Spring 3-20-2022

Prevention of Central Line-Associated Blood Stream Infection (CLABSI) in Adult ICU Patients

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DOI: https://doi.org/10.46409/sr.OUAU3057

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This Manuscript Partially Fulfills the Requirements for the

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Approved: March 20,2022

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Abstract

Practice Problem: Central line-associated bloodstream infections (CLABSI) account for most hospital-associated preventable infections in the United States and globally. Implementation of a multifaceted approach including evidence-based CLABSI bundle care has shown to prevent this infection in patients with a central line.

PICOT: The PICOT question that guided this project was that in adult intensive care unit (ICU) patients, how does the use of central line bundle care compared to central line care without bundle decrease central line-associated bloodstream infections within eight weeks?

Evidence: The evidence from a rigorous literature review showed that using a central line bundle care program in adult ICU patients effectively decreases CLABSI infection. The bundled care program includes the implementation of bundled care interventions through infection surveillance, infection control, and staff education.

Intervention: The intervention for the change project included developing ICU staff nurses' competency and compliance in implementing CLABSI bundle care. The ICU educator's competency in conducting all future staff training and periodic compliance auditing related to CLABSI was also developed as a part of this project.

Outcome: The project results revealed an effective clinical impact on the CLABSI prevention care as evidenced by increased use of midline catheters as a central line replacement, a decrease in the number of days the central line is left in place, and a decreased CLABSI infection rate.

Conclusion: The project aimed to evaluate the efficacy of bundle care in patients admitted to ICU with a central line and provided well-grounded CLABSI prevention practice recommendations to decrease negative clinical outcomes, including but are not limited to the extended hospital stay, significant morbidity, mortality, and increased healthcare costs.

Prevention of Central Line-Associated Bloodstream Infection (CLABSI) in Adult ICU Patients

Central line-associated bloodstream infections (CLABSI) are the leading cause of preventable hospital-associated infections (Lin et al., 2017). In the United States (U.S) intensive care units (ICU) alone, approximately 80,000 CLABSI cases occur each year (The Joint Commission, 2012), causing 28,000 deaths annually (Agency for Healthcare Research and Quality, n.d). The central lines are considered a vital medical device in providing complex treatment regimens to critically ill patients (Alanazi et al., 2020). The treatment includes but is not limited to lifesaving fluids and medications administration, hemodynamic monitoring, hemodialysis, and blood sampling (Mitchell et al., 2020). Despite its potential benefits, central lines significantly increase the risk of central line-associated bloodstream infection (CLABSI), the most severe hospital-acquired infection (Wichmann et al., 2018). This severe yet preventable infection (Khodare et al., 2020; Lin et al., 2017) leads to significant morbidity, extended hospital stays, and increased healthcare costs (Latif et al., 2015; Ziegler et al., 2015). Evidence-based bundle care interventions have been shown to significantly decrease the risk of developing CLABSI in Intensive Care Units (ICU) patients (Alvarez-Moreno et al., 2016; Lin et al., 2018; Victor et al., 2019), saving 6,000 lives and $414 million in potential healthcare costs in 2009 (The Joint Commission, 2012).

This evidence-based project aimed to evaluate the use of evidenced-based bundle care interventions to prevent CLABSI in ICU patients. The project established the significance of the problem, followed by evidence search and evaluation. Kotter's change model and Johns Hopkins evidenced-based practice model have been discussed in the context of the project implementation, evaluation, impact and dissemination.

Significance of the Practice Problem

Hospital-associated infections (HAI) are the most common complications of hospital care and have increased in the United States by 36% in the last two decades. Approximately 1.7 million hospitalized patients develop hospital-associated infections annually, and 98,000 lose their lives each year (Haque et al., 2018). It is ranked as the fifth leading cause of death in U.S acute care hospitals (Stone, 2009). Central line-associated bloodstream infections (CLABSI) are the most serious form of hospital-associated infections (Lin et al., 2017) and lead to poor clinical outcomes, including more extended hospital stays, increased morbidity, and higher health care cost (Dal Forno et al., 2012).

The substantial human suffering and financial burden induced by these infections are staggering. CLABSIs extend the length of stay in ICU by 5-8 days (Brown, 2020; Digiovine et al., 1999; Pittet et al., 1994) and the overall hospitalization by 12- 24 days (Alotaibi et al., 2020; Brown, 2020; Pittet et al., 1994). The extended length of stay is a cardinal outcome for CLABSI as it demonstrates the impact on the healthcare cost and the morbidities associated with the development of this infection. Each CLABSI costs between $17,896 to $94,879, averaging $48,108 per episode, after adjusting to 2020 U.S dollars (Agency for Research and Quality, 2017). Considered one of the leading causes of death in the U.S and worldwide, it accounts for 150 excess deaths for every 1,000 cases, causing a mortality rate between 12% to 25% (Agency for Research and Quality, 2017). The disability-adjusted life year (DALY) shows a loss of one full year of healthy life due to this infection.

The Standardized Infection Ratio (SIR) is a standard metric used to track and report CLABSI cases on national, state, and local levels. It is a ratio of the actual number of CLABSI cases to the predicted numbers of CLABSI cases. The CLABSI target set by Healthy People

2020 is a 0.5 ratio interpreted as aiming to achieve fifty percent fewer actual infection cases than the predicted number of CLABSI cases. In 2019, the United States and the State of California scored a ratio of 0.69 and 0.67, respectively, on the SIR scores (CDC, 2020), indicating more than 60% of actual CLABSI cases than the predicted infection cases in the nation and the state. The project site scored a ratio of 1.7 on the 2019 SIR report showing a significant prevalence of CLABSIs in the facility. The current CLABSI standard of care at the facility consists of maximal barrier precautions, hand hygiene, daily assessment of insertion site, and routine dressing changes. Several private, public, and professional organizations have established evidence-based CLABSI bundle care guidelines and recommendations for CLABSI prevention (Marschall et al., 2014). Studies have shown that as many as 70% of annual CLABSI cases (164,127) are preventable using bundle care, saving up to 20,239 lives and $2.19 billion to 3.17 billion dollars in healthcare cost (Umscheid et al. 2011).

PICOT Question

In adult intensive care unit (ICU) patients (P), how does the use of central line bundle care (I) compared to central line care without bundle (C) decrease central line-associated bloodstream infections (O) within eight weeks (T)?

Population

The population of interest for this project included all adult patients eighteen years and above. These patients had a central line in place and were admitted to the intensive care unit (ICU) of a 350- bedded hospital located in Southern California. The central line is established by inserting a central venous catheter or peripherally inserted central catheter (PICC) in one of the great blood vessels close to the heart. The purposes of establishing a line includes but are not is

limited to infusion, blood withdrawal, or hemodynamic monitoring (National Healthcare Safety Network, 2021).

Intervention

The intervention for this project was the central line bundle care. Bundle care is defined as a structured set of evidence-based interventions implemented collectively to improve patient outcomes (Karapanou et al., 2020). CLABSI prevention bundle care comprises a group of interventions identified as best practices. The Center for Disease Control (2010) supports the use of bundle care in preventing CLABSI by establishing standards of care and providing nationally published guidelines. The Agency for Healthcare Research and Quality (2020) and the Joint Commission on Accreditation of Healthcare Organizations (n.da) have also provided recommendations on integrating bundle care in CLABSI prevention (The Joint Commission, 2012). Lastly, this intervention is well-supported by the International Society for Infectious Diseases (Wasserman & Messina, 2018). Based on the recommendation and guidelines provided by the four national agencies mentioned above, the bundle care interventions measures for this project included evaluating catheter necessity, optimal site selection, hand hygiene, adherence to aseptic techniques, use of maximal sterile barrier precautions, daily assessment of insertion site with dressing changes (two days for gauze dressing and seven days for semipermeable dressing; and when soiled, damp or non-adherent), use of chlorhexidine baths in ICU patients, appropriate disinfection of the catheter hubs/needleless connectors/injection ports before each access, and daily reassessment of the need for continued central line access. Evaluating catheter necessity refers to assessing the need for central access and the use of appropriate catheter type (central line, PICC or midline) based on the need. Optimal site selection includes choosing the site based on the benefits and risks associated with each catheter access site (See Table 1, Figure 2 and 3).

Comparison

The comparison intervention consisted of evaluating the CLABSI rate of patients that received the standard of care, which included the use of maximal barrier precautions, hand hygiene, daily assessment of insertion site, and dressing changes. The routine dressing changes were performed every seven days and as needed.

Outcome

The primary outcome of this project was to evaluate central line-associated bloodstream infections using the CLABSI infection rates. The central line-associated bloodstream infection (CLABSI), as defined by the National Healthcare Safety Network (NHSN), is a laboratory-confirmed bloodstream infection that develops in a patient within 48 hours of central line placement. The infection is primary and is not related to an infection at another site (2021).

Time

The time duration for implementing the intervention was eight weeks. Collecting and reviewing data weekly and compiling it monthly allowed the project manager to provide staff feedback about improvement; refine intervention as needed; and make necessary changes to complete the evaluation process effectively in eight weeks, thereby meeting the deadline set to complete the project.

Evidence-Based Practice Framework & Change Theory

The Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) was used to guide this evidence-based project. This model provides problem-solving to clinical inquiries and decision-making while cultivating a culture of care based on evidence by simplifying the evidence-based practice process (Wyant, 2017). The model consists of a three-step PET process: practice question, evidence, and translation (Dang & Dearholt, 2017a). The first step of the

model was used to identify the clinical problem for the project leading to the development of the practice question. The practice question guided the search for evidence which was the second component of the model. The evidence supported by the literature led to the last element in the model relating to translating or implementing the change into practice (Dearholt & Dang, 2012).

The Kotter Change model was used to guide the project change process. Bringing effective and sustainable organizational changes required a systematic and thoughtful approach. Kotter's eight-step change model is considered a well-known approach to organizational transformation as it provides an essential reference in change management by assisting organizations through the change process (Vokes et al.,2018). This model best related to the project as it aimed to implement bundle care interventions to prevent the development of CLABSI in ICU patients requiring a change in organizational practice. Kotter's change framework served as a foundation in assisting the organizational journey for implementing this change.

Evidence Search Strategy

A thorough literature search was performed in Cumulative Index to Nursing and Allied Health Literature (CINAHL), ProQuest, and PubMed to review the literature available on this topic. Boolean Operators were used to combine keywords. The key terms used for the database search included "central line-associated bloodstream infection" OR "CLABSI" AND "bundle care" OR "bundle interventions." No alternate spellings of the identified keywords or any other abbreviations were used in this search.

Evidence Search Results

The database search resulted in 111,529 hits. The CINAHL search resulted in 1,529 articles, ProQuest generated 109,836 articles, and PubMed produced 164 articles. The inclusion

criteria to narrow the search encompassed full-text peer-reviewed articles with abstracts in the English language published in the last five years (2016- 2021). The five-year timeframe was selected to include the most up-to-date clinical practices. Studies conducted on non-human test subjects and non-research articles were excluded from the search. Five (5) articles were duplicated and therefore discarded. Thus, a total of forty-seven (47) articles were selected based on the inclusion and exclusion criteria. Reviewing the titles and abstracts of the chosen articles helped eliminate thirty-seven (37) articles as they did not relate to the PICOT question leaving ten (10) articles providing evidence to support this project.

All ten articles included in this project were quantitative studies (see Figure 1 for Prisma diagram summary). Eight of the ten studies were quasi-experimental pre-intervention post-intervention studies. The other two studies included a stepped-wedge cluster randomized control trial and an observational study. The Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) appraisal tool was used to critically appraise the ten articles' quality and strength (Dang & Dearholt, 2017b). While two studies were at levels I and III each, most studies (eight out of ten) were at level II. All ten studies ranged between A and B on the quality grade, with five studies ranging on each grade (See Appendix A & B).

Themes

An in-depth analysis of the literature guided by the PICOT question presented various consistent themes related to the use of CLABSI prevention bundle care in adult ICU patients. All studies (ten) were conducted on adult patients of eighteen years and older, supporting the population of this project. In addition, all studies implemented bundle care rather than individual interventions. A vital phenomenon emerging from this analysis was the more profound understanding of the CLABSI prevention process, including the central line insertion and the line

maintenance. Few interventions identified in the evidence applied to the insertion and maintenance processes, while some related to both. Nine studies included interventions applicable to both the central line insertion and maintenance. (Lai et al., 2018; Lee et al., 2018; Lin et al., 2018; Mazi et al., 2021; O'Neil et al., 2016; Poh et al., 2020; Salama et al., 2016; Tjallie et al., 2018; Yazici et al., 2018), In comparison, interventions exclusively associated with central line insertion were found in only one article (Wichmann et al., 2018). The evidence's three main overarching themes included infection surveillance, infection control, and staff education.

Infection Surveillance

Infection surveillance in CLABSI prevention was identified as a recurring theme. Daily evaluation for catheter necessity intervention was found in eight studies (Lai et al., 2018; Lee et al., 2018; Lin et al., 2018; Mazi et al., 2021; Poh et al., 2020; Salama et al., 2016; Tjallie et al., 2018; Yazici et al., 2018). In addition, observing the catheter site and the dressing on a regular and consistent basis was also supported by two studies (O'Neil et al., 2016; Poh et al., 2020). All the evidence supporting the role of infection surveillance strategies was level IIA or IIB with one study of level IA. The evidence established a statistically significant relationship between the infection control intervention and the desired outcome of decreased CLABSI rates.

