Implementing Central Line Necessity Tracking Tool in an Intensive Care Unit

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The project lead discloses a conflict of interest as the Project Lead is employed at the same institution where the quality improvement project was implemented. The Project Lead confirms no personal relationship with the participants of the project team and holds no financial stakes that might inappropriately affect the quality improvement project or project findings.

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Abstract

Problem and Purpose: A 30-bed adult intensive care unit (ICU) in a community hospital reported four central line-associated bloodstream infections (CLABSI) in 2023 and four CLABSIs in the first quarter of 2024. A root cause analysis identified prolonged dwell time and delayed removal as primary contributing factors. This quality improvement project (QIP) aimed to reduce the CLABSI rate among adult critically ill patients in the ICU by implementing and measuring the completion of a Central Line Necessity Tracking Tool (CLNTT) in daily rounds. *Methods*: The implementation process over 16 weeks in the Fall of 2024 included 100% staff education on the CLNTT, nurses screening for the necessity of the central line using the CLNTT with the provider in daily rounds, and provider documentation of the central line necessity, discontinuation, or alternative plan in the electronic health record. *Results*: A goal of 100% staff and provider education was achieved, and an average of five central lines were removed weekly. Average CLNTT compliance was only 65%. One CLABSI was reported in the week two. *Conclusion*: A validated tool assessing the need for continued central lines in daily rounds can objectively assess the need for central lines and promote prompt removal. The addition of a smart phrase on central venous catheter (CVC) documentation to provider notes is highly recommended.

Keywords: CLABSI prevention, adult, intensive care unit, checklist, tracking tool, CDC guideline

Introduction

A central line associated bloodstream infection (CLABSI) is a laboratory-confirmed bloodstream infection unrelated to other site infections, which develops within 48 hours of central line placement (Haddadin et al., 2022). Most CLABSIs can be prevented with proper surveillance and management strategies by an interprofessional team (Haddadin et al., 2022). A

collaborative effort of organizations such as The Society for Healthcare Epidemiology of America (SHEA), The Infectious Disease Society of America (IDSA), The Association for Professionals in Infection Control and Epidemiology (APICE), The American Hospital Association (AMA), and The Joint Commissions have put forth strategies to prevent CLABSIs in acute care settings (Buetti et al., 2022). Assessing the need for continued intravascular access daily during interdisciplinary rounds is one of the recommended strategies to remove catheters no longer required can reduce central venous catheter utilization and CLABSI (Buetti et al., 2022). The purpose of the QI project was to decrease CLABSI rate by 50% by assessing the need for central lines daily and ensuring prompt removal of unnecessary lines for which an evidence based "Central Venous Catheter (CVC) Necessity Tracking Tool" was implemented over 15 weeks in Fall 2024 (CDC, 2025).

Problem Description

An ICU with a 30-bed capacity in a community hospital outside of Washington DC encountered four CLABSIs in 2024. In the project site ICU, the total number of CLABSIs for 2023 was four with the hospital expectation being zero. A root cause analysis revealed multiple factors with prolonged indwelling time and lack of prompt removal of the central lines as leading causes. See Appendix A for root cause analysis.

Insertion of the Central Venous Catheter (CVC) is a process in which a catheter is inserted into a central vein directly leading to the heart (Suha et al., 2019). CVC enables the administration of fluids, medications, total parenteral nutrition (TPN), blood products as well as hemodialysis therapy, and hemodynamic monitoring (Palloto et al., 2019 & NHSN, 2025). While improving health, a CVC can place the patient at risk for bacterial infections leading to CLABSI (Alshahranie et al., 2023). Other risk factors that can cause CLABSI include prolonged

catheterization, inadequate hand hygiene, poor insertion, poor maintenance practice, and multiple comorbidities in patients. Prolonged catheterization is the major risk factor for CLABSI because bacteria have more time to colonize the catheter and cause an infection (Alshahrani et al., 2023). Central lines can remain in place for extended periods, ranging from weeks to months, according to the most recent Centers for Disease Control and Prevention (CDC) guidelines (CDC, 2025). After just two days post-insertion, a central line becomes susceptible to organisms causing a CLABSI event (NHSN, 2025, p 4-5). Alshahrani et al. (2021) emphasized the risk of CLABSI increases with the duration of the indwelling central line, as prolonged indwelling time allows bacteria to colonize the line and cause infection, leading to significant morbidity and mortality.

The precise financial impact of a CLABSI on the project site remains undetermined. However, the CDC estimates each CLABSI case costs approximately $48,000, with a staggering 30,100 cases occurring in ICUs nationwide (CDC, 2025). The Hospital-Acquired Condition (HAC) policy, implemented by the Centers for Medicare and Medicaid Services (CMS), restricts hospital reimbursement for ‘never events’ such as healthcare-associated infections (HAIs), which are considered preventable patient harm events (‘Medicare's never events’, 2008). Consequently, healthcare providers at the project site prioritize reducing CLABSIs to ensure patient safety and minimize healthcare costs, aligning with the most current CDC guidelines (CDC, 2025).

Available Knowledge

The quality improvement project lead (QI-PL) conducted an evidence review using databases such as CINHAL and PubMed to identify relevant evidence-based interventions. Various interventions are included in a care bundle recommended by Centers for Disease Control guidelines (CDC,2025). Application of a CLABSI care bundle, use of chlorohexidine cap for intravenous catheter hubs, daily chlorohexidine bath, educating health care providers regularly,

monitoring and reporting CLABSI rates can improve the rate of CLABSI to zero (CDC, 2025) Refer to Appendix B for PRISMA on evidence retrieval and Appendix C for citation. Along with a multidisciplinary team, the QI-PL, identified a quality improvement project (QIP) to reduce CLABSI rate at the project site. The purpose of the project was to assess the need for central lines and promote prompt removal of unnecessary lines using an evidence-based "Central Venous Catheter (CVC)Tracking Tool", (CDC, 2025)

There is robust literature base regarding safety attitude among nurses, CLABSI bundle implementation, 15-minute short education on CLABSI prevention, alcohol caps on IV hubs, and 4% chlorohexidine bath which has shown to decrease CLABSI rates Alnazi et al., (2023), Soha et al., (2019), Foka et al., (2021), Taşdelen Öğülmen, D., & Ateş, S. (2020), and Pallotto et al., (2019). Contrastingly, there is less literature on central line removal, prolonged insertion time, and standardized checklist to prompt removal of central lines. Burnham et al., (2018) identified CVC removal is associated with a decreased 30-day all-cause mortality rate for patients with multi drug resistant organism (MDRO)-CLABSI. Bevell et al., (2021) emphasized failure to remove CVCin patients audited for CVC removal was strongly associated with 30-day mortality. A study by Alnazi et al., (2021) revealed a zero CLABSI rate is achievable by intervention such as line checklist placement and regular monitoring. Suha et al., (2019) concluded the CLABSI rate decreased with a CLABSI bundle, however, the duration of the line placement and increased length of stay increased the CLABSI rate. Beville et al., (2021), Aufricht et al., (2019), and Burham et al., (2018) agree removal of CVCs as soon as they are not indicated is a proven intervention in the reduction of CLABSIs. Lastly, Alnazi et al., (2021) established knowledge to inform a checklist to remove CVCs in a timely manner which can decrease the rate of CLABSIs. Further search for evidence on a CVC removal checklist and a central line necessity tracking tool

(CLNTT) was retrieved from CDC (CDC, 2024). Refer to Appendix D for evidence table and Appendix E for synthesis Table.

Specific Aims

The main goal of this QIP was to decrease CLABSI rate by 50% among the critically ill patients in the ICU by implementing and measuring the completion of the CLNTT. This CLNTT is an evidence-based, research supported, practice change (CBC, 2025). The QIP aimed to educate 100% of the project site staff on the purpose of the CLNTT and respective relation to CLABSI, achieve 100% compliance of the CLNTT in daily rounds by nurses, achieve 100% compliance on CLNTT use survey by project site nurses post rounds, and 100% compliance on physician documentation of the necessity, discontinuation, or alternative plan for the CVC. The pre-existing process in the project site to prevent CLABSI included a CLABSI bundle with emphasis on a central line insertion checklist to ensure aseptic techniques and a central line maintenance checklist on proper management of CVC post placement. The pre-existing process did not systematically address prolonged dwelling time nor delayed removal. The QI project initiative implemented a CVC necessity tracking tool utilized during daily patient rounds on every patient with a CVC line. The desired outcome was to assess the need for a central line daily based on the indications for a CVC, and to ensure prompt CVC removal. See Appendix F for the process prior to the initiative and Appendix G for the QI process implemented for the practice change.

Rational

The Promotion action on Research Implementation in Health Service (PaRHiS) framework was used to guide the implementation of the CLNTT. PaRiHS framework proposes three elements evidence, context, and facilitation, that are closely connected to successful

interventions particularly for the healthcare setting that are examining the implementation of quality improvement interventions (Ward et al., 2017). The PARiHS framework argues a successful implementation of an intervention involves, the context or setting where the intervention is implemented, how the intervention is delivered (facilitation), and the quality of evidence being delivered. These elements align with the goal of the institution to utilize new knowledge (evidence), integrating providers and all interdisciplinary team members (context), to provide high quality and safe healthcare (facilitation). Refer to Appendix H for PARiHS framework. The PARiHS framework guided the QI project in identifying the key facilitators such as unit director, assistant nurse manager, nurse residents IV Therapy, infection control, unit champion, charge nurses, intensivist teal leader the providers. Identified facilitators provided assistance with mobilizing the completion of the CLNTT (evidence) and post survey daily, re-education on CLABSI prevention, documentation of the CVC plan under physician notes, placement of alternative lines, and tracked the rate of CLABSIs.

Methods

Context

The proposed project was a 30-bed ICU in a community setting outside of Washington DC. Adult critical care patients vary from moderate to severe acuity with multiple comorbidities requiring CVC to administer life-sustaining medications such as vasopressors, total parenteral nutrition (TPN), hemodynamic monitoring, and difficult intravenous access. The project lead conducted interviews with unit nurses, nurse in charge (NIC), nurse educator, unit director, the IV therapy team, the assistant chief nursing officer (ACNO), the ICU intensivists, and the infection control services to assess the safety culture and feasibility of a QI project. While the intensivist director stated line removal is not the problem, all other stakeholders showed great

enthusiasm regarding implementation of CLNTT to aid in decreasing CLABSI rate in the ICU and respective prompt removal of lines. The positive culture of the unit supported a CLABSI prevention project could be implemented and maintained effectively in the projective site. A review by Braun et al., (2020) identified various studies which support a positive relationship between unit safety culture and improvement in infection control -related processes (IPC) and decreases in health care associated (HAI).

