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A CLABSI Guideline for Healthcare Personnel During a Pandemic

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Abstract

Objective: The objective is to recommend the new guidelines to the standard central line associated bloodstream infection (CLABSI) guidelines for use during a pandemic.

Method: Articles from three different databases was conducted: PubMed, Medline, and CINAHL. One hundred articles were retrieved, and seventy-four articles were reviewed and evaluated. The articles were categorized based on the Johns Hopkins hospital/John Hopkins University (2017) hierarchy level of evidence. Four new guidelines were created and added to the ten standard guidelines. Eleven stakeholders rated the recommendations. The stakeholder ratings were sent to a statistician for analysis. The high score ratings are between three and four.

Result: The result of the analysis using Friedman's two-way analysis of variance. Chi-square value X^2 (13) = 7.313, p = .885. The result indicated the differences among the stakeholder's ratings of the fourteen recommendations were insignificant.

Conclusion: Implementation of the recommended guideline will be beneficial during a pandemic.

Keywords: CLABSI, Central Venous Catheter, Pandemic, Guideline.

A CLABSI Guideline for Healthcare Personnel during a Pandemic

A pandemic is an unprecedented outbreak with global repercussions, affecting international, national, and local areas. The World Health Organization [WHO], 2023) confirmed that the number of individuals infected with COVID-19 around the world were: Europe 276,390,270; Western Pacific 203,669,467; Americas 192,775,054; South-East Asia 61,155,081; Eastern Mediterranean 23,374,172; and Africa 9,530,267 (WHO, 2023). Given the high number of confirmed cases of COVID-19, we may assume that a potential next pandemic could have a similar scale. The total number of global infections reached 767,750,853 COVID-19 cases (WHO, 2023). The United States had 99,396,137 infections and continues to see new strains of COVID-19 (Center for Disease Control and Prevention [CDC], 2023).

In the United States COVID-19 infected 146.6 million individuals (CDC, 2022b). Many were hospitalized. Due to the burden of caring for these patients, new staffing models were employed, diverting focus away from routine procedures (Chervoni-Knapp, 2022). As a result, recurring issues such as central line associated bloodstream infection (CLABSI) that may have had low case numbers before the pandemic drastically increased during the pandemic (Alsaffar et al., 2023). The CDC (2022) has reported a significant increase from 2019-2020 in national CLABSI case numbers. It has taken time for many organizations to reduce the numbers of CLABSI back to the levels before the COVID-19 pandemic, an issue that has caused widespread problems in healthcare.

Texas alone had 8,508,204 infected individuals who were diagnosed with COVID-19 infections (CDC, 2023). The situation was further complicated by issues with healthcare staffing (Chervoni-Knapp, 2022). Nurses were observed not adhering to the standard policy for

controlling CLABSIs. Consequently, March and July 2020, one local organization admitted 126,137 patients with COVID-19. The last quarter of 2020 saw a substantial rise in CLABSI rates across the US, with an overall increase of 47%. More specifically, intensive Care Units witnessed a 65% spike, while acute care wards reported a 16% rise in cases (CDC, 2020). The CDC (2023) reported that as of spring 2022, nearly 100 million COVID-19 cases were recorded across U. S., with 1,101,208 related deaths. The state of Texas had reached 8,508,204 cases with 92,378 related deaths. The severity of the pandemic led to an increased casualty rate in acute settings, accompanied by more vascular access complications, thus causing a rise in CLABSIs.

The increased international, national, and local rates of CLABSI during COVID-19 led to hospital administrator and infectious disease officer at local facility confirming an increase of CLABSI. The ongoing pandemic surge resulted in healthcare gap at the local facility that reflected national and international pandemic trends. A solution to resolve the problem before another pandemic led to the project topic of a CLABSI guideline for healthcare personnel during a pandemic.

The CDC (2015) has guidelines for preventing CLABSIs, and healthcare organizations have policies and procedures to guide healthcare workers in their practice. Despite that, CLABSI rates still increased during the pandemic. The incorrect application of guidelines or policies related to vascular assessment procedures contributed to the increased infection rate. Some of these issues were attributable to staffing problems, including the involvement of traveling nurses, and others were due to staff nurses not adhering to the established policy (Haddadin et al., 2022).

The United States has experienced, pandemic situations in the past. Historically, the sixth cholera pandemic (1910-1911) resulted in 800,000 deaths, the influenza pandemic (1918-1920) led to about one million deaths, and the HIV/AIDS pandemic (2005-2012) caused a staggering

death of 36 million (MPH Online Staff, n.d.). In the recent pandemic, worldwide 766,895,075 people were confirmed to have a COVID-19 infection and 6,941,095, people died (World Health Organization [WHO], 2023). These diseases may not have been the sole reason why so many individuals died. Associated complications also play a part.

When evaluating the impact of the COVID-19 pandemic on CLABSI rates, it is important to recognize the rates not associated with pandemic disease. In their study, Baier et al. (2020) discussed the increased rate of CLABSI infections attributed to central venous catheter insertion among hematological and oncological patients undergoing treatment for reasons unrelated to the pandemic. The study involved the insertion of 680 CVC lines in patients with an average age of 47 years. The three different prevalent diseases of the patients were non-Hodgkin lymphoma, acute lymphoblastic leukemia, and hematopoietic stem/cell bone marrow transplantation. The results indicated that 111 cases with a primary nosocomial CLABSI prevalence of 18.2%, which indicated an increased rate of 10.6 CLABSI cases per 1,000 CVC days.

Haroun et al. (2021) detailed a study on the increase in CLABSI cases due to COVID-19 in an 889-bed teaching hospital. The retrospective review study involved evaluating CLABSI cases confirmed through PCR tests for COVID-19. These were compared with CLABSI cases without a COVID-19 diagnosis. The rate of CLABSI cases with COVID-19 was 6.6 times greater than non-Covid CLABSI cases, with the ICU setting having 94% and other units at 53%.

Fakih et al. (2022) reported an increased rate of CLABSI in a retrospective study conducted during the COVID-19 pandemic. The study compared CLABSI rates twelve months before the onset of COVID-19 to six months after its arrival. A marked increase of 51% was observed, with rates rising from 0.56 to 0.85 per 1000 catheter-days. Uncontrolled CLABSI led

to increased mortality rates, extended hospital stays, and elevated healthcare costs (Haddadin et al., 2021).

CLABSIs are known to impact both adults and neonates. Soarez et al. (2018) discussed a retrospective cohort study of infants with a central line placement from July 2014 to June 2016, which conducted at the neonatal intensive care unit (NICU) of Centro Hospital de Sao Joao. A total of 400 central lines were placed in 240 infants. The complications accompanying central line placements were 29.6 cases per 1000 catheter days. The highest incidence value of CLABSI among groups in the study rate was 12.4 cases per 1000 catheter days.

Van Bortel et al. (2016) discussed the Ebola outbreak in Africa, noting that Guinea, Liberia, and Sierra Leone were hardest hit, with a tragic history of over 28,000 cases and 11,000 deaths. The outbreak resulted in the disruption of impacted nations' health systems. During pandemics, the rate of patient admissions to acute care settings typically rises. This can lead to a higher incidence of hospital acquired infections (HAI). Complications from these infections, including vascular access issues, can cause sepsis and patient death, thus contributing to an elevated mortality rate (CDC, 2021).

The literature review underscores the critical need for preparedness by infectious disease control units in the face of unprecedented pandemics. The complications arising from COVID-19 resulted in increased mortality and higher government spending to manage the outbreak (Hyte et al., 2023). During these surges or pandemic periods, it was essential for healthcare organizations to adhere to CDC guidelines strictly. Unfortunately, during these surges, permanent healthcare staff nurses experienced burnout due to the increased patient load, extended working hours, and the psychological impact of the crisis. These factors led to a decrease in the number of staff

members available to work. To resolve the issue, healthcare institutions' management brought in agency staff nurses.

During the ongoing surge, the newly employed agency staff received only brief orientation training. One issue resulting from this change was that the agency staff members' methods for changing central line dressings may have ceased to fully align with the institution's policies and procedures (Almahmoud et al., 2020). Because of the surge, the intensive care units were full due to the critical conditions of the patients. Another factor contributing to increased CLABSI was the related practice of some physicians of inserting central vascular catheters at the bedside. Due to the urgency of the situation, the aseptic technique for vascular insertion was sometimes overlooked. These are some of the factors highlighting the importance of implementing practice guidelines for preventing CLABSI. The significance of practice guidelines lies in assisting healthcare providers and patients in making informed healthcare decisions.

The implementation of guidelines regarding policies and procedures can serve as a valuable tool for reducing CLABSI in acute care settings (OSHA, 2020). Furthermore, several evidence-based literature reviews support the finding that these guidelines significantly reduce CLABSI rates in acute care settings, both during pandemic and non-pandemic periods.

In their research study, Premkumar et al. (2023) used qualitative methods and a quasi-experimental research design to assess the knowledge of 150 frontline COVID-19 critical care unit nurses regarding CLABSI bundle protocols and strategies. The results showed that, before testing, 57% of the CCU nurses had inadequate knowledge regarding CLABSI prevention bundles. However, after receiving hands-on training, post-test compliance among staff nurses increased to 83%.

Orozco-Santana et al. (2023) aimed in their study to reduce the incidence of CLABSI in a Cardiothoracic ICU, and they discussed their findings. Nine CLABSI cases were reported during the fiscal year 2018. Evidence-based interventions were implemented, including rounding, education, auditing, the introduction of a blood culture algorithm, and accountability checks for central line care every seven days. As a result, the incidence of CLABSI dropped from nine cases to one in the fiscal year 2019 - 2020 and increased only slightly to two cases in 2021, even as the number of central line days continued to increase.

The American Society of Anesthesiologists (2020) summarized the findings of randomized controlled trials that compared subclavian and femoral insertion sites. They reported that the femoral site exhibited a higher rate of bacterial colonization compared to the subclavian site. Additionally, the internal jugular site had higher infection rates than the subclavian site.

Implementing CDC guidelines for pandemic situations ahead of a surge can help alleviate the burden and complications associated with unforeseen pandemic outbreaks.

Literature Review

A literature review lays the theoretical groundwork for the research project (Paré & Kitsiou, 2016). A literature review is essential for identifying clinical gaps, establishing research methodologies, and recognizing unresolved problems. The project topic for the study is a CLABSI guideline for healthcare workers during a pandemic. The three literature databases utilized were CINAHL, PUBMED, and MEDLINE. The search terms resulted in the identification of hundred publications, of which 74 articles were closely related and were used for the project. The articles were reviewed considering the following: The aim of the study, sample size, measurement method, results, strengths, and limitations, and the study was rated using the evidence level of hierarchy.

Synthesis of the Literature Articles

Four categories or themes: (a) sterile technique, (b) healthcare staff compliance (c) educational training & skills check off, (d) pandemic preparedness.

Sterile Technique

A sterile field reduces the microbial transmission of infective organisms during a procedure. The first theme of the synthesized article is the maintenance of sterile techniques for procedures. Healthcare personnel must use sterile techniques for the insertion and handling of the central venous catheter and the use of PPE by healthcare personnel (AHRQ, 2018). The sterile technique includes washing hands before and after procedures, wearing PPE, and strictly sterile fieldwork during the procedure.

To synthesize the literature articles for these themes, four of the literature articles was considered. Myatra (2019) in his study discussed improving hand hygiene practices to reduce CLABSI rates using an integral education combination of teaching methods and simulation on hand hygiene before and after Training to assess the nurse's knowledge. In their study, Lee et al. (2018) evaluates four-bundle compliance: hand hygiene, chlorhexidine skin preparation, appropriate central venous site, and maximal sterile barrier precaution. Cohen et al. (2019) use a positive deviance approach and work with the physician to determine steps in practice to maintain a sterile environment and safety in inserting the central venous catheters. Yazici and Bulut (2018) demonstrated the care bundle's efficacy in preventing multiple infections in intensive care units.

In a comparison of the reviewed literature for the first theme, it was found that even though the studies of each of the authors are different, they all have a similar theme in common,

and that was to limit infection with the maintenance of sterile technique during procedure or care of the patient. Myatra (2019) discussed the use of hand hygiene to restrict infection. Cohen et al. (2019) ideas were working with the physician to maintain a sterile environment for safe practice. Lee et al. (2019) evaluates four of the vascular bundles; his study is like Yazici & Bulut (2018), which study the efficacy of care bundles in the intensive care unit.

In contrast, Lee et al. (2019) the study was conducted on1672 adult patients for over three years. Yazici and Bulut's (2018) study were conducted on intensive care patients in a tertiary hospital. In summary, the theme of both authors was to maintain a sterile field, but the study's steps differed.

Healthcare Staff Compliance

The second theme is healthcare staff compliance. The category for the theme is the Antiseptic use of 2% chlorohexidine wipes for bathing patients with central venous catheter sites to limit infection. The healthcare staff must cleanse the central line catheter sites with chlorhexidine, and the needless connector must be covered with curos by the healthcare staff nurse to limit infection (Gillis et al., 2023).

Healthcare staff must maintain compliance after training or implementing a policy by a tertiary institution's leadership. The reviewed literature: Jusino-Leon et al. (2019) discussed using chlorhexidine gluconate baths to reduce central line-associated bloodstream infections. Engel et al. (2023) describe a quality improvement project to decrease CLABSI in a non-ICU setting. The aim is to assess the quality improvement of the study. The team implemented 2% chlorohexidine gluconate wipes with central lines for daily bathing for non-ICU patients. The CHG wipes intervention increased from 77% in Jan 2020 to 94% in Feb 2021. Pook et al. (2022) performs the use of chlorhexidine gluconate lock solution (CHGLS) as a locking device for

central line infection prevention. Three thousand seven hundred seventy-eight were participants in the study. Randomized control studies were done test, and control studies were used. The result indicates that 29% of patients with no chlorhexidine locks standard care and 18.7% of patients with control study with chlorhexidine locks. Lin et al. (2017) utilizes a systematic review and meta-analysis to assess the effect of a 2% chlorhexidine bed bath on the risk of central line-associated bloodstream infections.

In contrast, the study by Engel et al. (2023) was conducted in a tertiary 24-bed hospital with the healthcare staff in compliance with the use of wipes. The CHG wipes intervention increased from 77% to 94%. Lin et al. (2017) utilized a systematic review and a meta-analysis method for the result. However, there was a difference in the study's steps. Engel et al. (2023) and Lin et al. (2017) show that staff compliance will minimize infection.

Educational Training and skills check off.

The third theme is the educational Training of healthcare personnel to improve and assist in compliance with guidelines. Healthcare workers require educational training and skills check-off. Healthcare staff must comply with the policy (Aloush et al., 2018).

The reviewed article for the theme includes the following: Chi et al. (2020) assess the knowledge and practices of ICU nurses in China. The study was conducted using a survey grade. Each question, answered correctly, was graded as one. The mean score of the 11 questions was 4.02.43% of nurses reported using maximum barrier protection, 14% reported never using 2% chlorhexidine at the incision site, 40 % removed the catheter when no longer necessary, 33% reported routinely changing the catheter even when there was no CLABSI infection. Manzo et al. (2022) illustrate the knowledge and practices for central line infection prevention among Brazilian nurses. A mixed approach study design, a combination of qualitative and quantitative

techniques. Completion of questionnaires to assess knowledge and practices and semi-structured interviews to explore barriers to adherence to CLABSI guidelines. The result indicates that the nurses have moderate knowledge regarding CLABSI prevention practices and need more adequate resources to maintain the bundles. Foka et al. (2021) A systematic review was conducted to study the prevention of central line-associated bloodstream infections through educational intervention in healthcare. The results indicated that with academic interventions, there was a reduction in CLABSI infections.

Acharya et al. (2019) demonstrated hands-on Training for the nurses to determine the Impact of nursing education on CLABSI rates. The study aimed to evaluate the effect of nursing education on CLABSI bundles. Post training, there was a significant decrease of CLABSI 8.6 per 100- catheter days, and hand hygiene opportunities decreased to 33.5%.

To synthesize the article for third theme, it was found that there was a CLABSI reduction with educational Training for healthcare personnel.

Pandemic Effect

The fourth theme is to Plan for adequate isolation rooms, either existing rooms or those that may be adapted in preparation for a pandemic (Sharma et al., 2020). Adequate preparedness: The literature article for the fourth theme. Restrictions of visitors during the pandemic to alleviate the spread of infection (Jaswaney et al., (2023). The impact of COVID-19 on CLABSI causes an increase in hospital-acquired infections (Halverson et al., 2022). The effect of the COVID-19 pandemic on CLABSI: CLABSI rates increases by 51% during the pandemic from 0.56 to 0.85 per 1,000-line days (Fakih et al., 2022).

Synthesizing these articles for theme four: The similarity effect of the study indicates COVID-19 had an impact on increasing infection rate. The difference in these studies is that each

author used a variance factor as a determinant for the impact of COVID-19. The study by Jaswaney et al. (2023) was about restrictions of the visitors. Halverson et al. (2022) involved the infectious organism as a co-factor for the increased CLABSI infection rate.

Literature Review for CLABSI During the Pandemic

Alsaffar et al. (in press) examined the impact of the COVID-19 pandemic on CLABSI case rates in intensive care settings. The researchers conducted a retrospective analysis of CLABSI data collected from adult intensive care units over three years, from 2019 to 2022. The data was collected from the Saudi Health Electronic Surveillance Network, with 1440 CLABSI events collected for the study. The findings show a significant rise in CLABSI rates in 2020-2021, with 2.50 incidents per 1000 central line days, compared to 2.16 in 2019.

Aldawood et al. (2021) discussed the impact of the COVID-19 pandemic on CLABSI rates. The researchers conducted CLABSI surveillance data through the National Healthcare Safety Network at the adult trauma critical care unit of King Abdulaziz Medical City in Riyadh, Saudi Arabia. The study period it was ranged from April 2020 to October 2020. During the pre-pandemic period, from October 2019 to March 2020, there were zero reported cases of CLABSI. However, from April 2020 to October 2020, the rate significantly increased to 9.2 per 1000 central line days during the pandemic period.

Literature Review for Post-Pandemic CLABSI Rates

The rates of CLABSI after COVID-19 were not specified in most literature, indicating much research still needs to be done. Freire et al. (2023) noted that the COVID-19 pandemic has been associated with a surge in healthcare-associated infections, leading to increased use of broad-spectrum antibiotics. Therefore, there is a need for a guideline that can be used during a pandemic to prevent CLABSI

Project Question

Does a pandemic-specific practice guideline for prevention of CLABSI during a pandemic found to be useful for healthcare providers?

Objectives

1. Provide the PICOTS to the librarian at UTA and ask for articles from three different disciplines (nursing, medicine, biomedicine).
2. Read and evaluate the articles.
3. Categorize the articles.
4. Write follow-up recommendations.
5. Grade the recommendations.
6. Request that stakeholders rate the recommendations.
7. Analyze the descriptive data for article evaluations, recommendation grades, and stakeholder ratings.
8. Write a manuscript summarizing the findings.

Framework

The Agency for Healthcare Research (AHRQ) National Quality Measure Clearinghouse (NQMC) Domain Framework (Appendix C) was used by the project lead in the creation of the guideline project. The framework focuses on the rationale for health care delivery and population health measures and includes 1) keeps organizational measures consistent with historical convention; 2) clarifies the purpose and the use of the measure for the developers as well as the users; 3) simplifies the search and retrieval of measure within the NQMC; and 4) accommodates the expanding range of measure over time.

The healthcare delivery was used to assess the current performance status of the organization and all healthcare personnel, which supported the creation of this guideline that can be used in a pandemic. The areas of focus were assessment and prevention using the three sub-groups: 1) clinical quality measures, 2) related healthcare delivery measures, and 3) clinical efficiency measures (AHRQ, 2018). The framework supported the current guideline review and evaluation for creating a new guideline that can be used in a pandemic to prevent CLABSI.

The ten interventions from the framework included the following: First, only credential physicians can insert the central line catheters. The subclavian area is preferable to the femoral during the insertion to minimize infection. (AHRQ, 2018). Second, the physician must perform the central line placement aseptically and wear personal protection equipment using barrier precautions (Alfonso et al., 2016). Third, the healthcare staff must perform hand hygiene before putting on a glove and washing hands after removing gloves for a procedure. The healthcare personnel would observe hand-washing steps. Hand hygiene before and after entering the patient's room (Myatra, 2019). Fourth, the nurse must change the central line dressing every seven days, and when it is stained or soiled the procedure must be performed aseptically (Gamvroulli et al., 2020)

Fifth, the lumen of the central venous catheter must be cleansed daily with chlorhexidine wipes to limit infection; the needless connector must be covered with Curos disinfecting caps (Gillis et al., 2023). Sixth, the staff nurse must assess the site of the central venous catheters for any signs of infection at the beginning of the shift. Any infected catheter will be reported to the physician for removal order (Hecht et al., 2020) Seventh, the intravenous tubing should be well labeled with dates and times, and the staff nurse should change the tubing per policy (Van de pol et al., 2023). Eighth, the unit's leaders must observe and check off the regular staff annually for

skill performance. The agency and new staff nurse should go through the proper training as arranged by the leaders at the unit (Aloush et al., 2018). Ninth, during the pandemic, agency staff nurses undergo virtual training to know the policy guidelines of the organization (Achary et al., 2019). In the tenth intervention, the healthcare staff bathed patients with venous catheters with 2% chlorhexidine wipes to minimize infection (Lin et al., 2017).

Four new recommendations with evidence-based research articles were added to the framework to strengthen the interventions in preparedness for the pandemic. The recommendations are as follows—first, prepare for more isolation rooms during a pandemic. Most ICUs do not have isolation rooms or are not designed for airborne isolation infections. In preparation for a pandemic, the infection control manager discussed with the administrative department the estimated number of rooms needed for isolation in preparedness for the pandemic (Sharma et al., 2020).