Infection Control

Hand hygiene was a consistent intervention included in the bundle care in nine out of ten studies and was identified as one of the vital interventions in CLABSI prevention. The eight studies were of level II with grades A and B (Lai et al., 2018; Lee et al., 2018; Lin et al., 2018; Mazi et al., 2021; O'Neil et al., 2016; Poh et al., 2020; Salama et al., 2016; Tjallie et al., 2018), while one study was grade IIIA (Wichmann et al., 2018). The only study that did not include this

intervention in its bundle care already had it in their existing facility practice (O'Neil et al., 2016). Other infection control measures positively supporting CLABSI prevention included using maximum barrier precautions and chlorhexidine disinfectant to clean the insertion site before central line insertion. These two interventions were well-supported in eight studies consisting of six studies of level II ranging between grade A and B (Lai et al., 2018; Lee et al., 2018; Lin et al., 2018; Mazi et al., 2021; Poh et al., 2020; Salama et al., 2016) and one study of level IA and IIIA respectively (Tjallie et al., 2018; Wichmann et al., 2018). The maximum barrier precautions included wearing a sterile gown, gloves, mask, cap, and complete patient drape. Selecting the optimal site for line insertion, including avoiding femoral line to decrease the risk for infection, was found in seven studies (Lai et al., 2018; Lee et al., 2018; Lin et al., 2018; Mazi et al., 2021; Salama et al., 2016; Tjallie et al., 2018; Wichmann et al., 2018). The effect of dressing changes on CLABSI prevention was included and established in five studies only. Maintaining aseptic techniques when inserting or accessing central lines was found in three studies (Lai et al., 2018; Poh et al., 2020; Yazici et al.,2018). Only one study included strict indications for the central line as a bundle intervention for CLABSI prevention (Wichmann et al., 2018). Chlorhexidine bath for ICU patients is well-supported by the literature. The Center for Disease Control (CDC) checklist established for CLABSI prevention supports providing chlorhexidine baths to ICU patients. (Center for Disease Control, n.d). Interestingly, none of the studies included chlorhexidine baths or appropriate disinfection of the catheter hubs/needleless connectors/injection ports before each access in the maintenance bundle care.

Staff Education

Educating physicians and nurses on CLABSI prevention was a vital component of the CLABSI prevention bundle care program supported in four studies. (Lin et al., 2018; Mazi et al.,

2021; O'Neil et al., 2016; Poh et al., 2020). These four studies of level IIA or II B grade found a statistically significant relationship between staff education and decreased CLABSI rates. The education session consisted of lectures, simulation, and skills competency. The evidence found the return demonstration of prevention skills competency very successful in training staff. All the strategies mentioned above under the three over-arching themes align with and approve by the Center for Disease Control (n.d) and the Joint Commission (n.db).

CLABSI rates were used as the outcome measurement in all ten studies. The CLABSI rate per 1000 central line days was used as the outcome measurement in all ten studies. According to the Center for Disease Control (2020), CLABSI rates are reported per 1,000 central line days. They are calculated by dividing the number of CLABSIs by central line-days and multiplying by 1000 (National Healthcare Safety Network, 2021). Two studies also used the catheter utilization rates, calculated by dividing the number of central line catheter days by the number of in-patient days National Healthcare Safety Network, 2021) (See Appendix C & D).

Practice Recommendations

Based on a thorough and rigorous review of the literature using the PICOT question, the practice recommendation was that using a central line bundle care program in ICU adult patients would effectively decrease CLABSI in eight weeks. The central line bundle care program consisted of the following strategies: evaluating catheter necessity, optimal site selection, hand hygiene, adherence to aseptic techniques, use of maximal sterile barrier precautions, daily assessment of insertion site with dressing changes (two days for gauze dressing and seven days for semipermeable dressing; and when soiled, damp or non-adherent), use of chlorhexidine baths in ICU patients, appropriate disinfection of the catheter hubs/needleless connectors/injection ports before each access, and daily reassessment of the need for continued central line

access. The evaluation for catheter necessity includes assessing the need for a central catheter and the use of appropriate catheter type based on the need (central versus peripheral inserted central catheter {PICC} or a midline). Selection of optimal site refers to choosing the central line insertion site based on benefits and risks associated with each particular site (See Table 1, Figure 2 and 3).

These recommendations were consistent with the themes identified in the previous section. The strength of the evidence was graded as "B" on Johns Hopkin's evidence-based practice evidence level and quality guide (Dang & Dearholt, 2017b). Based on the recommendation and guidelines provided by the four national agencies mentioned above, the bundle care interventions measures for this project were established. The bundle included evaluating catheter necessity, optimal site selection, hand hygiene, adherence to aseptic techniques, use of maximal sterile barrier precautions, daily assessment of insertion site with dressing changes (two days for gauze dressing and seven days for semipermeable dressing; and when soiled, damp or non-adherent), use of chlorhexidine baths in ICU patients, appropriate disinfection of the catheter hubs/needleless connectors/injection ports before each access, and daily reassessment of the need for continued central line access.

Setting, Stakeholders, and Systems Change

Project Setting

The facility chosen for this project was a 350- bedded hospital medical center located in Southern California. The facility offers primary, tertiary, and long-term care in medicine, surgery, geriatrics, neurology, oncology, dentistry, spinal cord, physical medicine, blind rehabilitation, and extended care.

Mission, Vision, and Organizational Culture

The mission of this organization is to provide exceptional healthcare that improves the health and well-being of its patients. The vision is to uphold the pride of setting the benchmark of excellence and value in healthcare by providing patient-centered and evidence-based excellent services. With 2,200 full-time employees and health care providers, the organizational culture is deeply rooted in the values of integrity, commitment, advocacy, respect, and excellence (U.S. Department of Veterans Affairs, 2020).

Organizational Structure

The organizational structure for this facility consists of an Executive Leadership Board. This board comprises a leadership team (pentad) including the facility Director, Chief of Staff, Associate Director for Patient Care Services, Associate Director, and Assistant Director. The Director functions as the Chief Executive Officer (CEO) of the organization. The Associate Director for Patient Care Services is a Nurse Executive who works with the Chief of Staff in overseeing patient care and service areas (Department of Veterans Affairs Office of Inspector General, 2017).

Organizational Need

The organizational need was established based on the first quarter (January- April 2021) CLABSI report, which showed 6.63 CLABSI rates per 1,000 central line days. The rates were very high compared with the previous quarterly report showing 1.87 rates per 1,000 central line days. As a preventable hospital-acquired infection, the organizational goal was to have no CLABSI infections. The recent data indicated an urgent need to address the problem and thus provided support from the organizational leadership.

Organizational Dynamics and Support

Assessing the organizational dynamics, including the organizational culture, leadership, and the stakeholder's readiness for making a case for change was imperative. The Checklist to Assess Organizational Readiness (CARI) was used to determine the organizational readiness for evidence-based practice implementation (Barwicjk, 2011). In addition, the Implementation Climate Scale (ICS) was utilized to assess the organizational culture and support for the evidence-based practice implementation (Ehrhart et al., 2014). Both the assessments unanimously revealed optimum readiness and desire of the organizational staff members and the support from the organizational leaders along with the mission statement firmly aligning with this endeavor.

Project Sustainability and Levels of Systems Change

The project aligned with the short-term and the long-term organizational goals. Since the organization firmly believes in providing evidence-based excellent and safe patient care, the sustainability of this project intervention was promising not only at the unit level, as assured by the ICU and the vascular access team, but also at the organizational level. The project aimed to bring practice change at all three levels: microsystem, mesosystem, and macrosystem. The clinical microsystem for this project encompassed the vascular access team and the ICU teams working within their units to ensure CLABSI prevention strategies are implemented and evaluated regularly. It was, however, essential to acknowledge that the microsystems working in silos without a well-developed mesosystem would have a considerable gap. Therefore, the CLABSI surveillance program functioned as the mesosystems for the vascular access team and the ICU team to work collaboratively in achieving outcomes. This mesosystem acted as a glue connecting the microsystem and the overall organizational macrosystem in this project.

Stakeholders

The stakeholders for this project included the Executive Leadership Board, Deputy Chief of Quality and Safety, ICU nurse manager, physicians, and nursing staff, Vascular Access Team (VAT) comprising the nurse manager and nurses, infection control team, and ICU patients.

Interprofessional Collaboration

Interprofessional teamwork level was evaluated using the Assessment of interprofessional team collaboration scale (AITCS). The scale provided a compelling insight into the status of collaboration amongst the health care teams in terms of partnership, cooperation, coordination, and shared decision-making (Orchard et al., 2012). The four domains of Interprofessional Education Collaborative (IPEC): professional values and ethics, professional roles/responsibilities, interprofessional communication, and teamwork were integrated to ensure desirable and sustainable results (Interprofessional Education Collaborative Expert Panel, 2011).

SWOT Analysis

An analysis of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) was performed (see Appendix E). Strengths emerging from the exercise included leadership support, well-structured departments, and organizational accountability. The identified weaknesses were inconsistent practices and a lack of standardized staff education programs surrounding CLBSI prevention strategies. The solid scientific evidence supporting the practice change and setting an example for similar hospitals through this project were few opportunities surfaced. Finally, the two main threats associated with this project were the time constraints and the staff's resistance to change.

Implementation Plan with Timeline and Budget

The project's mission was to prevent the development of CLABSI- a preventable hospital-acquired infection by establishing and sustaining prevention bundle care interventions

for patients admitted in ICU with a central line. The project's vision was to provide safe and high-quality care to ICU patients by decreasing morbidity, hospital length, and mortality associated with central line-associated infections. The mission and vision of the project were closely aligned with the organizational mission and vision, which aimed at providing excellent patient-centered and evidence-based services to its patients.

The project aimed to achieve three short-term objectives, which were as follows: Educate ICU staff on CLABSI bundle care intervention program with a score of ninety-five percent (95%) or higher; assist ICU nurses in demonstrating compliance of ninety-five percent (95%) or higher with CLABSI bundle care in the care of patients with a central line, and facilitate ICU educator exhibiting competency at a ninety-five percent (95%) or higher in assuming responsibility for conducting all future staff training and periodic compliance auditing on CLABSI bundle. The project's long-term objective was to decrease CLABSI cases by sustaining this practice change of providing CLABSI bundle care to all ICU patients admitted with a central line. These objectives mentioned above were achieved through ongoing staff education, periodic auditing of staff compliance, and strengthening interprofessional communication and collaboration. The project's risk and unintended consequences included but were not limited to staff resistance to change and increased staff time in implementing bundle care interventions. The project manager intended to arrange meetings with the staff (ICU nurses and VAT) to provide opportunities to ask questions and verbalize any concerns related to the project, as well as meet individually with the staff resistant to change to bring them onboard utilizing principles of transformational leadership, effective interprofessional communication, and collaborative teamwork in this process.

The Johns Hopkins Evidenced-Based Practice (JHNEBP) model was utilized for this project. The model has guided the identification and development of the practice question for this project, the establishment of recommended practice change based on evidence, and has assisted with translating the project into practice by implementing and evaluating CLBASI prevention bundle care for ICU patients' central lines.

The Kotter Change model was employed for this project. This model comprising an eight-step process provided an essential reference for change management by primarily focusing on organizational leadership. This model best fitted the project as it assisted with creating a climate of change by introducing incremental steps and engaging and empowering stakeholders. The project planning in the light of Kotter's model was as follows:

Step 1: Establishing a Sense of Urgency

The awareness and interest were created amongst the stakeholders by sharing the local, regional and national CLABSI rates. In addition, key findings from the literature about the impact of CLABSI on patients, healthcare organizations, and society were discussed to develop a sense of urgency towards the problem.

Step 2- Creating a Guiding/Powerful Coalition

This phase assisted with the identification and representation of all project-related stakeholders. Teambuilding, trust, and commitment were established with the key "change leaders/change champion" amongst the stakeholders. These members included the assistant manager of the ICU, ICU physician, infection control and vascular access nurse, and an ICU nurse, each from a day and night shift.

Step 3- Developing a Change Vision and Initiative

A change vision was developed by involving the stakeholders and making the project's outcome clear and understandable with an "End in Mind." The organizational core values of commitment, patient advocacy, and service excellence were integrated into the practice change.

Step 4- Communicating the Vision

Individual and groups meetings were conducted to communicate the project vision. Examples of individual meetings included meeting with the deputy chief of quality and safety and the ICU and VAT manager. Conducting meetings with ICU staff nurses were examples of groups meetings. These meetings were arranged primarily to bring staff on board, provide opportunities to ask questions, and verbalize any concerns related to the project. Staff resisting change was identified, and one-on-one meetings were held with particular staff members to bring them on board.

Step 5- Removing Barriers

Some barriers to the project's successful implementation include a lack of safety culture (The Joint Commission, n.da.). and a lack of staff compliance (Valencia et al., 2016; Ider et al., 2012). The project manager planned to implement proactive actions to control these barriers. These activities included conducting regular meetings with the ICU nurses to actively engage staff in the project, gauge staff reactions to the intervention, identify emerging issues related to the intervention, and allow staff members to share any concerns about the intervention.

Step 6-Generating Short-Term Wins

In this phase, success was celebrated at each milestone with the stakeholders. For example, a "success celebration" was done upon completion of the staff education sessions. See Table 2 for a list of milestones identified for the project.

Step 7- Sustaining Acceleration

This phase was accomplished by continuously motivating and reinforcing the ICU staff and other stakeholders to look at the accomplishments versus setbacks by sharing success stories and milestones. The meetings mentioned in the fifth step were also aimed at sharing the compliance status of the staff and reinforcing positive behaviors contributing to successful compliance.

Step 8- Anchoring Change

The project practice change included developing CLABSI bundle care and educating ICU staff to implement bundle care competently in taking care of patients with the central line. The successful implementation led to this final step of anchoring change which was achieved by integrating the practice change into the ICU department and the organizational process of preventing CLABSIs. The practice change established by developing CLABSI bundle care and preparing all ICU staff competently through staff education served as the building block for anchoring this practice change.

This step materialized through developing a CLABSI prevention checklist consisting of bundle care interventions (see Appendix F) implemented by all ICU staff in caring for patients with a central line with the ultimate goal of reducing CLABSI cases. The ICU educator conducted periodic auditing of the ICU staff practices on the CLABSI bundle care compliance. Training the nurse educator to monitor the ICU staff for compliance was included as an objective of the project.