Intervention

The QI Project was implemented over 15 weeks in the Fall of 2024. The GANNT Chart illustrates the timeline of the QI project (see Appendix I). Daily assessment of the necessity of the CVC by electronic health record (EHR) reminders or daily rounding checklists on CVC is recommended by the CDC to promote discussion to remove CVC which are no longer necessary (CDC, 2025). Indications for the CVC include prolonged IV therapy, antibiotics, total parenteral nutrition, Chemotherapy, vascular or skin irritants, poor peripheral venous access, critical illness requiring central venous access, hemodynamic monitoring, vasoactive drips, hemodialysis, or plasmapheresis (CDC, 2025). Indications were included in the CLNTT used in the daily rounds. Education on the CLNTT and the importance of CLABSI prevention was provided to nurses, charge nurses, physicians, and physician assistants (PA) on week one. Hard copies of the CLNTT (see Appendix J), 4-step review process, and instructions on how to complete the assessment were posted in all nurses' stations, breakrooms, and by the clock as main unit visual reminders. The QI-PL conducted chart audits to assess and promote 100% compliance with the CLNTT. Re-education and reinforcement on knowledge of CLABSI and CLNTT were provided due to decrease in compliance of CLNTT from Week 3 through 16. The QI-PL collected completed CLNTT weekly and archived for data confidentiality and analysis. The survey data

was saved and secured in REDcap, a secure web application for building and managing online surveys and databases approved by the University of Maryland to utilize in QI projects. Refer to Appendix J for CLNTT, Appendix K for CLNTT use survey, and Appendix L for post implementation survey.

Measure

The primary outcome measure was100% nursing staff compliance with the use of CLNTT. The secondary outcome measure was the rate of CLABSI during the period of QI project implementation. The rate of CLABSI was measured by the following formula: the number of CLABSI for the project site (numerator) divided by the number of central line days for the project site (denominator) multiplied by 1000 (NHSN, 2025, p. 4-26). Data was collected by the infection control department of the community hospital. A key metric was the number of CLABSI and the number of days the line was dwelling in the patient. The rate of CLABSI before intervention and post-intervention was compared to assess improvement or the need for process change to sustain the proposed CLNTT. The compliance rate was measured by the number of patients with CVC on whom CLNTT was used against the total number of patients who had CVC during the intervention period.

Analysis

The Data analysis was conducted in REDCap to conclude the results of structure measures, process measure, and outcome measure (Gupta and Kaplan, 2020). The anticipated structure measure included 100% nurses and provider education on the CLNTT and CLABSI prevention. The process measures included a percentage of compliance with the CLNTT, percentage of patients with CVC on whom the CLNTT was used, a percentage of CVC removed, and rate of reported CLABSIs weekly (see Figure 3). All data was entered into run charts with

time plotted as weeks on the x-axis and process measure data on the y-axis to assess common cause variations via REDCap, and to make appropriate changes during the intervention (Gupta & Kaplan, 2020). The data variations obtained from the various measures is displayed in a graphical representation to chow the relationship between factors (Gupta & Kaplan et al., 2020). The percentage of CVC removed is graphically represented by the number of times the CLNTT was used on patients with CVC. The rate of CLABSI pre and post implementation is also represented graphically (See Figure 4).

Ethical Consideration

The project was conducted under a Non-Human Subjects Research determination from the Human Research Protections Office (HRPO) from the University of Maryland, School of Nursing's (UMCSON) Institutional Review Board (IRB) and IRB from the project site. The project lead discloses a conflict of interest as the Project Lead is employed at the same institution where the quality improvement project was implemented. The Project Lead confirms no personal relationship with the member of the project team or the participants and holds no financial stakes that might inappropriately affect the quality improvement project or project findings. All data collected was secured in REDCap to protect patient privacy and data confidentiality. The project site follows Health Insurance Portability and Accountability Act (HIPPA) protocol which was adapted throughout the project period to protect the confidentiality and integrity of electronically protected patient health information ("HIPPA", 2021). All required HIPPA and collaborative Institutional Training Initiative (CITI) training has been completed prior to implementation period for both UMSON and project site. Throughout the project period, project lead complied with policies and protocols per University of Maryland, Institutional Review Board (IRB), and the project site.

Results

During the 15-week implementation period, a total of 78 (n=78) CVC were reviewed with an unknown number of lines undocumented. A 100% compliance was achieved on CLABSI prevention education and the purpose of CLNTT. During week one, a 100% compliance was noted in CLNTT review and physician documentation of CVC in EHR with project lead at the project site. The CLNTT use survey compliance was less than 40% average throughout the implementation period (PA Harris et al., 2019). One CLABSI was reported on week one of implementation. Average compliance of the CLNTT review during the implementation period was 65% (see Figure 1) with an average of five (n=5) CVC being removed every week averaging 68.5 % (see Figure 2).

A steady decline of CLNTT review was noted from Week 3 to Week 7 with project lead visiting the site weekly. A 75% improvement was noted on Weeks 8 and 9 with re-education and continued reminders during morning and evening huddles prompted by project lead every day from off-site. Compliance fluctuated during Week 9-13 despite reminders by charge nurses, nurse residents, and unit assistant nurse manager prompting reassessment of the context. During Weeks 13-16, with QI-PL's frequent presence and guidance on-site, a significant improvement was noted from 48% on Week 13 to a steady 80% (Week 15) and 83% (Week 16). The data from the QI project provides great insight into the importance of need for consistent staff guidance to promote compliance. An informal survey was completed in place of post implementation survey due to decreased compliance of CLNTT use survey and revealed 75% of the staff supporting a shorter survey.

Discussion

Summary

The key findings of the initiative indicate that a validated Tool assessing the need for continued central lines in daily rounds can objectively assess the need for CVC daily and promote prompt removal. Removal of 68.5% (n=5) CVC during implementation period is consistent with the literature emphasizing the importance of CLABSI prevention through prompt removal of lines with continued review of lines in daily rounds using a validated Tool (CDC, 2025). The major strengths of this initiative were the collaboration of various systems within the organization. Another notable strength was this initiative was cost-effective and did not require funding for implementation.

To sustain regular assessment of necessity of line and removal, MOCHA framework form IHI was used. The MOCHA framework supports the collaboration of manager, owner, consults, helpers, and approver of the project on identifying strategies to ensure compliance of the CVC necessity Tracking Tool. The implementation of the Tool involved 1st week of education on Tool purpose and CLABSI prevention followed by data collection, data analysis, re-education, reinforcement, incorporating new strategies for compliance of the Tool, documentation, and prompt line removal. To improve sustainability, a smart phrase on physician note template was encouraged for regular documentation of lines, education of CLABSI prevention to newly hired nurses and physicians, continuing education of CLABIS prevention on HealthStream, and a simplified CLNTT for easier use and compliance.

Interpretation

The key findings in the run chart indicate that a CLNTT can objectively track the necessity of CVC in daily rounds and encourage prompt removal of non-essential CVC (Buett et al., 2022). Equally important is daily assessment of the need for CVC continuance and respective compliance with documentation (Buett et al., 2022). The QI project identified barriers and

decreased compliance with CLNTT which required re-education, increased unit involvement, and increased presence of QI-PL on-site for guidance. Barriers such as higher nurse-to-patient ratios and increased workload has been identified in literature base and is associated with decreased compliance of CLNTT in daily rounds (Beville et al., 2021; Aufrich at al., 2019). On-going new staff education on CLABSI prevention, physician prompts with improved documentation in EHR, and increased guidance from leaders align with various research recommendations for improved compliance (Beville et al., 2021; Aufricht et al., 2019).

Limitations

The Quality improvement project encountered various limitations which included a small sample size, a single unit, limiting generalizability and undocumented CVCs leading incomplete data for analysis, compromising the validity of the study findings. Prioritization of direct high acuity patient care and increased nurse-to-patient ratio hindered staff from completing the CLNTT and CLNTT use survey. Human Resource constraints included a higher proportion of new nurses versus experienced nurses also limited CLNTT compliance. Some staff reported reviewing the CLNTT in rounds without documenting led to self-reported data not counted in data analysis, decreasing the validity of the results. An exhaustive number of items in the surveys and CLNTT limited staff compliance, leading to measurement error. Three nurses did not comply with the CLNTT and CLNTT use survey due to general distain for surveys accounting for survey non-response bias. Due to the proportion of a higher new staff ratio and a high turnover of staff in the unit affecting the unit staffing during implementation period, careful attention was given not to overburden the staff to burnout and compromised staffing. However, nurse residents and charge nurses were regrouped and trained to give gentle reminders to document on the CVC and complete surveys via a group paging system which alarms staff phones prior to end of

shift. Should a decision be made to sustain the CLNTT, the CLNTT should be simplified for easier use.

Conclusions

A Central Line Necessity Tracking Tool effectively assesses CVC needs in daily rounds and promotes prompt removal. Results cannot be generalized beyond this single QI project. The target 50% CLABSI rate was not achieved, highlighting that 100% staff compliance with the Tool is essential to impact the infection rates. Compliance decreased without a consistent QI-PL in-person presence, demonstrating sustained leadership support is necessary for practice change adoption. Improvement strategies should include incorporating smart phrases in physician documentation to improve documentation of CVC necessity, enhancing education for new staff through HealthStream modules, an electronic training platform for health care sector, education during hospital orientation, supporting unit champions to educate and encourage daily CVC review and prompt removal of CVC, and simplifying the CLNTT for easier use.