The second recommendation Is the storage of Personal Protective Equipment (PPE). The last pandemic many healthcare organizations did not have an adequate supply of PPE at the beginning of the pandemic. The supply chain manager is responsible for ensuring adequate PPE and other needed materials for use in the unit and storage of the PPE equipment. The supply chain manager is accountable for giving the supply details of the needed PPE supplies to the chief operation officer. The chief operation officer submits the request to the chief finance officer, who is responsible for ensuring the availability of funds for the purchase (Haegdorens et al., 2022).

The third recommendation is implementing a visiting policy to limit community infection transfer to immunocompromised hospital patients. During the last pandemic, most institutions did not develop restriction policies early, and it resulted in an increased rate of COVID-19 in

healthcare institutions. When the administration of healthcare institutions enforced restrictions, it was later found that the COVID-19 rate decreased because of a decrease in the community's widespread infection (Jaswaney et al., 2022). The fourth recommendation is to cleanse and disinfect surfaces around the patients, such as side rails, overhead tables, doorknobs, and the nursing station surface area, that could be a source of widespread infection. The environmental service department is responsible for cleaning the hospital environment. Supervisors should ensure thorough cleaning of surfaces during the pandemic (Cutts et al., 2021).

Methods

The design of the project was a guideline. The guideline was designed for healthcare personnel operating in acute care during a pandemic. A risk assessment management plan was used for the project guidelines to discover some other recommendations that could be added to the standard guidelines for a pandemic (Appendix B). The development of the project was also supported by a SWOT (Strengths, weaknesses, opportunities, and threats) analysis (Appendix C) that helped in identifying available benefits and risks (Kenton, 2023). A risk assessment management plan expresses all foreseeable potential risks and appropriate action to mitigate the risk. A risk management plan assists in achieving project objectives since it facilitates proactively managing problems (Lima et al., 2021).

Population

The population who would be using the guidelines include healthcare personnel (doctors, residents, nurse practitioners, and nurses) and leadership team members caring for patients during a pandemic. This population would also include traveling nurses caring for patients in acute care settings during a pandemic. The administrative members responsible for maintaining compliance with governmental policies within the healthcare organization, like those set forth by

the Occupational Safety and Health Administration (OSHA), will also be considered in the guideline recommendations. The leadership of each acute care setting comprises the directors and managers of each ICU unit. The administrators and leadership would receive reports and are expected to have an active plan to eliminate CLABSIs.

Setting

The guidelines were designed for healthcare personnel operating in acute care during a pandemic. These acute care settings include intensive care units and medical-surgical units. The organizational setting where the stakeholders currently work was a 900-bed hospital-based facility in an urban metropolis in Texas. The intensive care units comprise neuro, cardiac, surgical, and medical ICUs. The medical staff includes nurses, nurse practitioners, residents, and physicians.

Measurements and Analysis

The measurement tools for implementing the practice guidelines included the Johns Hopkins Hospital/ Johns Hopkins University (2017) level of evidence hierarchy and a rating scale from one to four. The project leader developed written guidelines (Appendix D) for the stakeholders who evaluated the graded proposed CLABSI recommendations. The stakeholder used the scale which denotes one as ‘Poor,’ two as ‘Fair,’ three as ‘Good,’ and four as ‘Excellent.’ The statistician provided support for assuring reliability or validity when analyzing the result on this tool or the databases. However, project results are considered valid because the tool answered the PICOTS question.

Procedure (Intervention)

The practice guidelines for CLABSI and the new recommended guideline during a pandemic were utilized. Three dashboards were created. (Table 1, 2, & 3).

The project team is comprised of the project lead, stakeholders (doctors, residents, and nurses), the leadership team for the acute care setting, and the administrators. The project lead's responsibilities included organizing the project timeline, liaising with the librarian to collect 50-100 articles, reviewing the articles, and grading the articles. The project leader graded the literature, wrote the recommendations then provided them to the stakeholders for rating the project lead recommendations. The stakeholder's role was to rate the recommendation written by the lead. The project lead created three dashboards.

The first dashboard lists the reviewed articles by the project leader. The articles were graded using a scale of one to four. One represents the lowest grade, indicating poor quality, while four represents the highest grade, indicating excellent quality. The data collection includes reading and grading the literature to be put in an evidence table (Table 1).

The second dashboard featured the recommendations categorized using the hierarchy of evidence levels. The grades were divided into three categories. The first grade constitutes systematic reviews and randomized control trials, graded as A, the highest value. The second tier of recommendations is the correlational and comparative studies, denoted as B, and the third grade, C, represents descriptive studies and expert opinions. Writing the recommendations and grading the recommendations (Table 2).

The third dashboard presents the stakeholders' ratings of the recommendations. The stakeholders rated them on a scale of one to four, with one being 'Poor' and four being 'Excellent' (Table 3).

The measurement tools for implementing the practice guidelines included the Johns Hopkins /Johns Hopkins University (2017) level of evidence hierarchy (Appendix F) and a rating scale from one to four. The project leader and stakeholders use the scale, which denotes one as 'Poor,' two as 'Fair,' three as 'Good,' and four as 'Excellent.' The statistician determined statistical reliability or validity when analyzing the result on this tool or the databases. However, it was considered valid because the tool answered the PICOTS question.

Statistical Analysis

The data was analyzed using SPSS version 29 software by the statistician (Fig 1). The results were evaluated using a Nonparametric test and Friedman's two-way analysis of rank variances. The statistician displayed a graphical chart of the stakeholders' ratings and project leader recommendations for the result (Fig 2). The chi-square value was used to determine the significance level (Fig 3). The statistician assisting with the project study is Dr. Kao—a statistician at the University of Texas, Arlington.

Ethics Considerations

The Graduate Nursing Review Committee (GNRC), authorized by the University of Texas Internal Review Board (IRB), determines if a project has any ethical violations. The project proposal was approved, Human Subjects Protection Training (HSP) was completed (Appendix I). In compliance with ethical guidelines, the project leader reported no conflict of interest associated with the project.

Results

Project Outcomes

The project lead adapted the results of the stakeholders' ratings with the fourteen guideline recommendations (Figure 1). The results indicated that the majority highly supported the recommendations, with a score of four representing good grades, except for stakeholders five and seven, with a score grade of one representing poor. The stakeholder five and seven are both physician and physician assistant, the recommendation rated is not within the scope of their profession which is probably the reason they rated so low. The project lead recommendation for the ninth guideline was that the unit charge nurse is responsible for ensuring all staff comply with central line standards. It was rated as two and represented fair.

There was a score grade of two for recommendations eleven and thirteen; these are the recommendations added by the project lead for pandemic situations. For recommendation eleven, the project lead discussed a plan for adequate isolation rooms for pandemic situations, possibly the reason stakeholder three graded with a score grade of two, which represents weakness; the stakeholder did not project the possibility of creating more isolation rooms for the pandemic situation only. The same third stakeholder rated the recommendation thirteen, an adequate plan for visitation policy in readiness for a pandemic, with a score grade of two. Still, the recommendation could have been better. It is possible to use the stakeholder way of rating; this is one of the study's limitations because each individual is graded differently based on their judgment and perception.

The statistician used SPSS software to evaluate the stakeholders result, and the project leader's recommendation using Friedman's Two-way analysis of variance. The pairwise comparison allows the comparison ratings of any two recommendations. The pairwise

comparison result indicates that none of the comparisons reached a $p < .05$. With $X2(13) = 7.313$, the statistician determined the significance level of $p = .885$,which indicated the differences among the stakeholders' ratings of the fourteen recommendations were insignificant (Fig 3).

Figure 2 contains panel of each of the 14 recommendations plotted against the 11 stakeholders' ratings (Figure 2A through M). Panels A and N show the stakeholders' unanimous grade four for the specific recommendations have the fields filled with a single wide bar. The remaining panels have unequal bars demonstrating the different number of stakeholders' level of support for each recommendation. Stakeholder two scored all the recommendations as four except recommendation two. Considering the bar chart results based on the rated grade of the stakeholders affects the shape of the bar graph bar graph.

Discussion

All recommendations have received similar responses and high score grades from the stakeholders except for one or two recommendations with low grades rated by the stakeholders. The statistical analysis of the result also indicates that the P value is < .05, a less significant value. The interpretation implies that the guidelines recommendations eleven to fourteen, as stated by the project lead for preparedness, are appropriate for use during a pandemic. The result of the project study applies to the patient. The standard guideline recommendation, the use of chlorhexidine wipes for bathing and cleaning the catheter sites, was highly scored with all grades of four, and the statistical value indicates a statistical P value of < .05 indicates the compliance of the healthcare personnel to these guidelines, infection rate will decrease among the patient population with central venous catheters.

The project's product, a guideline that reduces concurrent infections, rates will be continued because local and regional disease outbreaks to worldwide pandemics will continue to erupt. Use of appropriate guidelines will stabilize and reduce mortality related to increased infectious rates. The guideline development should continue to be modified to achieve greater success. Improved guidelines that will minimize infections during a pandemic must be encouraged.

Summary

Key Findings

The strength of the project study is that the stakeholders worked at different healthcare levels. The stakeholders are physicians, residents, physician assistants, nurse practitioners, and registered nurses. This diversity eliminated occupational bias and promoted good generalizability of the resulting recommendations guidelines. Having 11individuals rate 14 guideline recommendations reduced information bias. The project and its results will move forward toward dissemination and utilization. No other problems or gaps were discovered during the course of project.

The future implications of the project underscored the need for adequate preparedness respond to a pandemic. The leadership and the administrative of each healthcare institution should recognize the standard guidelines and this newly created guideline should be implemented during disease outbreaks. The guideline recommendations should be added to the standard guidelines for CLABSI, as cited by the Agency for Healthcare Research and Quality (2018b), and implemented for use, as an improvement in preparedness for pandemics and the reduction of infectious diseases.

Limitation

The project was limited by its eight weeks duration; the project lead needed an extension to collect more articles and invite more stakeholders, which may have contributed to variance in grading of the recommendations by the stakeholders. It may also have resulted in added bias and impacted the generalizability of stakeholders' responses.

The project's weaknesses included the number of the stakeholders' and their professional roles; the number and ratio of registered nurse, nurse practitioner, physician assistants, resident, physician participants might affect the assigned grades and limit the generalizability of the overall results. However, these professionals were impacted by COVID-19 pandemic's effect on staffing and resulted in a shortage of staff nurses due to burnout, especially nurses with many years of experience. The healthcare personnel's continued compliance with the training and sterile technique of central venous insertion could improve productivity.

The threats or difficulties limiting the implementation of the project include non-compliance of healthcare workers. The rates of CLABSI after COVID-19 were not specified in most literature. It indicates that many research studies need to be emphasized.

Conclusion

The project lead confirmed a modification needed to improve the standard of care during a pandemic. It also supported other reported studies on CLABSI guidelines by different authors. A CLABSI guideline is vital for limiting the infection rate in a healthcare institution during a pandemic. An increased infection rate in a healthcare institution during a pandemic will complicate care and impacts patients and providers in at least three significant areas: First, there is an increase in the mortality rate of patients. Secondly, there are extended long stays for hospitalized patients resulting in lack of space and admission delays for other emergent situations. Thirdly, there is an increase in the cost of care.

This project focused on developing guidelines to limit mortality rates and complications associated with HAIs from infected CVCs. The focus guidelines can promote healthcare personnel's awareness of compliance with the CLABSI guidelines, the providers ability to assist in limiting HAIs, and contribute to improving healthcare outcomes for the patients. Further reasons for the project and the guidelines that result is that healthcare institutions leadership and administrators, and government officials should be prepared for another pandemic. Even considerations of minor resources like PPEs which was lacking during the early part of the last pandemic, COVID-19, remind us that preparedness needed for impending epidemics and pandemics.

This project, the development of a CLABSI guideline for healthcare personnel during pandemic, can be utilized during health care crises such as a pandemic in all healthcare institutions. It can also provide a base for others engaged in related healthcare efforts related to emergency preparedness and CLABSI HAIs.

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Table 1

Dashboard for Grading Articles, the Evidence Table with Grading

Database Article Author	Design Aim/Hypothesis Sample size Population	Measurement method	Results/Recommendation	Strength/ Limitations	Evidence Level & Quality Rating	Category 1=HP 2=PM 3=SC 4=IM
1.Medline The adherence to guidelines for preventing CVC- related infections: A survey among the Italian healthcare workers (Ferrara & Albano, 2018).	Cross-sectional survey using random sampling. Aim: To assess the level of adherence to guidelines for CVC among Italian healthcare workers. Sample Size: 549 healthcare workers. Population: Physicians, nurses, nurse practitioners	A questionnaire survey consisting of a series of questions to assess their general knowledge of healthcare associated infections and their perception of the utility of guidelines to prevent CLABSI and procedures about CLABSI insertion and management.	Of the 549 healthcare workers, 378 agree to participate, and the total response rate was 68.9%. Respondents to acknowledge about CDC guidelines was 20.7%. Recommend: High quality RCT was recommended to limit bias of the study.	Strength: Bias was limited because the study design was random sampling	Level II Randomized control trials. Rate: High- quality rating of the research article: The research content includes the introduction, abstract, methods, results, discussion, conclusion, and references The aim of the study was precise. The result of the study indicates the truth of the consistent lack of CDC guideline implementation. Conclusion express consistent recommendation	3
2.CINAHL	Random Control Trial	The study involved 34 nurses as	The result indicates a significant	Strength: The non-compliance	Level II Randomized control trials	2

Improving hand hygiene practices to reduce CLABSI rates: Nurse's educational integral for success. (Myatra, 2019).	Aim: Improving Hand hygiene practices to reduce CLABSI Rates: Nurses education integral for success. Sample size: 34 Nurses Population: nurses	participants. There was a combination of thirty minutes of education and simulation on hand hygiene-objective tests before and after the training to assess the nurses' knowledge of CVC care practices.	decrease from 12.5 to 8.6 per 1000 catheter days before and after the education. A decrease in non-compliance with hand hygiene decreases from 53% to 34%.	rate with hand hygiene was decreased. Limitation: The study involved only the nurses for the training. Other studies involved other healthcare personnel	were used for the study. Moderate or Good Rating: The author did not express the format of a research paper. The abstract, the duration of the study was not specified. The article should have stated the statistical analytical data used to obtain the results.	
3. CINAHL Compliance of Middle Eastern hospitals with the central line-associated blood stream infection prevention guidelines. (Aloush et al., 2018).	A prospective design was used for the study. Aims: (1) To assess compliance with CLABSI guidelines. (2) To assess predictors of compliance. (3) To examine the effect of compliance on the rate of CLABSI	Eighty hospitals were selected, and 58 hospitals were permitted to participate. The study was a prospective audit conducted in 58 hospitals in three different Eastern countries: Jordan, Egypt, and Saudi Arabia. The study was	The multiple regression model indicated that the hospitals experienced 82% variance compliance. The predictor of compliance includes fewer beds and a lower patient-to - nurse ratio.	Strength: Three different hospitals in Eastern countries were chosen for the study to remove the bias of using one hospital Limitation: Other variables were not stated in the study: the patients illness severity and the site of	Level II Prospective Randomized Control Trial. Good: The author achieved the aim of the study, and consistent recommendati ons of guideline predictors would improve compliance.	3

		from January 1 to March 30, 2017.		the CVC's location that determine infection rate.		
4. PubMed Emergent themes from a quality improvement program for CLABSI/CAUTI prevention in ICUs amid the Covid-19 Pandemic (Krauss et al., 2022).	Aim: To maintain infection prevention by implementing emergent concerns from a quality improvement program for CLABSI prevention in ICU during the Covid-19 pandemic	49 ICU teams out of 37 hospitals from seven different states were participants. The participant maintained the following as part of the AHRQ ICU safety program. Daily huddles, multidisciplinary rounds, central line monitoring, and pandemic guidelines limit provider time around the patients (Krauss et al., 2022)	The result was that the infection rate was below the target rate because of the implementation of a quality improvement program at the ICU before the pandemic. The guidelines were summarized under four themes. 1The Unit had CLABSI prevention policies and practices enforced before the pandemic 2. Units were complaisance with the implemented policies and practices 3. Units maintained activities to prevent HAI among the leadership	Strength: The study eliminates bias in the data collection The author used analysis of qualitative data collected to facilitate the execution of the AHRQ safety program, which limits infection during the pandemic Limitation: 11 of the ICUs for the study had the same similarities. They are large hospitals located in the city, and the result of the findings may not be generalizable to other healthcare centers.	Level II: Randomized Control trials. Good: The study identifies the importance of preparedness to prevent disruptions. It is essential to have guidelines implemented before a pandemic.	2

			and the care teams during the pandemic. 4. The unit's members are ready to learn new task to improve the unit.			
5 PubMed Effect of Central line bundle compliance on Central line Associated Bloodstream Infections (Lee et al., 2018).	Aim: To evaluate the direct effect of central line bundles compliance to decrease CLABSI infections in different dept of the hospital. The Four bundle components used are Hand hygiene, chlorohexidine skin preparation, appropriate central venous site, and maximal sterile barrier precautions. Sample Size:1672 Population: Patients	The study was carried over for three years with 1672 patients as participants The four departments involved in the study are ICU-371, ER-376, OR-769, and General Ward 156. The four components of the bundle were performed on 898 (53.7%) patients while 774 (46.3%) patients had omitted bundles.	29 CLABSI was identified for a total of 14829 catheter days. Out of 898 patients that the four bundles were completed seven (0.77%) CLABSI episodes. For the 774 patients the bundles were omitted 22(2.84%) CLABSI episodes. The CLABSI rates is expressed per 1000 catheter days.	Strength: The study has limited bias because most studies focus on ICU patients only, the author focuses on the ICU and other department in the hospital. Limitation: The factors that may affect CLABSI such as severity of the disease, catheterization days, removal of unnecessary catheters and maintenance care of the catheters	Level: II Randomized control Trials Good: The study results provide evidence that if CLABI bundles were maintained, the rate of CLABSI infection will decrease.	3

				were not specified.		
6 MEDLINE Compliance with international prevention guidelines for central line-associated bloodstream infections in neonatal intensive care units in Belgium: a national survey (Mahieu et al., 2022).	Participants in the study used an online survey questionnaire from 19 NICUs in Belgium. Aim: To assess compliance with international guidelines for the prevention of CLABSI in Belgium NICUs and to study the causal factor contributing to CLABSI	Measurement: A multivariable linear regression was used to estimate compliance with guidelines and determine factors for causing CLABSI between 2015-2016. Method: An online complete survey was used by the 19 NICUs. Close- ended questions for CVC practices were classified into three sections: CVC insertions, CVC maintenance, and monitoring quality indicators. The survey was based on three guidelines	The overall compliance results were different from each NICU. Variation was highest for quality control, followed by maintenance and lowest for insertion. The result indicates adherence guidelines for CVC insertion was 64%, low for maintenance 47%, and quality control was 50%. Chlorohexidine was not commonly used as a skin disinfectant.	Strength: A large portion of NICUs in Belgian participate to eliminate study bias. The author discussed about the variables that could be a determinant of HAI infections. The large size of NICU >20 beds, high patient- to - nurse ratio. The acuity of the patients in the ICU was considered. Limitation: The compliance was measured by self-reporting and not by observation. The participants compliance responses may need to be more accurate for	Level 1: A systematic review Rating: Very Good. The study indicates there are variables in CVC maintenance and quality control among the participants in NICUs in Belgium. These findings are consistent with the Nation Healthcare Safety network result, which observes variables in CVC maintenance from the survey results collected.	3

		published by the Center for Disease Control (CDC), the National Health Service (NHS), and the Society for Healthcare Epidemiology of America (SHEA).		actual practices.		
7 Medline Preventing of central line-associated bloodstream infections: A survey of ICU nurses' knowledge and practice in China (Chi et al., 2020).	AIM: To assess the knowledge and practices of ICU nurses in China.	An online survey questionnaire was used for the study. Method: A total of 835 ICU nurses from 104 hospitals in China were participants. Each nurse was expected to complete a questionnaire. The questionnaire consisted of 11 questions	The mean score of the 11 questions was 4.02.43% nurses reported using maximum barrier protection, 14% reported never use 2% chlorhexidine at the incision site, 40 % removed the catheter when no longer necessary, 33% reported	Strength: A large number of ICU nurses' participants. The variables such as sex, years of experience educational level, professional title, contribute to eliminating bias in the study.	Level II: Randomized control trials Rating: Good The author identifies lack of knowledge and non-compliance guidelines for ICU nurses in China. The author suggested that the National hHalth Administration adopt policies for training ICU nurses.	2

		related to evidence-based guidelines for preventing CLABSI each question, answered correctly will be graded as one.	routinely changing the catheter even when there was no CLABSI infection.			
8 CINAHL The impact of central line insertion and maintenance care checklist on central line-associated bloodstream infections (CLABSI): A literature review (Gamvroulli et al., 2020).	Aim: To determine the effect of central line insertion and maintenance care checklists on CLABSI in neonatal intensive care units (NICU), Pediatric intensive care units (PICUs), and hematology/Oncology units.	Method: A study was conducted from the PubMed database. 11 studies were conducted, of which seven referred to NICU, two to PICU, and two to Hematology /oncology units using a maintenance checklist for CLABSI guideline	Results: The finding indicated CLABSI was reduced in all the 11 studies, with 92% of CLABSI reduction, 50% from PICU, 28% from Hematology/ oncology units, and 64% in NICU.	Limitation: The author did not indicate the period of collection. The number of the participants ICU involved are relatively small. There is bias of population study,	Level 1: Systematic review. Rate: Weak The article was rated as weak, the period of collection for the study was not included in the study, and the population size for the study needed to be more significant. The article's discussion should have included the strengths and limitations of the study.	2
9 Medline Central Line-Associated Bloodstream Infections in Critically ill	Aim: To evaluate the effect of the Covid-19 pandemic on central line	Method: A retrospective analysis data was used for collection of data.	Results: 45(5.6%) CLABSI events were identified.	Strength: The ability to be able to collect the data for CLABSI	Level II: Randomized control trials. Rate: Good.	4

patients during and before the Covid-19 Pandemic Hlinkova et al., 2023)	associated bloodstream infections in critically ill patients admitted to the ICU.	Eight hundred and three patients that were admitted for 8385 days with 7803 central line days to adult respiratory intensive care units were participants. CDC guidelines for CLABSI were followed.	8 (2.3%) before the pandemic and 37 (7.97%) during the Covid-19 pandemic, the rate of CLABSI significantly increased during the pandemic compared to before the Covid-19 pandemic. It was concluded that Covid-19 was associated with increased CLABSI in the ICU during the Pandemic.	events before and during the Covid-19 pandemic. Limitation: For the study to be compared nationally, more healthcare settings should be added as participants for the study.	The article was rated as good. The topic of the study aligns with the results.	
10. Medline Reduction of CLABSI in a large acute care hospital in Midwest United States following implementation of a comprehensive central line insertion and maintainance bundle (Wei et al., 2021).	Aim: To reduce CLABSI after implementing comprehensive central line insertion and maintenance bundle.	Method: A retrospective study was used to determine the CLABSI rates and time of CLABBSI onset after the placement of CVC in both intensive and non-ICU settings. Between	CLABSI cases per 1000 CVC days decreased from 0.64 to 0.362 (42%) decreased.	Strength: The study period was long enough to determine the study variables. Limitation: In generalizing the variables other healthcare settings must be included.	Level II: Randomized control trials. Rate: Good. The study's objective was clearly defined, with a clear conclusion and consistent recommendation.	2