The project implementation phase actively involved utilizing transformational leadership and interprofessional collaboration throughout the process. Transformational leadership is integral to the process as it inspires and motivates the team to achieve the shared goals and vision (Larson, 2016). This leadership style engages and empowers the staff and transforms them into

effective and creative team members (Collins et al., 2020). The team's interprofessional collaboration was established and strengthened by arranging meetings amongst the group, including the ICU manager, ICU nurse educator, a member from the vascular access, and the infection control team. The meetings' underlying goal was to develop direct, clear, and focused communication to establish a shared understanding of the project. The project activities schedule with the timeline is provided in Appendix G, and the project budget is provided in Table 3.

Results

The change project intended to reduce CLABSI rates in ICU patients by implementing a CLABSI prevention program based on evidence-based, multifaceted bundle care interventions. All adult patients of eighteen years or older with a central line and admitted to the ICU were included in the project after receiving approval from the USAHS Evidence-based Practice Review Council (EPRC) and the facility's Institutional Review Board (IRB) (Appendix H). Patients diagnosed with any existing bloodstream infection and patients scheduled to have the central line discontinued in the following twenty-four hours were excluded from the study. The last four digits of Social Security Medical Record numbers were used as patient identifiers.

The project manager was primarily responsible for data collection. During the pre-intervention period, aggregated data on patients with central lines and CLABSI cases were collected. Aggregated data and data through direct observation were gathered during the intervention and post-intervention period at various points of the project implementation and evaluation phase (See Table 4). The two data collection tools (check sheets) utilized for data collection were mutually developed by the project manager and the VAT staff member and are based on the CDC CLABSI prevention checklist (see Appendix I and J). The VAT staff member is the content expert on CLABSI for the project facility. As a part of the project, the project

manager possesses considerable knowledge of CLABSI bundle care intervention. The CDC checklist is available for public use and does not require permission (see Appendix F); however, its reliability and validity have not been established.

The project manager performed all data collections, verified the data, and transferred it from the check sheets to the Microsoft Excel program and the Intellectus software weekly (Intellectus Statistics, 2021). The data was kept secure in a locked cabinet or digitally saved on the project manager's laptop, secured by a password, and stored in a locked cabinet. All missing data were accounted for by assigning a zero. The project manager collected, analyzed, and stored the data to maintain process integrity. Personal identifiers were replaced with non-identifying terms to maintain HIPAA privacy rules and minimize the risk of re-identification of the patient during the use of data (Kayaalp, 2018).

A pre-post comparison design was used to evaluate the impact of the intervention. Outcome, process, and balancing measures were assessed based on the benchmarks identified for each measure. (See table 3). A combination of categorical and numerical data was collected to evaluate the project (See Table 5).

Data Analysis

Fifty-two (52) ICU patients were identified with a central line during the intervention period. Most of these patients were male (n=49) (See Figure 4), correlating with the facility's higher male-to-female patient ratio. These patients ranged between 51 and 70 years (n=42) (See Figure 5) and were admitted with different types of central lines in place (See Figure 6).

The first process outcome related to developing ICU staff nurses' knowledge and competency on CLABSI bundle care was analyzed by running a Fisher's exact test. Based on the alpha value of .05 ($p < .001$), a statistically significant increase was observed in the staff

education level in the post-intervention period (See Table 6 and Figure 7). The second process measure of staff's compliance to the bundle care was also evaluated by conducting a Fisher's exact test. The results were found to be significant based on an alpha value of .05 ($p < .001$), suggesting the highest staff compliance rate during the post-intervention phase (See Table 7 and Figure 8). ICU educator's competency in conducting all future staff training and periodic compliance auditing was also assessed as another process measure and successfully achieved. (See Figure 9).

The project's primary outcome was to evaluate CLABSI infections in ICU patients. The relationship between the CLABSI infection rate and the period analyzed through Fisher's exact were statistically nonsignificant based on an alpha value of .05 ($p = 1.000$), indicating no association between the development of CLABSI infections and the assessment period (See Table 8). Since the risk for infection significantly increases when catheters remain in place for longer times, a correlation between CLABSI infections and catheter days was evaluated by running a Pearson correlation analysis (Cohen, 1988). Based on an alpha value of .05, no significant correlation between these two variables could be established (See Table 9). Though the primary outcome results were not statistically significant, the results are considered clinically meaningful as the CLABSI rate decreased from 4.54 in the pre-intervention period to 2.97 in the intervention period to zero (0) in the post-intervention period.

Minimizing central line usage in patients is directly proportionate to the development of CLABSI. One of the essential components of bundle care is assessing the need for a central line and replacing it with a midline or peripheral access. The data analysis on this balancing outcome measure showed that the midline uses in ICU patients as a replacement to the central line

increased five and four folds in the intervention and the post-intervention period, respectively (See Figure 10).

Estimating the financial burden of CLABSI on healthcare organizations requires an extensive accounting system (Scott, 2019) and therefore was not a part of this project. However, based on evidence, any reduction in the infection rates provides a cost-benefit to the facility by averting the excess cost imposed due to the increased morbidity and hospitalization (Herzer et al., 2014; Agency for Healthcare Research and Quality, 2013).

Impact

The implementation of CLABSI bundle care through this project established a positive clinical impact on the care provided to the ICU patients with the central line at the project facility. The change in practice from the standard CLABSI care to the bundle care has shown to significantly enhance the quality and effectiveness of patient care for this population, as evidenced by increased utilization of midline catheters as a replacement for the central line, a decrease in the number of days the central line is left in place and a decreased CLABSI infection rate. These three achievements directly support the optimum standard of care provided to patients in decreasing the risk for CLABSI development.

At the project facility, all central lines except the Peripherally Inserted Central Lines (PICCs) are inserted and maintained in the ICU only. PICCs are initiated and maintained in all adult units, including the outpatient department. Through this project, bundle care is well integrated into the ICU department CLABSI prevention program and supports the department goal of developing zero CLABSI cases in the ICU, as evidenced by achieving a declining infection rate during the implementation and a zero rate upon project completion. However, PICC lines initiated and managed outside the ICU and later transferred to the unit may affect the

achievement and sustainment of this goal. Since the central lines initiated outside the ICU are not implementing bundle care from the start, they drastically increase the risk for CLABSI when the patients transfer into the ICU, consequently overshadowing the efficacy and potency of this intervention in the future. Thus, expansion of this project to other units is highly suggested to ensure standardization of the intervention across the project facility.

The two limitations that the project faced during the intervention and the post-intervention period were mainly related to the Coronavirus (COVID) pandemic-induced surge. The acute staff shortage and the shifted priorities at the unit and the organizational level introduced challenges for the unit staff in supporting bundle care implementation and maintaining consistency in implementing bundle care in the patient care practices.

Preparing the ICU educator to conduct staff teaching and compliance auditing as a process measure was included to achieve project sustainability. The ICU educator is responsible for the ongoing project evaluation by regularly educating and auditing staff's compliance with the new practice. The ICU educator also ensures that the educational material on CLABSI provided to the team is up-to-date by staying in touch with the VAT, the CLABSI content expert at the facility.

Dissemination

The project results were shared within the organization, including the ICU manager, staff, VAT, and the infection control team in a face-to-face meeting through a PowerPoint presentation. Histograms and line charts were used to present the project results. The histogram provided an opportunity to evaluate patterns in performance and visualization of the distribution of data. (Patient Safety Network {PSNet}, 2021). Line charts were an efficient way of tracking

the improvement over time. Histograms represent the shape of the data, while the line charts show the direction of the data, which was very effective for stakeholders to see (Johnson, 2017).

The project results will be disseminated externally with the University of St. Augustine through an oral poster presentation. The project manuscript will also be submitted to the University of St. Augustine's (USA) institutional Scholarly Open Access Repository (SOAR@USA). This submission will allow the project manager to share the results with students, faculty, and alumni. In addition, the project manager will also share the project with the professional colleagues at the Alpha Alpha Alpha (AAA) Chapter Sigma at the USAHS Scholarly Project symposium.

Conclusion

This project addressed the PICOT question, which aimed to evaluate the use of central line bundle care in preventing CLABSI in ICU patients. CLABSI, as the leading cause of preventable healthcare-acquired infection, result in extended length of stay, high morbidity, and mortality in ICU patients (Lin et al., 2017). Along with human suffering, the financial burden imposed by this preventable infection on the healthcare system is astonishing. CLABSI prevention based on evidence-based bundle care interventions has shown a significant decrease in CLABSI rates and serves as the basis for this project. The practice recommendations provided through this EBP project are based on solid evidence resulting from a thorough and rigorous literature search supporting the use of bundle care in decreasing CLABSI rates in ICU patients. CLABSI prevention program includes a multifaceted approach grounded in infection surveillance, infection control, and adequate staff education and has demonstrated marked improvement in patient care outcomes.

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Table 1

Benefits and Risks of Central Catheters, PICC and Midline

Catheter	Benefits	Risks
Central Line (Subclavian)	• Most comfortable for conscious patients • Easier landmark • Less infection risk for long-term catheterization	• Highest risk for pneumothorax • Noncompressible bleeding vessels
Central Line (Internal Jugular)	• Chances of greatest successful cannulation (good landmarks) • Direct path to superior vena cava • Bleeding can be recognized and controlled (easily compressible vessels) • Rare chance of malposition	• Risk of carotid artery puncture • Possibility of pneumothorax • Poor landmarks in some patient population (obese/edematous) • Non-preferrable site for long-term catheterization • Higher infection and thrombosis rate than subclavian access
Central Line (Femoral)	• Easy landmark • High insertion success rate • Preferred site for emergencies and CPR • Easily compressible bleeding vessel	• Highest risk of infection • Risk for DVT • Not good for ambulatory patients
Peripherally Inserted Central Catheter (PICC)	• Quick and less invasive • Useable as outpatient treatment • Avoids repeated peripheral canulation • Decrease chance of infiltration	• Accidental puncture of an artery or tendon (rare incidence) • Issue injury secondary to infiltration • Risk of infection and DVT but much lower than the central lines
Midline (peripheral)	• Avoids repeated peripheral canulation	• Mild risks include local infection and tissue injury

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Table 2

Project Milestones

Milestones
Develop Project Proposal
Proposal approved by the IRB and the ERPC
Assessment of staff knowledge, skills and attitude on CLABSI bundle care
Develop staff education material on CLABSI bundle care
Train all ICU staff on CLABSI bundle care
Prepare ICU nurse educator through “Train the Trainer” program
Evaluate project outcomes

Table 3

Project Budget

EXPENSES		**REVENUE**	
Direct		Billing	$0
Salary and benefits Meetings with Stakeholders: ICU nurse manager ($80/hr. x 2 hrs.); ICU nurse educator ($60/hr. x 2 hours); Infection Control nurse ($60/hr. x 1 hr.), Deputy chief of quality and safety (100/hr. x 1hr.) Nurse Educator Training (3 hours x $60/hr.) Two nurse champions training (2 hours x $50/hr.)	$440 $180 $200	Grants	$0
Supplies Handouts and skills checklist for training Instructional Kit for ICU Nurse Educator	$250	Institutional budget support	$0
Services			
Statistician ($50/hr. x 10 hours	$500		
Indirect			
Overhead			
Total Expenses	$1,570	Total Revenue	$0
Net Balance: $1,570			

Table 4

Project Measures

Measure	Responsible Party	Frequency of measurement	Data collection tool	Target	Follow-up plan
Outcome Measure					
Total number of CLABSI per 1,000 Central Line Catheter-days. (NHSN definition: Total # of CLABSI cases/Number of central line days x 1,000)	Project Manager (PM)	Baseline, during intervention and & 2 weeks post-intervention	Log Sheet	0 case	Track the process measure to evaluate the gaps and re-enforce practice change interventions.
Process Measures					
Central line bundle care compliance performance	Project Manager (PM)	Baseline & weekly for four weeks	Check sheet	>95%	Evaluate the level of compliance. If compliance <95%, meet with designated party (For e.g., staff or nurse educator) to • identify reasons for not meeting the compliance target and • retrain, re-enforce and re-evaluate in the next measurement cycle.
Conduct staff education session		Baseline and post-completion of education session			
Conduct nurse educator training		Baseline and post-completion of education session			
Balancing Measure					
Use of midline or peripheral	Project Manager (PM)	Baseline & weekly for four weeks	Log sheet	>95%	Evaluate the assessment performed before central line insertion. If

intravenous device utilization		during intervention period			compliance <95%, identify factors causing hinderance, reinforce practice and evaluate in the following measurement cycle.
Financial Measure					
Cost of each CLABSI infection	Project Manager (PM)	Once at the end of the intervention period	Log Sheet	$0 CLABSI related healthcare cost	Any case of positive CLABSI cases will require gaps in practice change implementation and re-evaluation in the next measurement cycle.
Length of stay associated with CLABSI				0 length of hospital stay extended due to CLABSI	
Sustainability Measure					
Central line bundle care compliance performance	Nurse Educator	Three- and six-month post-project	Log Sheet	>95%	Evaluate the level of compliance. If compliance <95%, meet with staff to • identify reasons for not meeting the compliance target and • retrain, re-enforce and re-evaluate in the next measurement cycle.

Table 5

Aggregate Data

Period	# Of Patients	Gender	Age	Types of Line	CLABSI Infection	CLABSI Rate	Catheter Days	Staff Education	Staff Compliance rate
Pre-Intervention (Baseline)	27	M: 25 F:2	30-40: 0 41-50: 2 51-60: 2 61-70: 9 71-80: 13 81-90: 0 Missing Data: 1	CVC: 9 A-Line: 10 HD: 3 PICC: 4 Midline: 1	1	4.54	220	>95%= 5 <95%= 10	>95%= 8 <95%= 7
Intervention	52	M: 49 F:3	30-40: 0 41-50: 3 51-60: 4 61-70: 19 71-80: 23 81-90: 3 Missing Data: 0	CVC: 9 A-Line: 21 HD: 4 PICC: 13 Midline: 5	1	2.97	336	>95%= 15 <95%= 0	>95%= 15 <95%= 0
Post-Intervention	20	M:18 F: 2	30-40: 1 41-50: 0 51-60: 2 61-70: 7 71-80: 9 81-90: 1 Missing Data: 0	CVC: 5 A-Line: 7 HD: 2 PICC: 2 Midline: 4	0	0	30	>95%= 15 <95%= 0	>95%= 15 <95%= 0

Table 6

Results of the Fisher's Exact Test for Staff Education

	Staff Education		
Period	0	1	*p*
Pre-Intervention	10[1.40]	4[4.76]	< .001
Intervention	0[1.50]	15[5.10]	
Post-Intervention	0[1.50]	15[5.10]	

Note. Values formatted as Observed [Expected]

Table 7

Results of the Fisher's Exact Test for Staff Compliance

	Staff Compliance		
Period	0	1	*p*
Pre-Intervention	7[1.05]	8[5.70]	< .001
Intervention	0[1.05]	15[5.70]	
Post-Intervention	0[1.05]	15[5.70]	

Note. Values formatted as Observed [Expected.