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Figure 1

Run Chart 16 Weeks CVC Tool Tracking

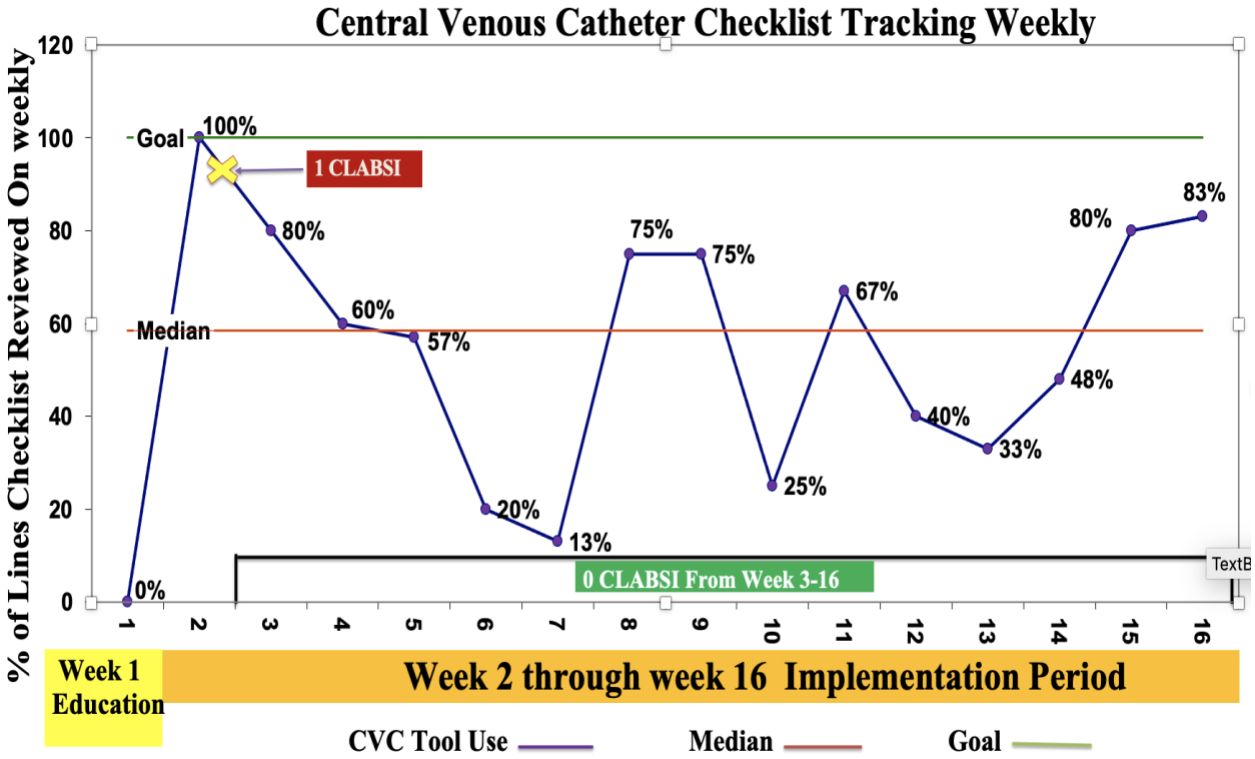


Figure 2

Run Chart # of Lines removed weekly

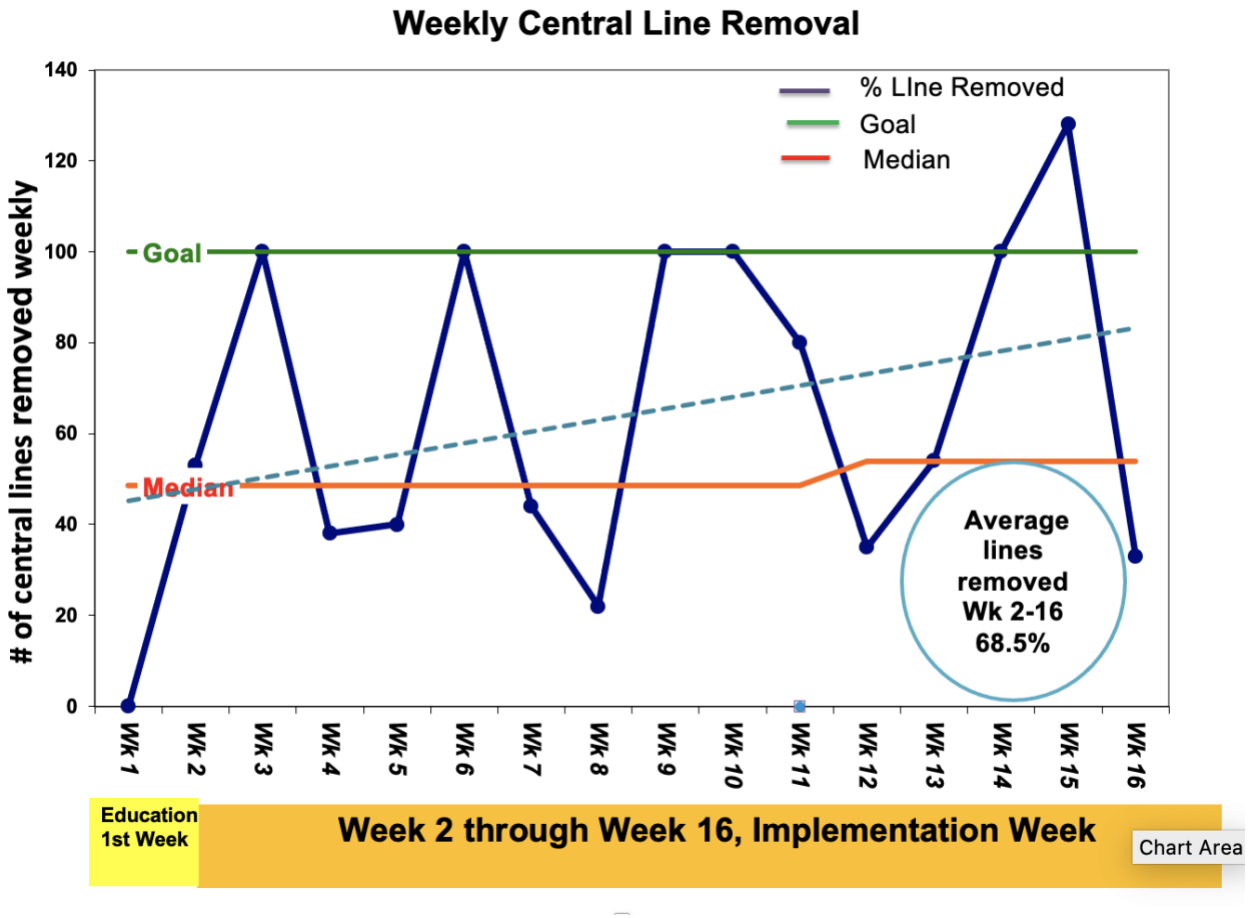


Figure 3

Graph of Weekly Lines Reviewed vs Discontinued vs # of CLABSIs

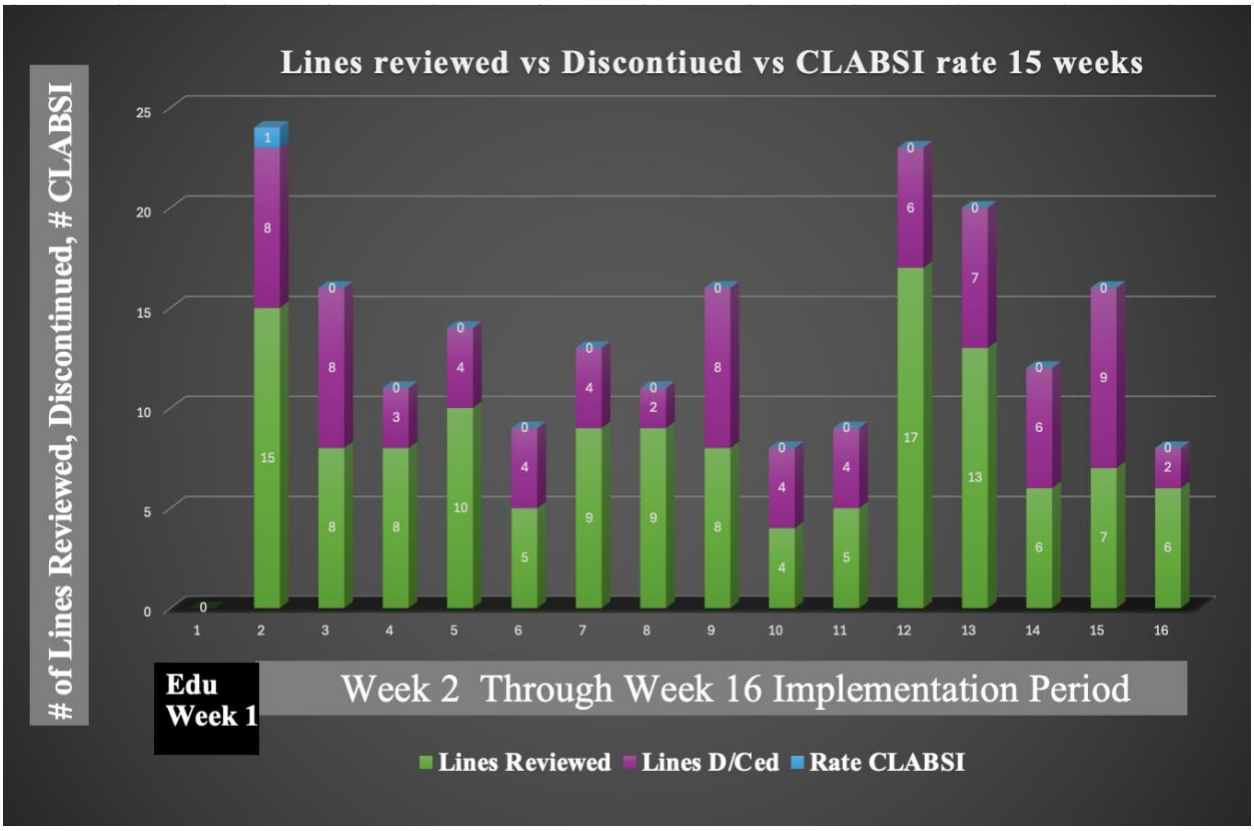
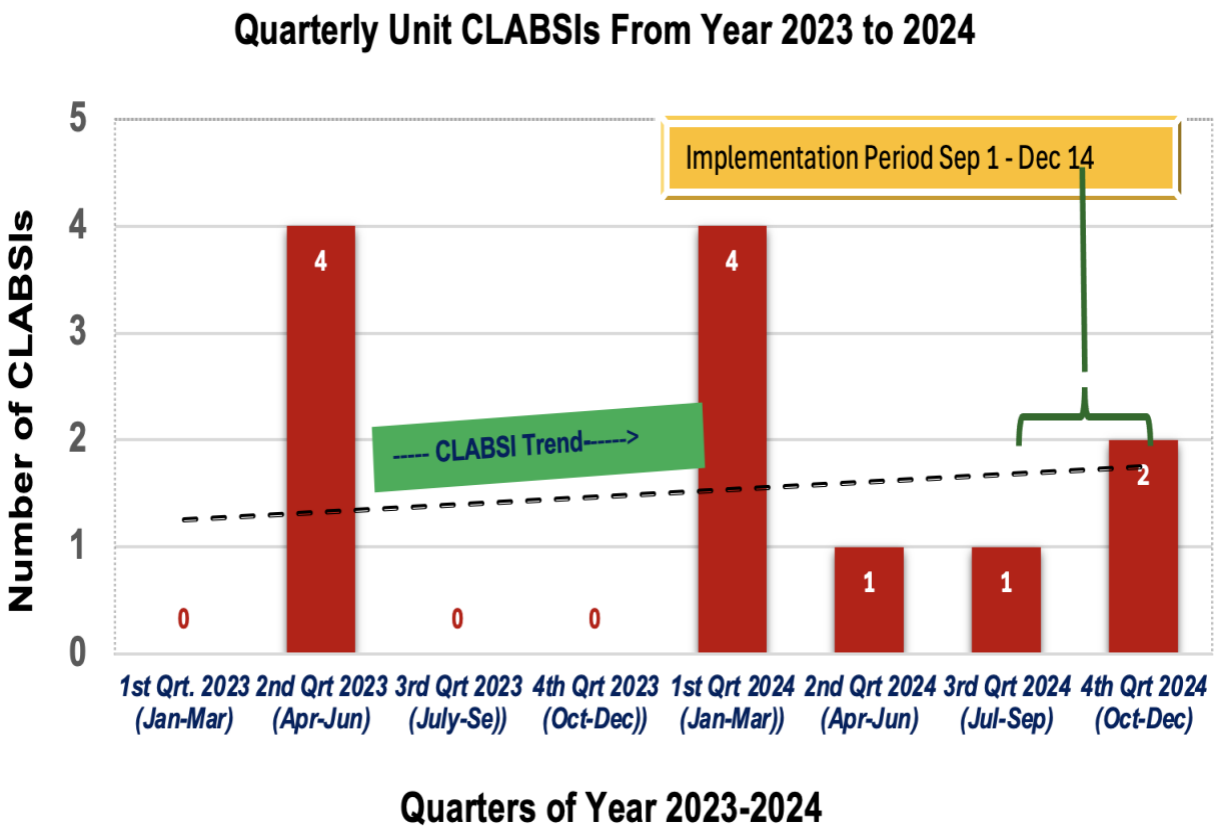


