduce Catheter-Associated Urinary Tract Infections in a Rehabilitation Facility

Submitted by

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Abstract

Despite national efforts to reduce catheter-associated urinary tract infections (CAUTIs), healthcare facilities continue to report CAUTI events. The project site reported CAUTI rates above local and national benchmarks even though a CAUTI bundle was in use. The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by organizational CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) *Comprehensive Unit-based Safety Program* (CUSP), would impact CAUTI rates among adult residents in a rehabilitation facility in Northern California for four weeks. Lewin's change theory and the IOWA evidence-based practice model were the theoretical and conceptual models used for the project. CAUTI data was obtained from the medical record for the total sample size of 32 patients with indwelling urinary catheters (IUC) and measured against the National Healthcare Safety Network (NHSN) criteria. A paired *t*-test showed a statistical and clinically significant improvement in CAUTI rates (M=5.18; SD=.02; p=.000). Based on the results, daily rounding by organizational CAUTI champions, using the AHRQ CUSP may reduce CAUTIs in rehabilitation facilities. Recommendations include continuation of the intervention and a repetition of the project at another clinical site over a more extended monitoring period using a larger sample size.

Keywords: Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), catheter-associated urinary tract infection, CAUTI champion, Catheter days, CAUTI events, Daily rounding, Device utilization ratio (DUR), IOWA evidence-based practice model, Lewin’s change theory.

Dedication

I dedicate this project to the Monarch of the Universe, Jehovah, for He alone deserves all the praise.

Acknowledgments

I would like to acknowledge my husband for his understanding and support throughout this program. Thank you so much. I appreciate my mother for her prayers and for instilling in me the confidence needed to finish strong and well. Thank you, Mum. I acknowledge my dearly beloved children for their understanding, prayers, and patience. I do love you both, and I thank you from my heart. I acknowledge my project chair, Dr. Price, for guiding me through the process of writing a very detailed manuscript successfully and completing my doctoral project. I appreciate Dr. Love for her reassuring words, explicit review, and constructive feedback. I acknowledge Dr. Schroetter and Dr. Fetter for their exceptional review and encouraging words, which comforted me in the last days of the manuscript completion. My sincere gratitude to Dr. Christine Johns, my content expert, who provided mentorship, great support, and input throughout this project. Your calmness and positive words impacted me greatly. Dr. Julius Kehinde, I appreciate your invaluable contribution to this work. I acknowledge my brothers and sisters who provided the moral support and prayers needed amidst ongoing challenges. I thank my GCU professors and the many professionals who have influenced my career and education to this point. Finally, I acknowledge the GCU IRB for the commendable turn-around time and my project site management for providing the opportunity to conduct this improvement project amidst the COVID-19 pandemic in the nation. Nursing is indeed a calling to impact, and I have accepted the mandate to influence our dynamic healthcare environment positively.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Project

Healthcare-associated infections (HAIs) are a significant threat to patient safety and quality of care, affecting over 3% of patients during hospital care and costing billions in dollars yearly in the United States (US) (Agency for Healthcare Research and Quality [AHRQ], 2019). These infections account for 1 in 3 million infections every year in long term facilities (Centers for Disease Control and Prevention, Long Term Care Facilities [CDC-LTCF], 2020). HAIs increase morbidity and mortality rates and healthcare costs, thereby causing additional suffering for patients and families (CDC-LTCF, 2020).

The most common HAIs are catheter-associated urinary tract infections (CAUTIs), which result from the insertion of an indwelling urinary catheter into patients during hospitalizations (Centers for Disease Prevention and Control [CDC], 2015). CAUTIs account for 20%-30% of all infections reported in long term facilities and often lead to hospital re-admissions, multidrug-resistant organisms, complications such as sepsis and endocarditis, and death (Letica-Kriegel et al., 2019; Mody et al., 2017). The incidence of CAUTIs continues to increase despite established guidelines for prevention in healthcare facilities. More effective strategies have been recommended to enhance CAUTI prevention amongst patients with indwelling urinary catheters.

The CDC Targeted Assessment for Prevention (TAP) strategy, and the AHRQ Comprehensive Unit-based Safety Program (CUSP) recommend daily rounding by nurses to track appropriate catheter indications for the reduction of CAUTIs in healthcare facilities (AHRQ, 2015; CDC, 2017). Literature confirms a significant reduction in CAUTIs and catheter utilization after implementing these interventions (Meddings et al., 2017; Miech et al., 2018; Miller et al., 2016; Snyder et al., 2020; Underwood, 2015). It

was therefore necessary to implement daily rounding by CAUTI champions at the project site for the reduction of CAUTIs and improvement of patient outcomes.

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. A quasi-experimental design was used to determine the relationships between these variables. The project's outcome would add to the body of knowledge on the impact of evidence-based practice on CAUTI prevention in rehabilitation facilities. This chapter discussed the background and purpose, clinical question, problem statement of the project, provided a rationale for the methodology and design, presented assumptions, limitations and delimitation, and the summary of the chapter.

Background of the Project

The health care system in the United States (US) has recorded remarkable progress in disease prevention and health promotion (CDC, 2020). However, the Institute of Medicine's (IOM) 1999 report, "To Err Is Human: Building a Safer Health System" and the follow-up report in 2001, "Crossing the Quality Chasm" revealed shocking numbers of preventable deaths resulting from medical errors (Dzau, 2016; Institute for Healthcare Improvement, 2020). The IOM report did not only raise awareness on the magnitude of the quality and safety problems prevalent in healthcare, but it also resulted in several initiatives spearheaded by the Federal Agencies to reduce preventable harm and improve patient safety (Crowley, 2017). Despite these initiatives and increased

awareness for safety, healthcare facilities continue to report rising rates of healthcare-associated infections (HAI), with two million occurring each year, resulting in over $4 billion in additional healthcare costs (Mody et al., 2017). The factors attributed to this increase include non-adherence to established guidelines and knowledge deficits amongst frontline nurses (Underwood, 2015; Meddings et al., 2017; Gesmundo, 2016).

Catheter-associated urinary tract infections (CAUTIs) are the most common HAIs, with an estimated 13,000 deaths and $150 to $450 million in treatment costs each year (Letica-Kriegel et al., 2019; Strouse, 2015). The Centers for Disease Control and Prevention (CDC) recommends evidence-based practice (EBP) interventions for CAUTI prevention, such as aseptic insertion, early removal, proper catheter care, and identifying infection prevention champions (CDC, 2015; CDC, 2017). The Agency for Healthcare Research and Quality (AHRQ) safety program proposed the use of CAUTI bundle (a group of evidence-based interventions) and catheter rounds by nurse champions for the reduction of CAUTIs (AHRQ, 2020). Studies confirm the effectiveness of these evidence-based interventions in reducing CAUTIs in healthcare facilities. However, very few studies are reported in rehabilitation or skilled nursing facilities (Mody et al., 2017; Parker et al., 2017).

Problem Statement

It was not known to what degree would the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. CAUTIs are acquired from a urinary catheter inserted into patients to aid urine drainage during

medical care (CDC, 2015). These infections are often caused by *Escherichia coli*, a bacterium introduced during aseptic insertion, manipulation, and management of urinary catheters (Bardsley, 2017). Over five million patients have a urinary catheter inserted into them every year in the US, and 12%-16% of these are unnecessary (CDC, 2020; Kazi et al., 2015; Safdar, Codispoti, Purvis, & Knobloch, 2016). The risk of CAUTI in patients increases by 3%-7% for each day with an indwelling urinary catheter (CDC, 2020). CAUTIs often lead to hospital re-admissions, multidrug-resistant organisms, and death (Letica-Kriegel et al., 2019; Mody et al., 2017).

The project site currently uses a CAUTI bundle based on CDC guidelines for the prevention of CAUTIs. However, there was no daily rounding of patients with IUC by nurse champions to ensure the appropriateness of catheter indications as the Agency for Healthcare Research and Quality recommended (AHRQ, 2015). The audit reports from the infection control preventionist revealed a lack of consistency in the CAUTI bundle maintenance checklist documentation by frontline nurses. There were also cases of inappropriate urine sampling and culturing, and urinary catheterizations on the units. The average CAUTI rate of 2.27 per 1000 catheter days in 2019 increased to 8.40 per 1000 catheter days in QI-2020. Foley catheter utilization rate (also known as device utilization ratio [DUR]) increased from 0.06 in FY-2019 to 0.09 in Q1-2020. The overall UTI rate in 2019 of 4.76 was above the national average of 2.73. Non-adherence to the established protocol for CAUTI prevention increases the risk of prolonged catheterization and the incidence of CAUTIs amongst patients with IUC (Parker et al., 2017; Taha et al., 2017)

The frailty of the patient population, coupled with comorbidities and non-adherence to practice guidelines by caregivers, increase the risk for CAUTIs, associated

complications, and costs of care at this project site. The nursing leadership expressed concern about the rate of CAUTIs and requested interventions be put in place to enhance patient safety. Daily rounding by CAUTI champions was implemented to mitigate the gaps in current practice and improve adherence to recommended guidelines for CAUTI reduction. This project also aimed to promote a sustainable safety culture by facilitating the active participation of the frontline workers in the CAUTI prevention protocol (Grove, Burns & Gray, 2014; Melnyk & Fineout-Overholt, 2015).

Purpose of the Project

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. The relationship between the dependent variable (CAUTI rates) and the independent variable (daily rounding by CAUTI champions) was established using a quasi-experimental design.

The leadership of this facility discussed the high rates of CAUTI at the monthly infection prevention committee meeting. The QI-2020 CAUTI data were extraordinarily high and prompted the need for a quality improvement project for CAUTI reduction at this facility. The project involved the collaboration of an interdisciplinary team composed of; physicians, nurse practitioners, registered nurses, licensed vocational nurses, advanced practice nurses, quality nurse managers, and infection control preventionists.

The quality improvement process was guided by Lewin's change theory and IOWA evidence-based practice improvement model. The CDC TAP strategy for daily

rounding was implemented to mitigate gaps responsible for the CAUTIs at this facility (CDC, 2017). Literature confirmed that daily rounding by nurse champions reduces the rate of CAUTIs and improves nurses' adherence to established CAUTI prevention guidelines in acute care settings (Dy et al., 2017; Gesmundo, 2016; Graham-Glover, 2017; Meddings et al., 2017). However, there is a paucity of literature on catheter-associated urinary tract infections (CAUTI) prevention in rehabilitation facilities. This project added to the quality improvement projects conducted on the impact of evidence-based practice interventions on CAUTI reduction in rehabilitation facilities.

Clinical Question

Catheter-associated urinary tract infection is a healthcare menace that compromises patient safety and quality of life. Despite recommended evidence-based guidelines for CAUTI reduction, toolkits, sanctions, and reimbursement penalties by federal agencies, most health care facilities report an increase in CAUTI rates (Calderon, Kavanaugh & Rice, 2015). The Centers for Disease Control and Prevention reported a consistent 3%-6% increase in hospitals from 2010 regardless of implemented guidelines, which further confirms the challenge with CAUTI prevention (CDC, 2010; Meddings et al., 2017).

The Agency for Healthcare Research and Quality (AHRQ) safety program and the Centers for Disease Control & Prevention (CDC) recommended evidence-based guidelines and toolkits for CAUTI prevention. The AHRQ suggested daily rounding, a nurse-driven protocol, to be instituted to evaluate and discontinue unnecessary catheters and evaluate urinary needs after catheter removal (AHRQ, 2019). The CDC Targeted assessment for prevention (TAP) recommended champions to improve adherence to

CAUTI prevention guidelines (CDC, 2017). Meddings et al. (2019) confirmed that reminder systems such as daily rounding could reduce CAUTIs by 50%. CAUTIs are preventable, and steps to reduce incidence in healthcare facilities involve implementing a nurse-driven protocol such as daily rounding by CAUTI champions.

This project determined to know the impact of daily rounding by CAUTI champions on CAUTIs. It established the relationship between the dependent variable (CAUTI rates) and the independent variable (daily rounding by CAUTI champions). The following clinical question guided this quantitative quasi-experimental project:

> Q. To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks?

Advancing Scientific Knowledge

CAUTIs are associated with increased patient discomfort, hospitalization, morbidity, and mortality in rehabilitation facilities. A deployment of evidence-based practices such as daily rounding by nurse champions, using the AHRQ CUSP, was recommended to mitigate CAUTIs, especially among the fragile population in long term care settings (CDC, 2017; Helber, 2015). Even though there is significant literature on CAUTI prevention in acute care facilities, there is minimal evidence on CAUTI prevention in the rehabilitation facilities. This project added to the body of evidence on the impact of evidence-based practice on CAUTI prevention in this patient population.

Theoretical foundations provide the support needed for a successful implementation of quality improvement projects. This project was grounded in Lewin's

change theory and the IOWA evidence-based practice model to promote excellence in health care. Lewin's theory explained three stages (unfreezing, change, and refreezing) that a facility must go through before a change can be implemented (Lewin, 1947). The theory postulated that restraining forces hindering process change required for CAUTI reduction are broken in the unfreezing stage before stability in health outcomes are restored in the refreezing state (Lewin, 1947). The IOWA evidence-based model served as a guide for nurses and providers to use for improving patient care (Titler et al., 2001). The model provided an algorithm that guided the identification of the gaps in current practice and the implementation of evidence-based interventions to mitigate these gaps. It also provided a system of continuous assessment of implemented interventions for the sustainability of practice change. The theoretical framework for this project supported the collaboration of the interdisciplinary team, the engagement of frontline workers, and the daily rounding by CAUTI champions, using AHRQ CUSP, for the reduction of CAUTIs and evaluation of the intervention.

Significant literature confirmed the reduction of CAUTI after implementing evidence-based practice guidelines in acute care facilities, but very minimal studies are reported in rehabilitation facilities or nursing homes. The AHRQ CUSP was reported in the literature to effectively reduce CAUTIs in acute care settings (Miller et al., 2016; Parker et al., 2017). However, this project added to the existing literature by showing that the AHRQ CUSP significantly reduced CAUTIs in a rehabilitation facility. It also highlighted the importance of a doctorally-prepared nurse's role in initiating institutional shifts towards best practice for infection prevention and translation of evidence to practice in rehabilitation facilities.

Significance of the Project

CAUTIs are associated with increased hospitalization and health care costs, increased morbidity, and mortality (Elkbuli et al., 2018; Helber, 2015). These infections significantly impair the quality of care and patient safety (Taha et al., 2017). CAUTIs pose a substantial financial burden on the patients and the healthcare facility. In 2016, the additional cost of CAUTI was $1,764 for Medicare non-ICU patients and $10,197 for Medicare ICU patients (Christopher, Hollenbeak & Schilling, 2018**).** The average cost of a CAUTI was reported to be $13,793 in 2019 (CDC, 2019). Evidence-based practice initiatives were introduced to mitigate this healthcare concern and enhance patient safety in healthcare facilities (Calderon, Kavanaugh & Rice, 2015; CDC, 2010).

High-reliability organizations (HRO) are organizations that "cultivate resilience by relentlessly prioritizing safety over other performance pressures" (AHRQ-HRO, 2019). The Joint Commission suggested that health care facilities seeking to become a high-reliability organization (HRO) build a solid foundation that includes leadership commitment to zero harm, promotion of a culture of safety, and a robust process improvement culture (AHRQ-HRO, 2019). Despite the existence of a CAUTI prevention bundle, the project site reported increased CAUTI rates over the past 12 months and a lack of adherence by nurses and clinicians to the established bundle. Therefore, a quality improvement project was necessary to address this safety concern by implementing EBP interventions that would improve adherence to recommended guidelines and promote a safety culture at this facility.

This practice improvement project introduced daily rounding by CAUTI champions, using AHRQ CUSP, to reduce CAUTIs. The additional financial costs

incurred from hospitalizations and re-admissions should decrease because of a reduction in CAUTIs. The project added to the literature on HAIs by establishing a relationship between CAUTIs and daily rounding by CAUTI champions, using AHRQ CUSP, in rehabilitation facilities.

Rationale for Methodology

A quantitative methodology was employed in this project to determine if the implementation of daily rounding by CAUTI champions would reduce CAUTIs at this rehabilitation facility. A quantitative method was best for this practice improvement project because it allowed the use of numerical data and statistics to determine the relationship between variables (Leung, 2015). This methodology was used in the literature for quasi-experimental projects with pre-post intervention designs with no randomization (Campbell, 2020). A research study utilized a quantitative methodology to collect data on the integrated review on CAUTI prevention (Meddings et al., 2017). The methodology was also used to collect and analyze data on a daily targeted rounding implemented for CAUTI reduction on a pediatric unit (Snyder et al., 2020). The rate of compliance to the established CAUTI bundle on this unit increased to 93% (Snyder et al., 2020). Numerical data such as CAUTI rates, catheter days, and device utilization ratios were collected before and after the intervention was implemented. Excel was used to collate the data before analyzing with Statistical Package for Social Science (SPSS), version 27, which reduced the time and effort required to describe the results (Daniel, 2016).

Information on the project plan and purpose was disseminated during staff meetings with the nurses and managers. The selection of CAUTI champions was made in

collaboration with managers and assistant nurse managers. The educational sessions for the nurses on CDC guidelines for CAUTI prevention, CAUTI bundle, and daily rounding took place in the conference room located at the project site. An additional session on CDC guidelines, National Healthcare Safety Network (NHSN) criteria for CAUTI definition, AHRQ urine culturing, and antibiotic stewardship was conducted for the site clinicians at the same location. Educational sessions were conducted for the nurses at different scheduled times for two days in the first and second weeks of implementation to accommodate selected CAUTI champions from all work shifts. Daily rounding was completed using the CAUTI bundle maintenance checklist in the electronic medical record (EMR). The CAUTI data were measured using the NHSN criteria definition and guidelines. Numerical data analyzed with descriptive statistics and paired sample *t*-test.

Nature of the Design

A quasi-experimental design was used to determine if the independent variable (daily rounding by CAUTI champions) would reduce the CAUTI rates (dependent variable). This project design was the most appropriate for a quantitative methodology with pre-post interventions and without randomization (Bhatia, 2018). The design was also able to answer the clinical question and problem statement for this project because of the impact of the intervention (Campbell, 2020). A quasi-experimental with pre-post intervention design was used in a project conducted by Snyder et al. (2020) to determine the effect of daily rounding on device days. The pre-intervention and post-intervention analysis showed a decrease in post-intervention device days, confirming an association between device days and daily rounding (Snyder et al., 2020).