Table 8

Results of the Fisher's Exact Test for CLASBI

	CLABSI Infection		
Period	1	2	*p*
Pre-Intervention	26[26.46]	1[0.54]	1.000
Intervention	52[51.94]	1[1.06]	
Post-Intervention	20[19.60]	0[0.40]	

Note. Values formatted as Observed [Expected]

Table 9

Pearson Correlation Results Between Catheter days and CLABSI Rate

Combination	*r*	95.00% CI	*n*	*p*
Catheter days-CLABSI Rate	.74	[-1.00, 1.00]	3	.466

Figure 1

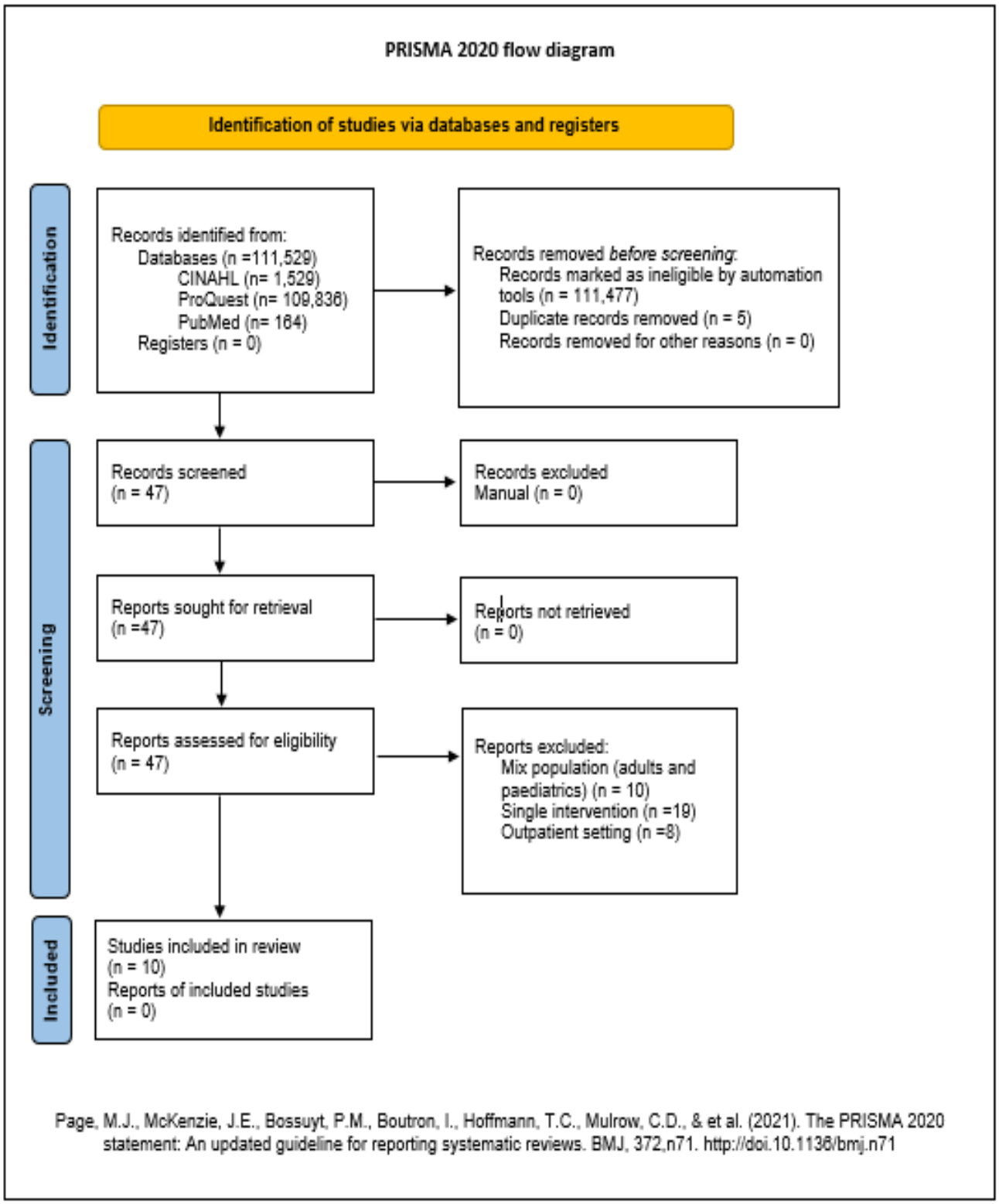
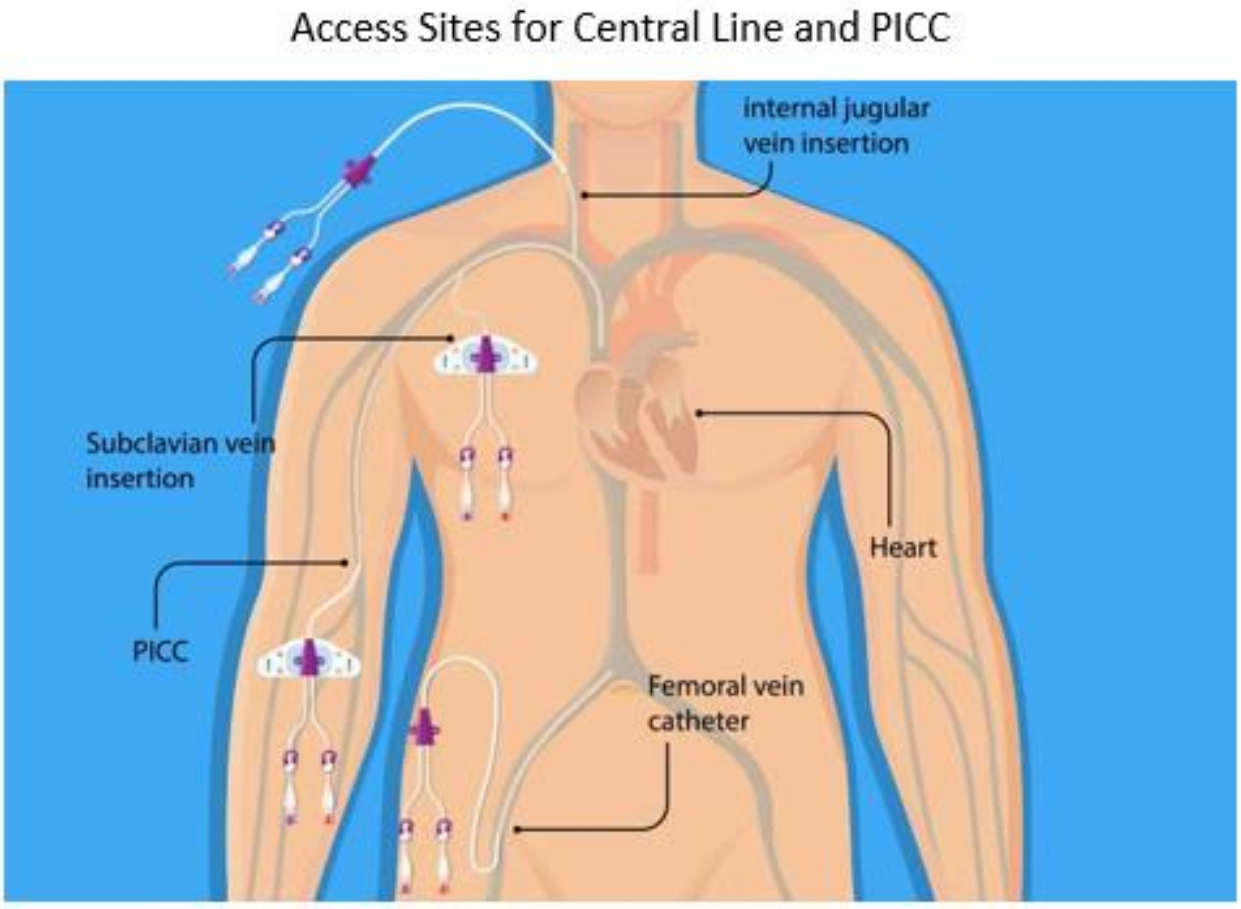
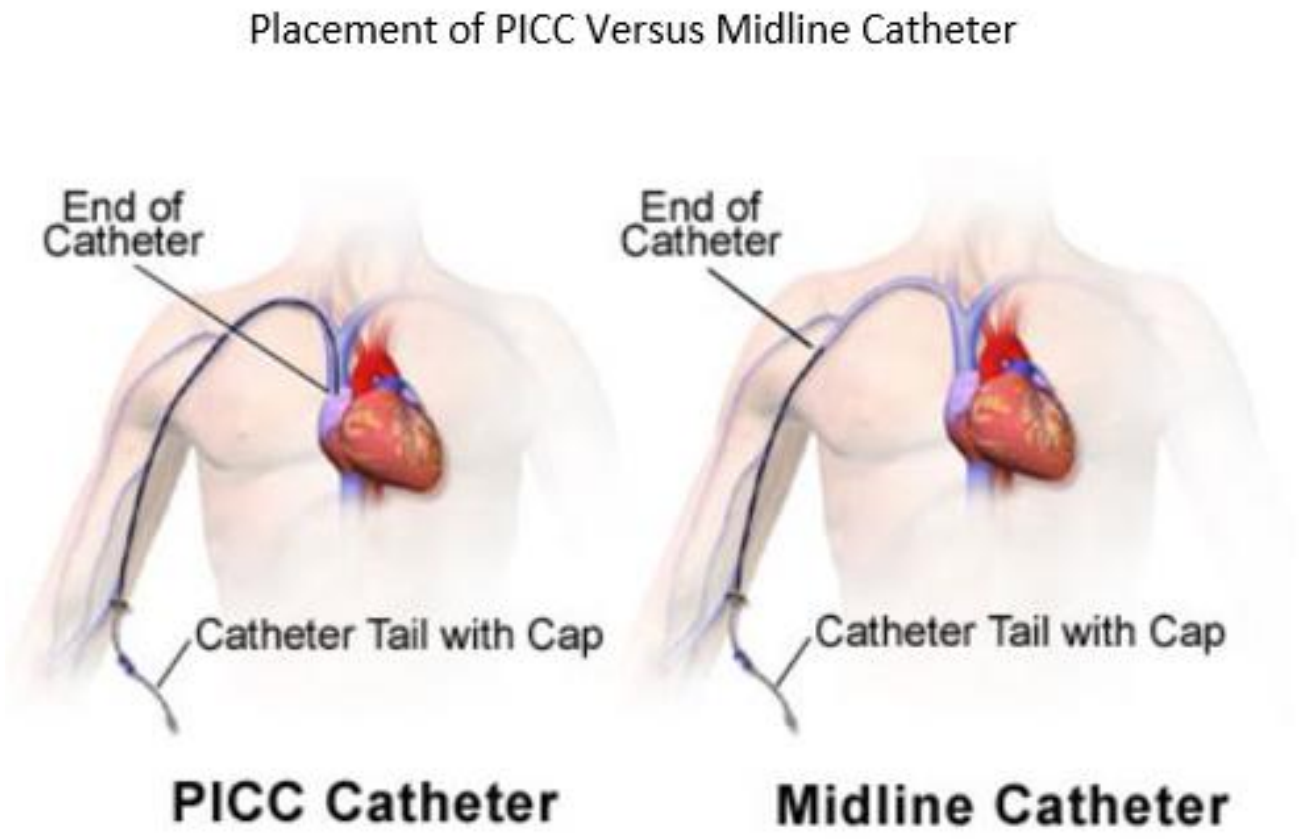

PRISMA 2020 flow diagram
Identification of studies via databases and registers
Identification
Records identified from:
Databases (n =111,529)
CINAHL (n= 1,529)
ProQuest (n= 109,836)
PubMed (n= 184)
Registers (n = 0)
Records removed before screening:
Records marked as ineligible by automation tools (n = 111,477)
Duplicate records removed (n = 5)
Records removed for other reasons (n = 0)
Screening
Records screened
(n = 47)
Records excluded
Manual (n = 0)
Reports sought for retrieval
(n =47)
Reports not retrieved
(n = 0)
Reports assessed for eligibility
(n = 47)
Reports excluded:
Mix population (adults and paediatrics) (n = 10)
Single intervention (n =19)
Outpatient setting (n =8)
Included
Studies included in review
(n = 10)
Reports of included studies
(n = 0)
Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., & et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372,n71. http://doi.10.1136/bmj.n71

Figure 2



Care of Central Venous Catheters. (2020, April 26). Ausmed. https://www.ausmed.com/cpd/articles/-central-venous-catheters

Figure 3



UConn John Dempsey Hospital. 2019, January 29). Memorandum: Medication safety committee members. Antimicrobial stewardship committee. https://health.uconn.edu/pharmacy/wp-content/uploads/sites/60/2019/02/Medication-Considerations-for-Midline-Catheters.pdf