		January 1, 2013, and December 31, 2017, in a community hospital with 848 beds. A comprehensive bundle of interventions including Center for Disease Control guidelines and measures such as root cause analysis, disinfection caps for all the catheter ports catheter dressing site changes, and weekly use of antithrombotic and antimicrobial coated CVCs with limited lumens.				
11.CINAHL Knowledge and Practices for central line infection prevention among Brazilian Nurses: A mixed method	Aim: To ascertain knowledge and practices of nursing professionals regarding CLABSI prevention and to identify	Method: A mixed approach study design method was used: combination of qualitative and quantitative	The findings indicate the nurses have moderate knowledge regarding CLABI prevention practices and the	Strength: the study reinforces the determinant factors that limits compliance to guidelines	Level II Correlational Control Trials Rate: Excellent. The author of the article used a combination	1

study (Manzo et al., 2022).	predictors and barriers to adherence to CLABSI guidelines in Brazilian neonatal intensive care units.	technique. completion of questionnaires to assess knowledge and practices, and semi structures interviews to explore barriers to adherence to CLABSI guidelines. The study took place in a level four NICU of a public hospital in Brazil. Collection of the studies was between March 2019 and May 2019.	interviews with the nurses revealed lack of adequate resources for maintainance of bundles such as lack of adequate equipment, resources for hand hygiene, and inadequate physical structure (Manzo et al., 2022).	and reinforcing education of the nurses will improve knowledge and practices of the nurses.	approach as identifier for non - compliance of the Brazilian nurses to the guidelines. The exclusion and inclusion criteria for the study were included in the article.	
12. CINAHL Gaps in infection prevention practices for central line-associated bloodstream infection as identified by Task Assessment for Prevention Strategy (TAPS) (Snyder et al., 2021)	Aim: To report gaps in infection practices for CLABSI in acute care hospital settings by responses to CLABSI TAP Assessment for the facility	Method: A systematic review of 1680 CLABSI assessments was used for the study. The study TAP strategy used consist of TAP reports, TAP facility assessments, and TAP implementati	Thirty-eight facilities provided 1680 CLABSI TAPS assessments. The respondents comprise of 72% nurses, 7.7% medical providers, 9.2% leadership, 3.5% nurse	Strength: The study indicates the gap in infection prevention. There is a need for infection champion who assists the facility in facilitating provider training for healthcare	Level 1: systematic review. Rate: Good The study included TAP assessments responses by healthcare and other non-medical personnel at the facility. Medical personnel included	2

		on guidelines. The National Healthcare Safety Network (NHSN) created the tap reports. TAP facility assessments included: Proper insertion of central line, appropriate use of the central line and maintainance of the central line. CDC assisted in summarizing TAPS facility assessment.	assistants and 2.7% infection prevention personnel. A review of responses highlighted that 54.5% reported their facility had a nurse champion for CLABSI prevention.	personnel and the leadership involvement in conducting continuous audits for successful progress in decreasing facility gaps.	providers, physicians, nurse practitioners, residents, nurses, nurse technician and non-medical personnel included admin leaders and infection prevention personnel. Bias ins study was eliminated.	
13 CINAHL Implementation of evidence-based maintainance bundles to reduce central line associated bloodstream infection (CLABSI): Quality assurance and performance improvement (Simoneaux & Guerra, 2022).	Aim: To reduce CLABSI rates with the implementation of maintenance bundle.	Method: A multidisciplinary team met in July to discuss the increased rate of CLABI. In August 2021, the team implemented a maintenance bundle. The maintainance bundle are maintained through	The result of the study indicated a 4% reduction in CLABSI between August and November 2021 (2.2 per 1000 device days). Maintainance bundle compliance increases by 21% from August to November 2021, and	Strength: The success of the study. 4% reduced rate in CLABSI and 21% in maintenance bundle compliance. Limitation: The article did not meet the IRB committee requirement for publishing a paper the	Level II Randomized studies Rate: Poor The study period was short from August - November 2021. The author should have discussed if one or more units were study participants.	3

		daily record by the nursing leader unit and weekly audits by infection prevention unit.	monthly compliance of 84%.	author did not specify the site and the location for the study.		
14. CINAHL Harnessing implementation science to optimize harm prevention in critically ill children: A pilot study of bedside nurse CLABSI bundle performance in the pediatric intensive care unit (Woods-Hill et al., 2020).	Aim: To optimize harm prevention in critically ill children in the pediatric intensive care unit using a pilot study of bedside nurse CLABSI bundle performance.	Method: A single center cross-sectional electronic survey of 226 (71%) PICU bedside nurses were participants. A phrase COM-B (capability, opportunity, motivation) and TDF (theoretical domains framework) and behavioral models were used to explore CLABSI bundle performance and identify barrier factors to compliance.	The study indicated 160 survey questionnaires were analyzed from 226 nurse participants. Using the COM-B model for analysis: CLABSI knowledge by the nurses were strong at 88.5% (capability). Challenges related to opportunity:32% of the nurses describe CLABSI bundle as stressful. 75% of the nurses reported they are motivated by the physician's attitude towards the CLABSI	Limitation. A single center for the study limits the generalizability. The survey items for the study were not validated using psychometric tests and the themes for the qualitative analysis was not specified.	Level II Correlational studies. Rate: Good Using the COM-B model for the study discovered the non - compliance indicators for the pediatric nurses.	2

			bundle (motivation).			
15. Medline Improving ICU physician engagement reduces pediatric central line-associated bloodstream infections. (Woods-Hill et al., 2018)	Aim: To reduce CLABSI in the pediatric unit by improving ICU physician engagement in the maintenance bundle of CVC.	Method: A retrospective review of a quality improvement adherence to CLABSI in an urban tertiary hospital in a pediatric unit. The study was a mixed study of PCART (Central access resource team to monitor the physicians and RN project leads. The PCART pilot the study of the ICU physician with the incorporatio n of maintenance of the central venous catheter and RN project leads weekly audits for the RN, several education programs were utilized for the bedside RN.	Results: The weekly audit report demonstrated areas of improvement needed by the ICU physician for maintenance practices. Compliances of the RN were positive from 89% to 98%. CLABSI rate decreased 10 1.3/1000-line days. (pre-intervention monthly rate was 6.03/1000-, 3.12/1000- and 2.78/1000-line days)-an overall decrease of 18.9% in CLABSI.	Strength: The article expresses an interprofessi onal activity between the physician and the nurses.	Level II. Comparative Studies. Rate: Very Good. The author was consistent with the results and highly recommends the improvement of maintenance bundle through multidisciplin ary MD/RN relationship.	1

16. PubMed Association of the coronavirus disease 2019 (Covid-19) pandemic with the incidence of healthcare-associated infections in California hospitals (Parriot et al., 2023).	Aim: To assess the effect of the Covid-19 pandemic on the incidence of CLABIs, Clostridioides difficile infections (CDI) and methicillin-resistant staphylococcus aureus (MRSA) bloodstream infection in California hospitals.	Design: Retrospectiv e cohort. Method: In the study, the author examined different factors. First, they compared standardized infection ratio (SIRS) for the infections. Secondly, they performed Interrupted time series from the second half of 2019 to 2020. Thirdly they used a binomial model to examine the relationship between the number of beds occupied by Covid-19 patients and the incidence of infection.	Results: The findings indicated increased SIRS for CLABSI and MRSA from 2019 to 2020. For ITS analysis, CLABSI had vital positive values-a positive association between Covid-19 bed occupancy and increased CLABSI and MRSA.	Strength: The article specifies the variables for the study. It eliminates bias in the study.	Level II Correlational studies Rating: Good The result of the study corelates with other studies on an increase of CLABSI with the Covid-19 pandemic	4
17. PubMed Coronavirus disease 2019 (Covid-19) pandemic, central line associated	Aim: To evaluate the effect of Covid-19 pandemic on central associated	Method: A retrospective study of CLABSI and CAUTI were done twelve months	Results: For the two study periods there were 795,022 central line days and 817,267	Strength: The results of the study increase in CLABSI was associated	Level II Comparative studies. Rate: Good. The authors stay focus to	4

bloodstream infection (CLABSI) and catheter associated urinary tract infection (CAUTI): The urgent need to refocus on hardwiring prevention efforts (Fakih et al., 2022).	bloodstream infection (CLABSI) and catheter associated urinary tract infection (CAUTI)	before Covid-19 and six months during Covid-19 pandemic.	urinary catheter days. CLABSI rates increases by 51% during the pandemic from 0.56 to 0,85 per 1,000-line days. It was also noticed that hospitals with monthly Covid-19 patients representing > 10%of admission had a National Health Safety Network (NHSN) standard infection ratio for CLABSI 2.38 higher than hospitals with < 5%. In contrast, there were no significant changes for CAUTI.	to Covid-19 pandemic	the purpose of the study and consistency of the results.	
18.PubMed Impact of Covid-19 pandemic on central line associated bloodstream infections	Aim: To determine the effect of COVID-19 on CLABSI as reported by the healthcare facilities to	Method: The US healthcare surveillance of healthcare acquired infection (HAI)includ	Results: 28% increased using standard infection ratio. From 0.68 in 2019 to 0.87 in	Strength: The variables that determines generalizabi lity was included in	Level 1: A systemic review. Rate: Good The article was rated no conflict of	4

during the early months of 2020, National Healthcare Safety Network (Patel et al., 2022).	National Health safety Network	es Center for disease control (CDC) and National Health safety Network. (NHSN). For the study analysis from acute care hospitals for 2019Q2 and 2020Q2 with consistent reporting of HAI for 3 months were included. The study reported 13,136 inpatient units from 2,986 acute care hospitals.	2020 Q2. Critical care units had the highest percentage increase 39% in standard infection ratio from 0.75 in 2019 to 1.04 in 2020 while ward locations had 13 % increase (Patel et al., 2022).	the study. The author considered the units for collection of data such as critical unit and ward unit.	interest; the result was based on report from the US surveillance health system report. National Health safety network (NHSN) and the center for Disease control (CDC)	
19. Medline Deconstructio n of central line insertion guidelines based on the positive deviance approach-reducing gaps between guidelines and implementatio n: A qualitative ethnographic research	Aim: To deconstruct CLABSI guideline through positive deviance approach, by working with the physician and determine what step in practice, assist to maintain a sterile environment and contribute	Method: A qualitative ethnographic studies, including 76 physicians. 41 from internal medicine and 35 physicians from critical care units. Using different data collections such as	Result: 23 extensive variations of central line insertion practices were created.	Strength: The study helps to bridge the gap between the theory practice already known and praxis. Limitation: The study focused on insertion of the catheters and not maintenanc e.	Level II Correlational studies. Rate: Good. The author was concise and focus about the study.	1

(Cohen et al., 2019).	to patient safety.	semi-structured interview, focused observation, video documentation, discovery & action dialogue, and simulations. Deconstruction analysis was done,				
20. Medline Factors affecting the timing of a central- line associated bloodstream infection onset in children with cancer (Park et al., 2021.	Aim: To determine controllable treatment-environment factors that are affecting the timing of CLABSI onset in children with CVC	Method: The study was an electronic survey of records from a tertiary hospital in Korea. The study was obtained from electronic records of 470 children with the age less than 18 years. Between 2010 -2016. The timing of CLABSI onset was classified between the insertion period and CLABSI onset. For statistical analysis,	Results: The rate of CLABSI was 0.28 per 1000 days. The findings indicated that the six variables are dependent factors.	Strength: The limitation of the study is a multicenter study using multi-hospital records to overcome the limitation to generalization of the results.	Level 1: Systematic review. Rate: Good The study concludes the importance of evidence-based CVC guidelines to reduce CLABSI infection.	2

		Cox proportional regression analysis was used to determine the effect of the six variables considered on the timing of the onset of CLABSI, and Kaplan Meier method analysis was used for the duration of catheterization. The six variables considered are the length of stay in the hospital, catheter insertion location, use of antibiotics after insertion, catheter function, number of blood transfusions per 100 days, and number of blood tests drawn from the catheter per 100 days.				

21Medline Central Venous catheter management in high-risk children with Bloodstream infections (Hecht et al., 2020)	Aim: To evaluate confounders impacting treatment failure using national guidelines recommendation for removal of the central venous catheter to prevent CLABSI caused by staphylococcus, fungi and pseudomonas.	Method: A retrospective analysis was used to study high-risk children aged less than 21 years from 1/2009-12/2015 with infected CVC due to CLABSI and other hospital-acquired infectious organisms. Compliance with national guidelines, re-occurrence, relapse, and patient death were evaluated concerning treatment failures due to catheter retention.	Results: Fifty-three children had 108 situations of CLABSI and 84 periods of hospitalization. Thirty-six Treatment failure was higher in patients with CVC retention compared to those with CVC removal with the confirmation of positive blood culture within seven days (Hecht et al., 2020).	Limitation: The author did not include the patients' demographics. The location and the name of the hospital used were not included.	Level 1: Comparative studies Rate: The study article is Weak. The author determined that noncompliance was the vital issue despite the national guideline recommending catheter removal and avoiding long retention of central venous catheters.	2
22. CINAHL Association of CLABSI with hospital length of stay, readmission rates, and mortality: A retrospective review (Chovanec et al., 2021).	Aim: To add to the contribution of evidence-based practice, the outcome of CLABSI infections among hospitalized patients includes prolonged length of stay,	Method: A retrospective study of hospitalized patients with central venous catheters between four hospitals in northwest Ohio and southeast Michigan	Results: The CLABSI infection rate across the four hospitals ranges from 9.2% to 34.2%. Hospitalized patients with CVC who developed CLABSI were 36.6%	Limitation: There was a bias in the study. The period of collection study was not specified.	Level II: Correlational studies Rate: Good The author finds a relation between the topic and the study. The study is an evidence-based practice	2

	readmission rates, and mortality rates.	was used for the study. The patient population was classified into two groups: CLABSI and no CLABSI; the outcomes of both populations were compared.	likely to die in the hospital and 37% readmission compared to patients who did not have CLABSI.		to effect a change to reduce CLABSI and improve quality care outcomes	
23. CINAHL Compliance with international prevention guidelines for central line associated bloodstream infections in neonatal intensive care units in Belgium: A national survey (Mahieu et al., 2022)	Aim: To assess for adherence to international prevention guidelines for CLABSI in NICU in Belgium and to study unit compliance to CLABSI	Method: A survey was used to determine the adherence of all the NICUs that are participant for the CLABSI guidelines: These includes catheter insertion, catheter maintenance, and quality control measurements Statistically multivariable linear regression was used to determine compliance to guideline,	Results: The overall results were 8.48/1000 central line days. CLABSI was found to be higher in larger NICU:10.87 %vs 6.69%. Compliance was highest for catheter insertion 64% but lower for catheter maintenance 47% and quality control measurements 50%.	Limitation: There was bias in the study, the author did not specify the number of NICU hospitals that are participants and the location either in the urban or rural. Generalization variables were not included. The number of catheter insertion, the rounding team how many times they did the measure for the results obtained.	Level II, Randomized Control Trial Rate: Moderate compliance to prevention guideline is associated to decrease CLABSI rate.	3

		unit characteristics and incidence rate of CLABSI from 2015 - 2016.				
24. CINAHL Factors associated with recurrence and mortality in central line associated bloodstream infections: A retrospective cohort study (Huerta et al., 2018).	Aim: To determine the factors causing the reoccurrence and mortality of CLABSI using retrospective cohort study.	Method: For over five years, a retrospective cohort study was done in a tertiary hospital for adults with hospital-acquired CLABSI (HA-CLABSI). Three hundred and sixty-six cases met the criteria. The primary outcome for antibiotic treatment is the time from the effective antibiotic treatment to the recurrence of infection or mortality, presumed to be 60 days after effective treatment. Effective	Results: The Median Sequential organ failure Assessment score was determined. It was six. The incidence of recurrence or mortality after 60 days was 22.1%. The effect of antimicrobial treatment was at its peak after 15 days. Using the Cox proportional-hazard model, the result analysis includes the following: antimicrobial hazard ratio was 0.35 (95% confidence interval). SOFA score hazard ratio was 1.16 (95% CI) and	Limitation: Performance bias was high.	Level: Randomized Control Trial/Cohort Rate: Weak The study will be rated as weak. The demographics of the patients in the study were not dictated. The location of the study needed to be stated. The author should have made mention of the limitations encountered during the study.	2

		treatment uses at least one antibiotic to which an infectious organism is sensitive. Patients were treated for a median of 15 days of antibiotics.	age 1.021 (95% CI). These factors were associated as determinants for recurrence and mortality in CLABSI.			
25. CINAHL Multidisciplinary efforts lead to CLABSI reduction (Klamka, 2023).	Aim: To focus on the in-depth needs of nurse managers through an in-depth environment of learning.	Method: The study was carried out at an urban free standing children hospital, the cardiac care unit (CCU) a 44-bed unit that cares for neonates and pediatric patients with congenital and acquired heart disease and adults with acquired heart disease. CCU leaders implemented multidisciplinary approach including intervention such as central line rounds, collaboration	Results: The focus was to decrease the infection rate from 1.64 to 0.75 over a 12-month period. The CCU was unable to achieve this goal but was able to decrease CLABSI infection to 1.05. After the 12-month period was able to achieve 100 days of CLABSI due to the continuity of the training and the intervention that was included.	Strength: The study was able to achieve positive result of decrease CLABSI from 1.65 to 1.05 even though the goal of 0.75 was not achieved.	Level: II Randomized Control Trial Rate: Good. The author of the article stated consistency for the time rounds for maintenance bundle and collaboration with IPC assist to buttress infection prevention.	3

		with infection prevention control (IPC) and use of maintenance bundle.				
26. CINAHL CLABSI rounding team: A collaborative approach to prevention (Pate et al., 2022).	Aim: To identify the effect of collaborative rounding team on the reduction of CLABSI	Method: The study was conducted in an 874-bed level 1 trauma at Academic Medical Center in Charlotte, North Carolina. A collaborative team approach of nursing leaders performs audits to assess the performance of individual units in the hospital and provide education tools as needed for intervention in each unit.	Result: There was a reduction in CLABSI, except for two peaks in CLABSI rate, due to an increase in Covid-19 hospitalizatio n and a decrease in audits	Strength: The results of the study, using a collaboratio n approach compliance with the guidelines for CLABSI reduction.	Level II Randomized Control trial. Rate: Good. The author was precise with the study.	3
27. Implementatio n of a central line rounding tool: Association for professionals	Aim: To observe the impact of central line maintenance bundle and nurse -led rounding, to	Method: The study was conducted in intensive care unit in Tennessee, due to inconsistent	Results: Compliance in central line dressing change was between 83.2-100%. CLABSI rate	Strength: The results of the study was positive. The quality improveme nt	Level: II Randomized Control Trial Rate: Good The study identifies the importance of	1

in infection control and epidemiology (APIC) 50th annual conference, June 26-28, 2023, Orlando, Florida (DeMuth et al., 2023).	prevent CLABSI.	in central line dressing maintenance and documentation. A quality improvement method, implementing central line bundle measures and nursing led interventions. A plan to do study act model was used for the study.	in the ICU. The monthly CLABSI rate in 2021 was 0.00-8.89. In the year 2022 monthly CLABSI rate was zero from planning to intervention phase.	intervention contributed to zero CLABSI maintenance in 2022.	compliance to guidelines	
28. Medline Reducing central line associated bloodstream infection (CLABSI) rates with cognitive science- based training (Lowery et al., 2022).	Aim: To determine the impact of cognitive science based CLABSI prevention training module among 541 registered nurses in different units in the Mountain West region of the United States of America.	Method: The participants were handed one CLABSI prevention bundle. Each bundle consists of 27 learning objectives to learn.	Result: The pre-training period consists of 6,642-line days. 9 CLABSI at a rate of 1.36 per 1000-line days. Post-training consists of 7,180-line days. Two CLABSI were discovered at a rate of 0.28 per 1000-line days. It corresponds to a 79% reduction in the CLABSI rate.	Limitation: The author should have discussed the study's limitations in the article. Limitation was not discussed in the article.	Level II: Randomized Control Trial Rate: Good The authors recommendation complies with the guidelines for the CLABSI bundle.	1