Observational designs are non-experimental, and they involve the observation of patients in a setting with no interference or manipulation of any aspect of the study (Munnango & Boktor, 2020). They are either prospective or retrospective (Munnango & Boktor, 2020). Retrospective studies use existing data such as clinical data, while prospective studies utilize the data from prior exposure (Houser, 2018). This quantitative practice improvement project utilized a quasi-experimental intervention design based on prospective and retrospective data. De-identified information was provided before and after intervention by the site infection control preventionist, nurse managers, and CAUTI champions of the three units. Training sessions were conducted for the CAUTI champions and clinicians in preparation for the daily rounding. The project's awareness was increased through multiple discussions with nurses, physicians, and unit managers via face-to-face meetings and phone calls.

Definition of Terms

There are some terms used repeatedly in this manuscript that need explanation. The list below provided a simple definition of terminologies used in this manuscript. The definitions provided would facilitate the comprehension of concepts in this project.

Adverse Event (AE) describes harm to a patient resulting from medical care and not caused by the underlying disease (Levinson, 2016).

Catheter-associated urinary tract infections (CAUTI) are urinary tract infections that occur when an indwelling catheter is in place for more than two calendar days (Centers for Disease Control & Prevention, 2015).

CAUTI rate refers to the rate of infection occurring because of a urinary catheter in place (CDC, 2015).

Daily rounding is a process measure that allows the tracking of catheter appropriateness and prevalence of use. It is a nurse-driven protocol instituted to evaluate and discontinue unnecessary catheters and evaluate urinary needs after catheter removal (AHRQ, 2015).

Device utilization ratio is the number of catheter days divided by patient days. (CDC, 2020).

Healthcare-Associated Infections (HAIs) are infections acquired by patients during hospitalization, from treatment with invasive devices and procedures (United States Department of Health and Human Services [USDHHS], 2020).

Indwelling urinary catheter (IUC) is a drainage tube inserted into the urinary bladder (through the urethra) to drain urine (CDC, 2020).

Nurse champions are healthcare workers fully versed in the facility's best practices, motivated and engaged in improving patient safety, and respected by co-workers (CDC, 2017). Examples are CAUTI champions and Fall champions

Quantitative research method is a traditional approach to scientific research in which variables are identified and measured in a reliable and valid way (Houser, 2018).

Quasi-experimental studies are similar to experimental studies because the independent variable is manipulated, but with no randomization (Houser, 2018).

Rehabilitation facilities are facilities that provide care by helping to restore vital function and movement for patients (American Hospital Association, 2020).

Skilled nursing facilities are healthcare facilities that provide skilled nursing and rehabilitation services care under supervision (National Institute on Aging, 2017).

Urinary tract infection (UTI) is an infection of the urinary system affecting the

urethra, bladder, ureters, and kidney (CDC, 2015).

Assumptions, Limitations, Delimitations

This DNP improvement project presented a successful implementation of daily rounding by CAUTI champions, using AHRQ CUSP, to overcome CAUTI in a rehabilitation facility. The project was guided by a change theory and an evidence-based practice model. The process involved major stakeholders such as executive leadership, physicians, nurse practitioners, nurse managers, unit nurses, nurse educators, and infection control preventionists. It was therefore necessary to address assumptions, limitations, and delimitations associated with conclusions made on the effectiveness of daily rounding by CAUTI champions on CAUTI prevention.

Assumptions.

1. It was assumed that the theoretical framework and study design were appropriate to answer the clinical question and problem statement of this project. The methodology was suitable for this quantitative project because it involved measurable data CAUTI rates, device utilization rations, and catheter days).
2. It was also assumed that the sample size was large enough to meet the minimum requirements for the project. The design was quasi-experimental because it included the pre-post intervention analysis of CAUTI data.
3. It was also assumed that executive leadership support would persist throughout the project implementation, and nurses and clinicians would comply with daily rounding for CAUTI prevention, using AHRQ CUSP. Evidence-based strategies were confirmed to empower nurses for improved

performance and better quality of care (Meddings et al., 2017; Melynk & Fineout-Overholt, 2015).

Limitations.

1. The sample size (N=32) and setting limited the project scope and transferability to other healthcare settings. The sample included only patients with IUC and excluded patients with other forms of catheters. The setting was a rehabilitation facility, which limited the applicability of the findings because of the peculiarity of the patient population.
2. The four-week duration of the project restricted the training sessions to selected CAUTI champions instead of all the licensed nurses at the facility.
3. The COVID-19 pandemic in the nation at the time of this project was also a major limitation to awareness creation, information dissemination, and team collaboration. Face to face meeting for information dissemination was restricted because meetings were either virtually conducted or to a limited to a few participants due to social distancing. The risk of the spread also limited participants from collaborating, and communication was mainly through emails.

Delimitations are boundaries and barriers set by the investigator based on the anticipated goals of the study (Armstead, 2019). These include the location of the project, the targeted population, and duration. The delimitations of this project are as follows:

1. Project site: A rehabilitation facility in Northern California was used for the project. The demographics applied to similar facilities and, therefore, not generalizable to other types of care settings.

2. Patient population: The project included only the patients with IUC because of the safety concern amongst this patient population at the facility. This inclusion criterion also affected the generalizability of the findings.
3. Project duration: The project utilized data collected four weeks pre-and post-implementation of interventions. All the data used for analysis were within this specified timeframe.

Summary and Organization of the Remainder of the Project

Catheter-associated urinary tract infections are a significant health concern and a hindrance to achieving patient outcomes in healthcare settings. There are many risk factors for CAUTIs. However, inappropriate catheter use is regarded as a major risk factor (Buckley Clements & Hopper, 2015). CAUTI is preventable, but the approach adopted for its reduction is crucial for impactful care delivery. Federal initiatives recommend evidence-based practice interventions to prevent CAUTI incidence in healthcare facilities (AHRQ, 2020; CDC, 2015). Research studies confirmed the effectiveness of the CAUTI bundle and daily rounding by nurse champions on CAUTI prevention (Meddings et al., 2017; Snyder et al., 2020). Adherence to the recommended CAUTI bundle was sustained for patient safety through a daily rounding by nurse champions, using AHRQ CUSP. A collaborative approach involving frontline nurses and an interdisciplinary team was required to successfully implement evidence-based interventions required for CAUTI prevention (Krein et al., 2017; Mody et al., 2017).

Daily rounding by CAUTI or nurse champions was a practice change that could only be successfully implemented and sustained with an adequate understanding of the barriers and facilitators of change, engagement, and collaboration of stakeholders. This

chapter provided an overview of the impact of evidence-based implementation on CAUTI reduction and the theoretical foundation. The statement of the problem was discussed, and the significance of the project was explained. The rationale for the selected quantitative methodology and quasi-experimental project design were discussed, and how the outcomes of the project advanced scientific knowledge were clarified. Lastly, the assumptions, limitations, and delimitations for the project were addressed, followed by a definition of terms used and a chapter summary.

Chapter 2 provides a review of the literature findings to support the information presented in this practice improvement project. Chapter 3 explains the methods used for the project, data collection and analysis procedures, survey tools and measurement for validity and reliability, and ethical considerations. Chapter 4 discusses the data analysis and a graphic summary of results. Data presented answered the clinical question on the impact of daily rounding by nurse champions on CAUTIs. Chapter 5 provides a discussion of the project findings, and how they significantly impact CAUTIs at the facility, the implications for practice and future research.

Chapter 2: Literature Review

One of the major issues of concern today in care facilities is the prevalence of healthcare-associated infections (HAIs), which are acquired by patients after admission into the healthcare facility for medical care or treatment. Though paradoxical, however, it is a reality with an estimated 687,000 HAIs reported in 2015, over $9 billion in medical costs, and 72,000 deaths during hospitalization (Strouse, 2015). Catheter-associated urinary tract infections (CAUTIs) are the most common HAIs, comprising 35% to 40% of all HAIs in the United States and costing $150 to $450 million in treatment annually (Strouse, 2015). CAUTIs are the leading cause of secondary nosocomial bloodstream infections, with an associated mortality of 10% (CDC, 2015). The literature reviewed confirms CAUTI is preventable, and the implementation of evidence-based practice results in substantial CAUTI reduction and promotion of quality care in hospitals and community-based nursing homes (Dy et al., 2017; Taha et al., 2017).

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. Recommendations from past studies and research work on CAUTI prevention were used to address gaps in practice and improve the safety of patients with an IUC. The AHRQ and CDC guidelines for CAUTI prevention also guided the implemented interventions for CAUTI reduction (AHRQ, 2015; CDC, 2017).

This project was supported by a literature review obtained by searching for best clinical practices for catheter-associated infection (CAUTI) reduction and prevention, published in the English language, within the past five years. The following electronic databases were used for the search: ProQuest, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, ScienceDirect college edition, Google Scholar, and OVID Nursing Essential Collection. An additional search was completed on websites of Federal agencies such as the Centers for Disease Control and Prevention (CDC), Agency for Research and Healthcare Quality (AHRQ), and the Association for Professionals in Infection Control and Epidemiology (APIC). Keywords used include healthcare-associated infections, HAI, CAUTI, rounding and CAUTI, daily rounding, catheter-associated urinary tract infections, urinary tract infections, evidence-based guidelines, UTI, UTI in a rehabilitation facility, AHRQ CUSP, CAUTI prevention in skilled nursing homes, and CAUTI reduction. A maximum number of two hundred and thirty-eight (238) articles were obtained from the search, and over 100 articles were reviewed for relevance to the project.

Although several studies and research work have been conducted on CAUTI prevention and reduction in the acute care setting, there is a paucity of such work in rehabilitation facilities or nursing homes. The studies conducted on CAUTI prevention in acute care facilities were found relevant and applicable, and findings generalizable to rehab settings because of the similarity in the project's variables and population group. This chapter included a theoretical framework and models, followed by a review of the literature used for the project and a summary. The literature reviewed was organized

according to the risk factors, evidence-based strategies for CAUTI prevention, hindrances to effective implementation, and how to overcome them through collaboration.

The health care system in the US has recorded some progress in disease prevention and health promotion. However, the Institute of Medicine's 1999 report, "To Err Is Human: Building a Safer Health System" and the follow-up report in 2001, "Crossing the Quality Chasm," revealed shocking numbers of preventable deaths resulting from medical errors (Dzau, 2016; Institute for Healthcare Improvement, 2020). The IOM report did not only raise awareness on the magnitude of the quality and safety problems prevalent in healthcare, but it resulted in several initiatives spearheaded by Federal agencies to reduce preventable harm and improve patient safety (Crowley, 2017). Despite these initiatives and increased awareness for safety, healthcare facilities continue to report rising rates of healthcare-associated infections (HAI), with approximately two million occurring each year and over $4 billion in additional health care costs spent (Mody et al., 2017).

Catheter-associated urinary tract infections (CAUTIs) are the most common HAI, with an estimate of 13,000 deaths and $150 to $450 million in treatment costs each year (Letica-Kriegel et al., 2019; Strouse, 2015). The Centers for Disease Control and Prevention (CDC) recommended evidence-based practice (EBP) guidelines for prevention, while the Agency for Healthcare Research and Quality (AHRQ) created a framework with toolkits to mitigate these infections (AHRQ, 2018; CDC, 2015). Literature confirmed recommended evidence-based practice interventions are highly effective in reducing catheter-associated urinary tract infection rates in acute care settings (Krein et al., 2017; Meddings et al., 2017; Mody et al., 2017; Taha et al., 2017).

However, there is minimal evidence to show the impact of EBP on CAUTI prevention in rehabilitation facilities. These interventions include early removal of inserted catheters, aseptic insertion and management of catheters, proper meatal cleansing, use of silver-alloy coated catheters, training sessions for nurses to improve knowledge of CAUTI prevention, implementation of CAUTI bundle, limiting the use of antibiotics, and preventing unnecessary cultures, and establishment of daily rounding by CAUTI champions (AHRQ, 2015; AHRQ, 2020; CDC, 2015; Elkbuli et al., 2018; Meddings et al., 2017; Mody et al., 2017).

Theoretical Foundations

Nursing theory is the framework designed to organize knowledge, describe, predict, and explain nursing phenomena (Matney, Avant & Staggers, 2016). It provides the foundations of nursing practice, facilitates the development of nursing knowledge, and indicates the direction of nursing development in the future (Lee, 2014; Matney, Avant & Staggers, 2016). Complex adaptive systems require organizations to be responsive to an ever-changing evolving environment for the maintenance of a state of equilibrium and survival (Wojciechowski et al., 2016). A healthcare organization, as a complex adaptive system, requires its various disciplines to collaborate to solve complex problems and implement changes or new practices (Wojciechowski et al., 2016). Implementation of change is inevitable, and adherence to existing guidelines is challenging because of poor planning and communication and uninterested employees (Barrow, Annamaraju & Toney-Butler, 2020). The application of change theory in this project helped to overcome these challenges and improve the success of practice improvement.

Lewin's change theory. Kurt Lewin was referred to as the pioneering father of social psychology (Wojciechowski et al., 2016). He theorized a three-stage model of change: unfreezing, changing, and refreezing (Lewin, 1947). Lewin's theory defined behavior as "a dynamic balance of forces working in opposite directions" (Lewin, 1947). The theory explained that individuals and groups of individuals are influenced by "restraining forces" or obstacles that counter "driving forces" or positive forces that push in the direction of change; the tension between the driving and restraining forces are needed to maintain equilibrium (Lewin, 1951). Lewin's theory's three step-model was applied to create change in this project as follows:

- Stage 1- Unfreezing: employees are made aware of the CAUTI problem and its impact on patient safety and care quality. The acceptance of change was initiated by disseminating information in meetings and on the nursing units.
- Stage 2- Changing/moving: The stage where change is initiated. Daily rounding by CAUTI champions, using AHRQ CUSP, was presented to mitigate the current gaps in practice, in collaboration with the interdisciplinary team. Strategies were put in place to ensure the change was implemented, such as daily charting and reporting in the electronic health record by CAUTI champions selected from the three different units.
- Stage 3- Refreezing: This is the stage where integration occurs, and a new equilibrium is stabilized; change becomes a habit, and all strategies are in place, and the positive impact is readily discussed every week for motivation and staff empowerment (Lewin, 1947). The daily rounding by CAUTI champions, using AHRQ CUSP, became part of the routine standards of care.

Leadership played a significant role as a change agent in Kurt Lewin's model to unfreeze the organization. The transformational leadership style is highly effective for evidence-based practice implementation for quality care, as it encourages employee involvement in the change process by providing an opportunity to participate in decision making and knowledge sharing (Hussain et al., 2018).

IOWA model of evidence-based practice to promote excellence in health care. Evidence-based practice (EBP) is responsible for improving the quality of patient care and controlling healthcare costs. Several EBP models facilitate the integration of best evidence into clinical practice (Brown, 2014). The "Iowa model of evidence-based practice to promote quality care," formerly referred to as the "IOWA model," is a framework developed by a team of nurses at the college of nursing and university of Iowa hospitals and clinics to guide improvement in patient care (Titler et al., 2001). The Iowa model guided the step-by-step process for EBP implementation for CAUTI prevention, provided assessment tools for knowledge gaps in nurses, and strategies needed to sustain and evaluate implemented interventions. The model consists of the following seven steps:

1. Identification of a practice problem;
2. Formation of a multidisciplinary team composed of stakeholders from the project site;
3. Conduction of literature review using the best evidence;
4. Critique of literature review;
5. Planning of evidence-based initiatives for CAUTI prevention;

6. Implementation of interventions;
7. Evaluation of the interventions (Titler et al., 2001).

The IOWA model identified a practice problem that indicated the need for interdisciplinary collaboration for the sustenance of the existing CAUTI bundle and adherence to CDC guidelines for CAUTI prevention. The revised IOWA model includes implementation and change sustenance strategies, which were adopted for the daily rounding intervention in this project (Buckwalter et al., 2017).

Review of the Literature

Numerous studies and research work have been conducted in healthcare facilities to inquire about the cause of CAUTI and strategies to mitigate gaps in practice resulting in the prevalence of these healthcare-associated infections. These include knowledge deficit, a lack of collaboration amongst caregivers, and non-adherence to established standards for prevention. The strategies recommended for CAUTI prevention include the AHRQ CUSP daily rounding by nurse champions, CAUTI bundle (which comprises proper indications for insertion, aseptic insertion, proper meatal cleansing, and early removal), proper hand hygiene, and education sessions to reinforce information on catheter use.

Risk/causal factors.

Prolonged catheterization. Microorganisms can attach to a medical device such as an indwelling urinary catheter to form vast colonies, often bound together and usually enclosed in a polymer matrix known as biofilm (Cortese, Wagner, Tierney, Devine & Fogarty, 2018). A biofilm is defined as "microorganisms bound to a surface of each other with the presence of an extracellular matrix composed of secreted products of the

organisms and/or components of the microorganisms themselves" (Sayal, Singh & Devi, 2014). A biofilm may contain one or multiple species of gram-negative or gram-positive bacteria and yeasts. The longer an indwelling urinary catheter is in place, the more likely the formation of a biofilm on its surface, which causes a CAUTI (Cortese et al., 2018; Sayal, Singh & Devi, 2014). Patients with short-term catheterization, less than or equal to seven days, present with biofilm 10–50% of the time. Patients with long-term catheterization, greater or equal to 28 days, present with 100% biofilm formation (Cortese et al., 2018).

Yatim et al. (2016) reported that CAUTI comprises 30-40% of all HAIs, and 70-80% of these relate to indwelling urinary catheter use. CDC confirmed that the manipulation of the urinary tract from long-term indwelling urinary catheter (IUC) placement is a major contributor to hospital-acquired UTIs (CDC, 2018; Buckley, Clements & Hopper, 2015). In the US, about 5% to 22% of all the residents in the nursing homes have a urinary catheter, and 80,000 to 352,000 of 1.5 million post-acute patients and long-stay residents have a urinary catheter (Mody et al., 2017). Federal regulations and public reporting have increased awareness of the duration of urinary catheters and when to discontinue inappropriate catheters (Mody et al., 2017). Nevertheless, clinicians continue to leave urinary catheters in residents for prolonged periods, thereby increasing the risk of CAUTI in this population. Mody et al. (2017) explained that CAUTIs result from the widespread use of inappropriate urinary catheterization, which clinicians prescribe out of convenience.

Hu et al. (2017) confirmed this assertion by conducting a study on the reason older adults admitted to hospital units have IUC placement, using medical note reviews

and questionnaires. A summary of ratios was done using descriptive analysis, while multiple regression analysis was used to measure adverse outcomes. Results confirmed that about fifty percent of all catheter placements were done for no evident reason. The Centers for Disease Control & Prevention (CDC) affirmed that prolonged catheterization of patients in healthcare facilities is the predominant risk factor of CAUTI even though there are other risk factors (CDC- LTCF, 2020).