Figure 4

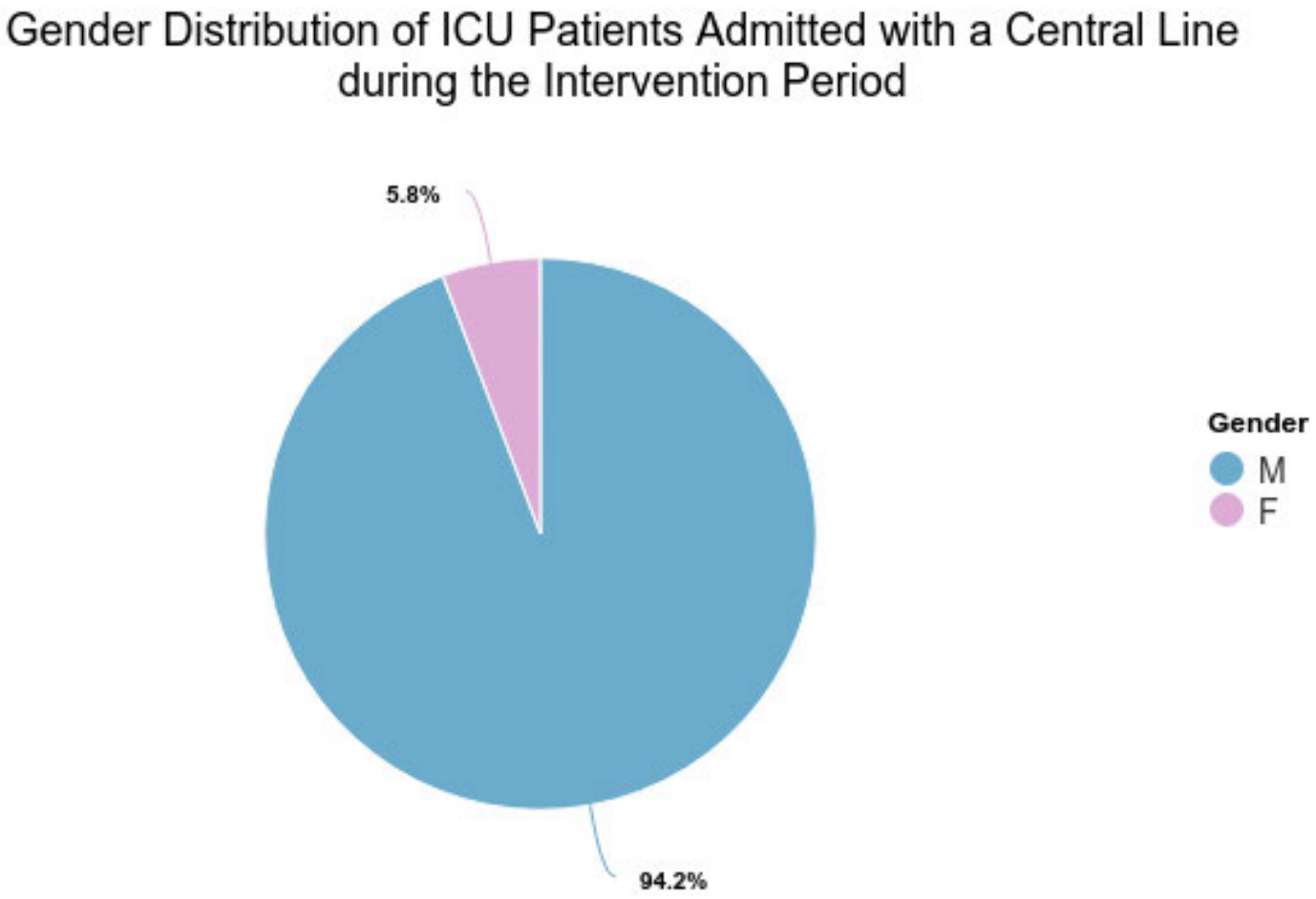
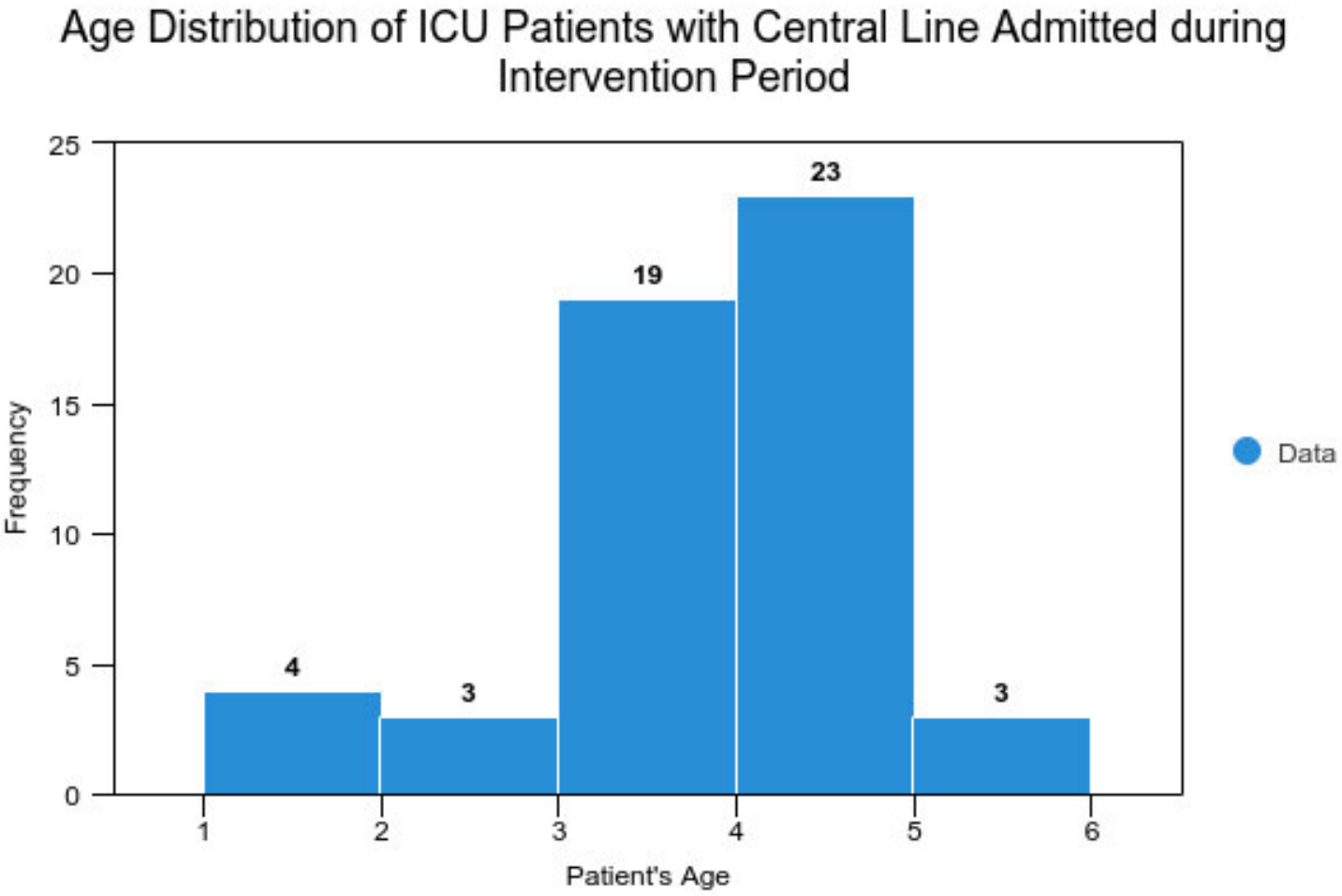
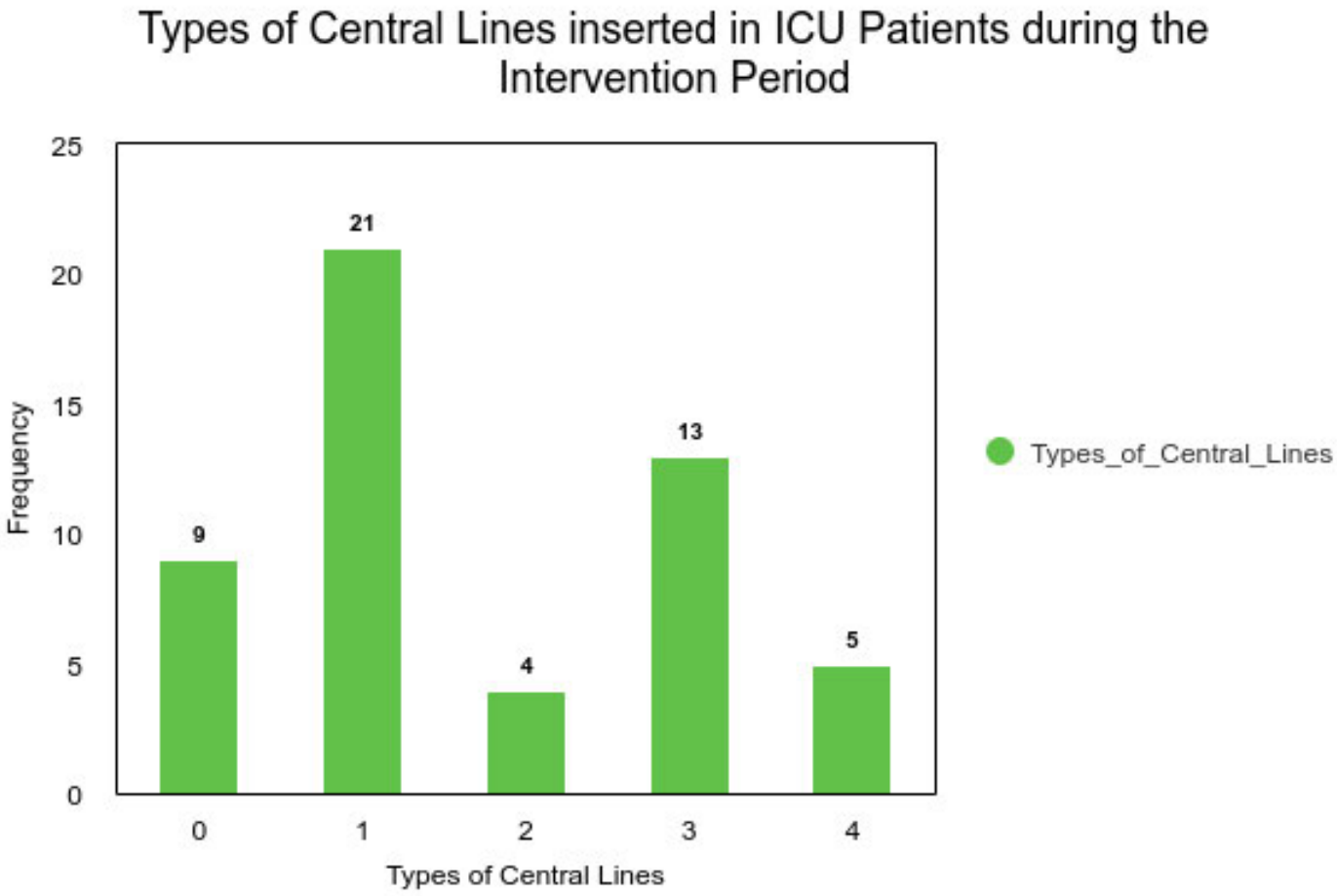

Gender Distribution of ICU Patients Admitted with a Central Line during the Intervention Period
5.8%
94.2%
Gender
M
F

Figure 5



Legend
1: 30- 40 years
2: 41-50 years
3: 51-60 years
4: 61-70 years
5: 71-80 years
6: 81-90 years

Figure 6



Legend:
0: Central Venous Catheter (CVC)
1: Arterial Line (A-Line)
2: Hemodialysis Catheter
3: Peripherally Inserted Central Catheter (PICC)
4: Midline

Figure 7

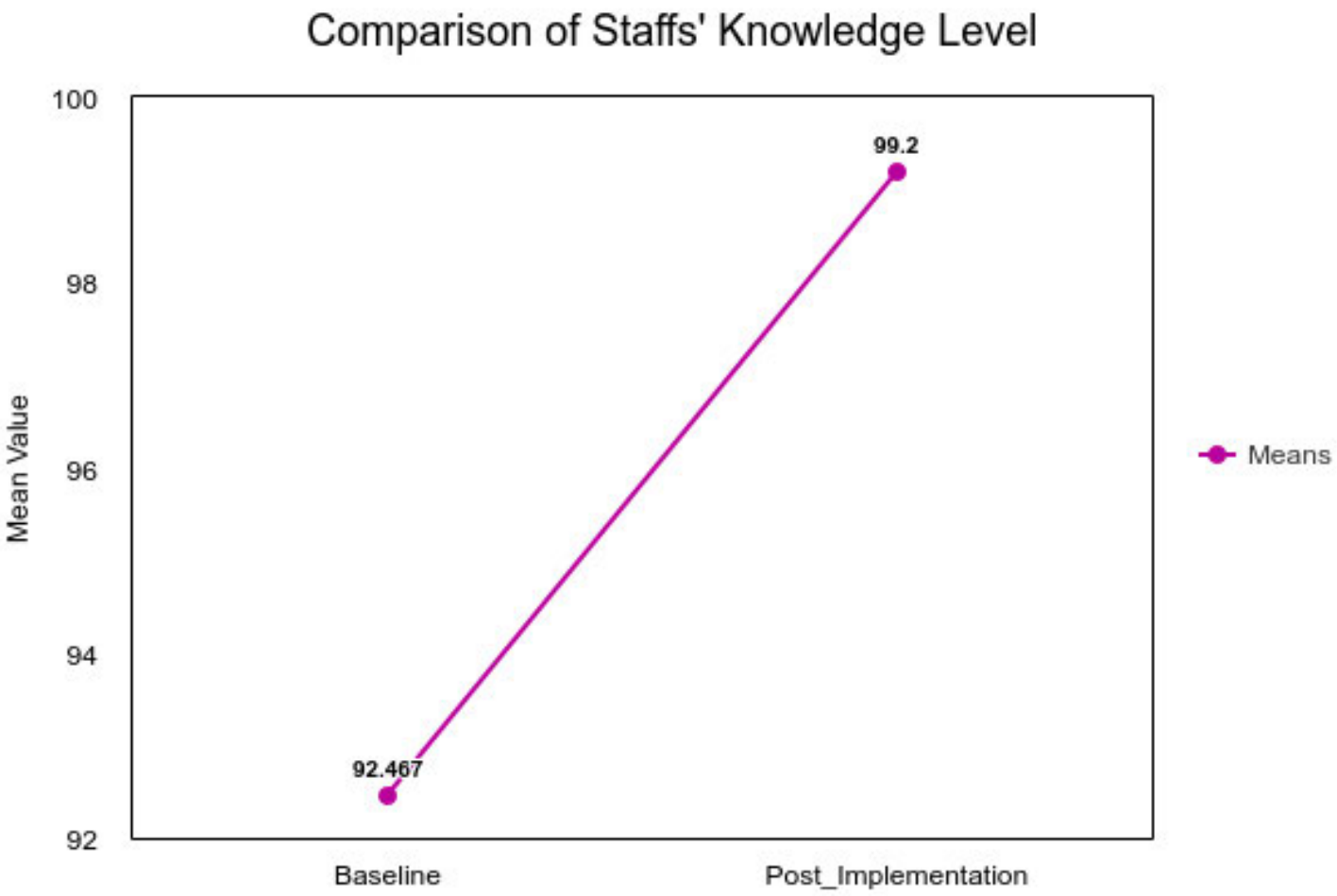

Comparison of Staffs' Knowledge Level
100
98
96
94
92
Mean Value
99.2
92.467
Baseline
Post_Implementation
Means