29. Medline Utilizing a multidisciplinary approach to reduce central line utilization and subsequent elimination of CLABSI (Trail & Fauth, 2023).	Aim: To utilize a multi-disciplinary approach to reduce CLABSI	Method: An action plan was set up, it includes vascular assessment specialist team, chief nursing officer, infection prevention team, and a nursing representative from each unit coming together for a huddle. Bedside nursing was being trained to impact change in CLABSI maintenance.	Results: Between April 2021-2022 CLABSI rate was recorded as 1.83 post-implementation CLABSI rate was zero.	Limitation: The variables of the study were not dictated in the study. It constitutes bias in the study.	Level II Randomized control trial Rate: Weak The article did not meet with the IRB requirements. The limitation of the study was not listed.	2
30. PubMed Decreasing central line-associated bloodstream infections through quality improvement initiative (Balla et al., 2018).	Aim: To study the effect of quality improvement using care bundle approach on central lines.	The study was conducted in a tertiary care neonatal intensive care unit (NICU) from June 2015 to August 2016. A quality control infection team was implemented for hand hygiene and CLABSI maintenance.	Results: There was an 89% reduction in CLABSI from 31.7 to 3.5 per 1000-line days. Bloodstream infection reduced from 7.3 to 2.3 per 1000 patient days and mortality reduced from 2.9% to 1.7%.	Strength: The positive reduction of CLABSI from the study, is compliance with the guideline's principles	Level II Correlational studies Rate: Good The author was precise with the study.	2

		Audits for assessing compliance were conducted.				
31. PubMed Nurses' compliance with central line associated blood stream infection guidelines (Aloush & Alsaraireh, 2018)	Aim: To evaluate the compliance of ICU nurses to CLABSI prevention guidelines and compliance predictors.	Method: A descriptive cross-sectional design was used for the study. Fifteen different hospitals in the urban city of Jordan were considered. The period of study from March to August 2017 and observation study was used to assess compliance of the 171 nurses as participants for prevention guidelines	Results: One hundred and twenty nurses are compliant. The mean score of compliance was 14.2. CLABSI score was variable among the units in the ICU; the predictor of compliance determined that the nurse-to-patient ratio was the only factor. The unit with a 1:1 nurse-to-patient ratio demonstrated increased compliance compared to their other colleagues with a 1:2 nurse-to-patient ratio.	Strength: The number of nurses as participants is sufficient, for the study. Five hospitals limit the bias of the study.	Level II Randomized Control Trial Rate: Good The author not only determines compliance to CLABSI prevention guidelines among the nurses but also identifies the predictor of variables to compliance. He found that the nurse-to-patient ratio was one of the predictors of variability.	3
32. PubMed Chlorhexidine Gluconate Baths: Supporting daily use to	Aim: To reduce CLABSI by adherence of the hematology-oncology	Method: The study was conducted at Emory University hospital with	Results: Three preventable CLABSI infections were due to	Strength: The article specifies the leadership steps before implementi	Level 1 Randomized control Trial Rate: Good	2

reduce central line associated bloodstream infections affecting immunocompromised patients (Jusino-Leon et al., 2019).	nurses to CHG baths with wipes per institution policy.	24 beds. The nurses were educated and trained before the implementation of the CHG wipes for cleaning the patients per hospital policy.	patient's refusal. The CLABSI rate was reduced from 8 events per 1000 central line days to 5.28 per 1000 central line days	ng the GHG wipes: Engage, educate execute and evaluate.	The author was precise, and the study's recommendation is evidence-based practice.	
33. PubMed Adherence to the central line bundle in intensive care: An integrative review (Burke et al., 2021).	To assess and integrate the existing literature on adherence to central line bundles for prevention of CLABSI	Design: An integrative review. The database used includes CINAHL, PubMed and Scopus.	Results: A total of 608 articles were identified, 407 articles were selected and screened for adherence to inclusion criteria. Nineteen articles were selected. None of the nineteen articles specify adherence to the central line bundle checklist..	Strength: The article identifies the cause of the gap in noncompliance with CLABSI prevention guidelines	Level 1 Systematic review Rate: Excellent. The author identifies the gap for noncompliance and recommends the creative and innovative techniques.	2
34. PubMed Prevalence of central line associated bloodstream infections (CLABSI) in intensive care and medical surgical units (Toor et al., 2022)	Aim: to evaluate CLABSI rate based on central line insertion sites using both ICU and Medical-Surgical units.	Method: A retrospective cohort study was conducted for the adults in the ICU (448 patients) and Medical-Surgical units	Results: A total of 13 CLABSI were observed from the patients: one patient from internal jugular, one patient subclavian catheter, four	Limitation: There is bias in the study. The generalization of the variables was not specified: These includes the acuity of the patient, the	Level II Randomized cohort study Rate: Good The author identified noncompliance and recommended measures to decrease	4

		(677 patients) a total of 1,125CVC were reviewed. The unit managers record the total number of central venous catheter insertions and the length of days on the daily unit log. The catheter insertion range was from five to 92 days. Central line insertion compliance was calculated as the number of clip forms submitted divided by the number of new central line insertions.	patients femoral and three patient peripheral inserted central catheter (PICC) and four patients' hemodialysis catheter	use of chlorhexidine at the site of insertion.	CLABSI, such as removing the CVC whenever the patient had an infection or the length of days for the central venous catheter was too prolonged.	
35. PubMed Development and Implementation of a real time bundle adherence dashboard for central line	Aim: To develop an electronic dashboard to monitor the adherence to CLABSI prevention guidelines	Method: An electronic dashboard was developed to allow virtual visualization for the adherence of	Result: Adherence increases from 25% in September 2018 to 44% in December 2019.	Strength: The virtual information the electronic dashboard allows the viewers to be able to	Level II Randomized Control Trial Rate: Excellent The author was consistent	3

associated bloodstream infections (Chemparathy et al., 2023).	across the hospital and in real time.	the bundle checks. The daily records for twice daily bundle checks would be documented and electronic dashboard would populate virtual display of adherence for the hospital.		compare CLABSI rates on all units simultaneou sly. An Increase in adherence from 25 to 44% specifies positive strength for the article.	with the study. Electronic dashboard usage allows data transparency for viewers and would be a useful tool for infection control.	
36.PubMed Quantitative results of a national intervention to prevent central line associated bloodstream infection: A pre-post observational survey (Patel et al., 2019).	Aim: To assess the effect of multimodal intervention for CLABSI in hospital with increase hospital acquired infection.	Method: The study was conducted between November 2016 and May 2018. 387 hospitals in 23 states of the District of Columbia were participants. A multimodal intervention for the study includes on-demand educational videos and webinars conducted by the experts.	Results: CLABSI rates before the study range from 0 to 71.4 per 1000 catheter days. Device utilization decreased from 24.05 to 22.07 central line days per 100 patient days between the pre and post-intervention period. CLABSI rate was from 0.88 to 0.80.	Limitation: Bias of the study: The author did not specify the number of central venous catheters used for the study. The results of catheter utilization were specified to decrease from 24.05 to 22.07.	Level II Randomized Control Trial Rate: Moderate. The result of the study for CLABSI was from 0.88 to 0.80. The multimodal intervention did not reduce the CLABSI in a hospital with disproportion ate hospital-acquired infections.	2
37. PubMed	Aim: To determine the	Method: A retrospective	Results: There was a	Strength. There was	Level 1	4

Impact of Covid-19 on hospital acquired infections (Halverson et al., 2022).	impact of the COVID-19 pandemic on CLABSI, causing increased hospital-acquired infection (HAI) rates at two hospitals within the same healthcare system in Illinois.	cohort study of two hospitals in Illinois. A suburban 159-bed community hospital and 894-bed urban academic training hospital between September 2017 and December 2020. The covariates for the study include diagnosis of COVID-19, total patient days, device days, standard utilization ratio, proportion of COVID-19 positive patient days, total registered nurse (RN hours per patient day, overtime hours, and total agency staff RNs (Halverson et al., 2022).	remarkable increase in CLABSI per 1000 patient days. When assessing staffing measures, there were notable increases in the percentage of hours premium pay for RNs per patient days and an increase per premium for agency hours paid. The results for the two hospitals as follow: During Covid-19 Patient: 12453 CLABSI per 1000 patient, d=0.24. CLABSI per 1000 device d=0.82. CLABSI SUR= 0.88 During Non-Covid Patient d=13288 CLABSI per1000 patient d=0.13	no bias in the study, and the covariates were listed. The hospitals were from two different areas, the urban and suburban areas, and the duration of the study was three years long enough for study.	Systematic review Rate: Excellent The result of the study indicates a clear understanding of the covariates that are significant factors for the increase of hospital acquired infection during this period.	

			CLABSI per 1,000 device d= 0.62 CLABSI SUR= 0.88			
38. PubMed The impact of coronavirus disease 2019 (Covid-19) on healthcare related associated infections in 2020: A summary of data reported to the National Healthcare Safety Network (Weiner-Lastinger et al., 2022).	To assess the effect of the COVID-19 pandemic on healthcare-associated infection incidence in hospitals at national and state levels. A standardized utilization ratio was utilized. SIR was calculated quarterly in 2020 and compared to 2019.	Method: CLABSI, Catheter-associated urinary tract infections (CAUTI), ventilator-assisted events (VAE), selected surgical site infections, C. difficile, and Methicillin-Resistant Staphylococcus aureus (MRSA) and bacteremia were reported to National Healthcare Safety Network between 2019 to 2020. The standardized infection ratio for 2020 was calculated and compared to that of 2019.	Results: There was a notable increase in CLABSI, CAUTI, VAE, MRSA and Bacteremia in 2020 compared to 2019. With CLABSI in 2020-Q3 SIR was 1.01 and had the most significant increase in the number of 4,460 CLABSI events compared to 2019 -Q3 with CLABSI rates of 2911 representing a 53% increase rate of CLABSI. The change in CLABSI SIR varies state to state and depends on the quarter. The national CAUTI SIR increased,	Strength: The result of the study provides a national increase in HAI due to the ongoing Covid-19 in 2020. It signifies a need for conventional adherence to guidelines for further pandemic that is yet to occur. Limitations: The results were analyzed based on the hospital that reported data for 2019 and 2020. New hospitals opened in 2020 were not recorded.	Level: 1 Systematic Review. Rate: Good The results of the study are congruent to the pandemic situation. The year 2020 was an unprecedented time for hospitals. Many hospitals faced the challenges of insufficient staff, increased patient admission rates, and inadequate staffing, which limited the implementation and effectiveness of CLABSI guidelines at the time.	4

			from Q1 to Q4 in 2020 from 0.59 to 0.82 (Weiner-Lastinger et al., 2022).			
39. PubMed Characterizing the relationship between coronavirus disease 2019 (Covid-19) and central line-associated bloodstream infection (CLABSI) and assessing the impact of a nursing-focused CLABSI reduction intervention during the Covid-19 pandemic (Ben-Aderet et al., 2022).	Aim: 1.To examine the effect of Covid 19 infection rate and characterize these patients that developed CLABSI due to COVID-19. 2. To evaluate the effect of a CLABSI reduction quality improvement control for inpatients with Covid and non-Covid patients.	Method: A retrospective cohort analysis was utilized for the study. The setting was a tertiary care hospital with 889 beds in the urban city of Los Angeles. Participants are 18 years or older with CLABSI as defined by the National health Safety Network. CLABSI rate were analyzed for two cohorts between March 2020-August 2021. The first cohort analysis was Covid-19 CLABSI patients and non-Covid-19 patients. The second	Results: The rate of CLABSI during COVID-19 was notably higher, 4.75 per 1000 catheter days compared to non-COVID-19 CLABSI 0.63. For the second cohort, the results after implementing the quality control. For non-Covid 19 CLABSI, CLABSI rates were reduced from 0.97 to 0.43. with COVID-19 CLABSI, no significant difference changed from 5.11 to 4.56.	Strength: The analysis of the results corresponds to pandemic situations. There was an increase in CLABSI generally in all healthcare during the pandemic period. The quality control implementation on COVID-19 CLABSI patients showed no significance due to the comorbidities of these patients.	Level II. randomized control trial. Rate: Good The study compared the implementation of quality control measures on non-covid CLABSI, and there was a reduction in CLABSI rates; when compared with Covid CLABSI with the implementation of control measures, no significance in the reduction of CLABSI to prove CLABSI as the primary cause of the increase in CLABSI rates during the pandemic.	4

		analyses were non-Covid CLABSI rates utilizing a quality improvement control.				
40. PubMed Implementation of a vascular access team to reduce central line usage and prevent central line-associated bloodstream infections (Savage et al., 2019).	Aim: To demonstrate if establishing a dedicated vascular access team (VAT) will reduce central line usage and decrease CLABSI through education and implementation of guidelines.	Method: A VAT team was set up in a tertiary hospital with 373 beds in Western Kentucky due to an increased rate of CLABSI in the hospital. The VAT went through training and assisted in the hospital with the placement of midline and peripheral lines and the removal of unused central lines—a pre- and post-intervention retrospective study between January 2015 and April 2017.	Results: The period before the utilization of the VAT team Jan 2015 to April2016, central line usage was 19.7% and 20 CLABSI cases. In the period of VAT formation between May 2016 to April 2017, central line utilization was 15.9%, and there were seven cases of CLABSI. After VAT formation between May 2017 and August 2018, central line usage decreased to 10.8% and CLABSI cases	Strength: The success rate of CLABSI improvement was 80%, which declares the study's success. Limitation: According to the article's author, the hospital changed its charting program in September 2016. it was noticed that two different programs were used for data collection, contributing to a bias in the study.	Level II Randomized Control trial Rate: The study was rated as good. The author of the article discussed the limitations of the study. The study addressed the complications of CLABSI through the use of a vascular access team (VAT). The study contributes an impact to guideline principles for CLABSI.	2

			decreased to two. The utilization of central lines decreased by 45.2%, and incidence of CLABSI decreases by 90%. And CLABSI rate improved by 80% (Savage et al., 2019)			
41. PubMed CLABSI reduction using evidence-based interventions and nurse empowerment: A quality improvement initiative from a tertiary care NICU in Pakistan (Hussain et al., 2021).	Aim: A CLABSI prevention package was developed using evidence-based, proven interventions to reduce CLABSI rates.	Method: The study was done at a tertiary care level three NICU at Aga Khan University Hospital, Karachi, Pakistan. The study was performed in three phases: the pre-implementation phase between January 2017 and March 2017. All admissions in NICU between this period were included in this phase. In the second phase known as CPP	Results: CLABSI rates decreased from 17.1/1000 device days to 5.0/1000 device days and the utilization ratio decreased from 0.30 to 0.25. The results correspond to 70% reduction of CLABSI.	Strength: The result yields a reduction of CLABSI with the use of CPP. Limitation: It is a quality improvement project, there is a bias of study of unmeasured confounding variables.	Level: II Rate: Good. The study identifies the use of CLABSI prevention package for reduction of CLABSI in NICU. These package measures are included in the guideline principles for CLABSI.	2

		implementation phase from January 2017 to March 2017, all components of CPP were put in place, and these includes hand hygiene, central line insertion, central line maintenance, organism specific prevention for fungal infections, and nurse empowerment. The third phase post implementation phase is from April 2017 to March 2018. All NICU patients with central line are followed until discharge, transfer from NICU or death.				

42.PubMed The preventable proportion of healthcare-associated infections 2005-2016: Systematic review and meta-analysis (Schreiber et al., 2018).	Aim: The aim is to evaluate the rate of hospital acquired infections using different infection control intervention in different economic settings.	Method: Design: A systematic and meta-analysis was used for the study. Searching the following database: Ovid, Medline, Embase, CINAHL, PubMed, and the Cochrane Library for studies assessing interventions to reduce CAUTI, CLABSIs and Surgical site infections (SSI) ventilator assisted pneumonia (VAP)and hospital acquired pneumonia (HAP).in acute and long-term care settings. The risk ratio estimates were determined.	Results: 5,226 articles were generated; 144 articles were used for the final analysis. The pooled incidence rate ratio involved in the use of multifaceted intervention was 0.543. for CAUTI 0.459, for CLABSI 0.543 for VAP, 0.461 for SSI The pooled rate ratio was 0.611 for before studies and 0.509 after studies.	Limitation: The risk of bias was high in 143 of 144 studies (99.3%).	Level: I Systematic and meta-analysis Rate: Moderate The results of the preventable proportion of hospital acquired infection (HAI)of the systematic and meta-analysis 35 - 55% indicates many implementations of the guidelines' principles for evidence-based practice.	2
43. Medline	Aim: To evaluate the	Method: The study was	Results: The results	Limitation: The study	Level II	1

Assessing nurses' adherence to a central line maintenance care checklist on a pediatric inpatient unit (Sabo et al., 2018)	adherence of the nurses to central line bundle maintenance using an evidenced base checklist and to provide education for the nurses as a predictor of non-adherence.	carried out in a 24-bed pediatric unit. The study was carried out over thirteen months. It is a before- and -after design study. The nurses 'adherence to checklist was observed, before, and intervention was done by educating the nurses; adherence was also observed.	indicate improved dressing change and port access ($P< 0.001$ and $P= 0.0071$. The dressing site of the central line was found to be clean, and increased hand hygiene and cleansing of the port access 15 seconds prior to use was also improved.	was carried out in a single pediatric unit. Generalizability to other populations are limited.	Randomized control trial. Rate: Poor. The name of the hospital, location, and the number of nurses as participants were not mentioned and the number of central lines for the study was not indicated. These are covariates used for generalizability; there is bias in the study.	
44. Medline Poor adherence to guidelines for preventing central line associated bloodstream infections (CLABSI) results of a worldwide survey (Valencia et al., 2016).	Aim: To evaluate the attitudes and practices in intensive care units and assess compliance with CLABSI prevention guidelines.	Method: The study was between June and October 2015. They were using an online questionnaire for nurses and doctors in ICUs worldwide. The study aimed to explore practices such as central line insertion, maintenance,	Results: Ninety-five countries that participated provided 3407 as individual responses. No low income, 14 middle income (MIC) and 27 high incomes (HIC) provided 10 or more responses. 80% MIC and 81%	Limitation. The results of the study are biased because the results for the responses are questionnaire based, some of the responses may not be factual, and the priorities of each country are different	Level II Randomized control trial Rate: Good. The topic of the article was a guideline, and the study was a worldwide study; variability was included.	2

		and measurement of CLABSI using SHEA guideline as a standard. Weighted estimates were computed using high, middle and low income and population as weight, and only countries that responded with ten responses were considered as participants.	HIC reported writing clinical guidelines for CLABSI prevention in their ICU. 23% MIC, and 62% HIC reported compliance with the following items for central line insertion: hand hygiene, full barrier protection, chlorohexidine > 0.5%. MIC 60% and HIC 73% reported daily assessment of the need for a central line (Valencia et al., 2016)	based on the results.		
45. CINAHL Reducing central line associated bloodstream infections (CLABSI): An improvement project in a specialized tertiary hospital (Mostafa et al., 2022).	Aim: A performance improvement project to address 144 CLABSI events in a tertiary care hospital with a 1600- beds in Saudi Arabia.	Method: The performance improvement project team applied a plan to do study cycle (PDSA) and other interventions such as: policies and procedures for central	Results: The CLABSI rate dropped from 1.5 per 1000 device days to 1.03 per 1000 device days. In 2018, CLABSI events were 24% and 15 % in 2019. The overall	Strength: The intervention has progressed with a reasonable decrease in CLABSI reduction. The duration of the study was long	Level II Randomized control trial Rate: Good. The authors were consistent in their study, to attain achievable results.	2

		line insertion and maintenance, physician training for central line insertion by simulation, an awareness campaign that involved healthcare workers recognition and patients' engagement, performing root cause analysis for CLABSI events and maintenance of bundle documentation in the hospital information system.	decrease in CLABSI events was 35 % from 2017.	enough to reduce bias of study.		
46. CINAHL A quality improvement project to decrease CLABSIs in Non-ICU settings (Engel et al., 2023).	Aim: To assess the QI team implemented use of 2% chlorhexidine gluconate (CHG) cloths for daily bathing for non-ICU patients with a central line.	Method: The study was a pre- post design. Thirty-four non-ICU settings were participants, including medical-surgical, oncology, neurosciences, cardiac, orthopedic and pediatrics.	Results: The CLABSI rates after the intervention were not statistically significant P=0.15 but were clinically significant, with a CLABSI reduction of 22.8% .SPC charts demonstrated stability after	Strength: The setting used for the study was a non-ICU setting with other specialized units. No bias in the study Limitation: During the study, the facility's location needed to	Level: II Rate: Good The result of the study is consistent with guidelines of using CHG wipes to reduce CLABSI in all settings.	2

		2% CHG wipes were implemented using e-learning module, printed educational material, educational outreach, engagement of unit-based champions and electronic reminder in the electronic health record all these to assist compliance of using the 2% CHG wipes. A linear mixed effect model assessed CLABSI rate change before and after implementation. Stability Process Control (SPC) was used to monitor CLABSI stability, and CHG bath were documented and used as a	the intervention for all other three hospitals in the system. The CHG wipes compliance increased from 77% in Jan 2020 to 94% in Feb 2021.	be specified as an urban or rural area to determine variance in the inadequate supply of material needed.		

		process measure. All the audit results were compiled and provided to clinical manager of the unit. Qualtrics survey were provided to nursing leadership to evaluate their satisfaction with using the 2% CHG wipes.				
47. CINAHL Compliance with Central line maintenance bundle and infection rates (Sandeep et al., 2023).	Aim: To determine the correlation between the bundle compliance and the CLABSI rate and identify which hospital and process factors impact the correlation.	Method: One hundreds and fifty-nine hospitals were participants for the study. Data were examined from January 11 to December 21 on bundle compliance every month. The correlation between CLABSI rates and bundle compliance were done at network level.	Results: The hospital reported 27, 196 CLABSI on 20,274,565 lines days (1.34 CLABSI/1000-line days. From 2 460 133 observed bundle opportunities, 2 085 700 (84%) were compliant. There was a negative correlation between the monthly bundle reliability and monthly CLABSI rate	Strength: No bias in the study. Considering the data used, 20 274 565 lines and 27 196 CLABSI rates.	Level 1 Systematic review Rate: Good The author was consistent with the study. 84% compliant result is adherence to best practice guideline	2