Poor catheter management and improper insertion technique. Armstrong (2015) explained that other factors that increase the risk of catheter-associated infections in patients include: debilitation, immunocompromised status, chronic kidney disease (CDK), poor catheter care, poor management of drainage system (incorrect placement of bag), female patients, pregnant women, diabetic patients, patients aged 65+, fecally incontinent patients and chronic wounds patients. These risk factors indicate that older adults in rehabilitation facilities are at higher risk, and a more rigorous approach needs to be adopted to mitigate CAUTI in this population group. Studies have revealed that a misdiagnosis of CAUTI is a risk factor for a CAUTI event because a wrong diagnosis or clinically suspected UTIs result in an antibiotic prescription, which produces resistant strains of the causal agent.

Inaccurate diagnosis of clinical UTI/ASB. Cortes-Penfield, Trautner & Jump (2017) asserted that uncertainty in differentiating UTI from asymptomatic bacteriuria (ASB) by providers contributes to antibiotic overprescribing, a risk factor for UTI amongst nursing home residents. ASB is common in older adults and is defined as the presence of bacteria in the urine, with or without pyuria, in the absence of clinical symptoms suggestive of a urinary tract infection (Cortes-Penfield, Trautner & Jump,

2017). Asymptomatic bacteriuria (ASB) does not increase mortality in older adults when other comorbidities are adjusted for, and antibiotics prescriptions do not reduce the rates of subsequent complications (Nicolle, 2016). On the contrary, antibiotics may increase the risk of UTI because an unnecessary prescription is associated with infection caused by *Clostridium difficile*, a drug-resistant pathogen (Cortes-Penfield, Trautner & Jump 2017). The guidelines from the Infectious Diseases Society of America recommend antibiotic treatment for ASB in pregnant women or immediately before a urologic procedure involving mucosal injury (Cortes-Penfield, Trautner & Jump, 2017). Appropriate diagnosis is, therefore, necessary for the prevention of drug-resistant pathogens, and essential steps must be taken when ordering urine cultures and interpreting lab results.

Inappropriate urine culturing and urinalysis. Urine cultures should not be obtained from older adults unless clinical symptoms suggest a UTI, and urinalysis reveal pyuria (or neutropenic patient). Inappropriate ordering of urine cultures is harmful because these also, like urinalysis, do not distinguish between UTI and ASB. Detection of bacteriuria may lead to inappropriate antibiotic therapy, particularly when the culture reveals colonization of multi-drug resistant uropathies or peripheral leukocytosis (Cortes-Penfield, Trautner & Jump, 2017). A UTI diagnosis requires clinical symptoms of infection localized to the urinary tract or nonspecific, laboratory evidence of bacteriuria and pyuria (Cortes-Penfield, Trautner & Jump, 2017).

Evidence-based strategies for CAUTI reduction.

Evidence-based strategies aim to enhance the efficient delivery of appropriate care to individual patients for the achievement of an optimum outcome (Craig &

Dowding, 2020). The evidence-based practice integrates research evidence, clinical expertise, and interpretation of patients' needs and perspectives in decision making (Craig & Dowding). Policies and clinical guidelines have been developed to further the EBP process in care delivery. These include the guidelines for CAUTI prevention, such as aseptic insertion of a catheter, early removal of a catheter, and daily rounding by nurse champions (AHRQ, 2017; CDC, 2015).

Aseptic insertion of a catheter. CAUTI is linked to a lack of aseptic IUC insertion and poor catheter management (Elkbuli et al., 2018; Meddings et al., 2017). Studies have established the significance of adhering to recommended EBP guidelines for catheter insertion and management to reduce CAUTI in healthcare facilities. Mody et al. (2017) conducted a large-scale prospective implementation project in community-based nursing homes participating in the Agency for Healthcare Research and Quality Safety (AHRQ) program for Long Term Care. The objective was to develop, implement, and evaluate an intervention to prevent CAUTI. The interventions implemented include technical bundle, catheter removal, aseptic insertion, catheter care training, incontinence care planning, socio-adaptive bundle emphasizing leadership, resident and family engagement, and effective communication. Statistical analyses were performed using Stata/MP software. Results revealed a reduction in CAUTI rates by 54% in the nursing homes following the implementation of the CAUTI bundle and other socio-adaptive processes. While aseptic insertion of the catheter is necessary for CAUTI prevention, proper meatal hygiene, and bathing practice for patients with IUC are also crucial.

Proper meatal cleaning and bathing practices. Ferguson (2018) conducted a quality improvement (QI) project on two units in a 393-bed acute care hospital in the

United States. Methods adopted include exposing the nurses to educational programs on appropriate indwelling urinary catheter care and proper meatal cleaning to reduce CAUTI incidence. A pre-post-assessment of nurses' knowledge was done and analyzed. Paired t-tests showed a significant increase in the knowledge of nurses across all subscale scores (p=.000). The rates of CAUTI dropped from 7.49 and 4.12 to 0 and 1.56 per 1,000 catheter days, respectively. Strouse (2015) evaluated the impact of bathing practices on CAUTI rates in hospital in-patients. Bacteria growth was evident in 98 % of the cultures, and chlorhexidine gluconate (CHG) wipes reduced the rates of CAUTI when used for periurethral cleansing before catheter insertion. While CHG wipes may be deemed effective for meatal cleansing, some healthcare facilities may prefer 0.1% saline for cost-effective reasons (Strouse, 2015).

Mitchell et al. (2019), in a randomized control study conducted at three large Australian hospitals, demonstrated the cost-effectiveness of chlorhexidine gluconate (0.1%) compared to saline for meatal cleaning before urinary catheter insertion for CAUTI and bacteriuria prevention. Methods include adopting a simple decision tree to evaluate cost-effectiveness, which complied with the Consolidated Health Economic Evaluation Reporting Standards statement, and obtaining effectiveness outcomes from a 32-week stepped-wedge randomized controlled study. Findings confirm that a change to chlorhexidine from saline was estimated to save almost $400,000 per 100,000 catheterizations and prevent about 70 CAUTI cases (Mitchell et al., 2019). While meatal hygiene and bathing practices are essential for CAUTI prevention, the duration of urinary catheterization is the predominant risk factor of CAUTI, and preventive measures aimed at reducing placement and enhancing early withdrawal have proved effective.

Early removal of a catheter. Tyson et al. (2018) conducted a retrospective cohort study after implementing a multimodal CAUTI prevention bundle in the trauma care unit of a large tertiary care center. CAUTI rates were compared as well as pre-and post-intervention indwelling catheter utilization rates. Results showed a significant decrease in catheter utilization and a decline in CAUTI rate from 5.1 to 2.0 infections per 1000 catheter-days.

A project was conducted by Yatim et al. (2016) to assess the effectiveness of a nurse-driven urinary catheter removal process in reducing the duration of urinary catheter usage and CAUTI rate in an acute care facility in Singapore. Methods include a retrospective chart review, a pre-post study design, and a post-implementation nurse-driven process. Descriptive statistics were used to explain compliance, and the results showed that CAUTI decreased from 4 to 0 per 1,000 catheter days, thereby confirming that early removal is necessary for prevention. Nurses' adherence to practice guidelines for infection prevention is vital for preventing healthcare-associated infections (Yatim et al., 2016).

Daily rounding by nurse champions. Prolonged catheterization is the most important risk factor for CAUTIs (CDC, 2015). Daily rounding is a process measure that allows the tracking of catheter appropriateness and prevalence of use (AHRQ, 2015). The AHRQComprehensive Unit-based Safety Program (CUSP) provides tools and strategies to assist the clinical team in providing safer care (AHRQ, 2017). The program recommended daily rounding, a nurse-driven protocol, be instituted to evaluate and discontinue unnecessary catheters, and evaluate urinary needs after catheter removal (AHRQ, 2017). Daily rounding by nurse champions was recommended for sustaining

improvement in patient safety over time (AHRQ, 2017). Champions are healthcare workers fully versed in the facility's best practices, motivated and engaged in improving patient safety, and respected by co-workers (CDC, 2017). Miech et al. (2018), in an integrative review of champions in healthcare-related implementation, confirmed that more than 80% of articles reviewed identified champions as critical factors for implementation success and related outcomes.

Champions are used widely across published articles for specific topics (e.g., handwashing champion, guideline champion), specific job (e.g., nurse champions, physician champions), and broader organizational roles such as executive champion and clinical champion (Miech et al., 2018). The specific characteristics of effective champions include advocacy, communication skills, courage, enthusiasm, and energy to drive the implementation process, passionate, persuasive, personable, respected, credible, and well-liked by peers (CDC, 2017; Miech et al., 2018). The role of nurse champions involved in CAUTI prevention includes promoting best practices to reduce CAUTI risk. Daily rounding should include other process measures (such as aseptic insertion compliance, number of staff validated for catheter insertion competency) and maintenance measures (e.g., position of drainage bag below the bladder and away from the floor, drainage bag tubing with no loops or kinks; AHRQ, 2015).

A study by Graham-Glover, Mueller, Allio & Williams, 2017 conducted to determine the effect of daily rounding and education on IUC indications and catheterization reduction in a hospital setting revealed a decrease in device utilization ratio over a 3-month study period. The hospital device utilization (DU) decreased by 33% from January to April. ICU DU decreased by 19%, and non-ICU DU decreased by 32%

in the same period, and the overall hospital CAUTI rate decreased by 94%. (Graham-Glover et al., 2017). Meddings et al. (2019) confirmed that reminder systems such as daily rounding could reduce CAUTI by half or 50%. The rounding system also provided information on nurses who do not document their assessments on time (Graham-Glover, Mueller, Allio & Williams, 2017). Daily rounding reduced CAUTIs and improved adherence to the CAUTI prevention bundle for improved patient safety.

Snyder et al. (2020) completed a quality improvement project of daily targeted rounding for patients with an indwelling urinary catheter. The goals were to assess the appropriateness of catheterization, increase bundle compliance, and decrease catheter-associated urinary tract infection risk. The findings revealed a 100% reduction in CAUTI and increased adherence to the CAUTI prevention bundle for improved patient safety (Snyder et al., 2020). After targeted rounding, bundle compliance increased from 84% to 93%. The overall CAUTI rate dropped from 2.7 infections per 1,000 catheter-days to a baseline of 0, with one-year sustenance (Snyder et al., 2020). Multifaceted interventions based on the AHRQ CUSP were also introduced on hospital units to reduce inappropriate catheter use and CAUTIs (Miller et al., 2016; Parker et al., 2017). These interventions included daily assessment of patients with IUC by ward-based champions and educational sessions. The findings confirmed a significant reduction in catheter use and catheter-associated urinary tract infections using the AHRQ CUSP initiative (Parker et al., 2017). Daily rounding by nurse champions reduced CAUTIs and inappropriate use of catheters (Parker et al., 2017; Snyder et al., 2020).

Patients' hand hygiene. Haverstick et al. (2017) conducted a study in a cardiothoracic postsurgical step-down unit to improve patient hand hygiene by promoting

handwashing with soap and water and hand sanitizer for the prevention of hospital-acquired infections. Methods included handing over hand sanitizer bottles to patients, providing hand hygiene education, conducting a pre-post-implementation survey, and tracking infection data. Results revealed significant correlations between hand hygiene and infection rates of vancomycin-resistant enterococci ($p = .003$) and methicillin-resistant *Staphylococcus aureus* ($p = .01$) post intervention. Infection rates declined with hand hygiene interventions. Patient hand hygiene is necessary for keeping the infection rate low, but nurses' hygiene is also indicated for CAUTI prevention.

Fox et al. (2015) also conducted a research study using a pre-experimental study design to compare 12-month rates of central catheter-associated bloodstream infection and catheter-associated urinary tract infection and nurses' handwashing compliance. A significant reduction in the rates of the two types of infection was reported, though the decline was not statistically significant. A hand hygiene protocol for patients is, therefore, essential and associated with HAI reduction and improvements in nurses' handwashing compliance.

Catheter type. The use of an antimicrobial catheter for catheterization is indicated in CAUTI prevention. Different coating materials with antiseptic and antimicrobial properties are used for urinary catheters (Ahmad et al., 2018). However, noble metal alloy (NMA), nitrofurazone, hydrogel, chlorhexidine, silver metal alloy, and polymeric coatings were reported to produce positive results (Ahmad et al., 2018). Hydrogel and Noble metal alloy layers are described as the safest, most efficient, and most cost-effective in reducing CAUTI though results vary based on several factors.

Ahmad et al. (2018) conducted a prospective cohort study in a hospital to evaluate the effectiveness of Noble metal alloy catheters on CAUTI compared to standard catheters. A non-probability consecutive sampling technique was adopted to select the 56 patients in the study. Data analysis was conducted with SPSS version 27. The student t-test and chi-square test were applied to compare associations between groups, and the *p*-value ≤ 0.05 was significant. Results revealed a rate of 28.6 % CAUTI in the group with the standard catheter, and 7.1% in the group with noble metal alloy, thus confirming the effectiveness of a noble metal alloy catheter in preventing CAUTI. However, there are contrary views about these types of catheters when compared to silicone catheters.

A prospective cohort study was conducted by Stenzelius et al. (2016) to inquire whether the use of silicone catheters coated with noble metals (gold, silver, and palladium), compared to standard silicone catheters, had an impact on the rate of CAUTIs in neurological patients. Data on patient characteristics were recorded prospectively. The results confirmed no significant difference in CAUTI with coated silicone catheters. A prior study on a single female patient confirmed a successful treatment of recurring CAUTI when the traditional suprapubic catheter of a female patient was substituted for a Bactiguard Infection Protection (BIP) catheter with noble metal alloy (NMA) coating (Magnusson et al., 2019). A single-center randomized controlled trial was conducted in a hospital amongst neurosurgical patients. These were randomized to a Foley catheter impregnated with novel silver and followed for 30 days. Tests were done from urine collected for bacteriuria, and signs of infection were assessed in the subjects. The results showed that the long-term use of NMA coated catheters would prevent recurring CAUTIs. Healthcare organizations continue to search for new methods to combat CAUTI

and provide safe care to patients. The CDC revised CAUTI prevention guidelines with a focus on three essential components: 1). appropriate use of indwelling urinary catheters, 2). utilization of proper techniques for insertion and maintenance, and 3). daily routine hygiene for catheter care with no specific method or cleansing agent. (Strouse, 2015).

Nurse education and training for improved competencies. Nurses' compliance with the established protocol is improved through continuous competency training and education classes or in-service. Ferguson (2018) conducted a quality improvement (QI) project in two units in a 393-bed acute care hospital. Methods adopted include exposing the nurses to educational programs on appropriate indwelling urinary catheter care and how to reduce the incidence of CAUTIs. A pre-post-assessment of nurses' knowledge was done and analyzed. Paired *t*-tests showed a significant increase in nurses' knowledge across all knowledge subscale scores (p=.000). The rates of CAUTI dropped from 7.49 and 4.12 to 0 and 1.56 per 1,000 catheter days, respectively, in the next quarter. A multifaceted interactive educational program impacted nurses' knowledge of CAUTI prevention and decreased CAUTI rate in acute care settings.

A similar study conducted by Gesmundo (2016) on two hospital units evaluated the impact of a CAUTI education package on nurses' knowledge of indwelling catheter management. A multiphase mixed method with convenience sampling of the focus group was used. Qualitative data were analyzed with an inductive approach, while quantitative data utilized a paired *t*-test. Questions from previously published tests were used to ensure internal consistency, and nurses' knowledge was immediately measured after education sessions using the same instrument as the pre-test. The pre-test and post-tests provided after the training were analyzed with a paired *t*-test. Results indicated that a

continuous CAUTI education addressing all components of catheter care was impactful in filling the gaps in nursing knowledge for nurses. An effective CAUTI prevention program must address the components of catheter care through continuous education using multifaceted strategies. The identification of knowledge gaps is crucial for skill and competency development. Similarly, Parker et al. (2016) developed a multi-phased approach across four different acute care hospitals with multiple pre-post control interventions employed in a mixed research method. The study improved patient safety through the implementation and robust evaluation of clinical practice and practice change.

CAUTI bundle. CAUTI or care bundle is described as a package of interventions which, when used together, result in significant and sustained reductions in CAUTI (Damani, 2016). Research and guidelines from Federal organizations such as the Centers for Disease Control and Prevention (CDC) recommended the CAUTI bundle be adopted for the prevention and reduction of CAUTI in health care settings (AHRQ, 2015; CDC, 2010; Meddings et al., 2017). CAUTI bundle includes interventions for prevention such as proper indications for catheterization, steps for appropriate techniques for catheter insertion and placement, educating nurses on appropriate steps for maintenance, and early removal of catheter (Taha et al., 2017). Effective use of the CAUTI bundle reduces CAUTIs, improves patient safety and employee satisfaction, and reduces healthcare costs (McCoy et al., 2017; Melynk & Fineout-Overholt, 2015).

A study conducted by Elkbuli et al. (2018) evaluated the impact of the CAUTI bundle on adult trauma patients in a hospital. Measures included in the bundle were staff education, bladder catheter stabilization, patient and caregiver education, keeping the

collection bag below the bladder and above the floor, and daily evaluations for discontinuation. Statistical analyses include Chi-square and *t*-test, and a $p < .05$ significance. The findings of the study showed an 80% reduction in CAUTI rate upon execution of a CAUTI bundle using a multidisciplinary approach in this trauma population. Krocova, Prokesova & Horova (2017) confirmed the positive influence of multi-factorial measures such as education of personnel, instituting protocols regarding the care of catheters, observing standards of care, and accepting relevant indications. CAUTI bundle implementation also impacts the interpersonal relationship, besides improving the overall quality of care.

Krein et al. (2017) conducted qualitative research work to reduce CAUTI in nursing homes in nursing homes in the United States. The findings of the study revealed that the CAUTI prevention program was beneficial; the staff was able to communicate with physicians and other members of the team regarding catheter management. Access to evidence-based practices and practice tools led to improved knowledge amongst nurses, which increased staff empowerment and enhanced communication with team members and physicians. EBP improves patient outcomes, standardizes care, and decreases patient costs, which are essential for competition in today's healthcare market (Spruce, 2015). As health care transitions to value-based care from volume-based care, evidence-based practices supportive of effective care is imperative; however, challenges and barriers are hindering effective implementation.

Hindrances to effective EBP implementation. A study was conducted by Hernandez & Stewart (2019) to investigate catheter management practices in a public hospital in Auckland. An indwelling catheter management checklist with a

CAUTI prevention bundle was introduced. The components of the bundle of care are to minimize inappropriate catheter use, aseptic insertion of catheters, catheter maintenance based on guidelines, and ongoing review and evaluation of catheter necessity. A mixed-method, including quantitative research design, was selected for this research. The results revealed a sub-optimal performance of evidence-based catheter management practices because of non-adherence to the CAUTI bundle.