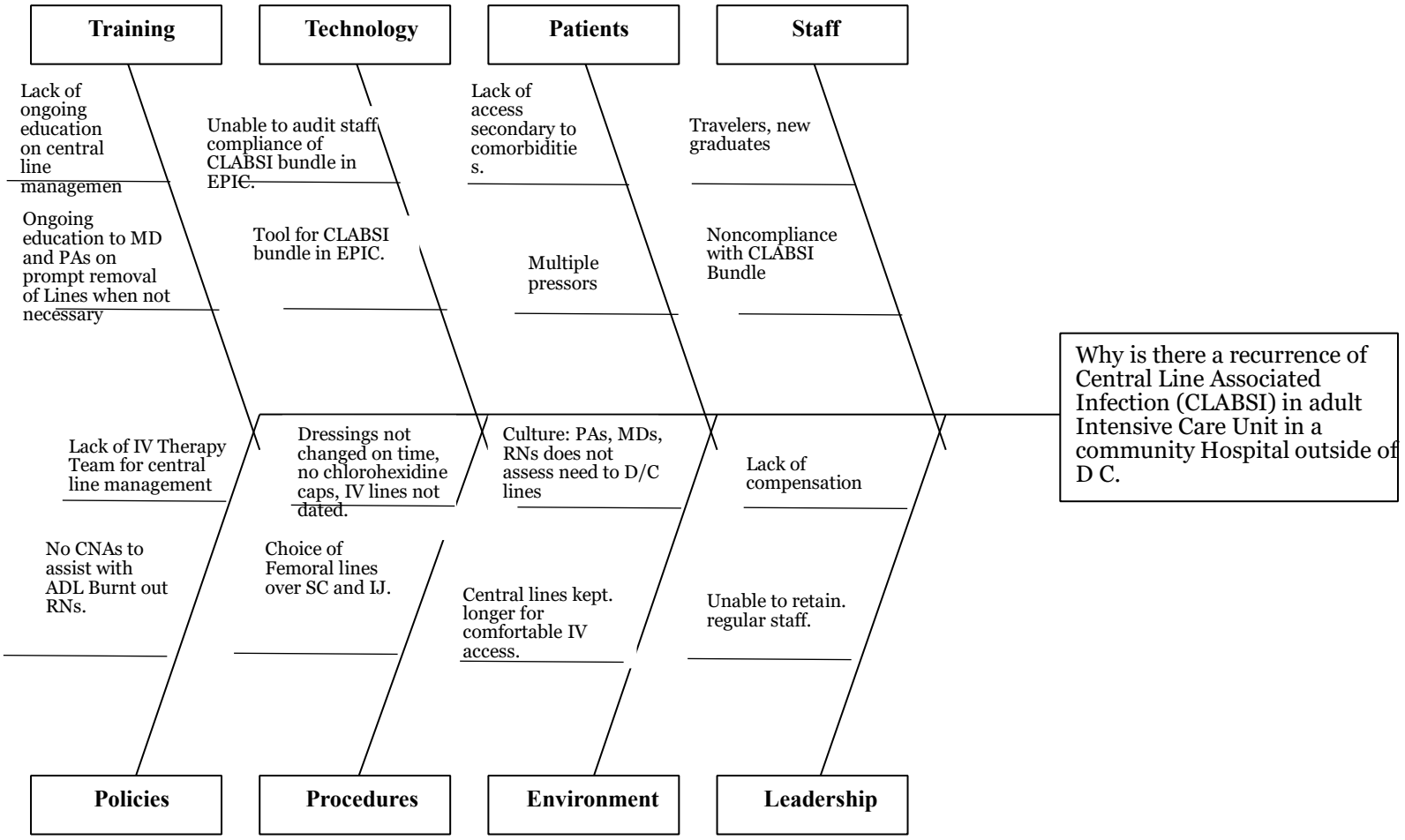
Figure 4

Quarterly CLABSI Rate for the Years 2023 and 2024



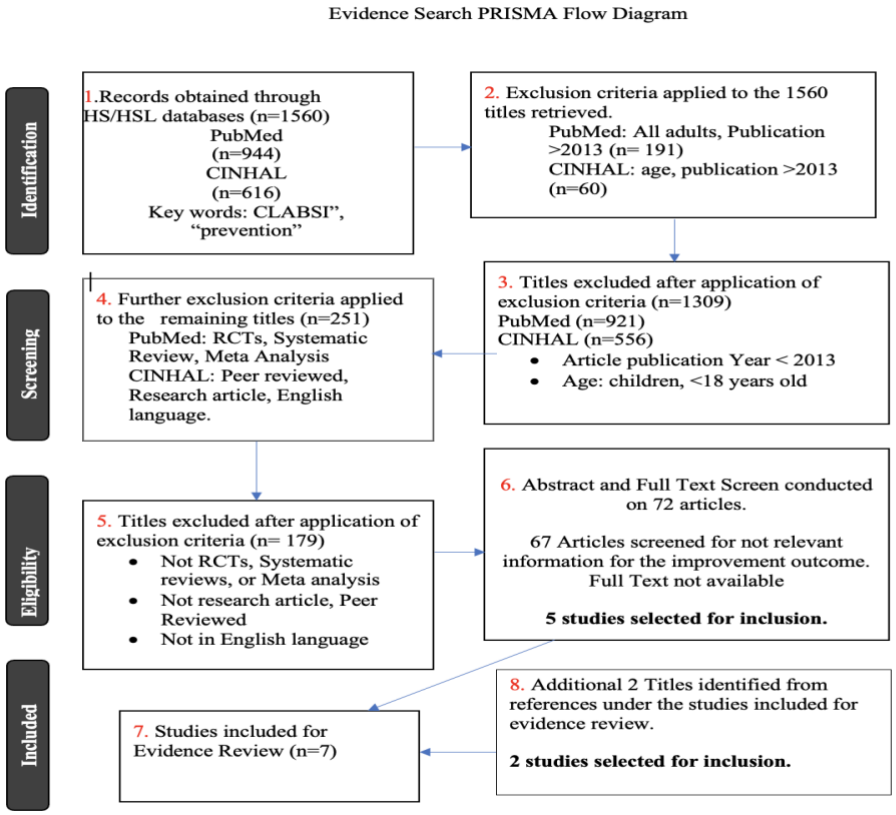
Appendix A

Fishbone Diagram



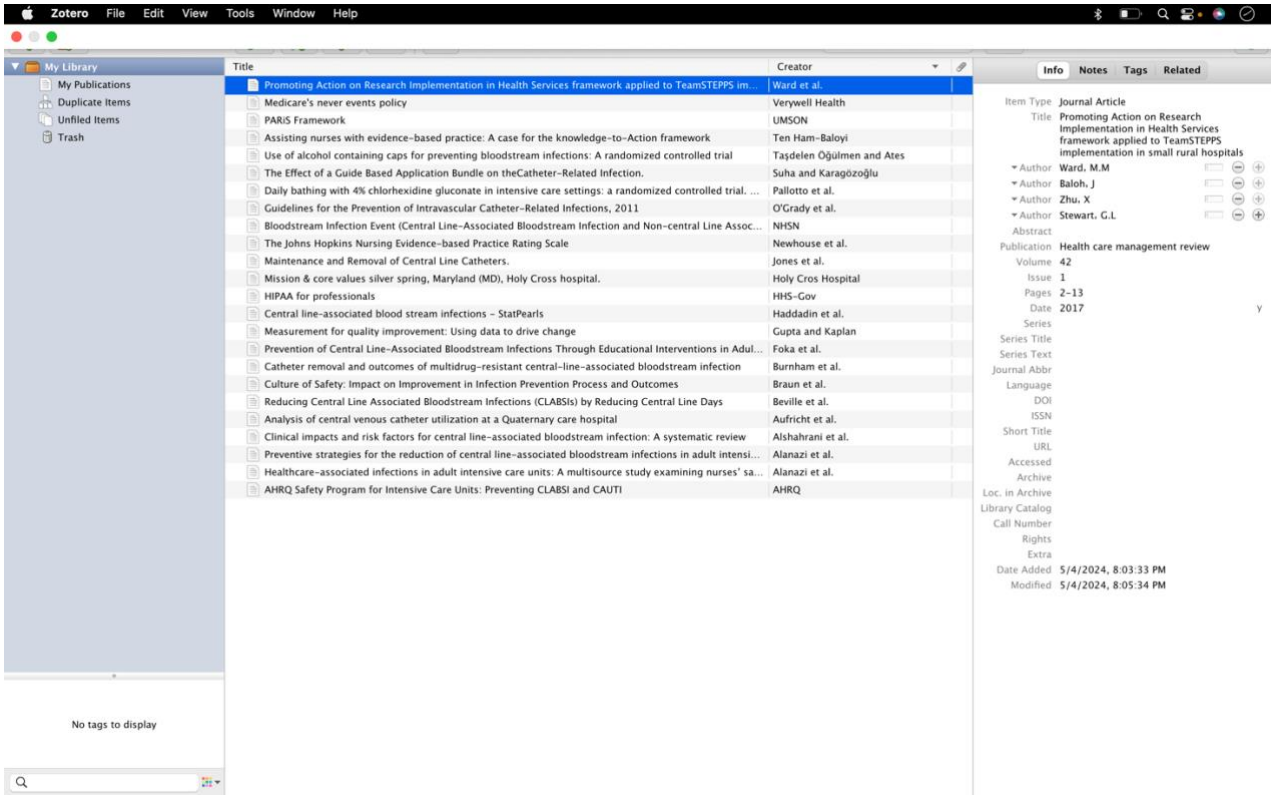
Appendix B

PRISMA Evidence retrieval



Appendix C

Citation



Appendix D

Evidence Review Table

Citation: Alanazi, T. N., Alharbi, K. A., Alrawaili, A. B., & Arishi, A. A. (2021). Preventive strategies for the reduction of central line-associated bloodstream infections in adult intensive care units: A systematic review. *Collegian*, *28*(4), 438-446. https://doi.org/10.1016/j.colegn.2020.12.001	**Level III** **Quality C**
Purpose or Hypothesis	To identify all existing evidence-based interventions to prevent or reduce CLABSI in ICU.
Types of Evidence Research Design	Retrospective Descriptive Review of non-randomized control trials.
Sample, Population, Size, Setting	**Sample Technique:** Non-probable convenience sampling **Eligible Participants:** non-randomized control trials on adult patients admitted to intensive care units. **Setting:** Adult intensive care unit. **Excluded:** Randomized Control Studies, non-English, non-academic, studies with a clear description of interventions, studies with unclear methodologies, aim, data collection process, missing data, studies conducted in pediatrics, units other than ICU, and studies conducted along with other healthcare-associated infections. **Accepted:** studies conducted in ICU, studies from 2016-2020, and studies utilizing all interventions recommend by CDC and IHIM.A total of 15 studies included. **Control:** No control as randomized control trial is excluded considering ethical issues with use of controls in prevention of CLBSI in ICU. **Intervention:** Review of studies **Power Analysis/Achieved:** Power analysis not explicit. 1238 records identified, only 15 articles included for studies. **Group Homogeneity:** Heterogenous. Various interventions: compliance with central line (CL) bundle and improvement using checklist, chlorohexidine and silver-plated dressings, infection control and multidisciplinary intervention through monitoring, use of positive displacement needles, and mandatory reporting

Intervention Procedures	**Control Protocol:** Exclusion of randomized control trials **Intervention Protocol**: Identify studies with evidence-based interventions to prevent CLABSI in adult ICU. Interventions include compliance with central line (CL) bundle and improvement using checklist, chlorohexidine and silver-plated dressings, infection control and multidisciplinary intervention through monitoring, use of positive displacement needles, and mandatory reporting.

	Treatment Fidelity: The review was conducted as per planned protocols. The study reviewed articles on specific interventions to prevent CLABSI rate as planned. The study did not include randomized control trials but weighed against a systemic review of randomized control trials to support current evidence-based interventions on preventing/reducing CLABSI. Included studies of high or moderate quality and complied recommendations. Randomized control trials and non-English articles excluded. No information on who conducted the review and what instruction given.
Primary Outcome and Measures	**Dependent Variable:** Rate of CLABSI in adult ICU. **DV Measures:** No information on tools and measures utilized for outcome measures.
Results and Conclusions	**Statistical Results:** In various countries, CL care bundle decreased CLABSI rate from preintervention to post intervention phase: Kuwait 14.9 to 11.8, Taiwan 7.40-3.93, Germany implementation of CL checklist decreased CLABSI rate from 5.9-3.8, and in India CL care bundle decreased CLABSI rate from 11.78 to 3.99. Chlorohexidine and silver-plated dressing effectiveness: US CLABSI rate decreased from1.10 to .80 from using chlorohexidine bath and 2.38 to 1.28 from using silver plated dressing. In the US, mandatory reporting laws of health care associated infection reduced CLABSI rate by 54% from 1.77 to .88 ($p<0.001$) in reporting states and 41% from 0.93-.55 from non-reporting states. A study conducted by Russel et al., (2019), revealed <1 monthly CLABSI though implementation of multidisciplinary intervention in four areas: technique (chlorohexidine impregnated dressing), awareness (educating nurses), environment (additional hand sanitizer dispensers), and monitoring (daily CL audits). **Conclusions:** A zero CLABSI rate is achievable through positive displacement needless connectors. Interventions like checklist placement and monitoring of central CL care bundle, use of silver-plated dressings, constant education of ICU personnel, regular real time bed-side monitoring, and mandatory reporting of CLABSI.

Citation: Alanazi, F. K., Lapkin, S., Molloy, L., & Sim, J. (2023). Healthcare-associated infections in adult intensive care units: A multisource study examining nurses' safety attitudes, quality of care, missed care, and nurse staffing. *Intensive and Critical Care Nursing*, *78*, 103480. https://doi.org/10.1016/j.iccn.2023.103480.	**Level V and Quality B**

Purpose or Hypothesis	Study examines the association between safety attitudes, quality of care, missed care, nursing staff levels to the hospital a quired infections (HAI): CLABSI, CAUTI, VAP.
Types of Evidence Research Design	Descriptive cross-sectional survey