		Negative binomial regression was used to determine the impact of the hospital type and central line audit rate and a safety culture program was adopted for the association between bundle compliance and CLABSI rates.	(-0.35, P< 0.001)			
48. CINAHL Chlorhexidine gluconate locking device for central line infection prevention in intensive care unit patients: A multi-unit, pilot randomized controlled trial (Pook et al., 2022).	Aim: To assess the use of chlorhexidine gluconate as a locking device for central line infection prevention.	Method: Participants for the study were randomized to standard care or with chlorhexidin e gluconate lock solution (CHGLS) within 72 hours after being admitted to ICU. The CHG solution was instilled into the catheter device and not infused.	Results: From the study 3, 848 patients were screened and 122 were eligible for the study. Consent was obtained from 82% of the patients. Each group comprised fifty participants, and tracking logs indicate the CHGLS was used 408 times per protocol. The	Strength: The number of participants screened for the study was 3,848 and only 122 were eligible, indicating that covariates that could cause bias in the study were already eliminated.	Level II Randomized control trial Rate: Good The positive result of the study complies with the CLABSI guidelines principles to control CLABSI infection.	2

		Blood cultures are taken as baseline and every 48 hours from the central venous access device.	result of the study also indicates proportion of colonization was higher with the standard group 40 (29%) as compared to the group with CHGLS 26 (18.7%)			
49. CINAHL Chlorhexidine Bed bath improves CLABSI: A meta- analysis (Lin et al., 2017).	Aim: A systematic review and meta-analysis were used to assess the effect of a 2% chlorhexidine bed bath on the risk of central line-associated bloodstream infections	Method: England's public health resource unit provides the critical appraisal skills program and estimates crucial appraisal tools from the Joana Briggs Institute, which assesses the quality of procedures. The study identified six studies using the keyword search terms CHG and Soap water for bed bath experiment. Revman analysis was used to	Results: The comprehensive effectiveness of the study was 0.45(95%, CL(0.35, 0.58), P < .001. The CHG bed bath was effective in reducing CLABSI.	Limitation: The article needed to give detailed information on how many central lines were used for the study, and the study period for the conclusion of the results was not included.	Level:1 Systematic and Meta-analysis study Rate: Good. The study's meta-analysis indicated that bed bath reduces CLABSI and is favorable to guideline principles.	2

		conduct the meta-analysis.				
50. CINAHL Reduction in patient refusal of GHG bathing (Destine et al., 2023).	Aim: Aim: To minimize patient refusal of CHG bath, increase compliance with CHG bathing, and evaluate the CLABSI and nurse's staff knowledge of CHG wipes.	Method: The study occurred in a community hospital of a 26-bed surgical unit in the southeastern United States. A Plan to Do Study Act PDSA was used using flyers, in-person education, and an electric module set up, and each nurse was required to pass 80% of the quiz. Electronic recordings of CHG bathing and patient refusal were documented in EHR.	Results: From January 2020 through February 2021, the median percentage of patient refusal was 23%. The median percentage dropped from March 2021 to September 2022 to 8%. From January 2020 through February 2021, the median percent of CHG compliance was 46%. The CLABSI rate before the PDSA cycle was 0.69 per 1000 central line days. After the PDSA cycle, the CLABSI rate was 0.65 per 1000 central line days, a 6% reduction.	Strength: The reduction rate of patients refusing CHG baths and the increase in CHG bathing is a remarkable success of the study	Level II Randomized trial Rate: Good The author was consistent with the study, using PDSA to improve the nurses' teaching and improving the patients' knowledge so they do not refuse the CHG bath to reduce hospital-acquired infections.	3

51 PUBMED Catheter securement impact on PICC related CLABSI: A university hospital perspective (Rowe et al., 2020)	Aim: To determine if the use of subcutaneous engineered securement device (SESD) for peripherally inserted central line catheters in acute care settings has an impact on CLABSI reduction compared to traditional adhesive engineered securement device (AESD)	Method: A retrospective study review of 7,776 cases was conducted at the University of Arkansas medical center in a 500- bed trauma hospital. The study was between January 2015 and December 2018. The participants have implanted central lines and they are grouped by securement device AESD and SESD	Result: Cumulative incidence for each group was AESD 1.79%, SESD 0.46%. A risk ratio of 3.88, which explains that those with AESD had 3.88 times the risk for a CLABSI than those with SESD. Using percent relative effect those who had AESD had a 288% increase in risk of CLABSI	Strength: The result of the study indicates the importance of securement devices to decrease CLABSI in acute care settings. The study demonstrate d direct positive impact of Using SESD instead of AESD	Level: II Randomized Control Trial Rate: Good The article was well presented, and the covariates of the study were included.	2
52 PUBMED Alcohol-impregnated caps and ambulatory central line-associated bloodstream infections (CLABSI): A randomized control trial (Milestone et al., 2021)	Aim: To determine the effect of 70% isopropyl alcohol-impregnated central venous catheter caps on ambulatory central- line associated bloodstream infections (CLABSI) in pediatric hematology	Method: The study was conducted in 15 pediatric healthcare institutions, including the 16 pediatric hematology-oncology clinics. The study was conducted for 24 months using a	Results: There was no significant reduction in CLABSI using 70% isopropyl-impregnated caps. The result of the study was 1.23 per 1,000 days using 70% isopropyl alcohol-	Strength: The strength of the study include inclusion of 15 hospitals, which eliminates bias in the study. Limitation: The study did not collect any information	Level II Randomized Control Trial Rate: Good The result did not show significant changes for CLABSI, but the use of Isopropyl 70% for blood cultures had a significant reduction.	2

	oncology patients.	cluster randomized clinic trial. The intervention for the study for each institution includes usual ambulatory central line care with caps impregnated with 70% isopropyl alcohol and without impregnated caps with 70 % isopropyl alcohol.	impregnated caps compared to standard practice 1.38 per 1,000 days.	about patient data.		
53.PubMed the chlorhexidine gluconate bathing implementation intervention to improve evidence-based nursing practices for prevention of central line associated bloodstream infections study: A stepped wedge cluster randomized control trial (Reynolds et al., 2021)	Aim: To evaluate the effect of the implemented chlorhexidine bathing for critically ill patients for CLABSI reduction and to determine the effect of nurses' compliance to the use of the Chlorhexidine baths for the patients.	Method: The study was conducted in two large hospitals in the southeastern United States. One academic hospital with 957-beds, and the other community with a total of 683-beds. Fourteen units in the hospital were part pf the study. Grol and Wensing	Results: There was a clinically significant reduction of 27.4 % decrease in CLABSI rates. CHG bathing compliance and the nurse's knowledge and perception about the important of CHG bathing have improved.	Limitation: The documentation of the CHG bathing by the nurses into HER may. Not be accurate and measuring CHG bathing by direct observation for audits will be challenging	Level I Randomized Control Trial. Rate: Good The authors were consistent with the study ensuring that the bias of the study was eliminated.	3

		Model of implementation was used as a study guide. The implementation strategies included educational outreach visits, audits, and feedback. Compliance with the appropriate CHG bathing documentation was assessed. The outcomes of the study were assessed after 12 months of the intervention.				
54.PubMed Prevention of central line associated bloodstream infections through educational interventions in adult intensive care units: A systematic review (Foka et al., 2021).	Aim: To evaluate the impact of educational interventions on healthcare for CLABSI reduction: A systematic review	Method: The study involves a search of electronic databases of Medline, CINAHL, Cochrane databases, for systematic review of published studies on CLABSI	Results: The database yielded 339 articles for the search databases (CINAHL, Medline and Cochrane). Some of the articles obtained needed to meet the inclusion criteria for	Limitations: The educational interventions used in the study are heterogenous. The study was conducted for ICU settings only, with bias. The findings cannot be	Level 1 Systematic review Rate: Good The studies included three databases (CINAHL, Medline, and Cochrane) and the period for the data used from 1995 to 2020 was long to	3

		from 1995 to 2020 with the inclusion of 27 interventions on CLABSI bundle with the documentation of CLABSI per 1,000 catheter days. Data extraction and quality assessment were considered as part of the criteria used during the systematic database search	the studies, but they were excluded. The total number of articles used for the study was 27 articles. These articles met the inclusion criteria. All studies used educational intervention. The results indicated with educational interventions, there was a reduced CLABSI	generalized to other units. The longevity period of studies from 1995 to 2020, could affect the educational intervention for the study because of the development of a new technology strategy	avoid limitation of study.	
55. PubMed An analysis of outcomes following a central line associated bloodstream infections (CLABSI) reduction quality improvement project in a tertiary care center (Harris et al., 2023).	Aim: To evaluate the effect of CLABSI reduction using quality improvement studies within a single ICU at a tertiary care medical center and compared with other healthcare systems that did not implement the CLABSI bundle.	Method: The study was conducted at a surgical intensive care unit ((SICU), and a quality improvement for CLABSI maintenance was implemented. Some of the practices as part of CLABSI reduction involve using chlorhexidin	Results: The period of study was from June 2021 to December 2022. CLABSI counts within the SICU were compared to other health care systems without implementing the CLABSI bundle. SICU showed a	Limitation: Only one SICU with the implementation of CLABSI bundle was used to compare with the other healthcare systems with no implementation of the CLABSI to confirm the results for CLABSI	Level: II Randomized control trial Rate: Weak The authors should have disclosed if the study was done in the urban area. The number of central line catheter used for the studies were not reported, and CLABSI line per day information	1

		e wipes for bathing the patients, line maintenance, cleaning the site daily with chlorhexidine wipes, changing the site every seven days, and removing infected lines and unused central lines. Daily checklist for line inspection, proper dating of IV tubing, and changing the lines when necessary, discouraging the use of central line for daily blood draw.	sustained reduction of CLABSI almost at zero following the implementation of the bundle. Compared to other health system ICUs with no implementation, it consistently showed CLABSI events greater than two per month.	reduction due to quality improvement practices that were implemented. There are confounding variables that causes bias in the study.	was not stated in the article.	
56.PubMed Impact of nursing education on CLABSI rates: An experience from a tertiary care hospital in Eastern India (Acharya et al., 2019)	Aim: To evaluate the impact of nursing education on CLABSI bundles.	Method: The CLABSI baseline rate was determined in the ICU for six months. Thirty-four nurses were participants, an educational	Results: The CLABSI rate was 12.5 per 1000 catheter days for pre-intervention. 53.4% of hand hygiene opportunities should have been included. Post training,	The bundle interventions for catheter maintenance were not disclosed. The sites of the catheter insertion, the severity of the patient's	Level II Randomized Control trial Rate: Good The authors admit that hand hygiene can be easily performed, but sustaining the practice is challenging	3

		program on hand hygiene steps was conducted, and objective assessments were done to assess the knowledge gained and compliance with hand hygiene training. CLABSI rate after the post-intervention was assessed	there was a significant decrease of CLABSI 8.6 per 100-catheter days, and hand hygiene opportunities decreased to 33.5%.	illness, and the presence of another catheter were not stated. Although the study yielded a reduction in CLABSI with hand hygiene, I cannot say specifically that hand hygiene alone is a contributory factor for CLABSI reduction in this study.	and suggest regular training, continuous reminders, and motivation for healthcare workers.	
57.PubMed Antiseptic barrier caps to prevent central line associated bloodstream infections: A systematic review and meta-analysis (Gillis et al., 2023).	Aim: To evaluate the efficacy and safety of antiseptic barrier caps by comparing CLABSI rates in patients using antiseptic barrier caps versus standard care.	Method: A System database: Medline, EMBASE, Cochrane, and CINAHL were used for the literature search. The articles were included in the meta-analysis if they have either of the two variables: total catheter days, number of	Results: The intervention group had antiseptic barrier caps 391 CLABSIs in 273,993 catheter days with an incidence rate of 1.43/1000 catheter days. The standard care group had 620 CLABSIs in 284.912 catheter days with an incidence	Strength: A comprehensive data search was done considering the variable factors and using several databases. Limitation: heterogenicity and high risk of bias are limitations of the study.	Level I Systematic review Rate: Good The study is evidence based: Antiseptic barriers caps are an effective strategy for CLABSI reduction.	2

		CLABSIs, and CLABSI per 1000 catheter days.	rate of 2.18/1000 catheter days with a risk ratio of 0.65			
58. PubMed Sustained reduction of catheter associated bloodstream infections with enhancement of catheter bundle by chlorhexidine dressings over 11 years (Eggimann et al., 2019).	Aim: To evaluate the effectiveness of chlorhexidine dressings in addition to CLABSI bundle on the incident density rate of catheter associated bloodstream infections.	Method: The study was conducted in a 35-bed mixed adult ICU of the Centre Hospital Universitaire, Switzerland. Chlorhexidine sponges and gel were added to the CLABSI bundle for all the central line dressings to evaluate the impact of the sponge dressing with chlorhexidine.	Results: From 2006 to 2014, 18,286 patients were reported to be admitted to the facility. 91,292 ICU days and 155,242 catheter days, 11 CLABSI were recorded. The significant decrease in CLABSI rates was 1.48. The progressive decrease of CLABSI when the chlorhexidine gel was used was 0.69, and with chlorhexidine sponges, 0.23	Strength: The long period of the study, eleven years, supports the recommendations for systematic use of CHG dressing in ICU because of the evidence-based study.	Level II Randomized control trial Rate: Good The author was consistent with the project study, and the positive results of the chlorhexidine sponges used in the ICU confirmed the study is imperative.	2
59. PubMed Prevention of hospital acquired bloodstream infections through	Aim: To assess the impact of daily bathing with 2% Chlorhexidine wipes on the occurrence of	Method: A system database search using Medline, EMBASE, Cochrane	Results: A reduction in the rate of hospital-acquired bloodstream infection was	Limitation: A system-generated study will result in heterogenicity of the	Level I Systematic and meta-analysis Rate: Good	2

chlorhexidine gluconate impregnated washcloth bathing in intensive care units: A systematic review and meta-analysis of randomized crossover trials (Afonso et al., 2016).	central line associated bloodstream infections and hospital acquired infections.	Library and Web of Science databases was used to search the literature for the project study. The inclusion criteria include Adult pediatric and neonatal ICU population. CHG bathing wipes, records of intervention on hospital acquired bloodstream infection and CLABSI. The search generated 22,850 patients from 15 adult and 10 pediatric population. The treatment group included patient that had 2% daily bathing and the control included patients with daily bathing non-	observed using the 2% CHG bathing daily. (OR: 74; 95%, p= 0.002) with moderate heterogeneity .	procedures used for the study, and it is a bias of the study.	The positivity of the results of the search corresponds to the topic of the study, that CHG wipes contribute to CLABSI reduction.	

		antiseptic-impregnated washcloths.				
60. Medline Compliance with Central line maintenance bundle and infection rates (Tripathi et al., 2023)	Aim: To identify the correlation between reported CLABSI compliance and CLABSI rate as a solution for patient safety network.	Method: The study was from January 11 to December 21 in a 159-bed hospital. Data on bundle compliance were examined in correlation with the CLABSI rate per month. Negative binomial regression was used for analysis to determine the impact of hospital type and central line audit rate.	Results: The hospital reported CLABSI during the study was 27 196 on 20 274 565-line days (1.34 CLABSI/1000-line days). The observed rate of bundle opportunities is 2 460 133, out of which 2 085 700 were compliant. There was a negative correlation between monthly bundle reliability for reported CLABSI bundle compliant and observed.	Strength: 159 hospitals are large enough for general variability. Limitation: The unit of the hospital, number of patents as participants and the site of the catheter were not listed as confound variables for the study.	Level I Randomized control trial. Rate: Good The result of the study is compliant to evidenced-based study. Adherence to practice guidelines will result to CLABSI reduction.	4
61.PubMed Insertion site Inflammation was associated with central line associated bloodstream infections at a tertiary care center, 2015-	Aim: To evaluate the association of insertion site inflammation with CLABSI	Method: A retrospective design of collecting data from January 2015 to October 2018 at the University of	Results: From January 2015 to October 2018, there were 714,709 patient days and 265,268 central line days. The	Limitation: The study was performed at one center; the results may not be generalizable. The	Level: II Randomized Control Trial (RCT) Rate: Good The findings of the study are associated	4

2018 (Kobayashi et al., 2021)		Iowa Hospital, an 811-bed tertiary care. The study involved a control case, a central catheter site with no inflammation, with the study case with inflammation Inflammation sites include any of the following: edema, erythema, redness, tenderness, and drainage.	total line assessments performed by the nursing staff were 2,324,446, and 286 CLABSI was detected. Insertion site inflammation (ISI) was associated with those with CLABSI compared to the control study (30.4% vs 22.4%). Odd ratio, 1.51; 95% CI, 1.03-2.23; P= 0.36.	definition of insertion inflammation site (ISI) was generated. It may be used only for a variety of studies. The assessment of the ISI was subjective, and independent assessments were done, not supervised. Recommendation: The author suggested from the study a close relationship between the Inflamed site of central venous catheters and the cause of CLABSI. There are no guidelines for central line insertion currently.	with the authors topic. The study is related to guidelines needed to reduce CLABSI.	

62. PubMed Infection prevention practices in the Netherlands: Results from a national survey (Huis et al., 2020)	Aim: To determine the extent of compliance by the acute care nurse to adopt to recommended practices to prevent CLABSI, CAUTI and Ventilator associated pneumonia (VAP) and C. difficle.	Method: The study was conducted between July 18, 2017, and October 31, 2017. All infection teams of all acute care hospitals in Netherlands were surveyed Intervention: The survey instrument used was translating Healthcare Associated Infection Prevention Research into Practice (TRIP) questionnaire.	**Results:** Out of 72 eligible hospitals, 47 responded. Surveillance systems used for monitoring CLABSI, CAUTI, VAP, and CDI are as follows: 95.4, 17.8, 26.2 and 77.3% of hospitals. An antimicrobial stewardship program was established in 91.5% of participating hospitals. For CAUTI, 95% of hospitals constantly use aseptic techniques. For CLABSI, all hospitals regularly use maximum sterile precautions and chlorhexidine gluconate as an aseptic technique for the insertion site. 65.9% of hospitals avoid the use of femoral central lines.	Strength: The decline of CLABSI using the surveillance system proves that it is an effective tool for the study. The study demonstrated that the compliance rate for daily checks of the central line increased from 60 to >80%. Limitation: The response rate was less than 1000%. The non-response hospital would have biased the study. Recommendation: The author comments on variations among the Dutch	Level II Randomized control trial. Rate: Good. The study maintains practice guidelines-consistent and definitive result.	2

				hospitals regarding infection practices. The suggestion is hospital-wide implementation.		
63. PubMed Decreasing central line associated bloodstream infection through limiting the use of central venous catheters for routine blood draws (Kuriakose, 2020)	Aim: To evaluate the rate of CLABSI with central line venous catheter constantly used for blood draws.	Method: The nursing staff were educated on limiting the use of central lines for blood draws. A pre- and post-education study was used to determine the CLABSI rate, and measurable outcome were compared.	Results: The number of Central venous catheters accessed for blood draws decreased. Decrease CLABSI event rate.	Strength: The result of the study supports CLABSI guidelines to limit CLABSI rate of infection. Recommendation: The use of central line catheter use for blood work should be limited. Since the results of the study indicated that limiting the number of times the central lines are accessed for blood draws reduced CLABSI.	Level II Randomized Control Trial Rate: Good The focus of the study is limiting CLABSI rate according to guidelines principles. That is a good and reasonable conclusion.	4
64. Medline Using the agile	Aim: To determine the effect of the	Method: The study was conducted	Results: The intervention	Limitation. Two hospitals for	Level: II Observational Study	2

implementation model to reduce central line associated bloodstream infections (Azar et al., 2019).	agile implementation model to reduce CLABSI	using an observational study in a tertiary care hospital in Indianapolis from January 2015 to June 2017	reduced the CLABSI from 1.76 to 1.24. Rate ratio=0.70, P=0.011. Clostridium difficile and surgical site infections were also observed to be reduced.	the study, the number of central line catheters, and central line days should have been discussed during the study. These confounded variables affect the generalization and cause bias in the study.	Rate: Weak The article needed to be more detailed. The central line days, the number of catheters observed, and what the agile implementation model entails need to be further explained.	
65. Medline Prolonged use of intravenous administration sets on central line-associated bloodstream infection, nursing workload and material use: A before-after study (Van de Pol et al., 2023).	Aim: To evaluate the impact of prolonged intravenous administration sets from four to seven days on the incidence of CLABSI	Method: A retrospective study was used for a single tertiary care hospital. St Antonius hospital Nieuwegein, in Netherlands. It is a 32-bed ICU that offers both medical and surgical care for patients above the age of 18. The study included pre and post-intervention.	Results: The number of CLABSI rates did not change despite the changes in the time interval from four to seven days. Recommendation The prolonged use of IV administration sets is safe for up to seven days, as in the case of 96 hours.	Limitation: The study did not indicate the severity of the illness of the patient to determine if the CVC insertion was done in an emergency for slight chances of infection	Level II Retrospective study. Rate: Good The article meets up with the requirement for human research and the contents of the article: Abstract, Aim/objective, method results discussion, and conclusion. Limitation of the project	4