Complete adherence to evidence-based catheter management practice via the four components in the bundle of care is necessary to prevent CAUTI. Continuous in-service education on the evidence-based CAUTI bundle and a regular audit for adherence to guidelines is recommended. Limitations include the exclusion criteria and the use of a self-administered checklist, which presented a form of bias.

Despite studies confirming the positive impact of EBP guidelines on CAUTI prevention, quality of care, and patient safety, the rates of catheter-associated infections continue to increase in healthcare facilities because of certain factors (Agency for Healthcare Research and Quality, 2018; Clarke et al., 2019). These include non-adherence to evidence-based practice (EBP) guidelines for CAUTI prevention and resistance from physicians and other healthcare professionals such as physical therapists, dietitians, and social workers ((McCoy et al., 2017; Melynk & Fineout-Overholt, 2015). A lack of collaboration amongst stakeholders results in a lack of support from team members, resistance to change, and non-adherence to guidelines.

Collaboration, an essential factor for EBP implementation. Quality improvement projects in health care are effectively implemented when there is a collaboration amongst the stakeholders (Leviton & Melichar, 2016). Evidence-based

practice for CAUTI prevention, such as the CAUTI bundle, can be successfully implemented when all team members are on the same page and involved in every stage of the new intervention for improved quality (Leviton & Melichar, 2016). A collaborative approach is, therefore, essential for the promotion of quality improvement and reduction of infection rates in care settings.

Steps for collaboration. The involvement of a skillful and courageous physician champion is necessary for effective communication of changes in processes adopted to enhance patient safety (Fletcher et al., 2016). Nurses and physicians are usually on different pages when discussing steps to take for CAUTI prevention. This difference in opinions is because nurses usually collect and disseminate CAUTI related data during the end of shift report while physicians do not disseminate the information shared even when medical directors are aware (Fletcher et al., 2016). Quality measures can be successfully implemented when there is a multidisciplinary team, strong executive leadership support, effective communication, and engagement of frontline workers (Dy et al., 2016). Safety measures can be enhanced by adopting the following strategies:

- EBP conference for nurses, nurse leaders, and all stakeholders to inform on practices, advantages, the process of adoption, and steps towards sustenance (McCoy et al. (2017).
- Brainstorming sessions with the team on causes of gaps in practice
- Implementation of interventions based on recommendations from the team (Dy et al., 2016)
- Methods of disseminating information to close every communication gap between providers and nurses

A collaborative approach is essential for the promotion of quality improvement in care settings. It has substantially reduced infection rates in acute care settings and community-based nursing facilities (Krein et al., 2017).

Summary

Catheter-associated urinary tract infections (CAUTIs) are a huge safety concern and financial burden to healthcare and the nation (Strouse, 2015). They are responsible for complications, re-admissions, prolonged hospitalizations, and death (Mody et al., 2017). CAUTIs are preventable, and federal agencies such as the CDC and AHRQ have recommended evidence-based practice guidelines and toolkits to mitigate infection rates (CDC, 2015, AHRQ, 2018). However, healthcare facilities continue to report increased CAUTI rates and high cost of care amongst patients with IUC receiving medical care (Clarke et al., 2019; Agency for Healthcare Research and Quality, 2018). Literature studies were conducted to inquire about causal or risk factors of CAUTIs and prevention strategies (Cortese et al., 2018).

CAUTIs are attributed to many factors such as non-adherence to recommended guidelines or standards and inappropriate prescription, poor catheter management, and insertion (Meddings et al., 2017). Nurses utilize indwelling catheter insertion as a convenient way of managing patients with urinary incontinence (Yatim, 2016). Clinicians ordered urine culture when not appropriate, followed by unnecessary antibiotic prescription, which increased the risk of CAUTIs and infection with resistant microorganisms. Hand hygiene of care providers and patients was found to play a significant role in CAUTI incidence (Mody et al., 2017). An understanding of the risk factors of CAUTI is critical for a proactive and preventative approach to care. Strategies

for prevention include the components of a CAUTI bundle, which are: appropriate indications for catheterization, aseptic insertion, the use of CHG bath wipes instead of bath basins for catheterized patients (Snyder et al., 2020; Strouse, 2015); early removal of inserted catheters, proper foley care, supportive leadership, effective communication and adherence to standards or evidence-based guidelines (Elkbuli et al., 2018) and patient hygiene (Fox et al., 2015; Haverstock et al., 2017). Appropriate urine culturing orders and accurate CAUTI diagnoses by clinicians are also crucial in preventing CAUTIs. The adherence to recommended guidelines for infection prevention is enhanced by the involvement of stakeholders such as frontline nurses and providers (AHRQ, 2015; CDC, 2017). Therefore, a collaborative approach is necessary for promoting a reduction in CAUTI and improving the quality of care in health care facilities (Meddings et al., 2017). Evidence-based practice interventions such as the daily rounding by nurse champions utilize a collaborative approach, empower nursing staff, and increase communication amongst stakeholders. This practice improvement project introduced daily rounding by CAUTI champions to reduce CAUTIs at the project site. The entire process was guided by Lewin's change theory and the IOWA model of EBP for determining, implementing, evaluating, and sustaining the appropriate intervention.

Chapter 3 presents data collection and analysis methods in this project. The project design and methodology, sample size, instruments used and sources of data, analysis methods and ethical considerations, and steps taken to ensure validity and reliability of collected data are explored in the chapter. CAUTI is a preventable safety issue that requires immediate intervention for patient safety. Implementing daily rounding by CAUTI champions on the patient units improves adherence to CAUTI

prevention protocol through early removal and appropriate indications for catheterization. This quality improvement project would improve patient outcomes, healthcare spending, and the quality of care provided to patients with IUC at this rehabilitation facility by reducing CAUTI incidence.

Chapter 3: Methodology

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. This practice improvement project explored the relationship between CAUTIs (dependent variable) and daily rounding by CAUTI champions (independent variable) using the IOWA model of EBP and Lewin's change theory to guide the process. Literature confirms a reduction in CAUTI rates in healthcare settings after implementing evidence-based practice interventions (Gesmundo, 2016; Meddings et al., 2017). However, most healthcare facilities continue to report CAUTI events despite reimbursement penalties and recommendations for prevention from Federal agencies (AHRQ, 2015; Calderon, Kavanaugh & Rice, 2015; CDC, 2010). The reasons attributed to CAUTI events in healthcare facilities include non-adherence to recommended evidence-based practice guidelines and nurses' sub-optimal knowledge about CAUTI prevention (Meddings et al., 2017, Melynk & Fineout-Overholt, 2015; Mody et al., 2017).

Several studies reported that daily rounding of patients with IUC resulted in reducing CAUTIs on units in acute care facilities, however minimal evidence was reported in rehabilitation and skilled nursing facilities (Graham-Glover et al., 2017; Miech et al., 2018; Miller et al., 2016). This project's outcome adds to the current literature on the impact of daily rounding on CAUTI reduction in these facilities. The relationship between the dependent variable (CAUTI rate) and the independent variable

(daily rounding by CAUTI champions) was determined. This chapter revisited the problem statement and clinical question, explained the methods and design selected and described the instruments used in the project. Secondly, it provided details of the data collection approach, sample size, and analysis procedures. Lastly, the validity and reliability of the instrument used were explained with discussions on the ethical considerations, limitations, and delimitations of the project.

Statement of the Problem

It was not known to what degree would the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. CAUTIs are acquired from a urinary catheter inserted into patients to aid urine drainage during medical care (CDC, 2015). These infections are often caused by *Escherichia coli*, a bacterium introduced during aseptic insertion, manipulation, and management of urinary catheters (Bardsley, 2017). Over five million patients have a urinary catheter inserted into them every year in the US, and 12%-16% of these are unnecessary (CDC, 2020; Kazi et al., 2015; Safdar et al., 2016). The risk of CAUTI in patients increases by 3%-7% for each day with an indwelling urinary catheter (CDC, 2020). CAUTIs often lead to hospital readmissions, multidrug-resistant organisms, complications, and death (Letica-Kriegel et al., 2019; Mody et al., 2017).

The project site currently uses a CAUTI bundle for the prevention of CAUTIs. However, there was no strategy to monitor clinicians and nurses' daily adherence to the established guidelines for CAUTI prevention. Catheters were inserted for wrong

indications, and patients were not monitored for proper maintenance following catheter insertion. The average CAUTI rate was 2.27 per 1,000 catheter days in 2019 and 8.4 per 1,000 catheter days in QI-2020. Foley catheter utilization rate (also known as device utilization ratio [DUR]) increased from 0.06 in FY-2019 to 8.40 in Q1-2020. The overall UTI rate in 2019 of 4.76 was above the national average of 2.73. The frailty of the patient population, coupled with co-morbidities, increases the risk for complications and costs associated with care. The nursing leadership expressed concern about this increase in the rate of CAUTIs and requested interventions to mitigate the gaps in practice. The intervention that was implemented in this project aimed to reduce CAUTIs amongst the patients with IUC by introducing daily rounding by CAUTI champions. The secondary outcome for this project was to promote the sustenance of the established protocol and improve the safety culture by facilitating the active participation of the front-line workers and providers (Grove, Burns & Gray, 2014; Melnyk & Fineout-Overholt, 2015).

Clinical Question

The clinical question that guided this quantitative quasi-experimental quality improvement project was: To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ *Comprehensive Unit-based Safety Program* (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? The dependent variable was the CAUTI rate, and it was calculated using NHSN criteria (CDC, 2015). The independent variable was the daily rounding by CAUTI champions implemented in this project. Data on CAUTI rates, catheter days, patient days, and device utilization ratio (DUR) were obtained from the infection control preventionist and nurse managers at the facility. All reports and

collected data were de-identified and stored in an Excel worksheet on a password protected computer accessible only to the primary investigator.

A quasi-experimental design was suitable for this project because the pre-post interventions were used to determine the relationship between the independent variable (daily rounding by CAUTI champions) and the dependent variable (CAUTI rate). The design also allowed the collection and statistical analysis of numerical data to determine the effectiveness of an intervention, even though generalizability was limited (Houser, 2018). Daily rounding by CAUTI champions was confirmed to reduce CAUTIs in healthcare settings and increased adherence to established standards of care (Graham-Glover et al., 2017; Snyder et al., 2020). An increase in compliance with guidelines for care improves the quality of care and patient outcomes.

Project Methodology

This project employed a quantitative methodology to establish the relationship between evidence-based practice intervention and CAUTI reduction at a rehabilitation facility. There are three types of methodology, quantitative, qualitative, and mixed (Cope, 2015). Quantitative methodology is based on statistics and quantities, and it aims to explain the relationships between two or three variables; qualitative methods gather verbal data to provide a detailed explanation or description about a phenomenon; mixed-method involves the use of both qualitative and quantitative methodology (Cope, 2015). A quantitative methodology was most appropriate because it involves gathering and analyzing measurable data such as CAUTI rates. It also allows the observer to evaluate the effects of an intervention [daily rounding by CAUTI champions] on a specific outcome [CAUTI rates] (Leung, 2015). A similar method was employed in a quantitative

project conducted in a nursing home, and the results confirmed that a quantitative methodology is appropriate for a quasi-experimental project (Campbell, 2020).

Information on the CAUTI project was disseminated to staff nurses on the patient units, and managers and assistant managers were informed during face-to-face meetings. Interventions were implemented in collaboration with managers and assistant nurse managers. According to the CDC TAP strategy for CAUTI reduction, training sessions on CDC guidelines for CAUTI prevention were conducted at various scheduled times to accommodate nurses working on different shifts. Information session on the reduction of unnecessary urine culturing and overuse of antibiotics was presented to the providers at the site. The AHRQ-NHSN definition CAUTI criteria pocket card was handed to all providers and nurses. Daily rounding by CAUTI champions was introduced on all the three patient units at the facility upon completing the training sessions. The CDC indications for catheterization and maintenance of catheters per guidelines for prevention guided the daily rounding. Documentation on rounding was done daily in the electronic health record for each patient with an IUC.

A qualitative methodology was not appropriate for this project because it seeks to understand behavior, participants' perceptions, and interpretations (Houser, 2018; Leung, 2015). Quantitative methods, on the other hand, allow the researcher to conclude the effectiveness of interventions, thereby providing some of the most robust evidence for nursing practice (Houser, 2018). It was, therefore, most applicable for this project to employ a quantitative methodology that utilizes measurable numerical data to determine the effect of daily rounding by CAUTI champions on CAUTIs. Measurable data collected on all the three patient units before and after the intervention were analyzed with

descriptive statistics and paired sample *t*-test on SPSS. Descriptive statistics provided a picture of the collected data and assisted in summarizing data and finding patterns. Examples are mean, mode median, and frequency (Ali & Bhaskar, 2016). The mean of the dependent variable on the three units pre-and post-intervention was obtained using descriptive statistics. The paired sample *t*-test was used to determine the difference between the means of the pre-and post-intervention data (Ali & Bhaskar, 2016). The clinical question and problem statement in this quantitative project were used to explain the relationships between CAUTIs and daily rounding by CAUTI champions (Cope, 2015). A pre-post intervention method was used for data collection because it is recommended in a quasi-experimental project with no randomization (Campbell, 2020). The results of pre-intervention tests and post-intervention tests were de-identified, collated, and prepared on an Excel worksheet. All data were stored in folders on a password-protected computer in the investigator's locked office.

Project Design

The design selected for a project must be appropriate for the selected methodology and apply to the clinical question and problem statement (Cope, 2015). Quantitative project designs may be experimental, quasi-experimental, or non-experimental (Zaccagnini & Waud White, 2017). Project designs may also be retrospective (the proposed cause and effect have already occurred); prospective (the cause, but not the effect, has occurred), cross-sectional (examines groups in various stages of development), or longitudinal (the same subjects are studied over some time; Schmidt & Brown, 2015).

A quasi-experimental design was appropriate for this practice improvement project because it allows the measurement of the dependent variable before and after interventions (Houser, 2018). The design also provides answers to the clinical questions because there is no randomization in the sampling technique (Campbell, 2020). The design allowed a comparison of CAUTI rates before and after daily rounding by CAUTI champions was implemented. The use of a convenience sampling technique in this design was a disadvantage because generalizability was limited to the selected population (Houser, 2018). Comparison and benchmark data on CAUTI rates were obtained from the site infection control preventionist via email communication.

Population and Sample Selection

The project was implemented in a 120-adult rehabilitation & skilled nursing facility located in Northern California. The facility has three 40-bed units, composed of hospice/palliative care, traumatic brain injury, and sub-acute specialty areas, respectively. This quality improvement project utilized a convenience sampling technique to select a sample of all the residents with an indwelling urinary catheter (IUC) at the facility. The exclusion criteria included all residents at the facility with no IUC. A sample size of residents with IUC (*n=18)* was considered for data collection and analysis before the intervention. A priori sample size calculation of 10 was obtained using GPower analysis, version 3.1.9.6, for a two-tailed test, and a 5% margin of error. A convenience sampling technique was appropriate for a small patient population size with no randomization. This technique was beneficial because it is cheap, efficient, and easy to implement (Jager, Putnick & Bornstein, 2017). There was no informed consent required for data collection

because de-identified aggregate data on CAUTIs was collected from the infection control preventionist for analysis.

The convenience sampling technique was also used to select nurses (registered nurses and licensed vocational nurses) at the project site as CAUTI champions. This sampling technique is a preferred method because of the ease of use and cost-effectiveness (Jager, Putnick & Bornstein, 2017). A priori sample size was calculated to be 10, using GPower version 3.1.9.6 analysis for a two-tailed test, the probable margin of error of 5% and power of 95%.). A disadvantage of the technique is a lack of clear generalizability, but this was mitigated by the homogeneous population of patients with IUC only.

Instrumentation or Sources of Data

The CDC NHSN criteria for CAUTIs guided the data collection and calculation of CAUTI data in this improvement project (CDC, 2017). The aggregate data on CAUTIs is stored in the facility's audit reporting system with access limited to the leadership and infection control preventionists. Raw CAUTI data was obtained from the infection control preventionist using the NHSN definition criteria for long term residents (AHRQ, 2017).

All de-identified CAUTI data (CAUTI rates, device utilization ratio, catheter days) were retrieved from the infection control preventionist by sending an email request on the first and last weeks of data collection. The CAUTI champions, nurse managers, and assistant managers were also available to provide daily and weekly CAUTI data as required for analysis. The retrieved data was collated and organized using an Excel

worksheet for collation and tabulation. These were stored on an electronic file saved in a password-protected computer with access limited to the investigator.

Validity

The validity of an instrument is the extent to which it measures what it is intended to measure (Tsang, Royse & Tekawi, 2017). Content validity is the extent to which an instrument includes essential items in the content domain (Taherdoost, 2016). It requires a panel of experts to evaluate an instrument in order to establish content validity (Taherdoost, 2016).

Construct validity is the most important concept in evaluating a questionnaire. It is the extent to which the instrument measures a construct that is not directly observable (Tsang, Royse & Tekawi, 2017). The NHSN criteria for CAUTI rates used in prior studies confirmed the accurate measure of CAUTIs in acute care settings and long-term facilities (Mody et al., 2015; Meddings et al., 2017). Redondo-González et al. (2018) confirmed the validity and reliability of administrative coded-data (ACD) with high specificity >93% for NHSN identification of HAIs.

Validity also includes internal validity and external validity (Creswell & Creswell, 2018. Internal validity is the extent to which the project is free of errors, and it determines if the results are related to the independent variable, and no outside influence, such as errors in measurements and the selection of participants in the study (Patino & Ferreira, 2018). External validity is the extent to which the results of a study are generalizable to patients in daily practice or a larger population. It refers to the usefulness and applicability of the findings (Houser, 2018). A lack of external validity implies that

the results of the trial may not be generalizable to other patient populations, which results in low adoption of the implementation by other clinicians (Patino & Ferreira, 2018).

Daily rounding by CAUTI champions, using the AHRQ CUSP, was validated for use in CAUTI prevention in different studies and amongst the various patient population in acute care settings (Graham-Glover et al., 2017; Parker et al., 2017; Siegel, Figueroa & Stockwell, 2018; Snyder et al., 2020). The intervention in this project was, therefore, applicable to this population because of similar diagnoses and demographics in the patient population and because the post-implementation results have been generalized to patient populations in other care settings.

Reliability

The reliability of an instrument is the consistency of the results of the survey or instrument (Taherdoost, 2016). Ferguson (2018) utilized pretest-posttest methods in the evidence-based practice implemented for the reduction of CAUTI rates. The results of the study showed a drop in CAUTI rate guided by NHSN criteria from 7.49 to 0 per 1,000 catheter days (Ferguson, 2018). Elkbuli et al. (2018) implemented an evidence-based CAUTI bundle for CAUTI prevention. The statistical analysis was done using Chi-square and t-test. The results revealed an 80% reduction in the CAUTI rates (Elkbuli, 2018).