Sample, Population, Size, Setting	**Sample Technique:** Convenience sampling **Eligible Participants:** 314 nurses from 8 ICUs. **Setting:** 8 Medical ICUs from 5 hospitals in the region of Kingdom of Saudi Arabia. **Excluded:** Nurses from pediatric and neonatal intensive care unit. **Accepted:** nurses who worked in the participating ICU for more than 3 months and who could read and understand English. **Control:** No control used, descriptive cross-sectional survey. Nurses' perception of HAI rate checked against MOH dataset rate of HAIs. **Intervention:** Survey on 314 ICU nurses who can speak and understand English. Survey on safety attitudes of nurses, missed care, staffing levels, quality of care, and perception of rate of HAIs. Intervention also included assessment of the incidence of HAIs. **Power Analysis/Achieved:** Power analysis not explicit. Sample selected conveniently. 5 hospitals in KSA were purposely selected as they collect patient outcome measures routinely. **Group Homogeneity:** Homogenous in that all participants were medical ICU nurses who spoke and understood English. Heterogenous in age, more females than males, educational levels, nationality, and shifts.

Intervention Procedures	**Control Protocol:** A control protocol not explicit. Nurses' perception of HAI rates was compared against MOH HAIs dataset. **Intervention Protocol**: 8 units received electronic survey between August and November 2021. Survey promoted by QR Code on noticeboard. All 314 nurses emailed with survey link and study protocol. Data collected from MOH, KSA Infection Prevention and Control database an incidence of HAI from each. Nursing unit. **Treatment Fidelity:** Nurse informed of the survey and study ahead. Intervention conducted as planned in the structure-process-outcome framework. Ethical approval granted. Study conducted in KSU so cannot be generalizable. Valid and reliable tool like SAQ used for survey.
Primary Outcome and Measures	**Dependent Variable:** Primary outcomes: rate of Hospital acquired infections: CAUTI, CLABSI, HAI **DV Measures:** Primary outcomes CLABSI, CAUTI, and HAI rate was obtained from MOH dataset. Secondary outcomes, nurses' perception of HAIs, were measured using a seven-point Likert scale. Self-assessment Questionnaire (SAQ) was used to measure nurses' attitude of nursing professionals. Descriptive analyses were performed summarize the data. Generalized, Linear model analysis used to assess the relationship between independent and HAI outcomes.

Results and Conclusions	**Statistical Results:** Mean of safety culture score is 60.85 (SD=3.53). Highest score for job satisfaction (M=67.20, SD=4.96) and lowest for working conditions (M=,53.12 SD=6.50). 73.11% nurses reported missing at least one required care activity. ICUs with strong job satisfaction had lower incidence and nurse reported frequency of HAIs. CLABSI incidence was highest among HAIs, 3.48 per 1000 central-line days. Higher patient load per nurse was positively associated with higher incidence of CLABSI (β=1.015, CI 0.149, 1.880). **Conclusions:** Positive safety attitude among nurses in ICUs are associated with lower number of HAIs. Improving nursing staffing may minimize workload, minimize missed care, improve job satisfaction, and minimize HAIs. However further research is needed to identify effective strategies.
Citation: Burnham, J. P., Rojek, R. P., & Kollef, M. H. (2018). Catheter removal and outcomes of multidrug-resistant central-line-associated bloodstream infection. *Medicine*, *97*(42), e12782. https://doi.org/10.1097/md.0000000000012782.	**Level III** **Quality B**

Purpose or Hypothesis	To determine the relationship between failure to remove a central venous catheter (CVC)and 30-day all-cause mortality in patients with MDRO CLABSIs.
Types of Evidence Research Design	Retrospective Cohort Study
Sample, Population, Size, Setting	**Sample Technique:** **Eligible Participants:** All patients with short term or long term central venous catheter (CVC) **Setting:** 1250 bed academic medical center in Missouri. **Excluded:** patients who had drug susceptible pathogens or died or were discharged withing 24 hours after the first positive culture. **Accepted:** 430 patients **Control:** No control group identified. **Intervention:** 430 patients with MDRO-CLABSIs. **Power Analysis/Achieved:** Power analysis not conducted. **Group Homogeneity:** Heterogeneity between survivors and non-survivors. Homogenous on comorbidities ESRD, Lymphoma, SOT and Apache Score.
Intervention Procedures	**Control Protocol:** No control protocol identified. **Intervention Protocol**: A retrospective data collection from hospital database on patients with CLABSIs, MDRO-CLABSIs, positive culture, and mortality rate. Patients whose information not found in database or in social security death index, considered lost to follow-up. **Treatment Fidelity:** Intervention protocol explained with no evidence of it being instructed to

Primary Outcome and Measures	**Dependent Variable:** Mortality in patients with MDRO-CLABSIs. **DV Measure:** Infection prevention specialists collected data from Comparisons between survivors and non-survivors were performed using chi-square test or Fischer Exact test for categorical value and Student t test or Mann-Whitney *U* test for continuous variables.