		The total number of participants in the study included 1409 patients			was all included	
		and 1,679 CVC's. For the pre-intervention, 579 patients participated, and 850 participated post-intervention. For pre-intervention, 674 CVCs were included. The number of days for intravenous administration sets were changed from four to seven days				
66. Medline A hospital-wide reduction in central line-associated bloodstream infections through systematic quality improvement initiatives and multidisciplinary teamwork	Aim: To examine the effect of systematic quality improvement initiatives and multidisciplinary teamwork in the reduction of CLABSI	Method: The prospective study was conducted in two phases: Baseline and intervention phase between January 2017 and October 2018 in a teaching	Results: The CLABSI rate decreased from 2.84-0.56 per 1,000 days in ICUs (P<0.001) and 0.82-0.47 per 1,000CVC days in non-ICUs (P=0.003).	Limitation: The confounding variables for the study, such as the number of central line venous catheters observed both before	Level II Prospective Study. Rate: The article is well-detailed. The author includes the abstract, aim, methods, discussion,	1

(Han et al., 2019).		hospital in China. For the intervention phase, A systematic quality improvement and multidisciplinary teamwork CLABSI infection control program was introduced. CLABSI was monitored, and data were collected and analyzed in the ICU and non-ICU units.	The time for CLABSI to occur increases from 8.72-13.60 days in ICUs (P=0.46) and 10.00-12.00 days in non-ICUs (P=0.48). Recommendation: The author comments on creating system quality improvement and multidisciplinary teamwork for the CLABSI infection program, effectively reducing CLABSI in patients with central venous catheters.	and after the phase and the central line days for the catheter, were not included in the article.	and conclusion.	
67. PubMed Quality improvement initiative in a community hospital to reduce central line device utilization rate	Aim: To reduce the device utilization rate (DUR) to 40%. Within six months. The DUR increase from 45% to 64% due to Covid.	Method: The study was conducted in a Southwest community hospital in Minnesota. The CLABSI	Result: Post implementation, the project goal of less than 40% of CLABSI was attained. The central line utilization	Limitation: It is difficult to identify which devised method is most efficient because the methods	Level II Rate: The author's opinion was consistent with the study. The required	4

(Hassan et al., 2023).		baseline during the study was 11.36. A multidisciplinary team was set up using define, measure, analyze, improve, and control (DMAIC) to identify the cause of the increased CLABSI. The team found that process, communication, education, and close-loop feedback are the primary causes of the CLABSI rate, and the issues were reversed by implementing countermeasures to address the barriers. The measures include staff education, team rounding, reviewing the current guidelines,	rate was decreased to 37.5%. Recommendation: CLABSI reduced rate was maintained three months post implementation. The quality improvement devised for the study is effective and efficient.	were created simultaneously for the project study.	contents for an article: Abstract, aim, methods, results, discussion, limitation, and conclusion were completed for the study.	

		and setting up an algorithm for vascular access. The team meets biweekly to discuss feedback and guide implementation. .				
68. PubMed Trends of central line-associated bloodstream infections in the intensive care unit in the kingdom of Bahrain: Four years' experience (Al-Khawaja et al., 2021).	Aim: To evaluate the trends of the rates of CLABSI over four years, the risk factors, etiology, and the antimicrobial susceptibility of the isolated pathogens.	Method: The study design was a prospective case-control. The study followed CDC surveillance methods for CLABSI in the intensive care unit. The implemented prevention bundle was audited.	Results: During the study, thirty-four CLABSIs were identified. With the implemented prevention bundle, there is a significant CLABSI reduction from 4.7/1000 central line days in 2016 to 1.4/1000 central line days by 2018. Recommendation: Implementing a prevention bundle at	Strength: The study achieved a positive result of CLABSI reduction. Limitation: The study was conducted at a single center, so the results of the study cannot be generalizable to other private or public settings. The critical condition of the patient used for the study was not indicated.	Level II Prospective Case control study. Rate: Good The article is well presented had all the information details.	2

			tertiary care is vital as part of CDC guidelines to control CLABSI.			
69. PubMed Prevention of central line associated bloodstream infections: ICU nurses' knowledge and barriers (Badparva et al., 2023).	Aim: To evaluate the knowledge of intensive care unit nurses on preventing CLABSI and barriers to implementing evidence-based guidelines.	Design: A cross-sectional study. Method: The study was conducted in seven hospitals in Iran for tertiary ICU nurses using census sampling from April to July 2020 to assess the nurses' knowledge and the implementation barriers. Two hundred and nine out of 220 ICU nurses are participants.	Results: The median score of ICUS nurses' knowledge towards the prevention of CLABSI was 3.0 out of 11. (50.72%). Intervention: Education intervention on practice guidelines was introduced for the nurses and practice guidelines implementation.	Strength: This is the first study in Iran to assess the knowledge and implementation barriers, and the study was successful in finding the barriers, including lack of knowledge and the workload of the nurses.	Level II Cross sectional study Rate: Good The author is precise the inclusion criteria (at least one month of ICU work experience and signed informed consent to be participants and exclusion criteria such as demographic characteristics was involved.	1

70. PubMed Efficacy of a care bundle to prevent multiple infections in the intensive care unit: A quasi experiment pretest-posttest design study (Yazici & Bulut, 2018).	Aim: To evaluate the efficiency of a care bundle targeted to prevent most frequent intensive care unit acquired infections.	Design: Quasi experimental study. Method: The study was conducted at a university hospital in Turkey, an 18-bed tertiary care. One hundred and twenty patients receiving mechanical ventilation therapy or having a central venous catheter or urinary catheter are participants. The study is in three stages: First, the ICU nurses are trained in the infection measures for VAP, CLABSI, and CAUTI. Secondly, the trained nurses applied the care bundle. Thirdly, the efficacy of the care	Results: There was a significant decrease in infection rate due to the implementation of the care bundle measures applied. VAP infection rates were 23.4, 12.6, and 11.5 during Jan-Mar, April-June, and July-September. For CLABSI, infection decrease rates are 9.9, 8.9, and 4.2 per 1,000 catheter days. Recommendation: The study declares that the infection rate will decrease with increased compatibility of care bundles as an evidence-based practice.	Limitation: A single tertiary center for the study, the results cannot be used for generalization because of single center bias of the study.	Level II Randomized Control Trial Rate: Very Good. The article was well detailed. The author added acknowledgements to the contents of the article.	4

		bundle is measured over three months.				
71 PubMed Infection Prevention and control for ICU during COVID-19 Pandemic: Position paper of the Indian society of critical care medicine (Sharma et al., 2020).	Aim: To focus on infection control and preventive measures In ICU during the pandemic.	Design: Quality Improvement. Method: The article discussed measures to prevent further spread of infection by the healthcare workers using the PPE during the pandemic	Results/Intervention. The intervention was to appropriate proper isolation rooms as needed during the pandemic.	Strength: The study discussed about maintaining standard measures to limit infection during the pandemic.	Level II Rate: Good. The author was well-detailed on measures to limit infection control.	3
72.Pubmed Sufficient personal protective equipment training can reduce COVID-19 related symptoms in healthcare workers: A prospective cohort study (Haegdorens et al., 2022).	Aim: The objective is to determine the impact of the correct selection of personal protective equipment on the incidence of SARS-COV-2 infection or positive cases in healthcare workers during the COVID-19	Design: A prospective cohort study. Method: The study was conducted in Belgium, and it involved healthcare workers: nurses, nursing aides, and midwives working in	Results: There were 617 responders. Most participants were nurses; 93% were employed in the hospital, and 83% were. The number of participants as front-line care providers	Limitation: The survey was self-reported so that the result could be biased. Secondly, the sample size was not randomly selected; the sample size was limited. The result of the study	Level: II Prospective study Rate: Good The author was well-detailed. He explained further that not only is the availability of PPE essential during the pandemic, but the training of the health	3

	pandemic in Belgium.	hospitals, home care services, and residential care services. Participants were invited for two-period sessions to complete a digital survey on personal protective equipment availability and selection. The first period was between May and July 2020, and the second was October 2020.	was 379 in total. The study observed that nurses were more likely to select the correct personal protective equipment than nursing aides and midwives due to the nurses' training. The author further concluded that training healthcare workers to use PPE promotes better outcomes on PPE availability.	cannot be generalized.	workers on the proper use of PPE reduces the further spread of the infection.	
73. PubMed Hospital policies during COVID-19: An analysis of visitor restrictions (Jaswaney et al., 2022).	Aim: Analysis of visitor restrictions during COVID-19 to alleviate the spread of infection.	Design: visitor restriction policies during the first three months were collected and analyzed. Method: A cohort study of 70 large hospitals representing	Result: Sixty-five hospitals from the seventy reviewed had visitor restriction policies. Forty-nine hospitals of the sixty-five had no visitor statements.	Limitation: Restriction policies varied remarkably among the hospitals reviewed.	Level: II A cohort study. Rate: Good. The author was exact and explained the weakness of the study. The author concluded that during the pandemic, hospitals are to	2

		23 states in the four regions of the United States were participants.	Sixty-three out of the sixty-five hospitals added exceptions to their visitation policies.		communicate with one another to develop visitation policies to ensure uniformity in visitation restriction policy.	
74. PubMed Decontamination of common healthcare facility surfaces contaminated with SARS-COV2 using peracetic acid dry fogging (Cutts et al., 2021).	Aim: To determine the significance of peracetic acid (PAA) dry fogging in decontaminating healthcare facility surfaces experimentally contaminated with SARS-CoV-2.	Method: Nine different materials in the hospital were used for the study: stainless steel, latex, painted wood, unsealed hardwood, melamine countertop, vinyl flooring, clear plastic, faux leather, computer keyboard button, and smartphone touch screen were surface contaminated with median tissue culture infectious dose (TCID50) of	Results: No infectious SAR-Co-v2 virus was recovered from decontaminated materials, while infectious viruses were recovered from untreated materials.	Strength: The study discussed preventive measures to decontaminate infectious organisms to limit contagious microorganisms. Limitation: There is bias in the study. Only PAA was used as a decontamination agent, and the study was conducted in one location.	Level: II Rate: Good The author discussed decontamination methods and processes that were well expressed.	2

		SAR-Co-V2. These materials were allowed to dry before applying of peracetic acid (PAA) dry fogging for decontamination.				

Key

Category

1 = Healthcare personnel
2= Preventive measure
3= Staff compliance
4= monitoring infection rates

Table 2

Project Leader Grade using Level of Evidence and Stakeholder Recommendations

Recommendations	Grade Using Level of Evidence Hierarchy	Recommendation for Practiced Based Upon Level of Evidence and Stakeholders
One	A	Yes
Two	A	Yes
Three	B	Yes
Four	A	Yes
Five	A	Yes
Six	B	Yes
Seven	B	Yes
Eight	B	Yes
Nine	B	Yes
Ten	A	Yes
Eleven	B	Yes
Twelve	B	Yes
Thirteen	B	Yes
Fourteen	B	Yes

Note: A = Systematic Review; Randomized Control Trial. B = Correlational studies

C = Descriptive/Expert opinion

Adapted from *Johns Hopkins nursing evidence-based practice. Appendix C: Evidence level and quality guide*, by Johns Hopkins Hospital/Johns Hopkins University, 2017, (https://www.hopkinsmedicine.org/evidence-based-practice/_docs/appendix_c_evidence_level_quality_guide.pdf)

Table 3

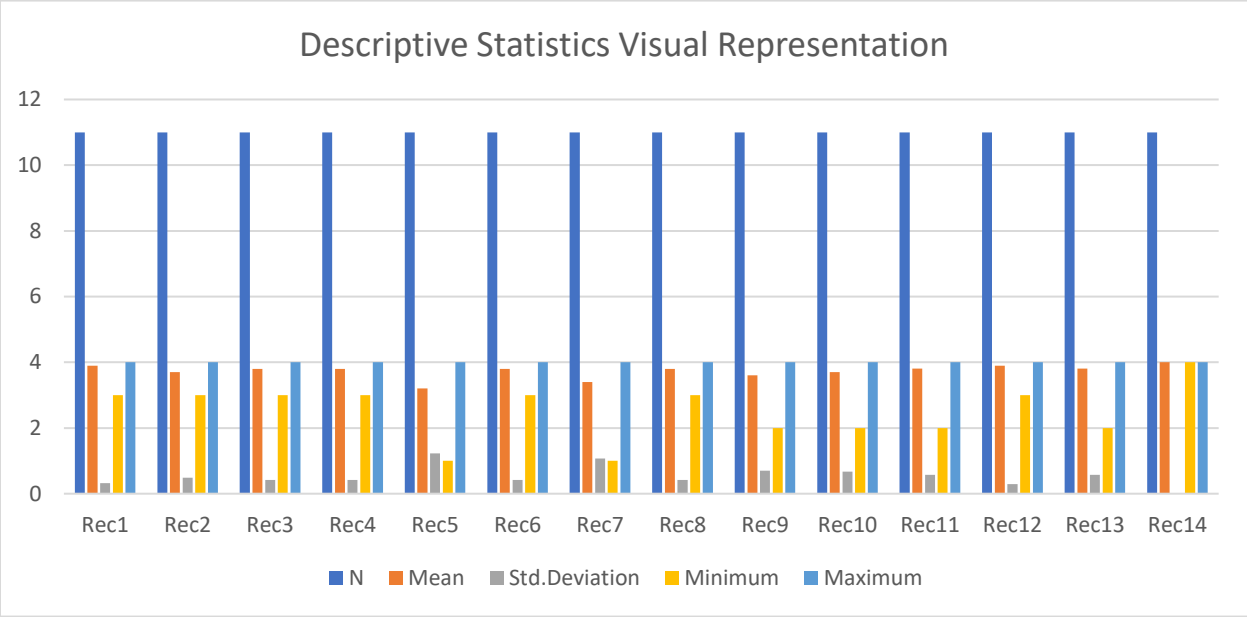
Descriptive Statistics Value

Column1	N	Mean	Std.Deviation	Minimum	Maximum
Rec1	11	3.90	0.316	3	4
Rec2	11	3.70	0.483	3	4
Rec3	11	3.80	0.422	3	4
Rec4	11	3.80	0.422	3	4
Rec5	11	3.20	1.229	1	4
Rec6	11	3.80	0.422	3	4
Rec7	11	3.40	1.075	1	4
Rec8	11	3.80	0.422	3	4
Rec9	11	3.60	0.699	2	4
Rec10	11	3.70	0.675	2	4
Rec11	11	3.81	0.575	2	4
Rec12	11	3.90	0.287	3	4
Rec13	11	3.81	0.575	2	4
Rec14	11	4.00	0.000	4	4

Note: Column one denotes 14 Recommendations, N = number of stakeholders, M = mean value for stakeholders rated value, Std. = standard deviation value, Minimum = stakeholders minimum rated value, maximum = stakeholders maximum rated value

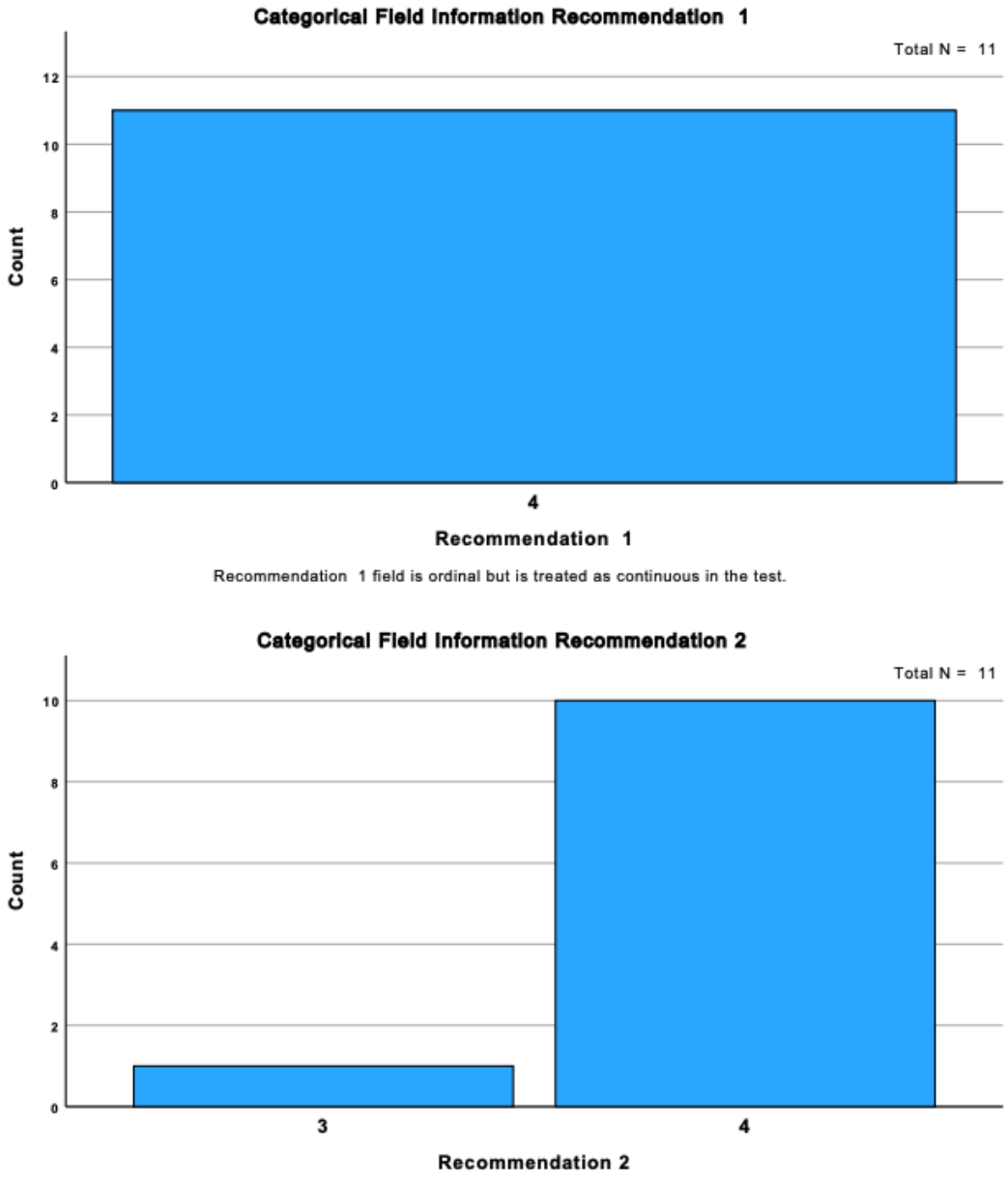
Fig 1

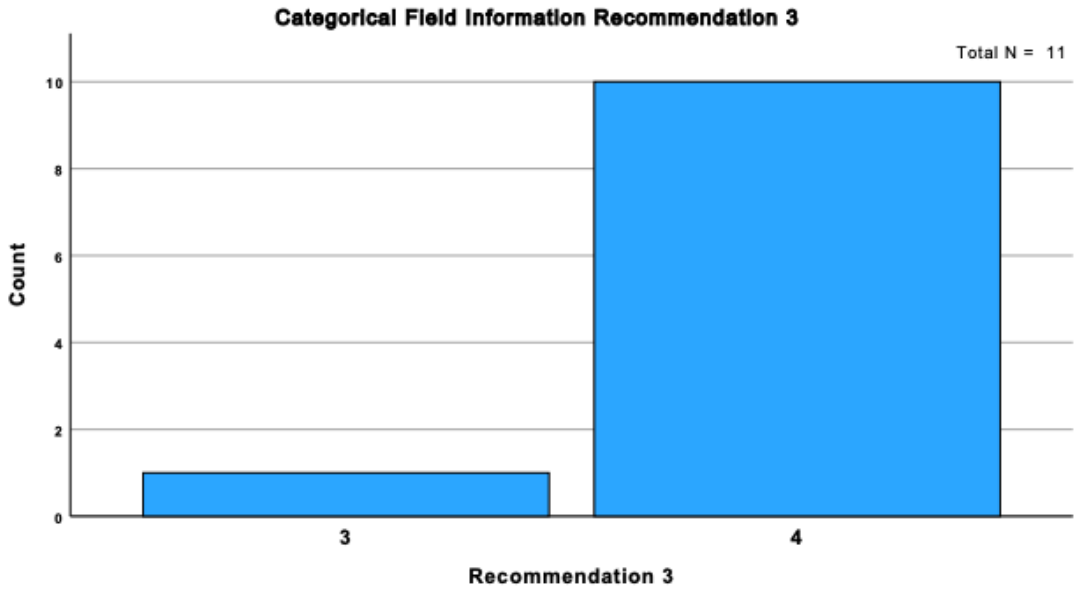
Bar Chart Showing Stakeholders rated value for the Fourteen Recommended Guideline