Figure 8

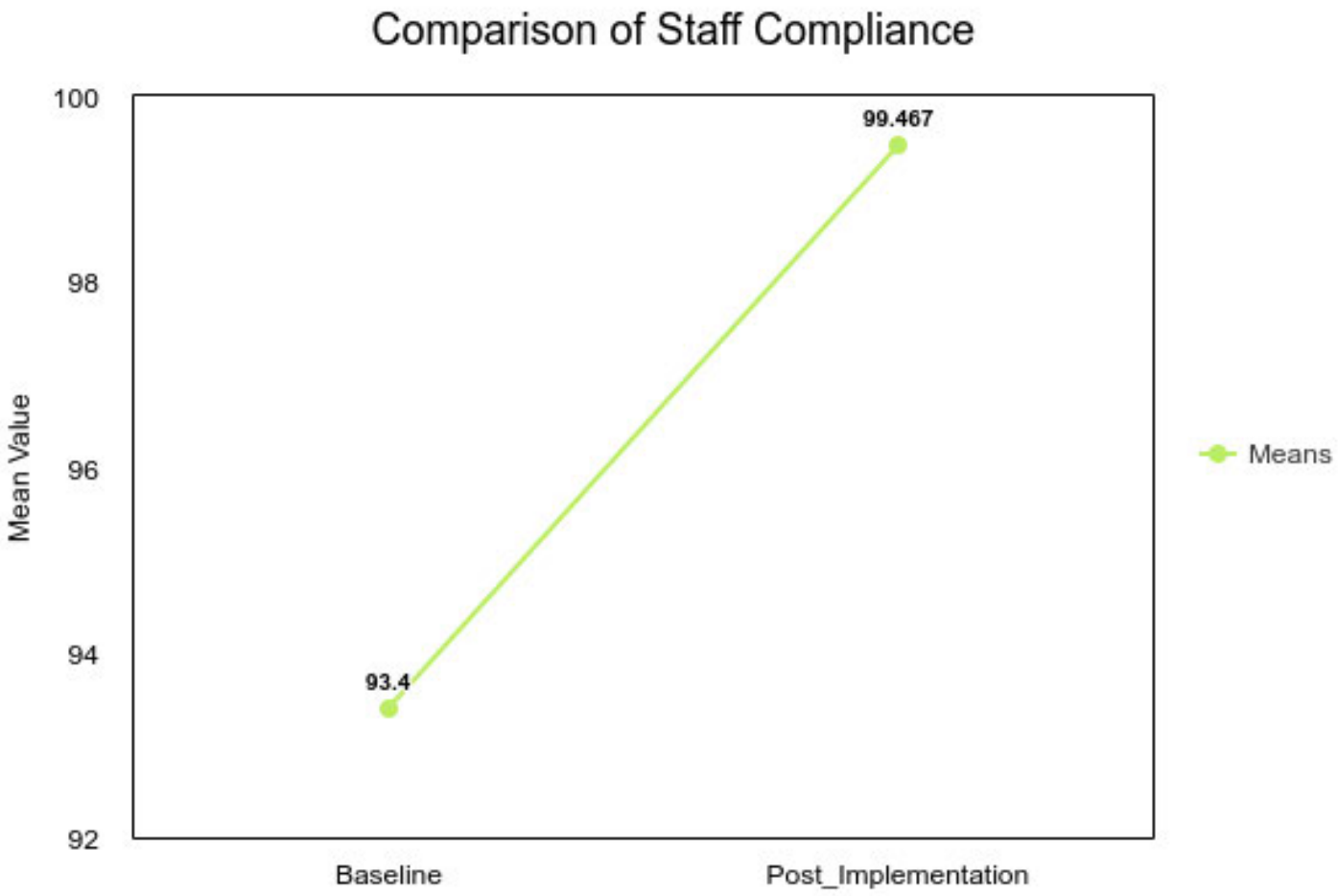

Comparison of Staff Compliance
100
98
96
94
92
Mean Value
99.467
93.4
Baseline
Post_Implementation
Means

Figure 9

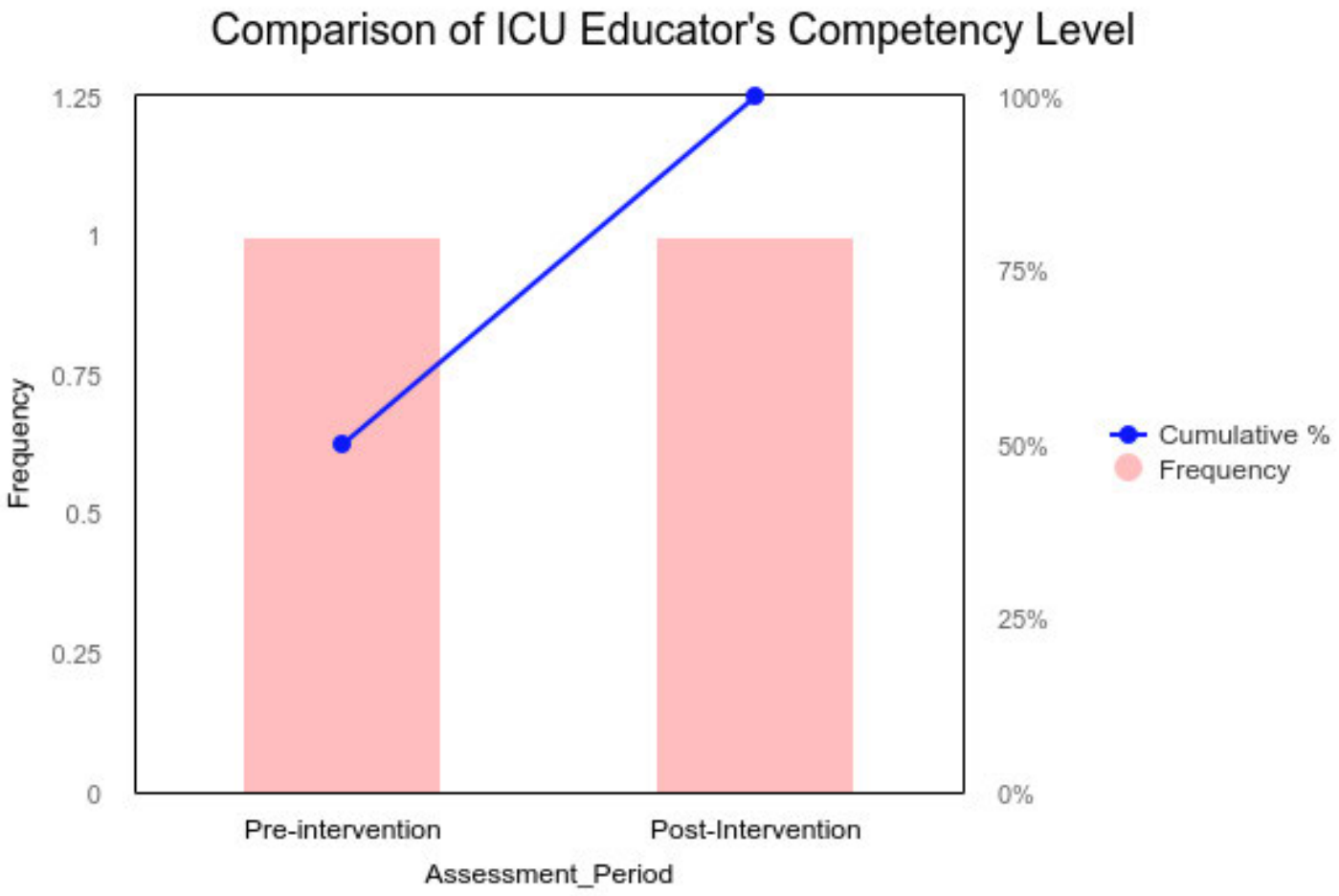
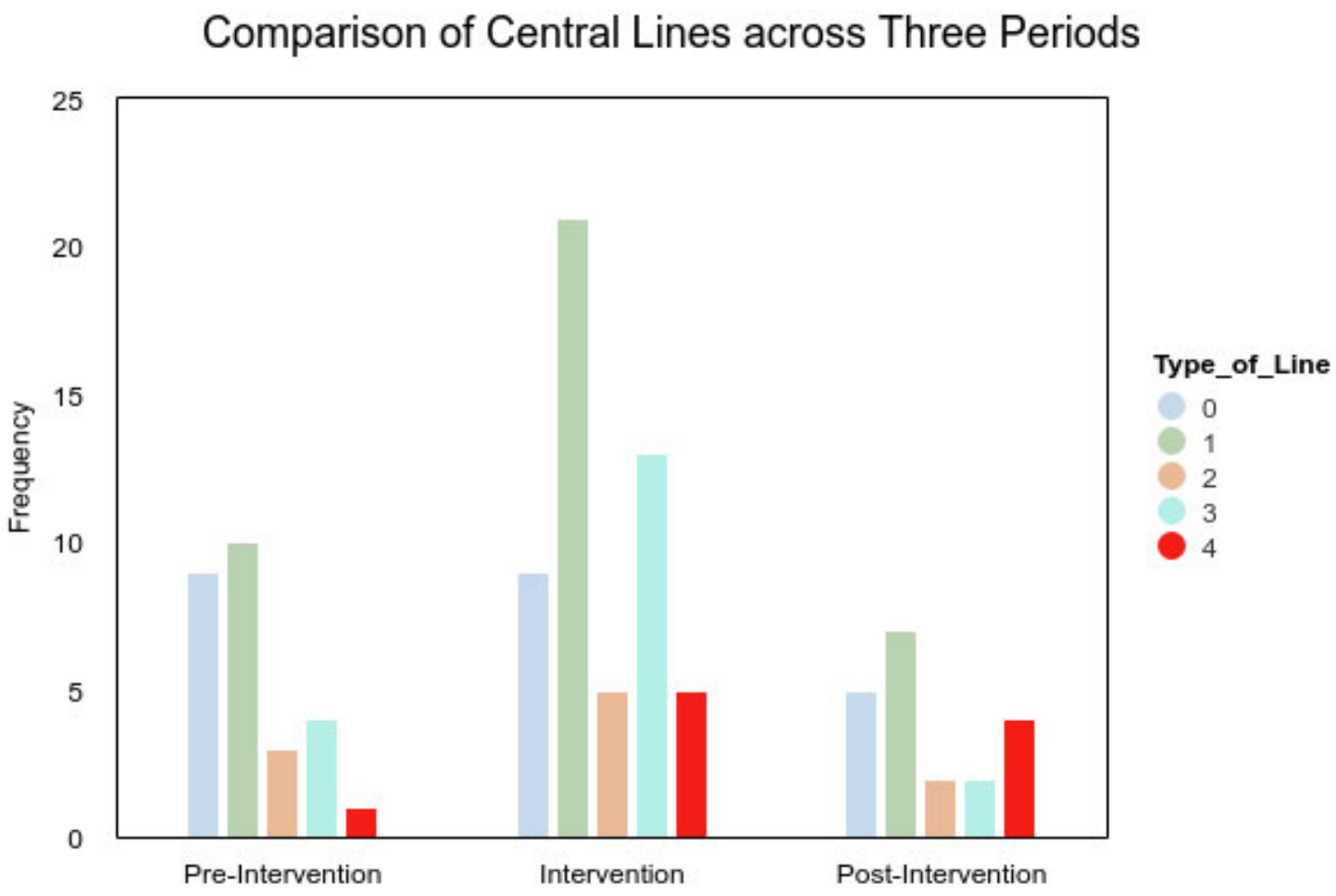

Comparison of ICU Educator's Competency Level
1.25
1
0.75
0.5
0.25
0
Frequency
100%
75%
50%
25%
0%
Cumulative %
Frequency
Pre-intervention
Post-Intervention
Assessment_Period

Figure 10



Legend:
0: Central Venous Catheter (CVC)
1: Arterial Line (A-Line)
2: Hemodialysis Catheter
3: Peripherally Inserted Central Catheter (PICC)
4: Midline