Results and Conclusions	**Statistical Results:** With Kaplan-Meier curve for time to death with and without CVC removal, no significant difference between survivors and non-survivors (p= .94). After adjustment using multivariate Cox Proportional Hazards model, failure to remove CVC was strongly associated with 30 -day all- cause mortality with a hazard ratio of 13.5 (6.8-26.7), p< .00). Removal of CVC occurred in 50.2% of patients of which 4.2% died by 30 days (n=9) On the other hand for patients whose CVC remained in place 45.3% died (n 97). **Conclusions:** This study found that CVC removal is associated with decreased 30-day all-cause mortality rate for patients with MDRO-CLABSI, particularly significant reduction of mortality in the subgroup, MDR-gram negative.

Citation: Foka, M., Nicolaou, E., Kyprianou, T., Palazis, L., Kyranou, M., Papathanassoglou, E., & Lambrinou, E. (2021). Prevention of Central Line-Associated Bloodstream Infections Through Educational Interventions in Adult Intensive Care Units: A Systematic Review. *Cureus*, *13*(8), e17293. https://doi.org/10.7759/cureus.17293.	**Level I** **Quality B**
Purpose or Hypothesis	The purpose of the systematic review is to investigate the effectiveness of educational methods on CLABSI rates in ICUs.
Types of Evidence Research Design	Correlational Descriptive Systematic Review.

Sample, Population, Size, Setting	**Sample Technique:** Convenience sampling through predefined selection. **Eligible Participants:** 27 articles, all randomized control trials, studies that provided details or before and after infection prevention control, studies that examined the effectiveness of educational intervention targeted at healthcare professionals for CLABSI prevention. **Setting:** ICU **Excluded: N**on-English languages, studies with other definitions of blood stream infections. **Accepted:** 27 studies **Control:** Control not explicit**,** comparison with previous studies conducted **Intervention:** Review of 27 articles to investigate the effectiveness of educational (CLABSI Bundle, Bundles in combination with lectures, stimulation training, discussion, checklist, bedside demonstration, posters) methods on CLABSI rates in ICUs. **Power Analysis/Achieved:** MINOR score assessed and less than 16 for the 27 non-comparative studies. MINORS scores include power analysis but a score of less than 16 indicate a potential bias. **Group Homogeneity:** Heterogeneity in length of time and type of studies based on Table 2, study characteristics.
Intervention Procedures	**Control Protocol:** No control protocol indicated in the systemic review. There is evidence of assessment for control protocol in the studies used for review per MINIRS score. **Intervention Protocol:** Review of 27 articles to investigate the effectiveness of educational (CLABSI Bundle, Bundles in combination with lectures, stimulation training, discussion, checklist, bedside demonstration, posters) methods on CLABSI rates in ICUs.

	Treatment Fidelity: Study protocol and model not clearly stated.
Primary Outcome and Measures	**Dependent Variable:** Primary outcome is incidence of CLABSI in ICUs. **Dependent Variable Measure:** Data collection. Results from the reviewed articles,No tools defined.
Results/Conclusions	**Statistical Results:** Short lecture of 15 minutes of 10 points of CDC and Disease Society of America guidelines, led to statistically significant decrease in CLABSI rates ($p<0.03$). **Conclusions:** systematic review identified several educational interventions that can reduce CLABSIs, but it was difficult to determine the most effective educational intervention due to variability.

Citation: Pallotto, C., Fiorio, M., De Angelis, V., Ripoli, A., Franciosini, E., Quondam Girolamo, L., Volpi, F., Iorio, P., Francisci, D., Tascini, C., & Baldelli, F. (2019). Daily bathing with 4% chlorhexidine gluconate in intensive care settings: a randomized controlled trial. *Clinical microbiology and infection: the official publication of the European Society of Clinical Microbiology and Infectious Diseases*, *25*(6), 705–710. https://doi.org/10.1016/j.cmi.2018.09.012.	**Level I** **Quality A**
Purpose or Hypothesis	To identify whether daily bathing with 4% chlorohexidine followed by water rinsing decrease Hospital acquired (HAI)Infection in ICU.
Types of Evidence Research Design	Single blinded, Randomized Control Trial
Sample, Population, Size, Setting	**Sample Technique:** Random sampling using Random.Org program. **Eligible Participants:** All patients admitted to ICU/PC-ICU between 10 August 2015 and 27 January2016 and between 10 August 2015 and 14 April 2016. **Inclusion:** Admission ICU/PC-ICU, ICU/PC-ICU stay for at least one night, Age > 18 years. **Setting:** ICU and Post Operative Cardiosurgical ICU. **Excluded:** Known allergy to chlorohexidine, toxic epidermal necrolysis Stevens-Johnson syndrome, Age < 18 years. **Accepted:** 449 patients in ICU. **Control:** 223 patients. Daily bathing with standard soap. **Intervention:** 226 patients. Daily bathing with CHGwr. **Power Analysis/Achieved:** Sample size of at least 410-420 required to meet an α error of 0.05, β error .1, and power 0.9. Power analysis met. **Group Homogeneity:** Homogeneous for Age, Sex, and comorbidities based on demographics table.
Intervention Procedures	**Control Protocol:** Bathing 223 ICU/PC-ICU patients with standard soap and water. **Intervention Protocol**: Bathing 226 ICU/PC-ICU patients with 4% CHGwr solution and rinsing with water.

	Treatment Fidelity: Nurses trained in the proper bathing technique for CHG and soap/water.

Primary Outcome and Measures	**Dependent Variable:** Primary outcomes: Incidence of HAI between CHG bath and standard soap. Secondary outcomes: incidence of blood stream infections (BSI), Central line associated blood stream infection (CLABSI), ventilator associated pneumonia (VAP), catheter associated urinary tract infection (CAUTI), and 4% CHG safety. **DV Measures:**
Results and Conclusions	**Statistical Results:** BSI plus CLABSI incidence significantly reduced in intervention group than control (9.2 versus 22.6infections/1000 patient days). 34/226 (15%) intervention group and 57/223 (25.6%) control had a HAI respectively (p = 0.008). 23.2 and 40.9 infections /1000 patient-days were detected in intervention and control arm respectively (p= 0.037). **Conclusions:** Daily bath with 4% CHGwr significantly reduced HAI incidence in ICU settings
Citation: Süha, B. K., & Karagözoğlu, Ş. (2019). The Effect of a Guide Based Application Bundle on the Catheter-Related Infection. *Florence Nightingale hemsirelik dergisi*, *27*(3), 222–230. https://doi.org/10.5152/FNJN.2019.426870.	**Level II** **Quality B**
Purpose or Hypothesis	To determine the effect of guideline-based care bundle on possible catheter related blood stream infection on patients with central line Cather in ICU.
Types of Evidence Research Design	Retrospective quasi-experimental design
Sample, Population, Size, Setting	**Sample Technique:** Non-probability convenience **Eligible Participants:** Patients in Anesthesia intensive care unit with central line catheter for at least 48 hrs.

	Setting: Anesthesia intensive care unit. **Excluded:** patients who are pregnant, transferred from another unit with central line, previously had CLABSI, or with central and care given beyond researcher's knowledge. **Accepted:** 58 patients, 31 females and 27 males. **Control:** 32 patients who received no treatments through the lines. **Intervention:** 2 groups: group with TPN treatment and group with hemodialysis treatment. **Power Analysis/Achieved:** power analysis not explicit. Effect size not specified. Out of 218, 58 patients included likely an adequate sample size. **Group Homogeneity:** Heterogeneous: Control and Intervention had both male (27) and female (31) and their ages varied.

Intervention Procedures	**Control Protocol:** No central line with TPN or Hemodialysis (31 patients). **Intervention Protocol:** Central lines with TPN (19 patients) and Hemodialysis (7 patients). **Treatment Fidelity:** Researcher educated 9 physician assistants and 32 nurses in Anesthesia ICU on compliance of the care bundle and protocol of the study. Meetings were conducted intermittently throughout the study to reinforce. Researcher supervised physician assistants with aseptic technique in compliance with guideline bundle. A power analysis was not explicit. Patients or designated caregivers were informed of the study and consent obtained.
Primary Outcome and Measures	**Dependent Variable:** development of central line associated blood stream infection. Development of CLABSI based on gender. Development of CLABSI based on age. **DV Measures:** The incidence of dependent variable, CLABSI, was calculated as the rate of CLABSI. The numerical value calculated refers to the number of infections developed during the use of central lines and the duration of central line use is calculated as 1000 catheter days.
Results and Conclusions	**Statistical Results:** No significant statistical difference with CABSI in terms of gender ($p>0.05$), The difference between age in terms of central line infection was not statistically significant ($Z=0.323$, $p>0.05$). Rate of CLABSI increased with length of stay and duration of line in patients with a significant statistical relationship between the two variables ($Z=2.794$, p 0.005). Patients with no special treatment had less CLABSI rate (3.12%) and higher rate with TPN (10.52%) and hemodialysis (14.28%). **Conclusions:** In the 6months study LABSI rate decreased by implementation of guideline care bundle. Age and Gender had no effect on the rate of CLABSI. However, duration of line in patients and length of stay in hospital increased CLABSI rate. It was also determined that administration of TPN and hemodialysis through the central line increased CLABSI rate higher than no treatments through the lines but without statistically significant difference.

Citation: Taşdelen Öğülmen, D., & Ateş, S. (2020). Use of alcohol containing caps for preventing bloodstream infections: A randomized controlled trial. *The Journal of Vascular Access*, *22*(6), 920925. https://doi.org/10.1177/1129729820952961	**Level I** **Quality A**
Purpose or Hypothesis	To investigate the effect of alcohol-containing caps on the prevention of CLABSI.
Types of Evidence Research Design	Single Blind Randomized control Trial.