The reliability of the project refers to the exact replicability or repeatability of the processes. It is obtained through project design and steps utilized for project implementation (Taherdoost, 2016). Snyder et al. (2020) introduced a daily CAUTI rounding to reduce CAUTI on an acute care unit, and the rates of CAUTI dropped to 0 per 1000 catheter days while the adherence to the CAUTI bundle increased from 83% to 94%. This project aimed to decrease CAUTIs by introducing daily rounding by CAUTI

champions on the patient units at this facility using a quasi-experimental design. The CDC Targeted Assessment Prevention (TAP) strategy implementation guide recommended daily rounding by champions for monitoring of catheter appropriateness in CAUTI prevention (CDC, 2017). The Agency for Healthcare Research and Quality CUSP program recommended the use of champions in daily rounding for the sustenance of implemented guidelines and improvement over time (AHRQ, 2015).

Data Collection Procedures

Approval was obtained from the Grand Canyon University Institutional Review Board (IRB) before the collection of any data (see Appendix A). Following approval, the investigator collaborated with the nursing leadership to select CAUTI champions. These were early adopter nurses and role models on the nursing units. The CAUTI champions participated in the CAUTI prevention educational sessions. The training sessions were conducted twice a week for the first two weeks of project implementation in a conference room at the facility. Sessions were also held for CAUTI champions from all work shifts and providers at the same location. The focus of the educational sessions was to inform nurses and providers of the CDC and AHRQ guidelines for CAUTI prevention. The topics presented to the CAUTI champions were as follows:

- Appropriate urinary catheter use or indications for indwelling urinary catheterization
- Proper techniques for urinary catheter insertion
- Proper techniques for urinary catheter maintenance
- Management of obstructions
- Specimen collection

- Importance of educational training sessions on catheter management.

(CDC, 2015).

The educational session for the providers addressed CAUTI prevention by providing information on the following:

- Appropriate indications for catheterization
- The culture of urine culturing: the importance of knowing when not to order urine cultures
- Antibiotic stewardship
- NHSN definition CAUTI criteria scorecard (see Appendix B & Appendix C) (AHRQ, 2017).

All documents were saved on a password-protected computer, with limited access in the investigator's locked office at the project site. Data on catheter days, device utilization ratios, and CAUTI rates collected before and after the interventions were labeled with the prefixes "unit A, unit B, and unit C" for the three units at this rehabilitation facility. The steps for data collection were as follows:

1. The principal investigator submitted the project to the University review board for approval
2. Upon IRB approval, data for the previous four weeks on CAUTI rates, catheter days, and device utilization ratios were obtained from the site infection control preventionist via email.
3. The investigator informed managers and nurses of the purpose of the project during meetings and discussions with nurses on the units. Managers were informed of the need to select 1-2 nurse champions per shift on every unit.

4. The selected CAUTI champions were trained in the site conference room by the principal investigator. Information on CDC CAUTI prevention guidelines and daily rounding using the AHRQ CUSP was presented to these nurses, as well as their role as CAUTI champions on their various units. Similar information on CDC guidelines and indications for catheterization, AHRQ antibiotic stewardship and urine culturing was presented to the nurse practitioners and providers.
5. Daily rounding by CAUTI champions, using the AHRQ CUSP, was initiated after the completion of educational sessions. CAUTI champions rounded daily using the CAUTI bundle maintenance checklist in the electronic medical record (EMR). The completed rounding documentation is reflected in a supplemental note attached to the patients' medical record
6. CAUTI related data was collected from the infection control preventionist four weeks before and four weeks after the intervention was fully implemented on all units at the project site.
7. The pre-intervention CAUTI data (CAUTI rates, catheter days, and device utilization ratios) was compared with post-intervention CAUTI data using descriptive statistics. The analysis was done with the paired sample *t*-test, and the *p*-value was determined for statistical significance.

This quality improvement project did not utilize direct or indirect protected health information (PHI). The HIPAA Privacy Rule specifies that a covered entity may always use or disclose PHI for research purposes once it is de-identified [per 45 CFR 164.502(d), and 164.514(a)-(c) of the Rule] (United States Department of Health and Human Services

[USDHHS], 2018). A research determination exempting IRB approval was obtained from the site research department. A site authorization without participant consent, due to anonymity and the use of de-identified data, was provided by the Chief Nurse of the facility.

Data Analysis Procedures

This DNP project analyzed pre-and post-implementation CAUTI rates, catheter days, and device utilization ratios. All CAUTI related data were calculated according to NHSN definition (CDC, 2020). CAUTI rate was calculated as the number of CAUTI episodes divided by catheter days multiplied by 1,000. Catheter days are the number of urinary catheter days for all patients with IUC. The catheter or device utilization ratio is the number of catheter days divided by patient days. (CDC, 2020). These numerical data were analyzed with descriptive statistics, which provided a summary of the pattern (Leung, 2015). Descriptive statistics include measures of central tendency (averages such as mean, median, and mode) and measures of variability about the average (range and standard deviation; Bhatia, 2018).

Deductions were made about the independent and dependent variables, and the SPSS version 27 was used for the analysis of all collected data. The paired sample *t*-test was used to compare the means of the pre- and post-intervention CAUTI data on the three units. The collected data were analyzed to evaluate the influence of implemented intervention, and results presented in tables and graphical forms using charts in Excel.

Ethical Considerations

The ethical issues relating to this project were considered to ensure the wellbeing and safety of all participants. The project was approved as a quality improvement project

by the research department at the project site and authorized by the Chief of the project site. The project was reviewed by the GCU IRB committee and approved before data collection. The ethical principles of veracity, beneficence, and non-maleficence were adhered to strictly in this project by ensuring full disclosure to all participants and conducting a quality improvement project to enhance patient safety and improve care delivery. There were no identifiable data used in this project in order to assure anonymity and confidentiality. All data were stored on a password-protected computer in the investigator's locked office after retrieval from the infection control staff. The purpose of this project supported the American Nurses Association (ANA) Code of Ethics provision of *Professional Responsibility in Promoting a Culture of Safety* (ANA, 2015*).*

An inter-professional quality improvement team at the project site was assembled by the investigator. This team was composed of infection control preventionists, physicians, clinical nurse leaders, clinical nurse educators, nurse practitioners, nurse leadership, and front-line nurses. The outcome of this project aligned with the mission of Grand Canyon University, College of Nursing, which is "to develop professionals using systems and evidence-based practice to promote health, wellness, safety and quality care for individual patients and populations supported by an academically rigorous liberal arts education reflecting Christian values" (GCU, 2020). It also supported DNP essential elements of inter-professional collaboration for improving patient health outcomes with evidence-based practice (GCU, 2020).

Limitations

The small sample size (N=32) used for this project limited the generalization of findings. However, findings could be applied to facilities with similar demographics.

The data obtained from nurses and infection control preventionist was dependent on the accuracy of the documentation of the provider of the information. Nurses are skilled professionals trained on the importance of accuracy in documentation and duly informed on ethical principles of veracity and integrity.

The four-week time frame for the project also limited the ability to capture enough data for the determination of trends. A more extended period would have provided the opportunity to monitor the trend in CAUTI rate and evaluate the effect of the daily rounding by CAUTI champions. The shorter period (four weeks post-implementation) may not reflect the required trend. Therefore, a follow-up of this project may be needed to capture its full impact on CAUTIs at this facility.

Delimitations of this project include implementing evidence-based practice for CAUTI reduction in a rehabilitation facility because of the importance of quality care delivery in healthcare organizations and commitment to ethical standards for patient safety. The nursing profession is responsible for facilitating nurse ethics competence through education and support (Grace, 2018). The project included only the patients with IUC because of the safety concern in this patient population. This inclusion criterion affected the generalizability of the findings.

Summary

Catheter-associated urinary tract infection (CAUTI) is a major concern and a hindrance to achieving patient outcomes. Evidence-based practice guidelines and strategies must be put in place to curb this preventable health care issue. Various methodologies and designs have been used in quality improvement work to reveal the causal factors and strategies to be implemented for prevention in health care facilities. It

is vital to use the appropriate methodology and design for a project because validity and reliability are confirmed when the study design matches the methodology and answers the clinical question. Different types of methodologies adopted for use in practice improvement projects include quantitative, qualitative, and mixed methods. The methodologies differ in the aim of the research, the hypotheses or clinical question, methods, and study designs utilized to produce reliable and valid results (Leung, 2015).

This project utilized a quantitative quasi-experimental design to establish a relationship between CAUTIs and daily rounding by CAUTI champions, using AHRQ CUSP. Methodology and designs differentiate project types and guide the process and rigor, so it is important to understand their impact on data collection and analysis (Schmidt & Brown, 2015; Zaccagnini & Waud White, 2017). Metric data involving catheter days, device utilization ratio, and CAUTI rates were retrieved from the infection control preventionist, CAUTI champions, and project site. Descriptive statistics was used to reveal the pattern and summary. The paired sample *t*-test was used to analyze the collected pre-intervention and post-intervention data and to determine the clinical and statistical significance.

All the collected data were de-identified and stored on a password-protected computer with access restricted to the investigator for the protection of confidentiality and privacy of the participants. The ethical principles of beneficence, autonomy, and justice, per the Belmont Report, were throughout the project implementation. Ethical considerations for this project included the completion of CITI training on the protection of human research participants, site authorization, site IRB determination, and GCU IRB approval. The project aligned with the GCU School of Nursing's mission of using

evidence-based practice to promote safety, wellness, and quality of care (GCU, 2020). Chapter 4 discusses the results and presents a graphic summary of the findings. The statistical analyses are presented with the figures and tables to show the relationships between the dependent and independent variables. A summary of the project and data presented answered the clinical question on the impact of daily rounding by CAUTI champions, using AHRQ CUSP, on CAUTI reduction.

Chapter 4: Data Analysis and Results

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTIs among adult residents in a rehabilitation facility in Northern California for four weeks. The increase in CAUTI rates when compared to previous years despite established CDC protocol for CAUTI prevention was a safety concern. The nurse leadership requested an intervention to mitigate this safety issue among patients with indwelling urinary catheters at the project site. The daily rounding by nurse champions was adapted from the Centers for Disease Control and Prevention (CDC) Targeted Assessment Prevention (TAP) strategy (see Appendix E) and Agency for Healthcare Research and Quality (AHRQ) CUSP for CAUTI prevention (AHRQ, 2015; AHRQ, 2017; CDC, 2020).

The following clinical question guided this quality improvement project: To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? This quality improvement project was conducted using aggregate data on CAUTI rates and device utilization ratio collected four weeks before and after implementing daily rounding by CAUTI champions. Data was retrieved from the facility infection control preventionist for the project site. All collected data were collated and analyzed by using Excel and SPSS version 27.

This chapter focused on the investigator's explanation of the collected data

analysis results and a concise summary of the findings. The result was displayed using tables and graphs for the three different units and for the entire facility four weeks pre- and post-intervention. The descriptive data and analysis of the variables (CAUTI rates, device utilization ratios, and catheter days) were presented using SPSS descriptive statistics and *t*-test. Cohen's *d* effect size was used to determine clinical significance.

Descriptive Data

This project was conducted at a rehabilitation facility located in Northern California. The patient population was composed of residents admitted from acute care hospitals and service areas. A sample size of all residents with an indwelling urinary catheter (N=32*)* was used for this project. The residents with no IUC were excluded from the project. The sample size pre-intervention was *n*=18, while the sample size post-intervention was *n*=14. Descriptive statistics was used to calculate the mean catheter days, the mean CAUTI rates, and the mean device utilization ratios four weeks before and four weeks after the intervention was implemented.

Table 1 depicts the sample size of the patients with an indwelling urinary catheter on the three units at the facility. A total number of six residents were reported on each of the units before implementing the project. The number of residents with IUC post-intervention decreased on Units A & C, as displayed in Table 1.

Table 1
Sample Size of Patients with Indwelling Urinary Catheters

	Unit A	Unit B	Unit C	Total
Pre-intervention sample	6	6	6	18
Post-intervention sample	5	6	3	14
Total sample size				32

Table 2 summarizes the pre-intervention and post-intervention CAUTI rates for the facility. The rates and ratios of the three units at the facility are displayed in the table below. The CAUTI rates for the units before intervention were: A=7.35, Unit B=7.51, and Unit C=0. The three units reported zero (0) CAUTI rate after project intervention. The average pre-intervention CAUTI rate for the facility was 5.18, while the average post-intervention CAUTI rate for the facility was zero (0). Table 3 presents the pre-and post-catheter days for the units and the facility. The pre-intervention device utilization ratios (DUR) for the three units were 0.15, 0.136, and 0.145, respectively. The post-intervention DUR was 0.12, 0.084, and 0.08 for the three units. The average DUR for the facility was 0.145 pre-intervention and 0.096 post-intervention.

Table 2
CAUTI Rates Per 1,000 Catheter Days and DUR

Variables	Unit A	Unit B	Unit C	Facility
Pre-intervention CAUTI rates	7.35	7.51	0	5.18
Post-intervention CAUTI rates	0	0	0	0
Pre-intervention DUR	0.15	0.136	0.162	0.145
Post-intervention DUR	0.12	0.084	0.08	0.096

Table 3 displays the pre-intervention catheter days for the three units. These were 136, 133, and 117 days, respectively, while the post-intervention catheter days were 133, 92, and 63 accordingly. The average pre-intervention catheter days for the facility was 386 days, and post-intervention catheter day was 288 days.

Table 3
Pre- and Post-Intervention Catheter Days for the Units and Facility

Variables	Unit A	Unit B	Unit C	Facility
Pre-catheter days	136	133	117	386
Post-catheter days	133	92	63	288

The CAUTI rate for the facility pre-intervention was 5.18 per 1,000 catheter days, while the CAUTI rate post-intervention was 0 per 1,000 catheter days. The pre-and post-intervention foley days were 386 and 288 days, respectively. The device utilization ratio was 0.145 pre-intervention and 0.125 post-intervention. The post-intervention CAUTI rate, DUR, and foley days were lower than the pre-intervention data.

Table 4
Pre- and Post-Intervention CAUTI Data

Variables	Pre-intervention	Post-intervention
CAUTI Rates	5.18	0
Foley Days	386	288
Device Utilization Ratios	0.145	0.095

Data Analysis Procedures

The clinical question for this project was to what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? The site authorization and Grand Canyon University IRB approval were obtained from Grand Canyon University and the project site, respectively. The data for the project (CAUTI rates, DUR, and catheter days) was obtained from the infection control preventionist, and from the nurse champions and nurse managers in the absence of the infection control nurse. Statistical methods included collecting and analyzing data and drawing meaningful interpretations of a finding (Ali & Bhaskar, 2016).

De-identified data on CAUTI rates, device utilization ratios, and catheter days (foley days) four weeks before the intervention were obtained from the infection control preventionist. The four-week post-intervention de-identified data on CAUTI rates, DUR, and catheter days was provided by the CAUTI champions and nurse managers, and the

infection control preventionist. The data gathered represented foley days and numbers of CAUTIs reported per week on patients with an indwelling urinary catheter on each of the three units at the facility. Data was collated and analyzed for consistency using Excel and analyzed with SPSS version 27 by the investigator.

It is necessary to utilize proper statistical tests in order to obtain precise results and accurate inferences. The analysis of collected data using statistical methods provides meaning to meaningless numbers. (Ali & Bhaskar, 2016). Descriptive statistics provided a summary of the pre-intervention and post-intervention CAUTI rates, foley days, and device utilization ratios for the sample. A paired *t*-test was conducted to determine the differences between the means of the pre-and post-intervention data. The "*p*" value measures statistical significance and is defined as the probability that study results are due to chance rather than an intervention effect. (Mellis, 2018). The cut off for the *"p"* value was considered statistically significant at a 0.05 significance level or margin of error, and 95% CI or confidence intervals (Ranganathan, Pramesh & Buyse, 2015). The *p*-value of .000 indicated statistical significance (Nahm, 2016).

The effect size of the *t*-test result, represented by Cohen's *d*, was used to determine the clinical significance or the likelihood of the results impacting current medical practice (Ranganathan, Pramesh & Buyse, 2015). Cohen's *d was* calculated using *t*-test results by dividing the mean difference of the two groups (pre-and post-intervention) with the standard deviation (Rana, Singhal & Dua, 2016). The effect size result is often interpreted as either small (d=0.2), moderate (d=0.5) or large ($d \geq 0.8$; Leppink, O'Sullivan & Winston, 2016). The paired *t*-test was the appropriate statistical test for this project because the clinical question was answered accurately, and all

assumptions for the test were met. The statistical and clinical significance were determined by comparing the means of the pre-and post-intervention CAUTI rates, catheter days, and device utilization ratios

Results

The clinical question for this project, "To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? was answered using descriptive statistics to evaluate and analyze the means of the collected data. A paired sample *t*-test was used to determine the difference between the means of the pre-intervention and post-intervention CAUTI rates.

All the post-intervention data dropped significantly in four weeks compared with pre-intervention data, as presented in Table 5 and Figures 1, 2, and 3. The pre-intervention CAUTI rate of 5.18 per 1,000 catheter days dropped to zero (0), a 100% reduction in CAUTI rate. The foley days dropped from 386 to 288 (25.34% reduction), and the DUR was decreased by 35% from 0.145 to 0.095 (see Figures 2 & 3). The three units had a significant drop in all collected data post-intervention. The DUR on Unit A dropped from 0.1432 to 0.12, Unit B dropped from 0.136 to 0.084, and Unit C from 0.162 to 0.08. The overall facility DUR dropped to 0.095 from 0.145 pre-intervention (see Figure 2).

Similar results were obtained on post-intervention catheter days when compared to pre-intervention data. The catheter days for Unit A dropped from 135 days to 133 days, Unit B from 133 days to 92 days, and Unit C from 117 days to 63 days. The overall

facility catheter days were decreased from 386 days, pre-intervention to 288 days post-intervention (see Figure 2).