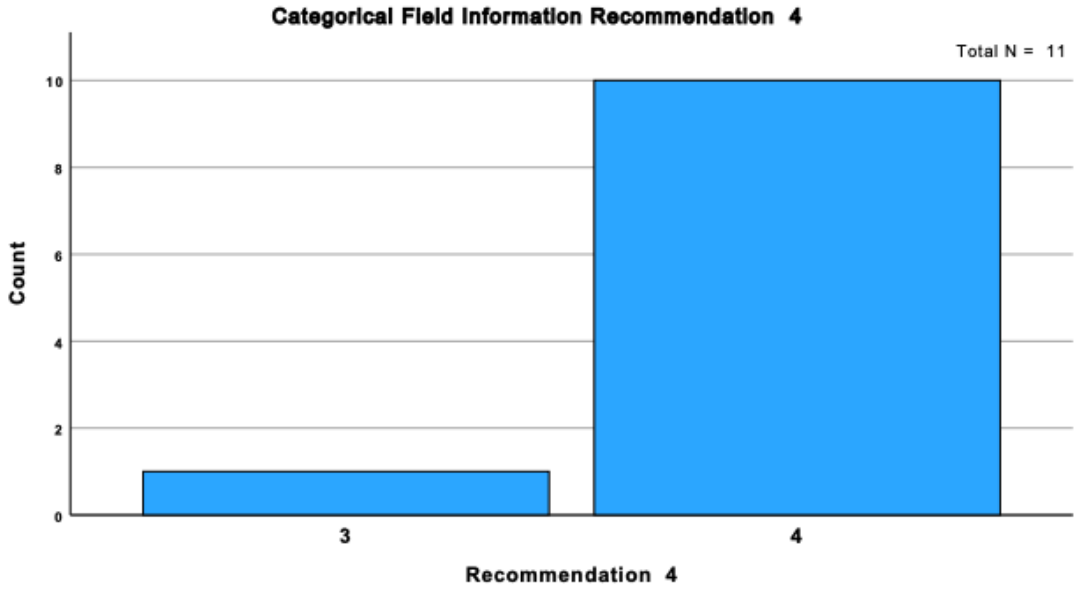
=

Figure 2

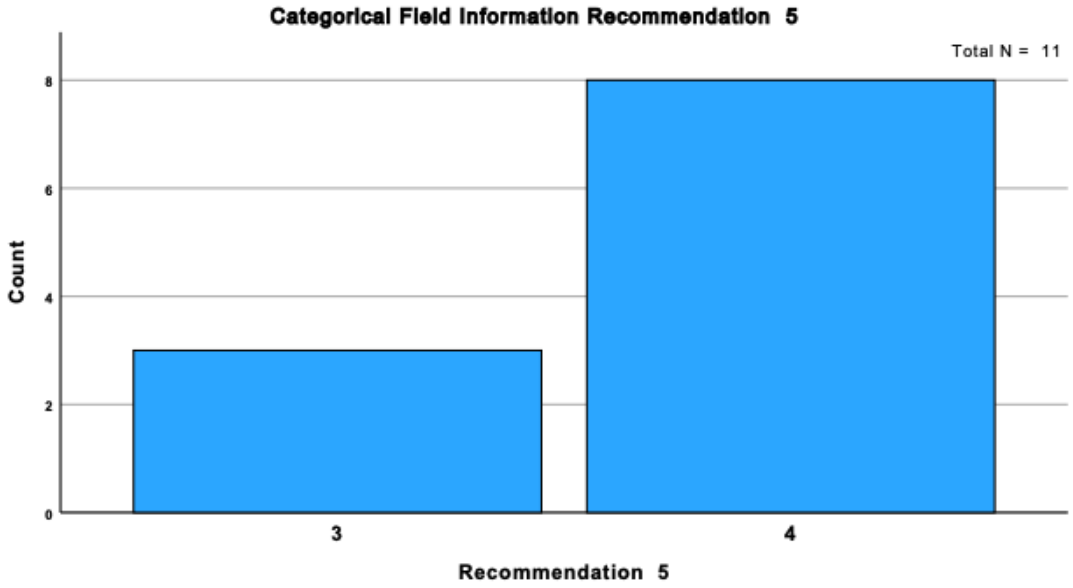

Categorical Field Information Recommendation 1
Total N = 11
Count
12
10
8
6
4
2
0
4
Recommendation 1
Recommendation 1 field is ordinal but is treated as continuous in the test.
Categorical Field Information Recommendation 2
Total N = 11
Count
10
8
6
4
2
0
3
4
Recommendation 2



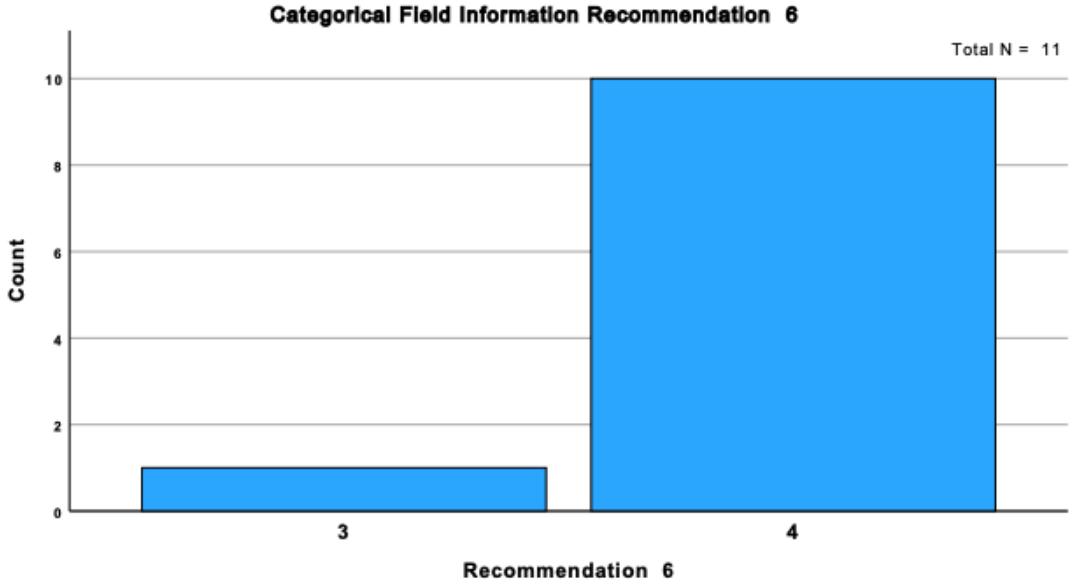
Recommendation 3 field is ordinal but is treated as continuous in the test.



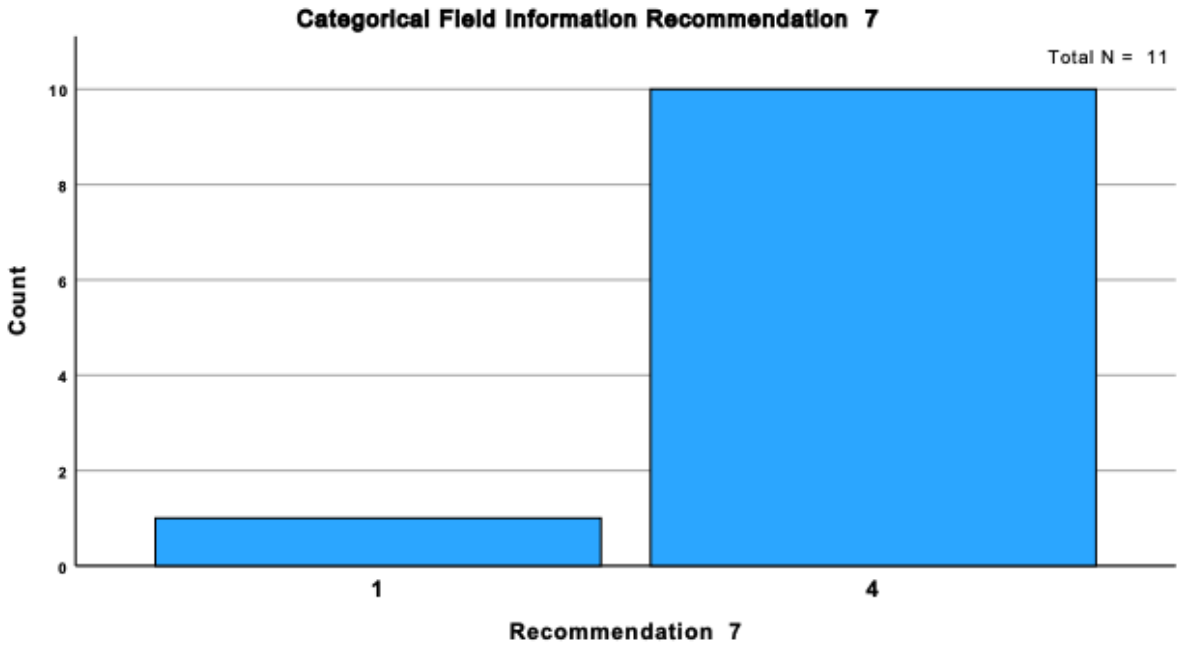
Recommendation 4 field is ordinal but is treated as continuous in the test.



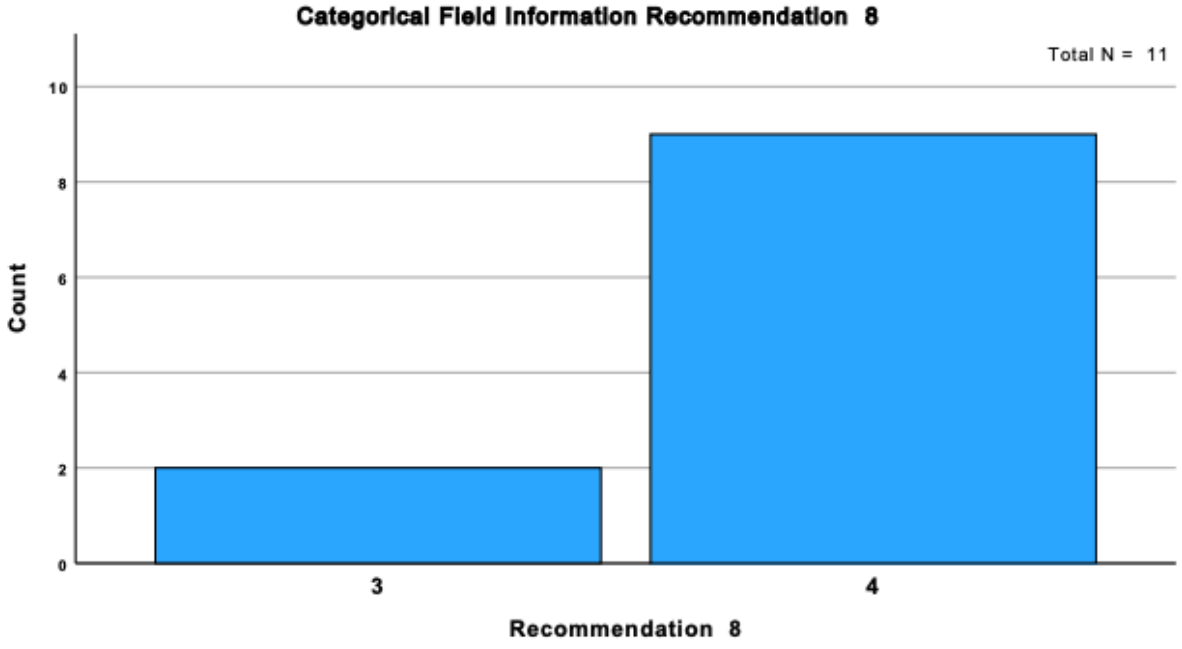
Recommendation 5 field is ordinal but is treated as continuous in the test.



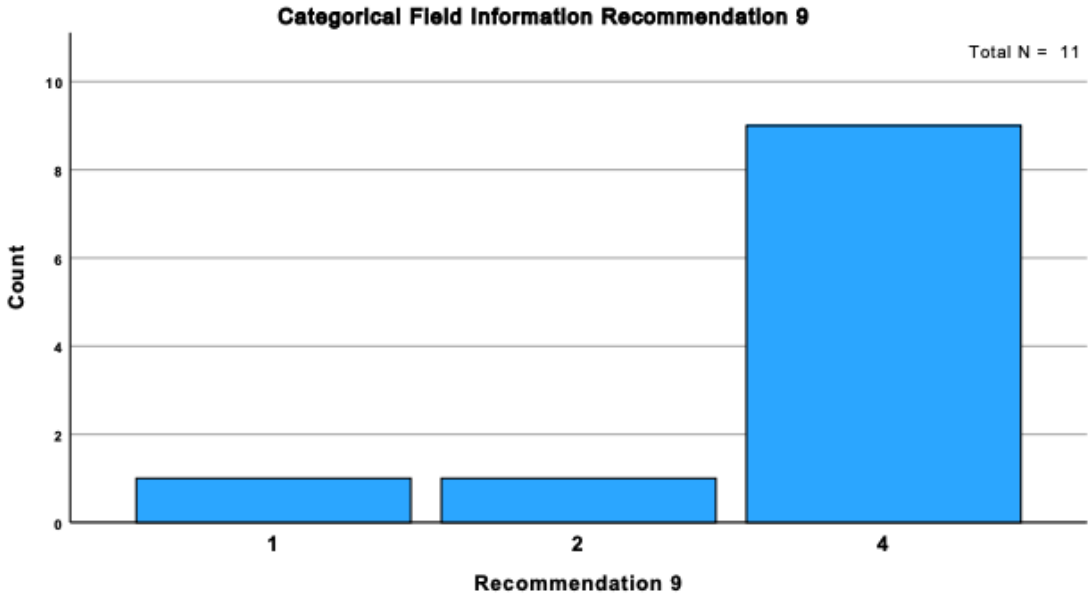
Recommendation 6 field is ordinal but is treated as continuous in the test.



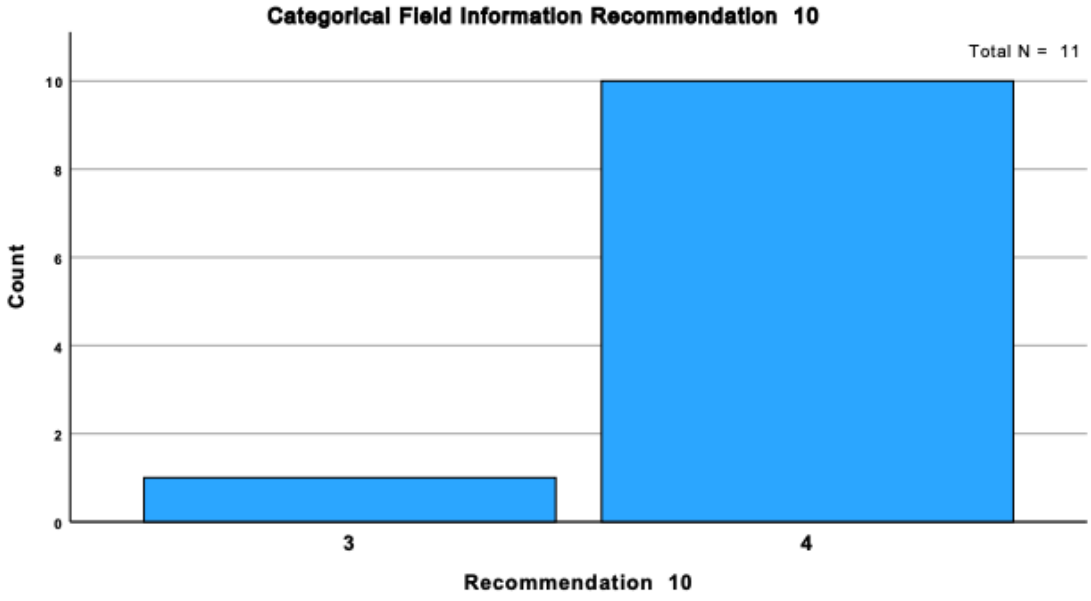
Recommendation 7 field is ordinal but is treated as continuous in the test.



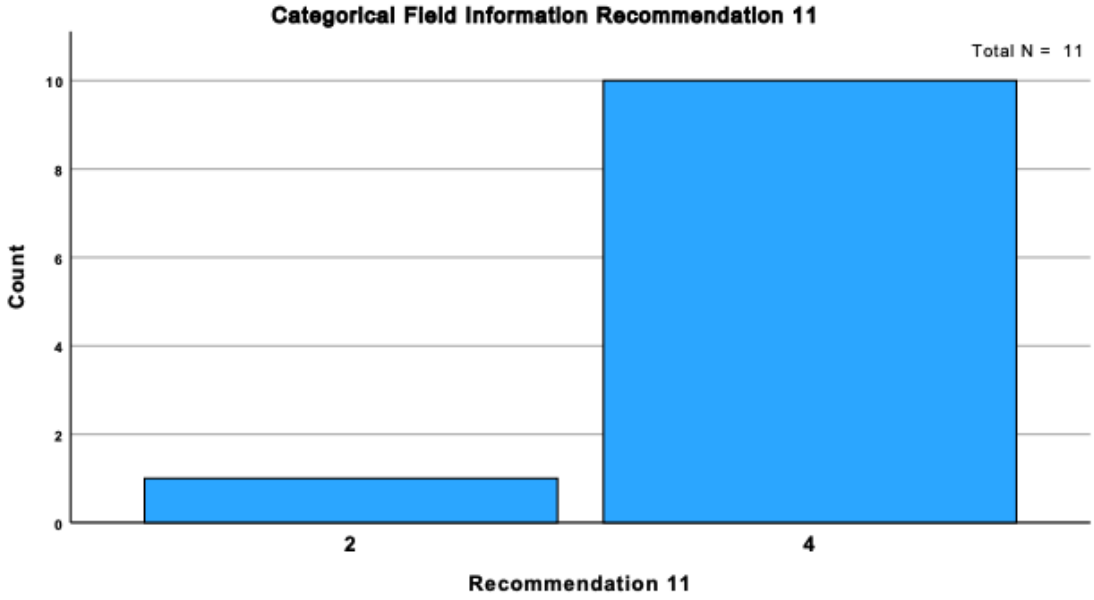
Recommendation 8 field is ordinal but is treated as continuous in the test.



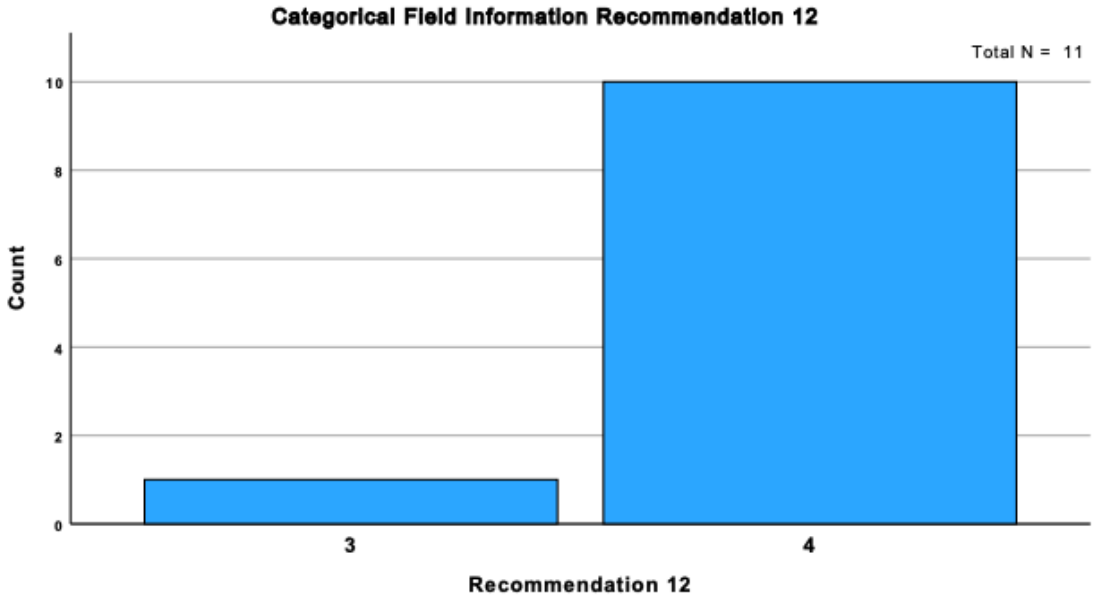
Recommendation 9 field is ordinal but is treated as continuous in the test.



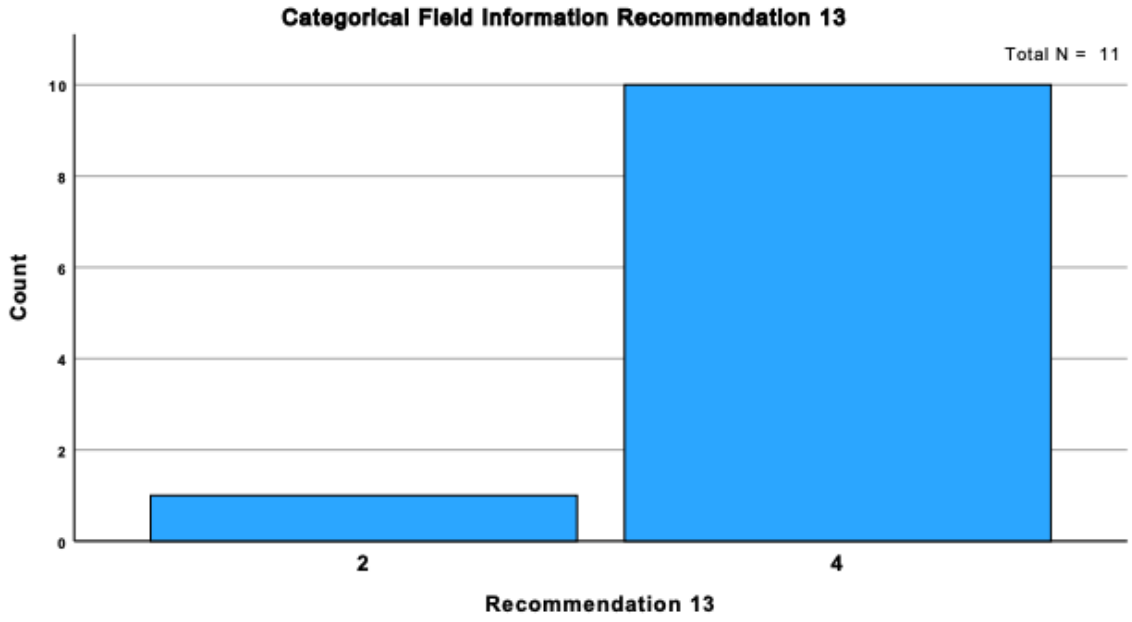
Recommendation 10 field is ordinal but is treated as continuous in the test.