Sample, Population, Size, Setting	**Sample Technique:** Probable random sampling. **Eligible Participants:** over 65-year-old patients with central lines: subclavian or internal jugular. **Setting:** Coronary Intensive Care unit and cardiovascular surgical hospital. **Excluded:** Patients with DM, immunosuppressive therapy, steroid therapy, chemotherapy, having an open sore, active infection, ECMO, Balloon pump, TPN, HD, and Blood transfusion. **Accepted:** 95 patients **Control:** 48 patients **Intervention:** 47 patients **Power Analysis/Achieved:** 95 patients required to meet 80% power. Power analysis met. **Group Homogeneity:** Homogenous in age.
Intervention Procedures	**Control Protocol:** 48 **c**ontrol group patients received standard caps for the hub of the CVC. **Intervention Protocol**: Isopropyl alcohol containing caps used for covering the central venous catheter (CVC)hubs in the interventional group. **Treatment Fidelity:** All patients participating was given necessary information and informed written consent obtained prior to study. The study protocol is explained, but no evidence of researcher educating nurses using the cap for the patients.
Primary Outcome and Measures	**Dependent Variable:** Rate of Central Line Associated Blood Stream Infection. **DV measures:** Data was collected through the form on demographics, vital signs, signs of infection, length of follow up, cultures. SPSS 25 program was used for statistical analysis.
Results and Conclusions	**Statistical Results:** There was a statistically significant difference between groups in terms of infection distribution (X2 = 13.058; $p < 0.001$). The risk of infection in the control group was 13.7 times higher than the risk of infection in the intervention group. **Conclusions:** Findings suggest that alcohol-containing caps on ports are effective in preventing CLABSI. The infection rate in control group is 13.7 times higher than the intervention group.

Appendix E

Evidence Synthesis

Project Title: CLABSI Prevention, 3 South Intermediate Care Unit.			
PICOT: Does the implementation of a CLABSI Bundle decrease the rate of CLABSI in Intermediate Care Unit.			
JHNEBP Model Level	**Total Number of Sources**	**Author and Quality Rating of each study**	**Synthesis of Findings**
Level 1 Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis	1single blind RCT 1 systematic Review with all RCTs 1 Single Blind RCT	Tasdelen et al., (2020) **A** Foka et al., (2021) **B** Pallotto et al, (2019) **A**	Tasdelen et al., (2020) found that alcoholcontaining caps on ports are effective in preventing CLABSI. The infection rate in control group is 13.7 times higher than the intervention group. Fpka et al., (2021) identified several educational interventions that can reduce CLABSIs, but it was difficult to determine the most effective educational intervention due to variability. Pallotto et al., (2019) found that daily bath with 4% CHGwr significantly reduced HAI incidence in ICU settings.
Level II Quasi-experimental studies · Systematic			

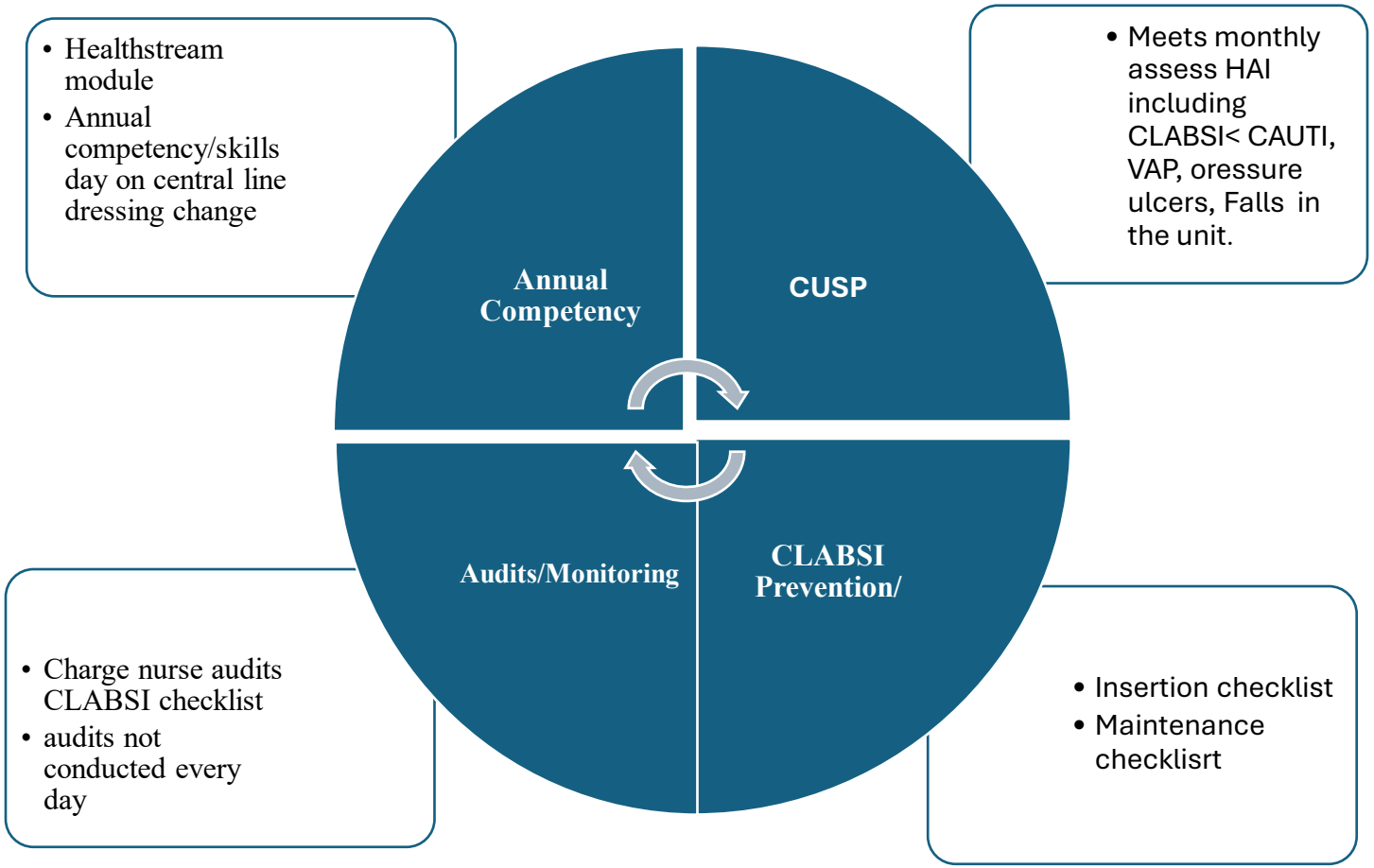
review of a combination of RCTs and quasiexperimental studies, or quasi-experimental studies only, with or without meta-analysis			
Level III Non-experimental study · Systematic review of a combination of RCTs, quasiexperimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis	1 retrospective quasi experimental study	Suha et al., (2019) **B**	Suha et al., (2019) found that in 6months study LABSI rate decreased by implementation of guideline care bundle. Age and Gender had no effect on the rate of CLABSI. However, duration of line in patients and length of stay in hospital increased CLABSI rate. It was also determined that administration of TPN and hemodialysis through the central line increased CLABSI rate higher than no treatments through the lines but without statistically significant difference.
	1 systematic review with nonrandomized control trials	Alanazi et al., (2021) **C**	Alanazi et al., (2021) found that a zero CLABSI rate is achievable through positive displacement needless connectors. Interventions like checklist placement and monitoring of central CL care bundle, use of silver-plated dressings, constant education of ICU personnel, regular real time bed-side monitoring, and mandatory reporting of CLABSI.
	1 Retrospective Cohort Study	Burnham et al, (2018)	This study found that CVC removal is associated with decreased 30-day all-cause mortality rate

			for patients with MDRO-CLABSI, particularly significant reduction of mortality in the subgroup, MDR-gram-negative.
Level IV Opinion of respected authorities and/or			

reports of nationally recognized expert committees/consensus panels based on scientific evidence			
Level V Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence	Descriptive Cross-sectional survey	Alanazi et al., (2023) **B**	Alanazi et al., (2023) found that positive safety attitude among nurses in ICUs are associated with lower number of HAIs. Improving nursing staffing may minimize workload, minimize missed care, improve job satisfaction, and minimize HAIs. However further research is needed to identify effective strategies.
Overall Quality Rating w/rational and Recommendation:			
Recommendations Based on Evidence Synthesis • Strong, compelling evidence, consistent results: solid indication for a practice change. • Good and consistent evidence – practice change • Good but conflicting evidence: questionable indication for practice change; consider risk/benefit analysis. • Little or no evidence: no indication for practice change			