Table 5
Percentage Change in Pre- and Post-Intervention Data

Variables	Pre-intervention	Post-intervention	% change
CAUTI rates	5.18	0	100.00%
Catheter Days	386	288	25.39%
DUR	0.14	0.095	34.5%

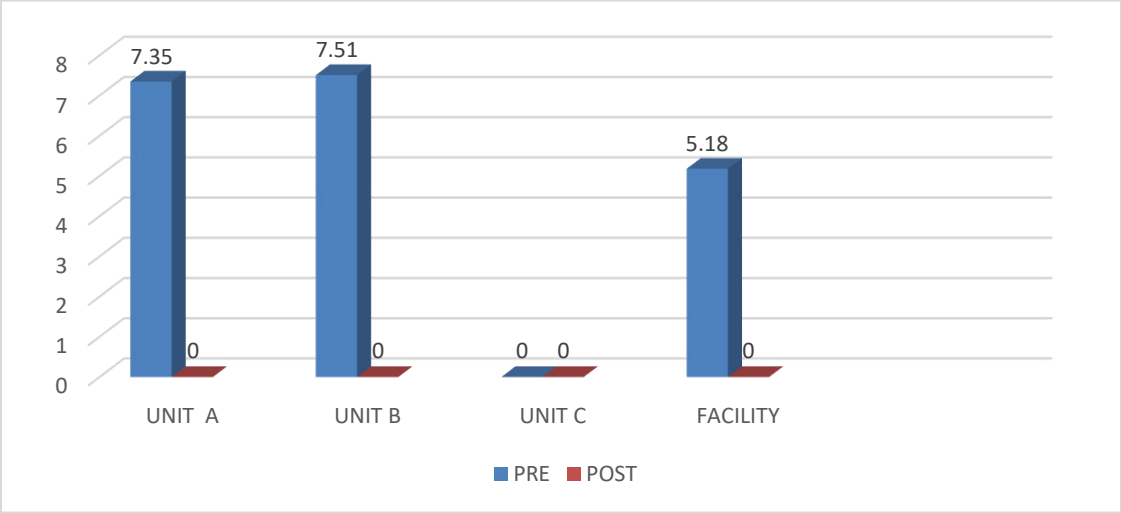


Figure 1. CAUTI Rates.

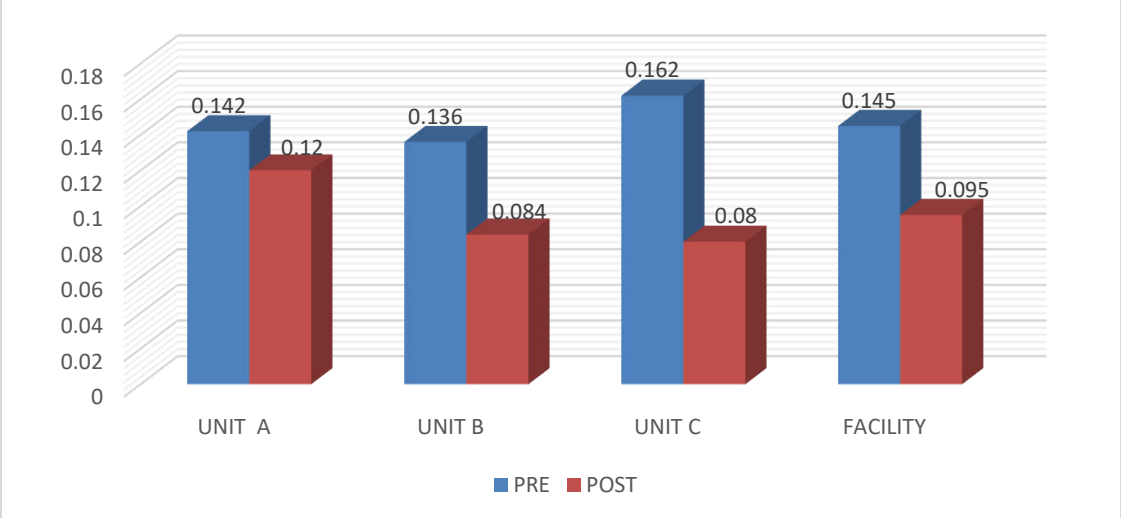


Figure 2. Device Utilization Ratios.

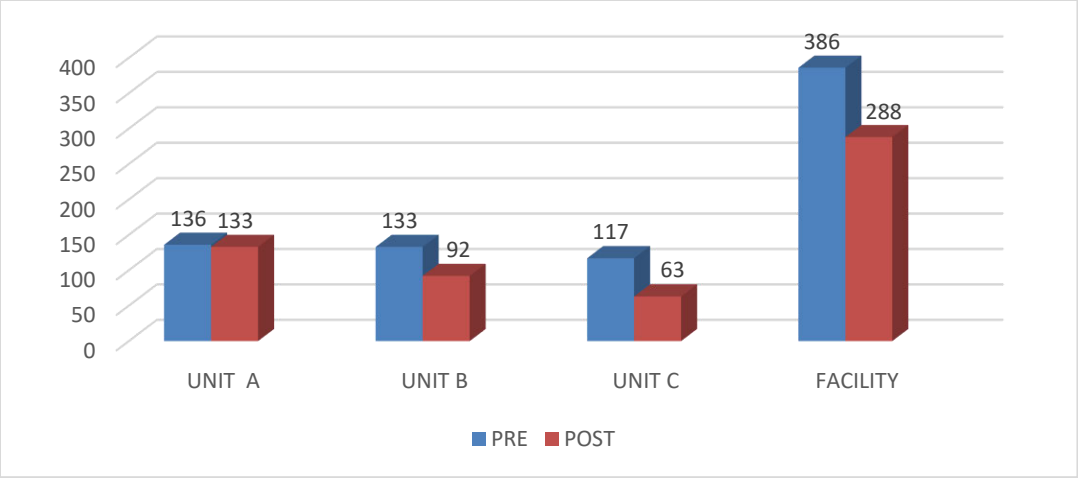


Figure 3. Catheter Days.

A repeated measure, paired sample *t*-test, was conducted to reveal whether the difference between the means of the pre-intervention and post-intervention data was statistically significant ($p \leq 0.05$). The results for catheter days revealed a 95% CI [95.40, 100.60] set at $\alpha = 0.05$, where 95.40 was the lower limit, and 100.60 was the upper limit for the confidence interval. The *p*-value was statistically significant for the CAUTI rate (M=5.18; SD=.02; *p*=.000), catheter days (M=98; SD=1.63; *p*=.000) and DUR (M=.005; SD=.002; *p*=.000). The effect size ($d > 0.8$) was large and significant, indicating that the difference between pre-and post-intervention CAUTI rates, DUR, and catheter days was meaningful. The results suggested that daily rounding by CAUTI champions significantly impacted CAUTIs at this facility within the specified time allowed for the project.

Table 6
Paired Sample t-test with p-values

				95% CI			
		Mean	SD	Lower	Upper	*p*	*d*
Pair 1	Pre-CAUTI rate Post-CAUTI rate	5.18	.02	5.15	5.21	.000	>0.8
Pair 2	Pre-catheter days Post-catheter days	98	1.63	95.40	100.60	.000	>0.8
Pair 3	Pre-DUR Post-DUR	.005	.002	.047	.053	.000	>0.8

Daily rounding by CAUTI champions effectively decreased CAUTI rates and foley days in acute care settings (Synder et al., 2020; Meddings et al., 2017). It also improved patient outcomes and nurses' compliance with established protocols (AHRQ, 2015; CDC, 2020; Mody et al., 2015; Snyder et al., 2020; Yatim et al., 2016). The intervention implemented in this project increased daily monitoring for catheter appropriateness and use. It also reduced prolonged catheterization, which is mostly reported in rehabilitation and long-term facilities. The findings of this project suggest that daily rounding by CAUTI champions, using AHRQ CUSP, reduced CAUTI rates, DUR and catheter days after four weeks of intervention at this rehabilitation facility.

Summary

The purpose of this quantitative quasi-experimental quality improvement project was to determine if the implementation of daily rounding by CAUTI champions for four weeks, using the Agency for Healthcare Research and Quality (AHRQ) Comprehensive Unit-based Safety Program (CUSP), would impact CAUTI rates when compared to routine care among adult residents in a rehabilitation facility in Northern California. The statistical analyses were conducted using descriptive statistics to identify the mean of the pre-and post-intervention CAUTI rates. The post-intervention CAUTI rate average (0 per 1,000 catheter days) was lower than the pre-intervention CAUTI rate average (5.18 per 1,000 catheter days). The paired sample *t*-test was significant, with a *p*-value ($p=.000$) indicating statistical significance. The effect size, $d>0.8$, further strengthened the significance of the *t*-test result. Daily rounding by CAUTI champions has been shown to improve patient outcomes by reducing CAUTI rates in various healthcare settings. However, the findings of this project showed its impact on CAUTI rates in rehabilitation

facilities. The statistical and clinical significance from the paired sample *t*-test indicated that daily rounding by CAUTI champions reduced CAUTI rates, DUR, and catheter days and should be adopted to improve patient outcomes and enhance safety in rehabilitation settings. Chapter 5 focuses on the summary discussion of the project and the findings. The theoretical, practical, and future implications are discussed, as well as recommendations and conclusions.

Chapter 5: Summary, Conclusions, and Recommendations

Catheter-associated healthcare-associated infections are the most common healthcare-associated infections and account for 20-30% of all infections reported in long-term facilities (AHRQ, 2015; CDC, 2020; Mody et al., 2015). CAUTIs are responsible for re-admissions, complications, and death in this patient population. These infections also impose a financial burden on the patients, the healthcare facility, and the nation (Meddings et al., 2017; Mody et al., 2015; Taha et al., 2017). The CDC and AHRQ CUSP recommended using toolkits and strategies for CAUTI mitigation, such as CAUTI bundle and targeted rounding by champions (AHRQ, 2015; CDC, 2017). Reviewed articles have confirmed these strategies reduce CAUTI in healthcare settings though not much evidence is available on rehabilitation facilities (Graham-Glover et al., 2017; Meddings et al., 2017; Mody et al., 2017; Snyder et al., 2020; Taha et al., 2017).

This quantitative project attempted to investigate the impact of daily rounding by CAUTI champions on CAUTIs amongst patients with IUC at this rehabilitation facility. The CAUTI rate dropped after implementing the intervention. The finding of this project was statistically significant and clinically relevant. It added to the evidence on CAUTI reduction in rehabilitation facilities. Chapter 5 presents the conclusion of the project, the implications, and recommendations for further research.

The project attempted to answer the following clinical question: To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? Chapter 1 presented the background, the problem statement, purpose, and significance of the

quantitative quasi-experimental project. Catheter-associated urinary tract infections (CAUTIs) are the most common HAIs, with an estimate of 13,000 deaths and $150 to $450 million in treatment costs each year (Letica-Kriegel et al., 2019; Strouse, 2015). The most common HAIs are catheter-associated urinary tract infections (CAUTIs), which result from the insertion of an indwelling urinary catheter into patients during hospitalizations (CDC, 2015). CAUTIs account for 20%-30% of all infections reported in long term facilities and often lead to hospital admissions, multidrug-resistant organisms, complications such as sepsis and endocarditis, and death. The CDC Targeted Assessment for Prevention (TAP) strategy, and the AHRQ Comprehensive Unit-based Safety Program (CUSP) recommend daily rounding by nurses to track appropriate catheter indications for the reduction of CAUTIs in healthcare facilities (AHRQ, 2015; CDC, 2017). It was therefore necessary to implement the daily rounding by CAUTI champions at the project site to determine its impact on CAUTIs and improvement of patient outcomes. The quantitative quasi-experimental design and methodology utilized were appropriate for this project.

Chapter 2 presented a theoretical framework for the project, and a comprehensive literature review to support implementing the evidence-based intervention, daily rounding by CAUTI champions, using AHRQ CUSP for CAUTI reduction. Lewin's change theory and IOWA model of evidence-based practice provided the project's framework. The IOWA model guided the step-by-step process in this project, from identifying the practice problem to evaluating the intervention. The themes and sub-themes focused on the risk factors for catheter-associated urinary tract infections and evidence-based strategies for reduction.

Chapter 3 documented how the project was conducted in detail to allow for replication. The chapter started with a summary of the project focus and purpose statement and expanded on the project's quantitative methodology and quasi-experimental design. The CAUTI rates, DUR, and catheter days were collected from the units. A total sample of 18 patients with IUC was selected pre-intervention. The project aimed to determine the impact of a four-week daily rounding by CAUTI champions on CAUTIs. The methodology and design were appropriate because: (a) the selected statistical methods and analyses were used to answer the clinical question posed in this project, and (b) deductions were made regarding the relationship between the independent and dependent variables in Chapter 4.

Summary of Findings and Conclusion

The clinical question in Chapter 1 was: To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? The statistical analyses presented in Chapter 4 determined that CAUTI rates dropped following daily rounding by CAUTI champions. The comparison of the pre-intervention and post-intervention CAUTI rate was statistically significant (p=.000), with a large effect size ($d>0.8$). Daily rounding by CAUTI champions decreased CAUTI rates after four weeks of implementation. In addition, the catheter days and device utilization ratios were decreased significantly on all three units at the facility.

The average pre-intervention CAUTI rate was 5.18 per 1,000 catheter days, and the average post-implementation CAUTI rate was 0 per 1,000 catheter days. The DUR

dropped from 0.14 to 0.12, and the catheter days dropped from 386 days pre-intervention to 288 days post-intervention. The *p*-value (.000) was statistically significant for CAUTI rates, catheter days, and DUR. The effect size was large with a Cohen's *d*>0.8. This project's findings revealed that daily rounding by CAUTI champions reduced CAUTI rates in rehabilitation facilities by increasing nurses' engagement and adherence to the CDC guidelines for CAUTI prevention. The project intervention also improved patient safety and quality of care by decreasing CAUTIs on each unit at the rehabilitation facility.

Implications

The project demonstrated statistical significance for the implemented daily rounding by CAUTI champions (*p*=.000). The reduction in post-intervention CAUTI rates, catheter days, and device utilization ratio indicated the intervention's clinical significance for CAUTI prevention. The project site's leadership had concerns about catheter-associated urinary tract infections because of the recurring numbers reported above local and national benchmarks. The CAUTI bundle in practice on the units did not reduce the rate of these infections. However, with the initiation of daily rounding by CAUTI champions, the catheter days and CAUTI rates decreased. The collaboration with providers and frontline nurses impacted the success of the intervention. Educational sessions on the CDC guidelines and AHRQ CUSP recommendations helped inform the latest practice and national requirements. It is crucial to involve frontline nurses in change implementation on the patient units because of their role in care delivery at the bedside. Another implication of this project was the importance of improving patient outcomes and the culture of safety. The facility's leadership was very pleased with the

project outcomes and opted to continue the daily rounding by CAUTI champions on all the units at the project site. The outcome of this project has significant implications for the facility as it seeks to become a high-reliability organization that upholds a culture of safety in addition to leadership's commitment to zero harm.

Theoretical Implications. The clinical question to be answered was: To what degree would the implementation of daily rounding by CAUTI champions, using AHRQ Comprehensive Unit-based Safety Program (CUSP), impact CAUTIs amongst adult residents in a rehabilitation facility in Northern California for four weeks? There were areas of strengths and weaknesses identified during this project. The areas of strength included the availability of data from the infection control preventionist and the nurses. The CAUTI champions provided daily catheter days and CAUTI events to the investigator upon request. Education materials were downloaded from the CDC and AHRQ websites with no restricted access**.** Relevant educational materials for CAUTI prevention were provided to all the CAUTI champions, unit managers, and providers for future reference.

Another strength of this project was the strong support from the executive leadership, unit-managers, and clinicians. The readiness for change amongst the stakeholders made the implementation easy and smooth with no form of resistance. The physicians and nurse practitioners cooperated with the CAUTI champions during daily rounding to ensure the appropriateness of catheter use and urine cultures. The project's weaknesses were the small sample size and project duration. Even though the findings were favorable, the small sample size limited the generalizability of the findings to similar settings. The project implementation duration was another weakness because of

its data collection over a short period. A more extended time would allow the collation of pre-post CAUTI data over months for establishing a pattern for the successful intervention.

The project was grounded on Kurt Lewin's change theory and the IOWA model of evidence-based practice. Lewin's change theory comprises three stages: unfreezing, changing, and refreezing (Lewin, 1947). The 'unfreezing stage' was not challenging because CAUTIs constitute a significant safety concern requiring immediate intervention. The transition process from one stage to the other was smooth and easily adaptable because the selected CAUTI champions were early adopters of change. The daily rounding facilitated the reassessment of patients' need for catheterization, proper catheter placement, and care. Team collaboration was evident amongst the care providers as nurses and unit managers worked together with providers to assure appropriate indications for indwelling urinary catheters and urine culture orders per CDC guidelines. The IOWA model of EBP guides healthcare workers and nurses in improving patient care (Titler et al., 2001). The model provided the step-by-step process for the project, from clinical problem identification to reviewing literature and setting up the interprofessional team, project planning, implementation, and sustenance of the evidence-based intervention.

Practical Implications. The literature confirmed that daily rounding reduces CAUTIs in acute care settings, with little or no research in rehabilitation or skilled nursing facilities. The outcome of this project indicated that daily rounding by CAUTI champions, using AHRQ CUSP, reduced CAUTIs, catheter days, and device utilization ratios at a rehabilitation facility. Similar rehabilitation facilities could introduce daily

rounding by CAUTI champions to reduce catheter use and CAUTIs. Another implication for the project was the influence of doctorally prepared transformational nurse leaders on quality improvement projects. These leaders facilitate executive leadership support, ignite providers' interest, and encourage frontline nurses' active participation necessary for EBP success. The improvement of a healthcare facility's safety culture requires executive leadership and middle management support, the collaboration of nurse leaders, engagement of early adopter nurses and providers, and the EBP coordination by a doctorally-prepared transformational nurse leader.

Future Implications. This project's findings revealed that daily rounding by CAUTI champions, using the AHRQ CUSP, reduced CAUTIs by decreasing the CAUTI rates, catheter days, and device utilization ratio at this rehabilitation facility. A reduction in CAUTIs decreases the costs associated with hospitalizations and treatments (Krein et al., 2017). Daily rounding of patients with IUC improved nurses' and providers' adherence to established CAUTI prevention guidelines, thus enhancing the facility's safety culture. CDC and AHRQ CUSP have recommended evidence-based guidelines for CAUTI prevention in all health care facilities. Nevertheless, the following factors are crucial for a successful EBP implementation: readiness for change by the major stakeholders (frontline nurses, nurse managers, providers, executive leadership); relevant EBP model to guide the process and the inclusion of a doctorally-prepared transformational nurse leader to spearhead the change process.

Recommendations

Daily rounding by CAUTI champions, using the AHRQ CUSP is an effective way to engage frontline caregivers in an EBP intervention for CAUTI reduction. The CAUTI

champions displayed a commitment to patient safety by complying with CDC guidelines for CAUTI prevention and AHRQ CUSP recommendations. Printed posters and information reinforced information on catheter indications, insertion and maintenance, and urine cultures.