Appendix A

Primary Evidences Summary

Citation	Design, Level Quality Grade	Sample Sample size	Intervention Comparison (Definitions should include any specific research tools used along with reliability & validity)	Theoretical Foundation	Outcome Definition	Usefulness Results Key Findings
1. Lai, C.-C., Cia, C.-T., Chiang, H.-T., Kung, Y.-C., Shi, Z.-Y., Chuang, Y.-C., Lee, C.-M., Ko, W.-C., & Hsueh, P.-R. (2018). Implementation of a national bundle care program to reduce central line-associated bloodstream infections in intensive care units in Taiwan. *Journal of Microbiology, Immunology and Infection*, *51*(5), 666–671. https://doi.org/10.1016/j.jmii.2017.10.001.	***Design:*** Prospective pre-intervention post intervention study. ***Level:*** II ***Quality Grade:*** B	***Sample:*** Adult patients admitted in twenty-seven ICUs in nine medical centers, three regional hospitals and one district hospital in Taiwan. ***Sample size:*** Not specified in the article.	Intervention consists of insertion bundle (hand hygiene, maximal sterile barrier upon insertion, use of CHG for prepping skin and avoidance of femoral line) and maintenance bundle (hand hygiene, proper dressing changes, aseptic technique for accessing and changing needleless connectors and a daily review of catheter necessity). A checklist was developed to evaluate bundle practice compliance. Reliability and validity of the checklist is not	Not identified or mentioned in the article.	CLABSI rates and catheter utilization rates were used to measure outcomes. (Definitions provided in the legend)	The CLABSI rate decreased by 12.2%, from 5.74 per 1000 catheter-days in the pre-intervention phase to 5.04 per 1000 catheter-days ($p < 0.001$). and the catheter utilization rate decreased by 1.1% from 55.3% in the pre-intervention phase to 54.2% in the intervention phase. The multidimensional central-line bundle significantly

			addressed in the article.			reduced CLABSI rates in ICU patients. The study also found that hospital settings did not affect the CLABSI rates (Medical center versus regional hospitals versus district hospitals).
2. Lee, K.H., Cho, N.H., J, S.J., Kim, M.N., Han, S.H., & Song, Y.G. (2018). Effect of Central Line Bundle Compliance on Central Line-Associated Bloodstream Infections. *Yonsei Medical Journal*, *59*(3), 376–382.	***Design:*** Pre-intervention post intervention study. ***Level:*** II ***Quality Grade:*** A	***Sample:*** Patients admitted between August 2013 through July 2016 receiving new CL insertions during the first week of each month. ***Sample size***: 1672 patients (ICU, n=371; ER, n=376; OR, n=769; GW, n=156)	CL bundle consisted of four components: hand hygiene, use of maximum barrier precautions, use of CHG skin preparation, and selection of an appropriate site for CL access. A checklist was developed to evaluate compliance. Reliability and validity of the checklist is not addressed in the article.	Not identified or mentioned in the article.	CLABSI cases and catheter days were the outcome measure of the study.	A total of 29 (1.73%) CLABSI cases were identified in a total of 14829 catheter-days. The study also found that the CLABSI rates were highest in patients for whom one or more components of the CL bundle were not performed. Thus, performing all components of

						CL bundle increases the efficacy of CLABSI prevention.
3. Lin, W. P., Chang, Y. C., Wu, U. I., Hung, M. C., Chuang, P. Y., Wang, J. T., Sheng, W. H., Chen, Y. C., & Chang, S. C. (2018). Multimodal interventions for bundle implementation to decrease central line-associated bloodstream infections in adult intensive care units in a teaching hospital in Taiwan, 2009-2013. *Journal of microbiology, immunology, and infection,51*(5), 644–651. https://doi.org/10.1016/j.jmii.2017.08.008	***Design:*** Prospective pre-intervention post intervention study. ***Level:*** II ***Quality Grade:*** A	***Sample:*** Adult ICU patients admitted in a 238-bed medical center in Northern Taiwan. ***Sample size:*** n= 31,966 (baseline period) and n= 52,137 (intervention period)	Intervention consists of bundle care: hand hygiene, maximal sterile barrier precaution, use of CHG skin antiseptic and selecting the optimal site for central line insertion and timely removal of catheter. Data was collected on an online, hospital-based bloodstream infection surveillance and classification system.	Not identified or mentioned in the article.	CLABSI rates in a given month was measured as the outcome of this study. (Definition provided in the legend)	The incidence rate of CLABSI per 1000 CL-days decreased from 9.27 during the baseline period to 7.66 during the intervention period ($p < 0.001$).
4. Mazi, W. A., Abdulwahab, M. H., Alashqar, M. A., Aldecoa, Y. S., Bahat, Z. R., Suaking, J. L., Saeed, A., Yassin, O. S., Mahfouz, S. A.-D., & Senok, A. (2021).	***Design:*** Prospective pre/post intervention study. ***Level:*** II ***Quality Grade:*** B	***Sample:*** Adult patients admitted in the 27-bed ICU with a diagnosis of CLABSI between January 2017-December 2019 in King Faisal Medical Complex in Taif, Saudi Arabia.	The bundle care included the following: hand hygiene; maximal barrier precautions; CHG skin antisepsis; optimal catheter site selection, and daily	Not identified or mentioned in the article.	The outcome measures included CLABSI rates days and the catheter utilization ratio.	CLABSI rate decreased from 1.12/1,000 central-line days with a 0.51 utilization ratio to 0.46/1,000 central line days

Sustained Low Incidence Rates of Central Line-Associated Blood Stream Infections in the Intensive Care Unit. *Infection and Drug Resistance, 14*, 889. https://doi.org/10.2147/IDR.S290791		***Sample size:*** Not specified in the article.	review of line necessity, with prompt removal of unnecessary lines.		(Definitions are provided in the legend)	with a 0.44 utilization ratio in the post-intervention period indicating positive impact of bundle care on CLABSI.
5**.** O'Neil C, Ball K, Wood H, McMullen K, Kremer P, Jafarzadeh SR, Fraser V, Warren D. (2016). A central-line maintenance bundle for the prevention of catheter-associated bloodstream infection in a non-ICU setting**.** *Infection Control Hospital Epidemiology, 37*(6), 692-8. http://doi:10.1017/ice.2016.32	***Design:*** Prospective pre-intervention post intervention study. ***Level***: II ***Quality Grade:*** A	***Sample:*** Adult in-patients admitted to an urban tertiary care academic medical center general ward with central lines in place for one or more days between July 1, 2012 and December 31, 2013. ***Sample size:*** n= 1250	Intervention consisted of a multifaceted, central line care maintenance bundle including catheter dressings change, insertion sites and dressing observation, and educational program for nursing emphasizing catheter/dressing care and enhancement of hospital catheter-care policies The control group consisted of CL care including hand hygiene and catheter insertion practices.	Not identified or mentioned in the article.	CLABSI rate was measured as the outcome of this study. (Definition provided in the legend)	CLABSI rate decreased from 1.72 per 1000 catheter days from 3.02 per 1000 catheter days in the intervention group compared to control group which decreased from 1.43 per 1000 catheter-days to 1.39 per 1000 catheter-days. A multi-faceted approach comprising of education and bundle interventions showed significant

						decrease in CLABSI rates.
6. Poh, K. W., Ngan, C. H., Wong, J. Y., Ng, T. K., & Mohd Noor, N. (2020). Reduction of central-line-associated bloodstream infection (CLABSI) in resource limited, nonintensive care unit (ICU) settings. *International Journal of Health Care Quality Assurance.* https://doi.org/10.1108/IJHCQA-11-2019-0195	***Design:*** Prospective cohort pre-intervention post intervention study. ***Level***: II ***Quality Grade:*** B	***Sample:*** All patients admitted with a central line in general medical ward of Tuanku Ja'afar Seremban hospital in Malaysia. ***Sample size:*** Not specified in the article.	Intervention consists of multi-faceted intervention bundle (education program for doctors and nurses, weekly audit and feedback, implementation of central line bundle of care (hand hygiene, maximal barrier precautions, use of CHG for skin preparation, daily inspection and review for the need to continue central line placement, using care bundle checklist, using transparent dressing and proper aseptic technique when handling of central line. A checklist was developed to evaluate the CL insertion and maintenance bundle. Reliability and validity of the checklist is not addressed in the article.	Not identified or mentioned in the article.	CLABSI rate was the outcome measure of this study. (Definition provided in the legend)	CLABSI rates decreased from 19.3 per 1000 CL days to 7.3 per 1000 CL days in a four-month period.

Salama, M. F., Jamal, W., Al Mousa, H., & Rotimi, V. (2016). Implementation of central venous catheter bundle in an intensive care unit in Kuwait: Effect on central line-associated bloodstream infections. *Journal of Infection and Public Health, 9*(1), 34–41. https://doi.org/10.1016/j.jiph.2015.05.001	***Design:*** Prospective cohort pre-intervention post intervention study. ***Level:*** II ***Quality Grade:*** B	***Sample:*** Adult patients admitted between January 2010 and February 2012 in a 23-bed ICU with a stay longer than 48 hours and a diagnosis of healthcare associated infection in a general teaching hospital in Kuwait. ***Sample size:*** Not specified in the article.	Intervention consisted of central line insertion bundle which included hand hygiene, maximum barrier precautions (PPE and patient draping), use of 2% CHG, optimal site selection, daily examination of the necessity of the line) Kuwait National Health Surveillance System (KNHSS) worksheets were used. Reliability and validity of these worksheets are not addressed in the article.	Not identified or mentioned in the article.	CLABSI rates were used as the outcome measure. (Definition provided in the legend)	CLABSI episodes decreased from 80 to 56 from baseline to post-intervention period and CLABSI per 1000 CL days decreased from 14.9 to 11.08 however, the difference was not found to be statistically significant ($P = 0.0859$). The study concluded that the insertion bundle by itself is effective in decreasing in CLBSI as it helped in decreasing the patient days from 7161 to 6474 and catheter days from 5367 to 5052 However, a combination of insertion and

						maintenance bundle can significantly affect the outcomes.
Tjallie van, d. K., Sax, H., Pittet, D., Jaap, v. D., Birgit, v. B., Walder, B., Cartier, V., Clack, L., de Greeff, S., Wolkewitz, M., Hieke, S., Boshuizen, H., van de Kassteele, J., Annemie Van, d. A., Teck, W. B., Diab-Elschahawi, M., Dumpis, U., Ghita, C., FitzGerald, S., . . . Zingg, W. (2018). Prevention of hospital infections by intervention and training (PROHIBIT): Results of a pan-European cluster-randomized multicentre study to reduce central venous catheter-related bloodstream infections. *Intensive Care Medicine, 44*(1), 48-60. http://dx.doi.org/10.1007/s00134-017-5007-6	***Design:*** Stepped-wedge, cluster randomized, controlled design. ***Level:*** I ***Quality Grade:*** A	***Sample:*** All adult patients (≥ 16 years of age) with a CL inserted and admitted to one of the fifteen participating ICUs across Europe between January 2011 and June 2013. ***Sample size:*** n= 25,348	The three randomized group consist of the following: The first group included a CL insertion bundle consisting of selecting appropriate insertion site, catheter type, indication for CL insertion, and CL dwell time. The second group consisted of a hand hygiene improvement strategy based on World Health Organization (WHO) recommendations and third group consisted of the combination of the above-mentioned two strategies.	Not identified and mentioned in the article.	CLABSI rate was measured as an outcome. (Definition provided in the legend)	All three groups showed decrease in CLABSI cases however the hand hygiene and the combination group showed significant decrease in the development of CLABSI cases. Hand hygiene strategy if practiced thoroughly and consistently can significantly decrease CLABSI cases alone.

Wichmann, D., Belmar Campos, C.E., Ehrhardt, S., Kock, T., Weber, C., Rohde, H., & Kluge, S. (2018). Efficacy of introducing a checklist to reduce central venous line associated bloodstream infections in the ICU caring for adult patients. *BMC Infectious disease, 18(*1), 1-6. http://doi.org/10.1186/s12879-018-3178-6	***Design:*** Observational, prospective, single-center study. ***Level:*** III ***Quality Grade:*** A	***Sample***: All admitted adult patients with a central line admitted in 132- bedded ICU of a University Medical Center in Germany between 1st October 2011 to 30th September 2012. ***Sample size***: Observation group (n=1518) and control group (n= 2898)	Bundle care intervention consisted on hand hygiene, full barrier, sterile disinfection of the insertion site, avoidance of the femoral vein and strict indication for CVL. A checklist was created to evaluate the process measure. No reliability or validity of the checklist is mentioned in the article.	Not identified or mentioned in the article.	CLABSI incidence rate per 1000 CL days was the outcome measure of this study. (Definition provided in the legend)	39 CLABSI cases were identified in the observation (checklist) group contributing to 11,540 catheter days (3.8 per 1000 catheter days) compared with 127 cases in the control (without checklist) group contributing to 21,349 catheter days (5.9 per 1000 catheter days).
Yazici, G., & Bulut, H. (2018). Efficacy of a care bundle to prevent multiple infections in the intensive care unit: A quasi-experimental pretest-posttest design study. *Applied Nursing Research, 39*, 4–10. https://doi.org/10.1016/j.apnr.2017.10.009	***Design:*** Quasi-experimental pre-post intervention design. ***Level:*** II ***Quality Grade:*** B	***Sample:*** Adult patients 18 years and older with a CL admitted in adult Anesthesiology ICU in Turkey between 1st April − 30th September 2015. ***Sample size:*** n= 120	Forms developed by the author was used. The article does not discuss the reliability and validity of the forms.	None identified in the article.	CLABSI rate per 1000 CL days was measured in the study. (Definition provided in the legend)	CLABSI decreased from 8.9 to 4.2 per 1000 catheter days however it was not statistically significant due to increased nurse to patient ratio and decreased availability of CL materials.

Legend:

- CHG: Chlorhexidine gluconate (CHG)
- CL: Central Line
- CLABSI: All studies defined CLABSI based on CDC definition which included meeting the three criteria: Positive blood culture from a peripheral vein, no alternate source of bloodstream infection and presence of clinical signs of infection e.g., fever, rigors, altered mental status, and hypotension.
- The CLABSI rate is calculated per 1,000 central line-days by dividing the number of CLABSIs by the number of central line-days and multiplying the result by 1,000.
- The catheter utilization rates are calculated by dividing days of catheter use by total in-patient days.