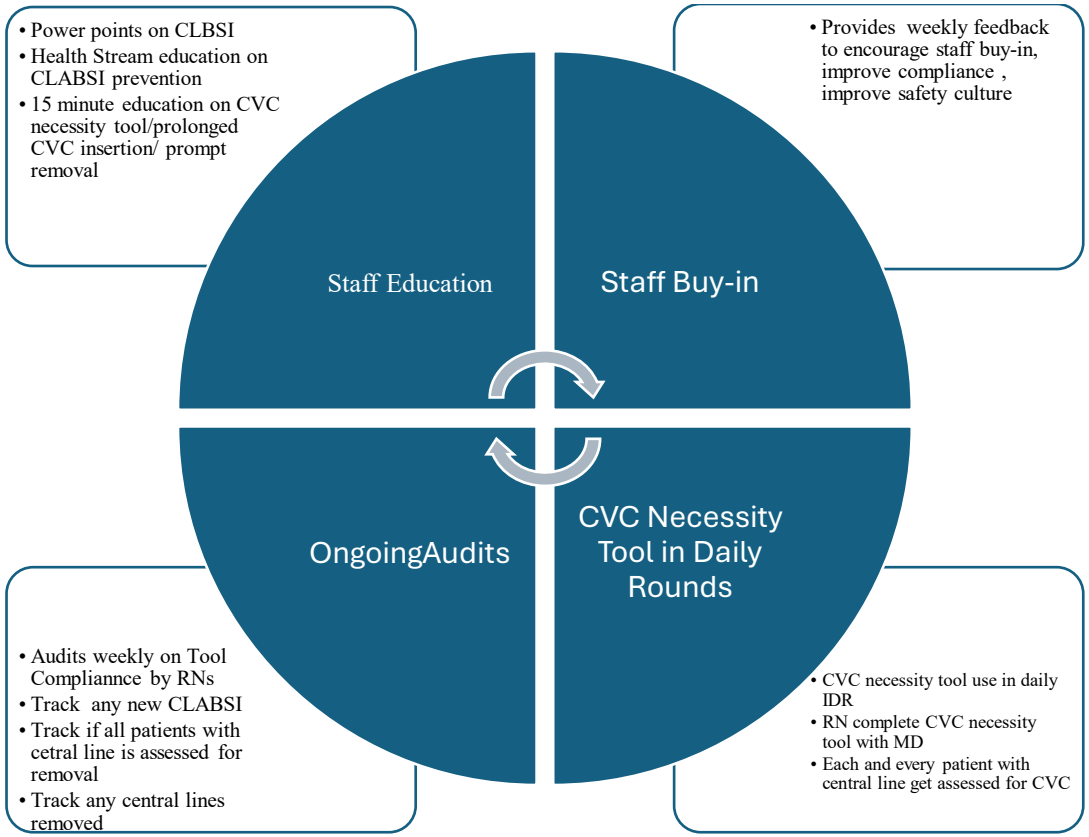
Appendix F

Current Process Map



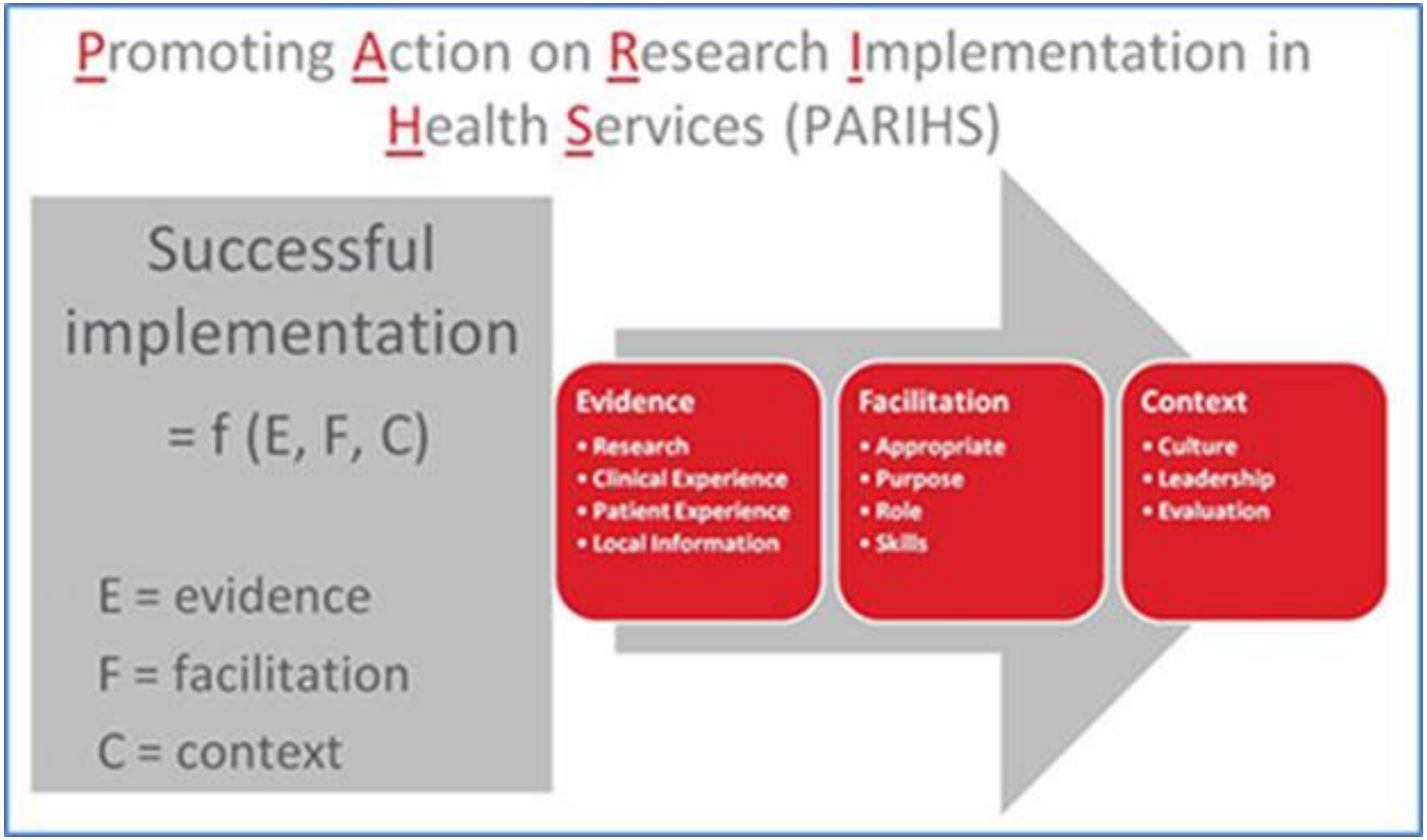
Appendix G

Desired Process Map



Appendix H

PARiHS Framework



(Kitson et al., 2008)

Appendix I

GANNT Chart

DNP Project Title: Impolementing CVC Necessity Tracking Tool in an Intensive Care Unit.

Student: Soneya G Daniel

Project Site: Holycross Hospital, Silver Spring

Project Start: Mon, 1/22/2024

Display Week: 1

Project Identification (NDNP810)/Assessment	Responsible	START	END	
Identify stakeholders/team		1/22/24	2/19/24	29
Identify practice problem/root cause		1/22/24	2/1/24	
Site IRB Inquiry	Completed/cleared	1/22/24	2/12/24	22
Literature Search & Evidence Review on CLABSI			2/12/24	
Identify roles/responsibilities for CLABSI in 2S ICU	Ongoing		2/12/24	
Observe central line Practices in the 3S IMC	Ongoing		2/15/24	
Staff Interview on knowledge of CLABSI	Ongoing		2/14/24	
ID Hospital Policy on Central Line Management			1/22/24	
Development project plans			3/11/24	
Identify scope/goals.outcome/measures			3/11/24	
MILESTONE: Submit project proposal			4/1/24	
REDcap/CITI/HIPPA			1/29/24	
End of Spring Term		1/22/24	5/15/24	115
Project Development (NDNP811)/Planning				
Start of Summer Term		6/1/24	7/26/25	421
Develop EBP implemenation plans for CLABSI		6/8/24	6/8/24	1
Develop teaching plan:CLABSI PPT & Fact Sheet		6/8/24	6/8/24	
MILESTONE: Site Presentation and Approval		7/`10/24	7/10/24	
MILESTONE: IRB Determination		7/10/24	7/10/24	
Assign Roles to various Staff for Audits		7/26/24	7/26/24	
Project Implementation (NDNP812)/Implement				
Start of Fall Term		8/26/24	12/14/25	476
MILESTONE: Project go-live (implement) CLABSI Bundle		8/26/24	12/14/24	111
Ongoing Educator//Flyers/Posters/Reminders	Ongoing	8/26/24	12/14/24	111
Monitor tactics and progress	Ongoing	8/26/24	12/14/24	
Communicate with stakeholders/Incorporate input	Ongoing	1/22/24	5/2/25	
Audits/Data Collection	Daily/weekly	8/26/24	12/14/24	
Dissemination Plan				
MILESTONE: Manuscript		11/11/24	11/11/24	
End of Fall Term		8/26/24	12/14/24	111
Project Evaluation and Dissemination (NDNP813)				
Start of Spring Term		1/27/25	5/21/25	115
Analyze, synthesize & evaluate CLABAI results pre and post intervention		8/25/24	12/16/24	114
Sustainability Plan/ incorporate changes needed to maintain "0" CLABSI			1/15/25	
MILESTONE: Develop Poster			2/4/25	
MILESTONE: Site Presention			5/2/25	
MILESTONE: Extremal Dissemination		3/10/25	3/13/25	
MILESTONE: Final Manuscript			5/11/25	
MILESTONE: UMSON Poster Day			5/2/25	
Project Closure w/site			5/21/25	
Post intervew of Staff/Nurse Knowledge/Feedback			12/16/24	
End of Spring Term			5/21/25	

Appendix J

CVC necessity Tracking Tool

Review Daily with Physician for Central Line Necessity Tracking Tool

Patient Name: _____ **Room #** _____ **MR #** _____
Central Line Insertion Date: _____ **D/C Central Line Date:** _____

Date	Time *(check once per day)*	Necessity of Central Line Reviewed	Indication for Central Line Use/ Continued Use *(see list below)*	If no longer indicated, is there a plan to remove Central Line?	RN Signature
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	
		Yes No		Yes No N/A	

INDICATIONS FOR CENTRAL LINE USE/CONTINUED USE: (List all that apply)

1. Prolonged IV therapy
a. Antibiotics
b. Total parenteral nutrition
c. Chemotherapy
2. Irritating medications
3. Poor peripheral venous access
Comment: Blood sampling is not indication for a central line unless there is poor peripheral venous access
4. Critical illness requiring central venous access
a. Hemodynamic monitoring
b. Vasoactive drips
5. Hemodialysis or plasmapheresis

Modified from IPRO's "Review Daily With Physician for Foley Catheter Necessity" Tracking Tool.

(Used with permission: New York State Partnership for Patients and IPRO. Review Daily with Physician for Central Line Necessity Tracking Tool [NYSPP], adapted from Review Daily With Physician for Foley Catheter Necessity Tracking Tool [IRPO]. Accessed [date] at

Appendix k

CVC Necessity Tool Use Survey

Central Line Necessity Tool Survey

Please complete the survey below.

Thank you!

1)	Date	_____
2)	MRN	_____
3)	Type of CVC	☐ Internal ☐ Femoral ☐ Subclavian ☐ Tunneled Catheter ☐ PICC ☐ Implanted Port ☐ HD/Quinton Catheter
4)	Date of insertion	_____
5)	RN Reviewed CVC Necessity Tool in Rounds	☐ Yes ☐ No
6)	Order For CVC Removal	☐ Yes ☐ No
7)	Indication to Continue CVC	☐ Prolonged Antibiotics ☐ TPN ☐ Chemotherapy ☐ Vasopressors ☐ Poor Access ☐ Hemodialysis ☐ Plasmapheresis ☐ Hemodynamic Monitoring ☐ Critical Illness Requiring CVC ☐ N/A
8)	Total number of CVC in the Unit	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10 ◯ 11 ◯ 12 ◯ 13 ◯ 14 ◯ 15

Appendix L

Post Implementation Survey

Post CLABSI Survey

Please complete the survey below.

Thank you!

1)	Did you find the Central line necessity tool easy to use	☐ Yes ☐ No
2)	Education received on the CVC necessity tool and CLABSI prevention	☐ Yes ☐ No
3)	Do you find the central line necessity tool in daily rounds to be useful in removing central lines promptly	☐ Yes ☐ No