The readily available information increased nurses' confidence. A better understanding of the indications for catheterization and urine cultures empowered CAUTI champions to take necessary actions to prevent CAUTIs on their units. It also facilitated improved adherence to CAUTI bundle for CAUTI prevention. The increased nurses' engagement improved communication with providers on discussions regarding patients with IUC.

Daily rounding on the patient units by CAUTI champions improved CAUTIs, nurses' confidence level, communication with providers, and patient safety. In order to prevent CAUTIs effectively in a rehabilitation facility, it is recommended that a CAUTI bundle must be supported with (a) ongoing education for healthcare providers to reinforce information on CAUTI prevention guidelines and catheter maintenance; (b) daily rounding or frequent monitoring of patients with an IUC by nurse champions to better assess the continued need for placement and proper care; (c) a sustainable system of evaluating bundle compliance by health care providers; (d) frequent communication of decreasing CAUTIs to nurse champions, because it increases staff engagement and ownership of the success (AHRQ, 2020).

Recommendations for Future Projects. Nurses' attitude and a lack of collaboration amongst stakeholders are a major barrier to change (McCoy et al., 2017; Melynk & Fineout-Overholt, 2015). Future projects should include an assessment of

nurses' attitudes towards CAUTI prevention strategies such as daily rounding. A qualitative descriptive design helps to capture the attitudes and behavior in a survey tool or questionnaire.

Leadership style is significant for nurse retention and empowerment. Another recommendation for future projects is evaluating the leadership readiness for evidence-based practice, which is a significant driver of change in the healthcare organization. A qualitative descriptive or exploratory project provides information on how leadership influences change readiness and patient safety.

The knowledge of infection control protocol such as CAUTI bundle, prevention guidelines needs to be reinforced through ongoing in-service sessions. Improving nurses' knowledge of prevention guidelines was found to reduce CAUTIs (Ferguson, 2016). A quantitative project with a quasi-experimental design is recommended to assess nurses' knowledge of CAUTI prevention guidelines after an educational session. An interactive CAUTI prevention educational program impacted nurses' knowledge and decreased CAUTIs in acute settings (Gesmundo, 2016).

Catheter types also significantly influence CAUTI prevention in health care settings. Silicon-coated catheters were reported to decrease CAUTIs compared with standard catheters (Ahmad et al., 2018). Literature also confirmed the effectiveness of a noble metal alloy catheter in CAUTI prevention (Magnusson et al., 2019). However, there are contrary views about the types of catheters that are most effective for CAUTI prevention. CDC recommends silicone catheters because they reduce the risk of encrustation in long-term catheterized patients with frequent obstruction (CDC, 2015). Further research is suggested to clarify the benefit of catheter valves in reducing the risk

of CAUTI and other urinary complications (CDC, 2015). Future projects could compare catheter types to determine their impact on CAUTIs and cost-effectiveness in rehabilitation facilities.

Recommendations for Practice. The incidence of CAUTIs is a safety issue in long-term and rehabilitation facilities because it increases the hospitalization, morbidity, and mortality of residents. The inclusion of daily rounding by CAUTI champions in the CAUTI bundle is highly recommended to assure the appropriateness of indwelling urinary catheter indications, aseptic insertion, and maintenance of catheters. The compliance to CAUTI prevention guidelines by nurses and clinicians improves with daily rounding, thereby enhancing patient safety (Snyder et al., 2020).

As discussed in Chapters 1 and 2, collaboration amongst major stakeholders is crucial for the effective implementation of evidence-based interventions. Strategies must include the active participation of front-line nurses with buy-ins from physicians to prevent resistance to change implementation. The nursing leadership's active involvement, lead physicians, and strong executive leadership support are essential for evidence-based practice implementation (Krein et al., 2017).

An annual or bi-annual competency on catheter use, indications, and care is recommended to harness the knowledge on catheter maintenance. CAUTI prevention training should be included in the orientation for newly hired nurses. The strategies to mitigate CAUTIs include continuous in-service education on the evidence-based CAUTI bundle and a regular audit for adherence to recommended guidelines (Hernandez & Stewart, 2019). The improved knowledge of nurses increases staff empowerment, enhances communication with physicians and other team members, and increases

employee satisfaction (Dy et al., 2016; Krein et al., 2017). An overview of appropriate indications for catheterization and urine cultures prevents physicians from making wrong diagnoses, resulting in over-prescribing antibiotics.

The leadership style of the managers of change is significant for a successful implementation. Transformational leadership is effective for evidence-based practice implementation (Hussain et al., 2018). It inspires and motivates the participants to create the needed change for patient safety. A combination of executive leadership support, dedicated and knowledgeable nurses, transformational nurse leadership, and evidence-based interventions for infection prevention facilitates a safety culture crucial for the reduction of CAUTIs, and for facilities seeking to become a high-reliability organization committed to zero patient harm.

References

Agency for Healthcare Research and Quality. (2015). *Toolkit for reducing catheter-associated urinary tract infections in hospital units: Implementation guide: Frameworks for change and improvement*. https://www.ahrq.gov/hai/cauti-tools/guides/implguide-pt2.html

Agency for Healthcare Research and Quality. (2015). *Toolkit for reducing catheter-associated urinary tract infections in hospital units: Implementation guide* https://www.ahrq.gov/sites/default/files/publications/files/implementation-guide_0.pdf

Agency for Healthcare Research and Quality. (2017). *Forming a Comprehensive Unit-based Safety Program team: Facilitator guide.* https://www.ahrq.gov/hai/tools/mvp/modules/cusp/forming-cusp-team-fac-guide.html

Agency for Healthcare Research and Quality. (2018). *Six domains of health care quality*. https://www.ahrq.gov/talkingquality/measures/measure-questions.html

Agency for Healthcare Research and Quality. (2018). *Toolkit for reducing CAUTI in hospitals*. https://www.ahrq.gov/hai/tools/cauti-hospitals/index.html

Agency for Healthcare Research and Quality. (2019). *High reliability*. https://psnet.ahrq.gov/primer/high-reliability

Ahmad, H., Abbas-Anjum, H. M., Khan, M., & Naeem, A. (2018). Comparison of noble metal alloy-coated urinary catheters with non-coated catheters in reducing catheter-associated urinary tract infections. *Isra Medical Journal*, *10*(3), 134–137.

Ali, Z., & Bhaskar, S. (2016). Basic statistical tools in research and data analysis. *Indian Journal of Anesthesia, 60*(9), 790-798.

American Nurses Association. (2015). *Code of ethics for nurses 2016: The 9 provisions.* https://anacalif.memberclicks.net/assets/Events/RNDay/2016%20code%20of%20ethics%20for%20nurses%20-%209%20provisions.pdf

Armstead, T. J. (2019). *A qualitative study of reciprocal self-disclosure and parental school engagement* (Order No. 13897373). Available from ProQuest Central. (2243787170). https://lopes.idm.oclc.org/login?url=https://www-proquest-com.lopes.idm.oclc.org/docview/2243787170?accountid=7374

Armstrong, K. (2015). Diagnosing and treating urinary tract infections in older people. *British Journal of Community Nursing*, *20*(5), 226–230.

Bardsley, A. (2017). Diagnosis, prevention, and treatment of urinary tract infections in older people. *Nursing Older People, 29*(2), 32-38.

Barrow, J. M., Annamaraju, P. & Toney-Butler, T. J. (2020). *Change management*. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK459380/

Bhatia, M. (2018). *Data science: Your guide to qualitative and quantitative data analysis methods*. https://humansofdata.atlan.com/2018/09/qualitative-quantitative-data-analysis-methods/

Brown, C. G. (2014). The Iowa model of evidence-based practice to promote quality care: An illustrated example in oncology nursing. *Clinical Journal of Oncology Nursing*, 18*,* 2, 157–159. https://doi-org.lopes.idm.oclc.org/10.1188/14.CJON.157-159

Buckley, C., Clements, C., & Hopper, A. (2015). Reducing inappropriate urinary catheter use: quality care initiatives. *British Journal of Nursing, 24*, S16-22.

Buckwalter, K. C., Cullen, L., Hanrahan, K., Kleiber, C., McCarthy, A. M., Rakel, B., Steelman, V., Tripp, R. T., & Tucker, S. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing*, *14*(3), 175–182. https://doi-org.lopes.idm.oclc.org/10.1111/wvn.12223

Calderon, L. E., Kavanagh, K. T., & Rice, M. K. (2015). Questionable validity of the catheter-associated urinary tract infection metric used for value-based purchasing. *American Journal of Infection Control*, *43*(10), 1050–1052.

Campbell, B. J. (2020). *Improving patient outcomes through implementation of a nurse-directed protocol for urinary catheter removal* [Dissertation]. Grand Canyon University, Arizona. https://lopes.idm.oclc.org/login?url=https://www-proquest-com.lopes.idm.oclc.org/docview/2389565768?accountid=7374

Centers for Disease Control and Prevention. (2010). *Urinary tract infection CAUTI and non-catheter-associated urinary tract infection and other urinary system infection events*. https://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf

Centers for Disease Control and Prevention. (2015). *Catheter-associated urinary tract infections (CAUTI): Guideline for prevention of catheter-associated urinary tract infections (2009)*. https://www.cdc.gov/infectioncontrol/guidelines/cauti/index.html

Centers for Disease Control and Prevention. (2017). *Healthcare-associated infections: The Targeted assessment for prevention (TAP) strategy-Infection prevention champions*. https://www.cdc.gov/hai/prevent/tap/preventionchampions.html

Centers for Disease Control and Prevention. (2019). *HAI data*. https://gis.cdc.gov/grasp/PSA/HAIreport.html

Centers for Disease Control and Prevention. (2020). *2019 progress report*. https://www.cdc.gov/about/24-7/2019-Progress-Report.html

Centers for Disease Control and Prevention. (2020). *Healthcare-associated infection surveillance protocol for urinary tract infection (UTI) events for long-term care facilities*. https://www.cdc.gov/nhsn/pdfs/ltc/ltcf-uti-protocol-current.pdf

Clarke, K., Wiley, Z., Tejedor, C., Kim, J. S., Reif, L., Witt, L. & Jacob, J. T. (2019). Catheter-associated urinary tract infections in adults: Diagnosis, treatment, and prevention. *Journal of Hospital Medicine, 15*(9), 552-556.

Cope, D. G. (2015). Case study research methodology in nursing research. *Oncology Nursing Forum,* 42, 6, 681-682.

Cortese, Y. J., Wagner, V. E., Tierney, M., Devine, D. &, Fogarty, A. (2018). Review of catheter-associated urinary tract infections and in vitro urinary tract models. *Journal of Healthcare Engineering, 10*, 1-16.

Cortes-Penfield, N. W., Trautner, B. W., & Jump, R. (2017). Urinary tract infection and asymptomatic bacteriuria in older adults. *Infectious Disease Clinics of North America*, *31*(4), 673–688. https://doi.org/10.1016/j.idc.2017.07.002

Craig, J. V. & Dowding, D. W. (2020). *Evidence-based practice in nursing (*4th ed.). Poland: Elsevier.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Los Angeles CA: SAGE.

Crowley, R. A. (2017). *American College of Physicians: Patient safety in the office-based practice setting* [Position paper]. https://www.acponline.org/acp_policy/policies/patient_safety_in_the_office_based_practice_setting_2017.pdf

Damani, N. (2016). *Prevention of catheter-associated urinary tract infections*. https://www.theific.org/wp-content/uploads/2016/04/18-UTI_2016.pdf

Daniel, E. (2016). The usefulness of qualitative and quantitative approaches and methods in researching problem-solving ability in science education curriculum. *Journal of Education & Practice, 7*(15), 91-100.

Dy, S., Major-Joynes, B., Pegues, D., & Bradway, C. (2016). A nurse-driven protocol for removal of indwelling urinary catheters across a multi-hospital academic healthcare system. *Urologic Nursing, 3*(5), 243-249.

Dzau, V. J. (2016). *Improving the safety and quality of health care: The impact of the National Academy of Medicine on Research and Collaboration*. AHRQ Research Summit & National Academy of Medicine. https://www.ahrq.gov/sites/default/files/wysiwyg/news/events/ahrq-research-summit/dzau-summit2016.pdf

Elkbuli, A., Miller, A., Boneva, D., Puyana, S., Bernal, E., Hai, S., & McKenney, M. (2018). Targeting catheter-associated urinary tract infections in a trauma population: A 5-S bundle preventive approach. *Journal of Trauma Nursing*, *25*(6), 366–373.

Ferguson, A. (2018). Implementing a CAUTI prevention program in an acute care hospital setting. *Urologic Nursing*, *38*(6), 273–302.

Gesmundo, M. (2016). Enhancing nurses' knowledge on catheter-associated urinary tract infection (CAUTI) prevention. *Kai Tiaki Nursing Research, 7*(1), 32–40.

Grace, P. (2018). Enhancing nurse moral agency: The leadership promise of Doctor of Nursing practice preparation. *The Online Journal of Issues in Nursing, 23*, 1.

Graham-Glover, B., Mueller, S., Allio, E., & Williams, C. (2017). The intern intervention: The effect of daily rounding on reducing indwelling urinary catheter device utilization. *Open Forum Infectious Diseases, 4*(1), S631.

Grand Canyon University. (2020). *College of Nursing and Healthcare professions: Our college mission*. https://www.gcu.edu/college-of-nursing-and-health-care-professions.php#:~:text=The%20mission%20of%20the%20College,arts%20education%20reflecting%20Christian%20values.

Grove, S. K., Burns, N. & Gray, J. R. (2013). *The practice of nursing research: Appraisal, synthesis, and generation of evidence* (7th ed.) St. Louis, MO: Elsevier/Saunders.

Helber, B. (2015). *The impact of an evidence-based practice protocol on catheter-associated urinary tract infections and urinary catheter days* [Dissertation]. Walden University.

Hernandez, M., King, A., & Stewart, L. (2019). Catheter-associated urinary tract infection (CAUTI) prevention and nurses' checklist documentation of their indwelling catheter management practices. *Nursing Praxis in New Zealand*, *35*(1), 29–42.

Houser, J. (2018). *Nursing research: Reading, using and creating evidence* (4th ed.). Burlington, MA: Jones & Bartlett Learning.

Hu, F., Tsai, C., Lin, H., Chen, C. & Chang, C. (2017). Inappropriate urinary catheter reinsertion in hospitalized older patients. *American Journal of Infection Control 45*(11), 8-12.

Hussain, S. T., Lei, S., Akram, T., Haider, M. J., Hussain, S. H. & Ali, M. (2018). Kurt Lewin's change model: A critical review of the role of leadership and employee involvement in organizational change. *Journal of Innovation & Knowledge, 3*(3), 123-127.

Institute for Healthcare Improvement. (2020). *Across the chasm aim #1: Healthcare must be safe:* http://www.ihi.org/resources/Pages/ImprovementStories/HealthCareMustBeSafe.aspx

Jager, J., Putnick, D. L., & Bornstein, M. H. (2017). II. More than just convenient: The scientific merits of homogeneous convenience samples. *Monographs of the Society for Research in Child Development*, *82*(2), 13–30.

Kazi, M. M., Harshe, A., Sale, H., Mane, D., Yande, M., & Chabukswar, S. (2015) Catheter-associated urinary tract infections (CAUTI) and antibiotic sensitivity pattern from confirmed cases of CAUTI in a tertiary care hospital: A prospective study. *Clinical Microbiology, 4*(2), 1-4. doi: 10.4172/2327-5073.1000193

Kleinpel, R. M. (2017). *Outcome assessment in advanced practice nursing* (4th ed.). New York, NY: Springer Publishing Company, LLC.

Krein, S. L., Harrod, M., Collier, S., Davis, K. K., Rolle, A. J., Fowler, K. E., & Mody, L. (2017). A national collaborative approach to reduce catheter-associated urinary

tract infections in nursing homes: A qualitative assessment. *American Journal of Infection Control, 45*(12), 1342–1348. doi:10.1016/j.ajic.2017.07.006

Krocová, J., Prokešová, R., & Horová, J. (2019). The prevention of healthcare-associated urinary tract infections from the point of view of nursing care. *Journal of Nursing and Social Sciences Related to Health and Illness, 21*, 1-9.

Leppink, J., O'Sullivan, P., & Winston, K. (2016). Effect size – large, medium, and small. *Perspectives on medical education, 5*(6), 347–349.

Letica-Kriegel, A. S., Salmasian, H., Vawdrey, D. K., Youngerman, B. E., Green, R. A., Furuya, E. Y., Calfee, D. P., & Perotte, R. (2019). Identifying the risk factors for catheter-associated urinary tract infections: A large cross-sectional study of six hospitals. *British Medical Journal Open*, *9*(2), 1-7. https://doi.org/10.1136/bmjopen-2018-022137.

Leung, L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine, 4*(3), 324–327.

Levinson, D. R. (2016). *Adverse events in rehabilitation hospitals: National incidence among Medicare beneficiaries*. Retrieved from https://oig.hhs.gov/oei/reports/oei-06-14-00110.pdf.

Leviton, L. C. & Melichar, L. (2016). Balancing stakeholder needs in the evaluation of healthcare quality improvement. *BMJ Quality and Safety, 10*, 803-807. doi: 10.1136/bmjqs-2015-004814.

Lewin, K. (1947). Frontiers in group dynamics: Concept, method and reality in social science; equilibrium and social change. *Human Relations, 1*(1), 5–41

Lewin, K. C. (1951). *Field theory in social science*. New York, NY: Harper & Row.

Magnusson, B., Kai-Larsen, Y., Granlund, P., Seiger, Å., Lindbo, L., Sanchez, J., & Johansson, D. (2019). Long-term use of noble metal alloy-coated urinary catheters reduces recurrent CAUTI and decreases proinflammatory markers. *Therapeutic Advances in Urology*, *11*, 1-13.

Matney, S. A., Avant, K., & Staggers, N. (2016). Toward an understanding of wisdom in nursing. *Online Journal of Issues in Nursing, 21*(1), 7. doi:10.3912/OJIN.Vol21No01PPT02

McCoy, C., Paredes, M., Allen, S., Blackey, J., Nielsen, C., Paluzzi, A., … Radovich, P. (2017). Catheter-associated urinary tract infections: Implementing a protocol to decrease incidence in oncology populations. *Clinical Journal of Oncology Nursing*, *21*(4), 460–465. https://doi.org/10.1188/17.CJON.460-465

Meddings, J., Saint, S., Krein, S., Gaies, E., Reichert, H., Hickner, A., … Mody, L. (2017). Systematic review of interventions to reduce urinary tract infection in nursing home residents. *Journal of Hospital Medicine*, *12*(5), 356-368.