Appendix B

Quality and strength analysis of primary evidences based on the Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) appraisal tool

Author/Year	Study/Design	Level of Evidence	Grade of Evidence
Lai et al., 2018	Pre-intervention post- intervention study	II	B
Lee et al., 2018	Pre-intervention post- intervention study	II	A
Lin et al., 2018	Pre-intervention post- intervention study	II	A
Mazi et al., 2021	Pre-intervention post- intervention study	II	B
O'Neil et al., 2016	Pre-intervention post- intervention study	II	A
Poh et al., 2020	Pre-intervention post- intervention study	II	B
Salama et al., 2016	Pre-intervention post- intervention study	II	B
Tjallie et al., 2018	Stepped-wedge, cluster randomized, controlled design	I	A
Wichmann et al., 2018	Observational study	III	A
Yazici et al.,	Quasi-experimental pretest-posttest design	II	B

Appendix C

Primary Evidences Synthesis I

Article	Population & Setting	Intervention used	Frequency of the intervention generating the best outcome?	Outcome measurement
Lai et al., 2018	Adult ICU patients	***Central Line Care Bundle (multifactorial)*** 1. Hand hygiene **2.** Use of CHG for site preparation 3. Use of maximum barrier precautions 4. Optimal site selection (avoiding femoral line) 5. Aseptic technique 5. Dressing change (proper and timely) 7. Daily reassessment of catheter necessity	Before and during line insertion and with each line access	Decrease in CLABSI rates catheter utilization rates
Lee et al., 2018	Adult ICU patients	***Central Line Prevention Bundle*** 1.Hand hygiene 2. Use of maximum barrier precautions 3. Use of CHG for site preparation 4. Optimal site selection **(avoiding femoral line)** 5. Daily reassessment of catheter necessity	Before and during line insertion and with each line access	Decrease in CLABSI rates catheter days
Lin et al., 2018	Adult ICU patients	***Central Line Care Bundle*** 1.Hand hygiene 2. Maximal sterile barrier precaution 3. Use of CHG skin antiseptic 4. Optimal site selection (**avoiding femoral line)** 5. Daily reassessment of catheter necessity 6. Dressing Change B. Education training for staff on CLABSI-specific infection control measures (lectures and simulation)	Before and during line insertion and with each line access	Decrease in CLABSI rates
Mazi et al., 2021	Adult ICU patients	***Bundle care*** 1.Hand hygiene 2. Maximal barrier precautions 3. CHG skin antisepsis	Before and during line insertion and with each line access	Decrease in CLABSI rates & catheter utilization rates decreased

		4. Optimal catheter site selection 5. Daily reassessment of catheter necessity Educational program on CLABSI care Use of catheter cart		
O'Neil et al., 2016	Adult ICU patients	***Bundle care (multifactorial)*** 1. Infection control (handwashing) 2. Dressing change 3. Daily observation of line/dressing 4. Educational program for nursing emphasizing CLABSI care	Before and during line insertion and with each line access	Decrease in CLABSI rates
Poh et al., 2020	Adult ICU patients	***Bundle care (multifaceted)*** 1. Hand hygiene 2. Maximal barrier precautions 3. Use of CHG for skin preparation 4. Daily inspection of the line/dressing 5. Daily reassessment of catheter necessity 6. Dressing changes 7. Aseptic technique B. Educational program for healthcare professionals on CLABSI care.	Before and during line insertion and with each line access	Decrease in CLABSI rates
Salama et al., 2016	Adult ICU patients	Insertion Bundles: 1. Hand hygiene 2. Maximum barrier precautions 3. Use of 2% CHG 4. Optimal site selection 5. Daily reassessment of catheter necessity	Before and during line insertion and with each line access	Decrease in CLABSI rates
Tjallie et al., 2018	Adult ICU patients	***Insertion Bundle*** 1. Hand hygiene 2. Maximum barrier precautions 3. Use of 2% CHG 4. Optimal site selection 5. Daily reassessment of catheter necessity	Before and during line insertion and with each line access	Decrease in CLABSI rates
Wichman n et al., 2018	Adult ICU patients	***Bundle Care*** 1. Hand hygiene 2. Maximum barrier precautions 3. Sterile disinfectant of the insertion site 4. Optimal site selection (avoidance of femoral vein) 5. Strict indication for line need	Before and during line insertion and with each line access	Decrease in CLABSI rates and catheter days

Yazici et al., 2018	Adult ICU patients	***Bundle Care*** 1. Daily reassessment of catheter necessity 2. Dressing change 3. Aseptic technique	Before and during line insertion and with each line access	Decrease in CLABSI rates

Legend:
Hand Hygiene: Hand hygiene
Maximum barrier precaution: Maximum barrier precautions
Sterile disinfectant of the insertion site: Sterile disinfectant of the insertion site
Optimal site selection: Optimal site selection
Daily reassessment of catheter necessity: Daily reassessment of catheter necessity
Dressing change: Dressing change
Educational program for healthcare professionals on CLABSI care.: Educational program for healthcare professionals on CLABSI care.
Aseptic technique: Aseptic technique
Daily inspection of the line/dressing: Daily inspection of the line/dressing

Appendix D

Primary Evidences Synthesis II

Level of Studies	Level 1 (1 study) Level II (8 studies) Level III (1 study)
Strength of Evidence	Quality A (5 studies) Quality B (5 studies)
Study population	Adult (18 years and older) admitted in the ICU (10 studies)
Intervention and Frequency (Insertion and/or maintenance bundle)	Hand Hygiene. Frequency: Performed upon before line insertion and each time the line is accessed or needed dressing change. (9 studies). Aseptic techniques. Frequency: Maintained throughout the duration from line insertion to line discontinuation. (3 studies). Educational training of staff on CLABSI care (4 studies). Frequency: on-going at least twice a year Use of catheter cart (1 study)
Intervention and Frequency (Insertion bundle)	Maximum barrier precautions. Frequency: before and during line insertion. (8 studies). Use of disinfectant (2% CHG). Frequency: before line insertion. (8 studies) Optimal site selection. Frequency: before line insertion. (7 studies). Strict indication for line. Frequency: before line insertion (1 study).
Intervention and Frequency (Maintenance bundle)	Review of catheter necessity. Frequency: Daily while the line is in place. (8 studies). Dressing change. Frequency: Gauze dressing every 5 days and PRN. Transparent dressing every 7 days and PRN. (4 studies) Observation of catheter site and dressing. Frequency: Once a day. (2 studies).
Duration of the intervention	One year or less (4 studies) 13 months to 2 years (2 studies) 25 months to 3 years (3 studies) 37 months to 4 years (1 study)
Outcome Measurement	Decrease in CLABSI rate. (10 studies). The rate is calculated per 1,000 central line-days by dividing the number of CLABSIs by the number of central line-days and multiplying the result by 1,000. Decrease in catheter utilization rates (2 studies). It is calculated by dividing days of catheter use by total in-patient days.

Appendix E

SWOT Analysis

Strengths (Internal positive)	Weaknesses (Internal negatives)	Opportunities (External positives)	Threats (External negatives)
• Engaged leadership open to the practice change • Well-structured department with clear roles and responsibilities • Organizational accountable to the larger VA healthcare system for patient quality and safety • Experienced, motivated and capable vascular access team members • Ease of financial support due to large organization	• Inconsistency in providing CLABSI prevention care • Lack of consistent feedback and reinforcement for standardized practice • Lack of standardized educational program to strengthen knowledge and skills competency	• Strong scientific evidences supporting the change practice • Establishment of standardized surveillance program • Strengthen staff education component • Setting examples for other similar hospitals	• Limited implementation period due to project timeline • Resistance to change

Appendix F

CDC CLABSI Prevention Checklist

Checklist for Prevention of Central Line Associated Blood Stream Infections

Based on 2011 CDC guideline for prevention of intravascular catheter-associated bloodstream infections:
https://www.cdc.gov/infectioncontrol/guidelines/bsi/index.html
Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update
http://www.jstor.org/stable/10.1086/676533

For Clinicians:

Follow proper insertion practices

- ☐ Perform hand hygiene before insertion.
- ☐ Adhere to aseptic technique.
- ☐ Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape).
- ☐ Choose the best insertion site to minimize infections and noninfectious complications based on individual patient characteristics.
  - Avoid femoral site in obese adult patients.
- ☐ Prepare the insertion site with >0.5% chlorhexidine with alcohol.
- ☐ Place a sterile gauze dressing or a sterile, transparent, semipermeable dressing over the insertion site.
- ☐ For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.

Handle and maintain central lines appropriately

- ☐ Comply with hand hygiene requirements.
- ☐ Bathe ICU patients over 2 months of age with a chlorhexidine preparation on a daily basis.
- ☐ Scrub the access port or hub with friction immediately prior to each use with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol).
- ☐ Use only sterile devices to access catheters.
- ☐ Immediately replace dressings that are wet, soiled, or dislodged.
- ☐ Perform routine dressing changes using aseptic technique with clean or sterile gloves.
  - Change gauze dressings at least every two days or semipermeable dressings at least every seven days.
  - For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short-term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.
- ☐ Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days.
  - If blood or blood products or fat emulsions are administered change tubing every 24 hours.
  - If propofol is administered, change tubing every 6-12 hours or when the vial is changed.

Promptly remove unnecessary central lines

- ☐ Perform daily audits to assess whether each central line is still needed.

For Healthcare Organizations:

- ☐ Educate healthcare personnel about indications for central lines, proper procedures for insertion and maintenance, and appropriate infection prevention measures.
- ☐ Designate personnel who demonstrate competency for the insertion and maintenance of central lines.
- ☐ Periodically assess knowledge of and adherence to guidelines for all personnel involved in the insertion and maintenance of central lines.
- ☐ Provide a checklist to clinicians to ensure adherence to aseptic insertion practices.
- ☐ Reeducate personnel at regular intervals about central line insertion, handling and maintenance, and whenever related policies, procedures, supplies, or equipment changes.
- ☐ Empower staff to stop non-emergent insertion if proper procedures are not followed.
- ☐ Ensure efficient access to supplies for central line insertion and maintenance (i.e. create a bundle with all needed supplies).
- ☐ Use hospital-specific or collaborative-based performance measures to ensure compliance with recommended practices.

Supplemental strategies for consideration:

- ☐ Antimicrobial/Antiseptic impregnated catheters
- ☐ Antiseptic impregnated caps for access ports

CDC

Appendix G

Project Schedule with Activities and Timeline

	NUR7801								NUR7802								NUR7803								
Activity	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
Meet with preceptor to identify organizational needs.																								
Kotter Change Model Step 1: Establishing a Sense of Urgency Identify and create a list of stakeholders. Ensure that all parties are fairly and evenly represented.																								
Prepare the agenda and material to share in the meeting (e.g., agency, local and national data and literature review etc.).																								
Discuss the urgency with the Vascular Access and ICU management team first to get their buy-in and support before the actual stakeholder meeting.																								
Conduct meeting with all stakeholders (Chief of Patient Safety and Quality, VAT team, Infection control, ICU manager, ICU nurse educator, ICU clinician, nurses & patient representatives).																								
Step 2: Creating a Guiding/ Powerful Coalition Identify and put together a																								

	NUR7801						NUR7802									NUR7803								
Activity	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
team of key champions or key change leaders representing stakeholders																								
Define shared objective for the team and ensure that the team is in mutual agreement with the objectives.																								
Stage 3 & 4 Developing and Communicating Change Vision and Initiative Create the project mission and vision. Share the vision with the change champions and get consensus. Share the vision with all the stakeholders.																								
Prepare Project Proposal																								
Get proposal approved by the IRB and the ERPC																								
Step 5: Removing Barriers Evaluate staff knowledge, skills and attitude on CLABSI prevention.																								
Strengthen culture of safety through staff education.																								
Establish compliance of ICU staff in implementing prevention strategies.																								
Step 6: Generating Short-Term Wins Celebrate successes on achievement of milestones. For e.g., upon developing staff education material and completing all staff training sessions																								

	NUR7801						NUR7802									NUR7803								
Activity	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
Step 7: Sustaining Acceleration ICU staff demonstrates consistent performance on CLABSI prevention program.																								
ICU nurse educator trained to conduct future staff education sessions as well as perform periodic audits (Train the trainer).																								
Data collection & analysis																								
Project Completion																								
Step 8: Anchoring Change Integrate CLABSI prevention program into ICU department policy																								

Appendix H

UNIVERSITY OF ST. AUGUSTINE
FOR HEALTH SCIENCES

Doctor of Nursing Practice Program
Evidence-Based Practice Review Council
1 University Blvd.
St. Augustine, FL 32086

October 1, 2021

Dear **Salima Allahbachayo**,

Your proposal titled **Prevention of Central Line-Associated Blood Stream Infection (CLABSI) in Adult ICU Patients** has been reviewed by the University of St. Augustine for Health Sciences Doctor of Nursing Practice Evidence-Based Practice Review Council (EPRC) and determined to not meet the requirements for research as defined in the Federal Register.

Your proposal reflects an evidence-based practice change project and is approved. The proposal must be implemented as submitted (changes are not permitted). You may proceed to obtain approvals from the facility where the project will be implemented as soon as the primary course faculty member has reviewed and approved all facility application materials. Implementation may not begin until you have submitted the EPRC approval letter and the facility approval letter to NUR7802 and are notified in writing by practicum course faculty that you may implement the project.

Questions regarding the USAHS approval process should be addressed to Dr. Sarah Cartwright at scartwright@usa.edu. Questions regarding the facility approval process should be addressed to course faculty.

Sincerely,

Sarah M. I. Cartwright, DNP, MSN-PH, BAM, RN-BC, CAPA, FASPAN

Appendix I

Data Collection Tool for Process Measures

Participant Number	**CLABSI Bundle Care Interventions**								
	Evaluating catheter necessity	Optimal site selection	Hand hygiene	Adherence to aseptic techniques	Use of maximal barrier precautions during catheter insertion	Dressing Changes	Bathing patient with chlorhexidine	Disinfection of catheters/ ports/ connectors	Daily reassessment of catheter necessity

Note: All the interventions included in the check sheet have been extracted from the CLABSI prevention checklist provided by the Center for Disease Control for public use.

Reference: Center for Disease Control. (n.d.). Checklist for prevention of central line associated blood stream infections. https://www.cdc.gov/hai/pdfs/bsi/checklist-for-clabsi.pdf

Appendix J

Data Collection Tool to evaluate Outcome, Balancing and Financial Measures

Participant Number	Age	Gender	CLABSI Rate	Use of midline	Cost of each CLABSI infection	Number of Hospital Day(s) extended due to CLABSI