Meddings, J., Manojlovich, M., Fowler, K. E., Ameling, J. M., Greene, L., Collier, S., Bhatt, J. & Saint, S. (2019). A tiered approach for preventing catheter-associated urinary tract infection. *Annals of Internal Medicine, 171*(7), S30-S37.

Mellis, C. (2018). Lies, damned lies, and statistics: Clinical importance versus statistical significance in research. *Paediatric Respiratory Reviews, 25*, 88–93. https://doi-org.lopes.idm.oclc.org/10.1016/j.prrv.2017.02.002

Melnyk, B. M. & Fineout-Overholt, E. (2015). *Evidence-based practice in nursing & healthcare: A guide to best practice* (3rd ed.). New York: Wolters. Kluwer. Retrieved from http://gcumedia.com/digital-resources/wolters-kluwer/2014/evidence-based-practice-in-nursing-and-healthcare_a-guide-to-best-practice_ebook_3e.php

Miech, E. J., Rattray, N. A., Flanagan, M. E., Damschroder, L., Schmid, A. A. & Damush, T. M. (2018). Inside help: An integrative review of champions in healthcare-related implementation. *Sage Open Medicine*, *6*, 1-11.

Miller, K., Briody, C., Casey, D., Kane, J. K., Mitchell, D., Patel, B., … Drees, M. (2016). Using the Comprehensive Unit-based Safety Program model for sustained reduction in hospital infections. *American Journal of Infection Control*, *44*(9), 969–976. https://doi-org.lopes.idm.oclc.org/10.1016/j.ajic.2016.02.038

Mitchell, B. G., Fasugba, O., Cheng, A. C., Gregory, V., Koerner, J., Collignon, P., … Graves, N. (2019). Chlorhexidine versus saline in reducing the risk of catheter-associated urinary tract infection: A cost-effectiveness analysis. *International Journal of Nursing Studies*, *97*, 1–6. https://doi-org.lopes.idm.oclc.org/10.1016/j.ijnurstu.2019.04.003

Mody, L., Meddings, J., Edson, B. S., McNamara, S. E., Trautner, B. W., Stone, N. D., Krein, S. L., & Saint, S. (2015). Enhancing resident safety by preventing healthcare-associated infection: A national initiative to reduce catheter-associated urinary tract infections in nursing homes. *Clinical Infectious Diseases*, *61*(1), 86–94.

Mody, M., Greene, T., Meddings, J., Krein, S. L., McNamara, S. E., Trautner, B. W., … Sanjay Saint, S. (2017). A national implementation project to prevent catheter-associated urinary tract infection in nursing home residents. *Journal of American Medical Association, 177*(8), 1154-1162. doi:10.1001/jamainternmed.2017.1689

Munnangi, S. & Boktor S. W. (2020). *Epidemiology of study design*. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470342/

Nahm, F. S. (2016). Nonparametric statistical tests for the continuous data: The basic concept and the practical use. *Korean Journal of Anesthesiology, 69*, 8-14.

National Institute on Aging. (2017). *Long-term care*. https://www.nia.nih.gov/health/residential-facilities-assisted-living-and-nursing-homes

Nicolle, L. E. (2016). Urinary tract infections in the older adults. *Clinical Geriatric Medicine, 32*(3), 523-538.

Parker, V., Giles, M., Graham, L., Suthers, B., Watts, W., O'Brien, T., & Searles, A. (2017). Avoiding inappropriate urinary catheter use and catheter-associated urinary tract infection (CAUTI): A pre-post control intervention study. *BMC Health Services Research, 17*, 1–9.

Patino, C. M., & Ferreira, J. C. (2018). Internal and external validity: can you apply research study results to your patients? *Jornal Brasileiro de Pneumologia : Publicacao Oficial da Sociedade Brasileira de Pneumologia e Tisilogia, 44*(3), 183. doi:10.1590/S1806-37562018000000164

Rana, R. K., Singhal, R. & Dua, P. (2016). Deciphering the dilemma of parametric and nonparametric tests. *Journal of the Practice of Cardiovascular Sciences, 2*, 95-98.

Ranganathan, P., Pramesh, C. S., & Buyse, M. (2015). Common pitfalls in statistical analysis: Clinical versus statistical significance. *Perspectives in Clinical Research*, *6*(3), 169–170. https://doi.org/10.4103/2229-3485.159943.

Redondo-González, O., Tenías, J. M., Arias, Á., & Lucendo, A. J. (2018). Validity and reliability of administrative coded data for the identification of hospital-acquired infections: An updated systematic review with meta-analysis and meta-regression analysis. *Health Services Research*, *53*(3), 1919–1956.

Safdar, N., Codispoti, N., Purvis, S., & Knobloch, M. J. (2016). Patient perspectives on indwelling urinary catheter use in the hospital. *American Journal of Infection Control*, *44*, 3, e23–e24. https://doi.org/10.1016/j.ajic.2015.10.011

Sayal, P., Singh, K. & Devi, P. (2014). Detection of bacterial biofilm in patients with indwelling urinary catheters. *Center for Info Biotechnology Journal of Microbiology*, *3*(3), 9–16.

Schmidt, N., & Brown, J. M. (2015). Sharing the insights with others. In N. Schmidt & J. M. Brown (Eds.), *Evidence-based practice for nurses: Appraisal and application of research* (5th ed., pp. 505–529). Burlington, MA: Jones & Bartlett Learning.

Siegel, B. I., Figueroa, J., & Stockwell, J. A. (2018). Impact of a daily PICU rounding checklist on urinary catheter utilization and infection. *Pediatric Quality & Safety*, *3*(3), e078. https://doi.org/10.1097/pq9.0000000000000078

Snyder, M. D., Priestley, M. A., Weiss, M., Hoegg, C. L., Plachter, N., Ardire, S. & Thompson, A. (2020). Preventing catheter-associated urinary tract infections in the pediatric intensive care unit. *Critical Care Nurse, 40*(1), e12-e17.

Spruce, L. (2015). Back to basics: Implementing evidence-based practice. *The Association of Perioperative Registered Nurses (AORN) Journal, 101*(1), 106-112.

Stenzelius, K., Laszlo, L., Madeja, M., Pessah-Rasmusson, H., & Grabe, M. (2016). Catheter-associated urinary tract infections and other infections in patients hospitalized for acute stroke: A prospective cohort study of two different silicone catheters. *Scandinavian Journal of Urology, 50*(6), 483–488.

Strouse, A. C. (2015). Appraising the literature on bathing practices and catheter-associated urinary tract infection prevention. *Urologic Nursing, 35*(1), 11-17.

Sylvia, M. L. & Terhaar, M. F. (2014). *Clinical analytics and data management for the DNP*. New York, NY: Springer Publishing Company.

Taha, H., Raji, S. J., Khallaf, A., Abu, H. S., Mathew, R., Rashed, H., ... Ellahham, S. (2017). Improving catheter-associated urinary tract infection rates in the medical units. *BMJ Quality Improvement Reports, 6*(1), u209593.w7966. https://doi.org/10.1136/bmjquality.u209593.w7966

Taherdoost, H. (2016). Validity and reliability of the research instruments: How to test the validation of a questionnaire/survey in research. *International Journal of Academic Research in Management, 5*(3), 28-36.

Titler, M. G., Kleiber, C., Steelman, V. J., Rakel, B.A., Budreau, G., Everett, L. Q., ... Goode, C. J. (2001). The Iowa model of evidence-based practice to promote quality care. *Critical Care Nursing Clinics of North America, 13*(4), 497-509.

Tsang, S., Royse, C. F., & Terkawi, A. S. (2017). Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi Journal of Anaesthesia*, *11*(1), S80–S89. doi: 10.4103/sja.SJA_203_17

Tyson, A. F., Campbell, E. F., Spangler, L. R., Ross, S. W., Reinke, C. E., Passaretti, C. L., & Sing, R. F. (2018). Implementation of a nurse-driven protocol for catheter removal to decrease catheter-associated urinary tract infection rate in a surgical trauma ICU. *Journal of Intensive Care Medicine, 35*(8), 738-744.

Underwood, L. (2015). The effect of implementing a Comprehensive Unit-based Safety Program on urinary catheter use. *Urologic Nursing*, *35*(6), 271–279. https://doi-org.lopes.idm.oclc.org/10.7257/1053-816X.2015.35.6.271

United States Department of Health & Human Services. (2018). *Health information policy*. Retrieved from https://www.hhs.gov/hipaa/for-professionals/special-topics/research/index.html.

United States Department of Health & Human Services. (2020). *HealthyPeople 2020*: *Healthcare-associated infections*. https://www.healthypeople.gov/2020/topics-objectives/topic/healthcare-associated-infections.

Wojciechowski, E., Murphy, P., Pearsall, T., & French, E. (2016). A case review: Integrating Lewin's theory with lean's system approach for change. *The Online Journal of Issues in Nursing, 21*(2), 1-13.

Yatim, J., Wong, K., Ling, M., Tan, S., Tan, K. & Hockenberry, M. (2016). A nurse-driven process for timely removal of urinary catheters. *International Journal of Urological Nursing, 10*(3), 167–172.

Zaccagnini, M. E. & Waud-White, K. (2017). *The Doctor of Nursing Practice Essentials: A new model for advanced practice nursing* (3rd ed.). Burlington, MA: Jones & Bartlett Learning.

Appendix A

Grand Canyon University Internal Review Board Outcome Letter

GRAND CANYON UNIVERSITY
3300 West Camelback Road | Phoenix, Arizona 85017 | 602.639.7500 | Toll Free 800.800.9776 | www.gcu.edu

DATE: September 22, 2020

TO: Folashade Oluwafunmi

FROM: COLLEGE OF NURSING AND HEALTH CARE PROFESSIONALS

STUDY TITLE: Implementation of Catheter-Associated Urinary Tract Infections (CAUTI) Champion Daily Rounding in a Rehabilitation Facility

ACTION: DETERMINATION OF QUALITY IMPROVEMENT/PROGRAM EVALUATION STATUS

DATE: September 22, 2020

REVIEW CATEGORY: QUALITY IMPROVEMENT/PROGRAM EVALUATION

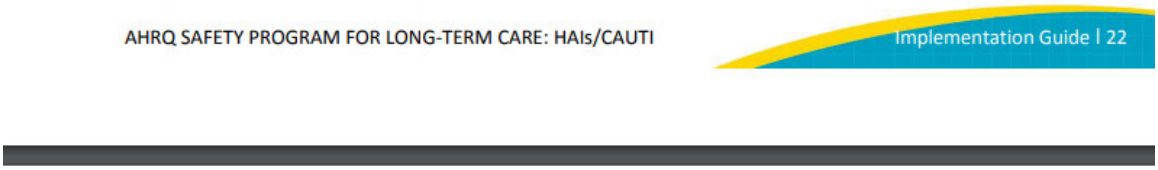
In collaboration with the Institutional Review Board, The College of Nursing and Health Care Professions at Grand Canyon University has determined that this submission does not meet the definition of human subject research. The submission qualifies as Quality Improvement and/or Program Evaluation; therefore, further IRB review is not required. In future publications and/or presentations, please refer to this submission as Quality Improvement and/or Program Evaluation, not research. If the results of the project will not be published, presented, or disseminated outside of the institution, ensure that all those associated with the project are aware that the project is ongoing.

We will put a copy of this correspondence in your student file in our office. If you have any questions, please contact The DNP Program Lead Faculty, Dr. Katherine Fetter in the College of Nursing and Health Care Professions, Katherine.Fetter@gcu.edu.

Please include your project title and reference number in all correspondence with this office.

Appendix B

Agency for Healthcare Research and Quality Permission



Prepared by Health Research & Educational Trust with contract funding provided by the Agency for Healthcare Research and Quality through Contract No. HHSA 290201000025I.

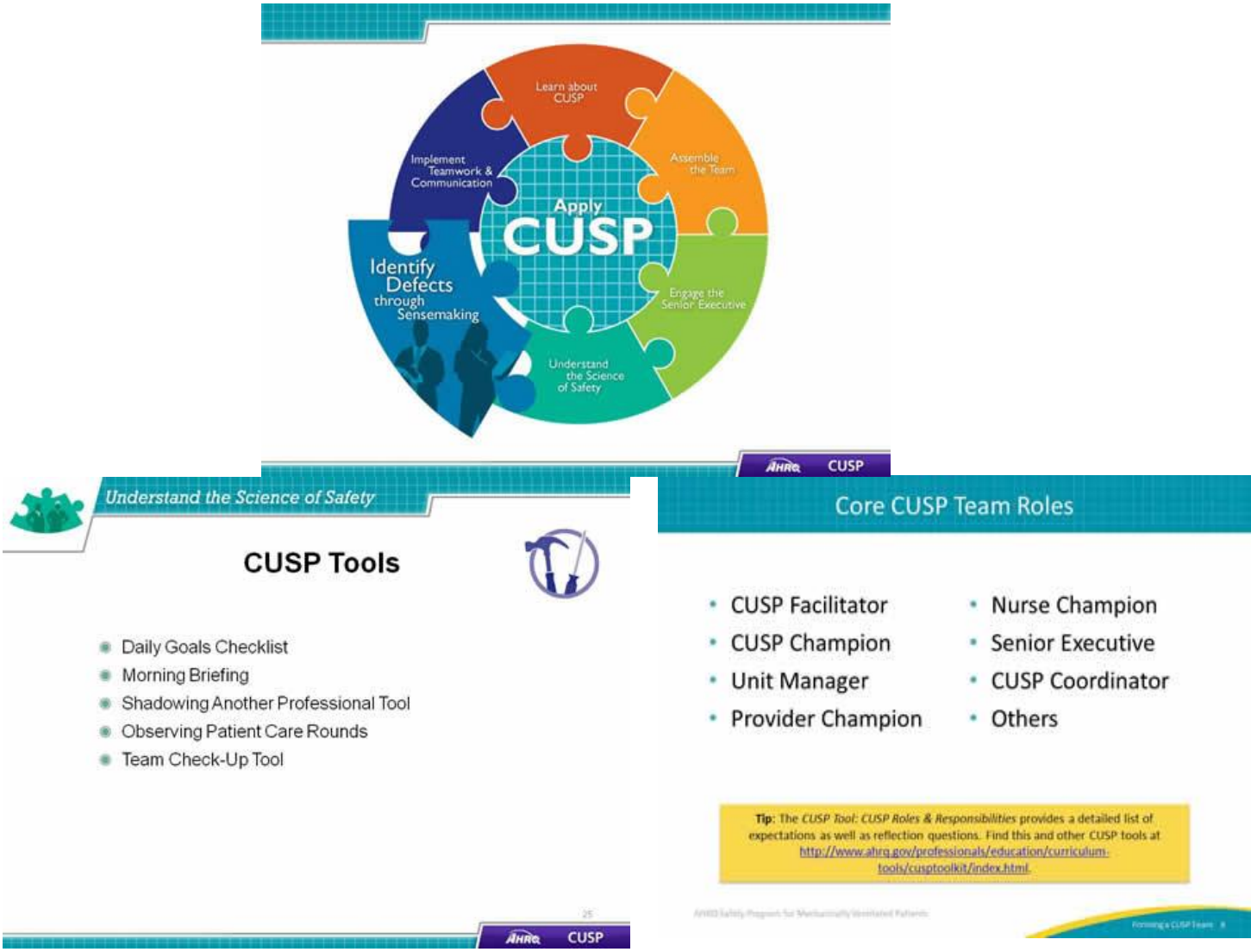
Disclaimer: The opinions expressed in this document are those of the authors and do not reflect the official position of AHRQ or HHS.

None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this document.

(Agency for Healthcare Research and Quality, 2017)

Appendix C

Agency for Healthcare Research and Quality Comprehensive Unit-Based Safety Program (CUSP)



(Agency for Healthcare Research and Quality, 2017)

Appendix D

Centers for Disease Control and Prevention Permission

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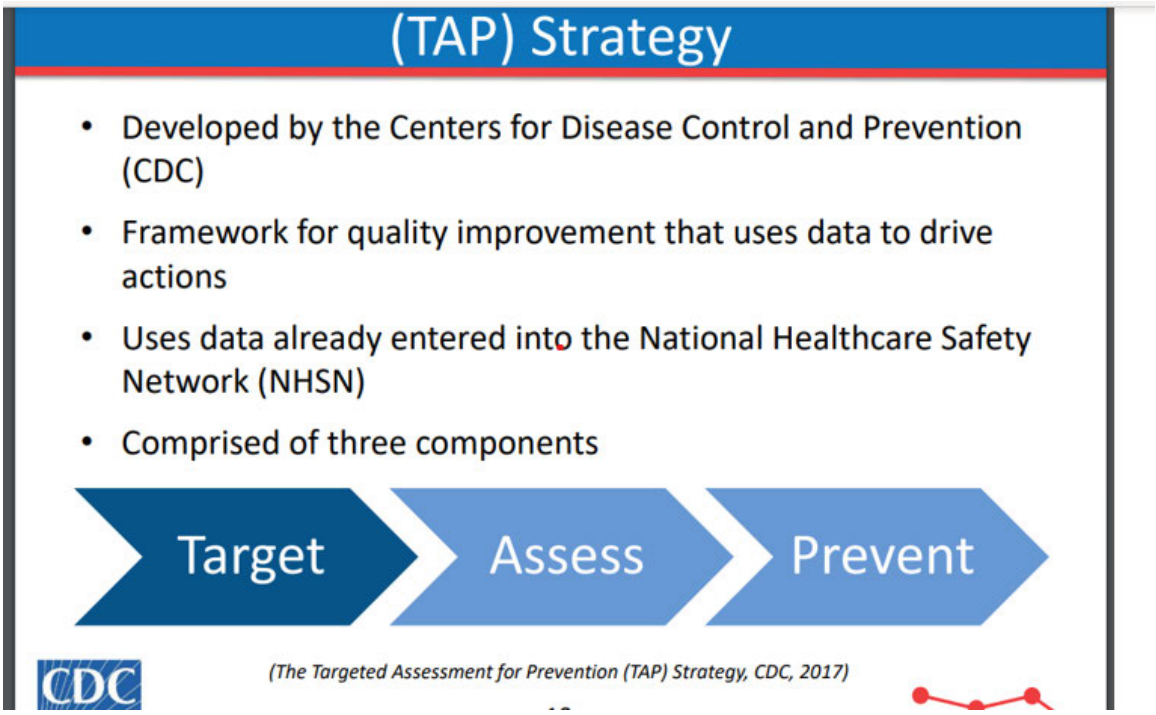
(Centers for Disease Control & Prevention, 2019)

Appendix E

Centers for Disease Control and Prevention TAP Strategy (TAP tool)



(Centers for Disease Control & Prevention, 2019)