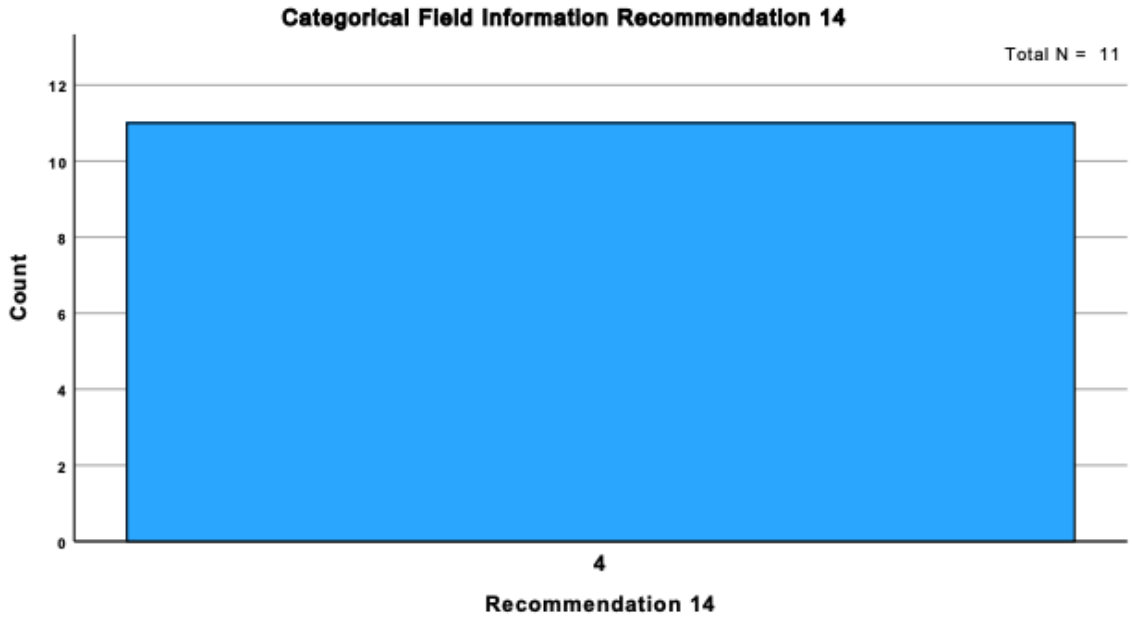
Recommendation 11 field is ordinal but is treated as continuous in the test.



Recommendation 12 field is ordinal but is treated as continuous in the test.



Recommendation 13 field is ordinal but is treated as continuous in the test.



Recommendation 14 field is ordinal but is treated as continuous in the test.

Figure 3

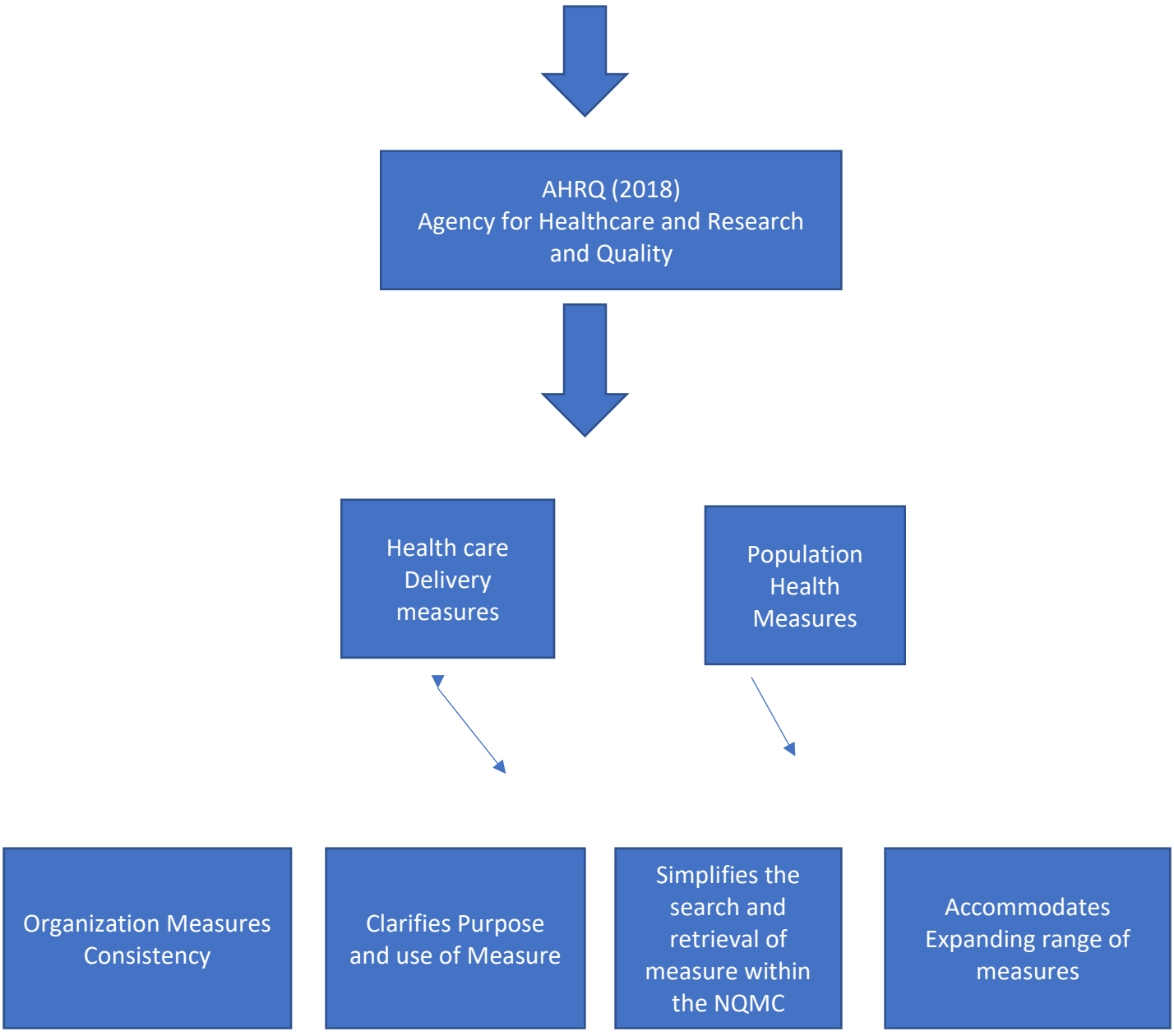
Statistical Result of Chi Square Value Using the SPSS (V.29)

$$\text{Chi-square value } X^2 (13) = 7.313, p = .885$$

Interpretation: The result indicated that the differences among stakeholders rating to the fourteen recommendations were not significant. It explains that the stakeholders had similar responses to the recommendations.

Appendix A

Visual Map of Framework



Adapted from *Agency for Healthcare Research and Quality [AHRQ]. 2018).*

(https://www.ahrq.gov/gam/about/index.html

Appendix B

Risk Management

Event	Possibility	Compliance Factors	Compliance Possibility
CLABSI Infection during a Pandemic	Likely	• Insufficient articles to review • CHG Bath Q12 hours • Changing of catheter site every seven days • Assessment of the catheter site for infection before each shift. • Placement of the central venous catheter to subclavian rather than the femoral site • Insufficient period for the healthcare personnel to adjust to the new practice guideline	• Likely • Unlikely • Unlikely • Unlikely • Likely • Unlikely

A risk management plan expresses all foreseeable potential risks and appropriate action to mitigate the risk. Risk management plan assist to achieve project objectives, since it facilitates proactive management of problems (Lima et al., 2021).

Appendix C

SWOT Analysis

Strength	**Weakness**
Approval of the proposal to complete the study Implementation of CLABSI guideline specifically for Pandemic	Insufficient articles for reviewing and bias of the stakeholders
Opportunities	**Threats**
Reduced death mortalities during pandemic CLABSI infection rate will be reduced or maintained instead of increase.	Stakeholders not completing the rating recommendation Pandemic Situation

Adapted from Word Stream: *SWOT Analysis*

https://www.wordstream.com/blog/ws/2017/12/20/swot-analysis

Appendix D

Dashboard (data collection tool deidentified)

Stakeholders Recommendation on Reviewed Articles for CLABSI Guidelines

		R One	**E Two**	**C Three**	**O Four**	**M Five**	**M Six**	**E Seven**	**N Eight**	**D Nine**	**A Ten**	**T Eleven**	**I Twelve**	**O Thirteen**	**N Fourteen**
S	One	4	4	4	4	4	4	4	4	4	4	4	4	4	4
T	Two	4	3	4	4	4	4	4	4	4	4	4	4	4	4
A	Three	4	4	3	4	3	3	4	4	4	4	2	3	2	4
K	Four	4	4	4	4	4	4	4	4	4	4	4	4	4	4
E	Five	4	4	4	4	4	4	4	4	4	4	4	4	4	4
H	Six	4	4	4	4	4	4	4	4	4	4	4	4	4	4
O	Seven	4	4	4	4	4	4	4	4	4	3	4	4	4	4
L	Eight	4	4	4	4	4	4	4	4	1	4	4	4	4	4
D	Nine	4	4	4	4	4	4	4	3	4	4	4	4	4	4
E	Ten	4	4	4	3	3	4	1	3	2	4	4	4	4	4
R S	Eleven	4	4	4	4	3	4	4	4	4	4	4	4	4	4

Note: Deidentification of the stakeholders will occur using numerical numbers

Appendix E

Recommended Guideline for Stakeholders Grading

The survey includes recommendations that have been written according to the literature in CLABSI during and after pandemic. Please rate each recommendation on a scale of 1-4.

1-Poor, 2-weak, 3-Moderate, and 4-Good.

A link to share folder where you will find all the literatures that was used to write the recommendations as well as the evidence table is at the link. You are welcome to view them but not required to view them.

Recommendation 1. Only credentialed healthcare providers may insert central venous catheters (AHRQ, 2018).

Recommendation 2. Full PPE and aseptic technique is required for catheter insertion (Afonso, et al., 2016).

Recommendation 3. Hand hygiene with soap and water should be done before and after procedure (Myatra, 2019).

Recommendation 4. The central venous catheter site dressing must be changed every seven days or as needed when contaminated (Gamvroulli et al., 2020).

Recommendation 5. The lumen (s) of the central venous catheter must be cleansed daily with chlorhexidine wipes, and the needless connectors covered with curo caps (Gillis et al., 2023).

Recommendation 6. The staff nurse must assess the central venous catheter site at the beginning of each shift for signs of infection (Hecht, et al., 2020)

Recommendation 7. Intravenous tubing changes per guidelines. Primary line changes every 96 hours, secondary and parenteral nutrition line (TPN) every 24 hours, and the lipid line changes every 12 hours (Van de pol et al., 2023).

Recommendation 8. All staff nurses including agency nurse must receive education and skill check off on central line care. Permanent staff will check off annually (Aloush et al., 2018).

Recommendation 9. The unit charge is responsible for ensuring all staff are compliant with central line standards (Achary, et al., 2019)

Recommendation 10. Patients with central venous catheters must be bathed daily with 2 % chlorhexidine wipes (Lin et al., 2017).

Recommendation Eleven. Plan for adequate isolation rooms, either existing rooms or those that may be adapted in preparation for a pandemic (Sharma et al., 2020).

Recommendation Twelve. Plan for an adequate supply of personal protective equipment (PPE) in preparedness for the pandemic. The supply chain manager and chief operational and finance officer manager make a budget for the purchase of extra-large supplies of PPE (Haegdorens et al., 2022).

Recommendation Thirteen. Plan for visitation policy in readiness for a pandemic—the infection control manager and administration effect restriction policy (Jaswaney et al., 2022).

Recommendation Fourteen: Plan to decontaminate surfaces such as overhead tables, doorknobs, and nursing stations to minimize infection rate. The environmental service manager and the supervisor ensure that environmental staff members do thorough and constant cleaning (Cutts et al., 2021).

Appendix F

Screening Tool: Evidence Level Hierarchy

Evidence Levels	**Quality Ratings**
Systematic reviews of randomized control trial with or without meta-analysis.	A – High quality. Consistent, generalize results, consistent recommendation based upon literature review that is evidence-based practice.
Correlational studies	B – Good quality. Equitably consistent results, reasonably consistent recommendations based on comprehensive literature reviews.
Expert/Opinion studies	C – Low Quality. Little evidence with inconsistence results, conclusion cannot be drawn.

Adapted from *Johns Hopkins nursing evidence-based practice. Appendix C: Evidence level and quality guide,* by Johns Hopkins Hospital/Johns Hopkins University, n.d., (https://www.hopkinsmedicine.org/evidence-based-practice/_docs/appendix_c_evidence_level_quality_guide.pdf)

Appendix G

GNRC Statement

GNRC Proposal for _____Abiodun Adejumobi_____ (student name)

Student Email for GNRC Letter to be sent to_____ oa8655@mavs.uta.edu ____

Title of Project_____ A CLABSI Guideline for Healthcare Personnel during a Pandemic__

Faculty Instructor _____Dr. Deborah Behan_____

GNRC Decision: CONDITIONS MET WITH FACULTY HELP 7-28-23

This form reflects information required on the Proposal Rubric. Faculty Instructors initial indicating criteria is met. Students submit the form with their Proposal.

Section	Meets criteria
Provides gap in the area of population and the practice setting with supportive data (National, State, and Local). This is addressed in the introduction. If a Guideline should be created, states the need for a guideline for nurses to follow. If a database project, then states the need for data and what counties/state in which there is a need to create a scorecard.	Yes; Condition: needs to support with citations pg. 9 the complications arising from COVID-19….spending to manage the outbreak. Does not clearly say pg. 9 last paragraph speaks to her local organization. It needs to say that using personal communication or provide numbers.
Writes the PICOTS (Population, Intervention, Comparison, Outcome, Time, Setting)	Yes P- Healthcare staff personnel: Doctors, Resident doctors, and nurses. Taking care of patients with a central line and at risk for CLABSI during a pandemic I – developing a guideline for CLABSI prevention to be used by healthcare personnel during a pandemic C- Comparison with the efficacy of guidelines typically used during non-pandemic time periods O- Evaluation of literature, writing of recommendations, grading of recommendations, and rating of recommendations by stakeholders T- 8 weeks S- Acute care setting
Review of Literature (ROL) The intervention's specific evidence is discussed from three different disciplines. The evidence table is in the appendix; For a guideline project the ROL focuses on the topic and the grading of literature to solve the problem/gap. If a database project the ROL focuses on the topic of the database that is needed to create a scorecard.	Yes
Correctly identifies project as QI, EBP, Guideline, or Database Quality Improvement change in process, Evidence-Based change in practice, a Guideline with a specific format that	Yes

will be followed to create the guideline, or a database project that states where and how the data will be used.	
Uses appropriate framework for the type of project. Example: QI – PDSA or equivalent EBP – IOWA, John Hopkins, Stettler, or equivalent Guideline – AHRQ Clinical Practice Guidelines Database- SDOH model (Health People 2030)	yes
Correctly constructs a project question to include: 1. Patient population 2. Intervention or change 3. Specific and measurable outcome 4. Time 5. Setting Example for Guideline: Does a guideline on xx that is developed in response to an identified need and supported by critically appraised published literature and reviewed and graded by stakeholders result in recommendations for implementation? Example for Database: For xx population will patterns and trends identified in large data on xx to create a scorecard that will guide to best interventions to improve quality and safety of the patient population in the identified public use data file (PUDF) within xx (state)?	Yes
Correctly constructs objectives for the project Action verbs are used with objectives that include each step of the plan to complete the project.	yes
Methodology includes the following:	
1. **Setting** (should not be identifying) in detail; for a guideline describes the setting in which the guideline could be used (population) for a database it should be the same as for QI and EBP	yes
2. **Population** (describes the population in relation to their project with inclusion/exclusion criteria) in detail; documents the anticipated sample size. A guideline may describe the population of stakeholders that the guideline targets as well as patients (as applicable) receiving the care from the recommendations. The database will be the same as QI and EBP	yes
3. **Role on team** (no names) for all involved in the project; for guideline the team is the librarian involved in searching databases and stakeholders who are involved in grading the recommendations. For a database project Dr.	Yes

Tietze and FA will be the team that work on review of data.	
4. **Education of team** involved in project (is in outline, PowerPoint, or detailed form if required for implementation of project); for a guideline should be about the communication with librarian and stakeholders involved in evaluating the recommendations; for a database the education will be Dr. Tietze and the FA on what variables are needed for analysis and how the scorecard is going to be created	Yes; fix slides
5. **How the intervention or change will be implemented** (specifics); For a guideline the search strategy, detailed decisions on grading the literature, decision on specific article use, stakeholder interaction plan; for a database detailed information on how the database will be accessed and used as well as building the scorecard for red, yellow, and green and what percentages are to be met for each.	yes
6. **Exact data to be collected**; the process of data collection, instrument used for data collection; for a guideline would include stakeholder opinion and the scale of 1-4 to rate recommendations, expert opinion decisions on what is included, how decisions will be made regarding the grading of literature, grading of recommendations. For a database the excel file of all variables that will be collected for analysis as well as creation of a scorecard where the range of acceptable is identified according to the literature.	yes
7. **Detail of the statistical methods and ethics** to be used including descriptive, and /or inferential methods; for a guideline descriptive stats on grading of literature, recommendations (A,B,C), and stakeholder opinions (1-4); for database descriptive data will be used to put into the scorecard for determination if the range is met for safe quality care.	yes
Dashboard is included in appendix and has method for de-identifying data; Includes the master coding for de-identification and the master coding values for data.	yes
If using a tool for the project, includes validity and reliability (references and permission in appendix); for a guideline the NIH/AHRQ framework is used. For a tool that is created using the literature there is no established reliability or validity, thus students must identify there is no established reliability; however, if the PICOTS can be answered using the tool they can say it was assessed to have face validity; for database project the reliability and validity of the PUDF.	Yes

APPENDICES Includes:	
If updating a current **guideline,** it is included in the appendices, Legend for grading of recommendations, evidence table and grading of literature	Yes;
Approval Letter	yes
If education of team or patients is part of proposal, includes the **educational outline and/or PowerPoint**	Yes; Condition: take dashboard out of the slide on pg. 46 and put the new one in; slide on pg. 49 change to read literature, grade literature, write recommendations, grade recommendations, ask stakeholders to rate the recommendations written by project lead
Dashboard for data collection; **Includes every tool** that will be used: screenings, surveys; Marketing announcement; scripts; timeline, scorecard	yes
SWOT, Risk Management, Organizational Readiness, and GANTT chart in appendix	Yes; do not see the RM nor OR
Monetary **budget** for the project and if receiving a grant or scholarship	yes
Verification of UTA ***Protecting Human Research Participants*** Training	yes

University of Texas at Arlington College of Nursing and Health Innovation
Student Project Review Application

Student Name: Abiodun Adejumobi

N6333 Professor Name: Dr Deborah Behan

Project Title: A CLABSI Guideline for Healthcare Personnel during a Pandemic

Project Type: Please select the appropriate Project Type (R**efer to definitions at the end of this document**):

___ Quality Improvement Project
___ Evidence-based project
_--x-Guideline project

Description of Project: Follow the GNRC DNP Proposal Rubric to make sure the proposal is complete for submission

Please note: If you have received a grant, you must complete the financial form from the university http://www.uta.edu/fao/apply/forms.php

Project starting semester date (DNP Practicum I start date): August 22nd, 2023

Project expected completion Date (DNP Practicum II end date): March 2024.

The checklist below will assist you to determine whether a project requires review for approval only at the Graduate Nursing Review Committee level or also at the UTA Institutional Review Board (IRB). **Note: A GNRC member will review all projects as a first step in the full review process.**

Preliminary Questions:

1. Is the proposed project a guideline?

   ___x_Yes or _____No

If you answer "no" to the question, continue with the secondary checklist.

	Decision Checklist	False	True
1	The purpose of the project is to describe standard care, determine best practice based upon the evidence or improve **internal** (local agency) processes, practices, costs, or productivity.		
2	You are measuring an **existing practice** that may or may not have been shown effective in the literature.		
3	There are **no risks** to human subjects such as disclosure of **protected health information or risks from changes in usual care delivery.**		
4	You will use a small sample size data set but large enough to observe the purpose of the project. There is no need for a power analysis to determine a sample size.		

5	There will be no participants data used outside your setting because another setting may not provide care the same way.		
6	The project will **NOT be described as research** in public presentations, portfolios, or other representations and it is not generalizable.		
7	There is **NO** withholding of any aspect of a standard of care or **NO** testing of an intervention that is not standard of care (neither consensus-based or evidence-based.)		
8	The project **DOES NOT** involve grant/contract funding or sponsorship for a **research study** that requires IRB approval?		
9	The project **DOES NOT** involve a drug or device used outside of usual medical practice, including non-FDA approved agents or the use of any off-label uses of FDA approved drugs/devices.		
10	The project **DOES NOT** involve an animal in the project.		

If you answer ***False*** to **ANY** of the questions above, a review at all levels may be necessary (i.e. the department level and the university level.) You must complete this checklist, sign it and submit it to the GNRC with the **UTA university level IRB protocol document).** If determined necessary to go to the UTA IRB, then final approval of your project will come from the UTA (university level) IRB. If an animal is involved, then the university IRB for animal involvement will review.

If you answer ***True*** to **ALL** of the above questions, you must complete this checklist, sign it and submit it to the GNRC. Final approval for your project will come from GNRC.

In general, Quality Improvement and Evidence-based projects and Guidelines are NOT considered human subjects' research.

According to 45 CFR 46.102(d) research is defined as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge."[1]

**** Student attestation: In signing below, I confirm that I have reviewed this application form with my N6333 Professor, and he/she is in full agreement with the form as submitted****

I have reviewed the decision checklist and believe my answers to represent the project titled above.

Student signature: Abiodun Adejumobi. Date: 07/02/2023

I have reviewed this form with the student and the answers represent the project titled above.

N6333 Professor signature __*Dr. Deborah Behan*_____Date:_____*7-23-23*_____

Note: *Any forgery or intentional misinformation represented in this document can be considered grounds for termination from the University.*

1. United States Department of Health and Human Subjects. *Code of Federal Regulations.* Available online at: http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html

DEFINITIONS FOR USE WITH GNRC DNP PROPOSAL

Evidence Based Project (EBP):

Guideline Development: The process of developing evidence-based statements which assist providers, recipients, and other stakeholders to make decisions about appropriate health interventions (World Health Organization, 2003).

Implementation Project: A project consisting of a specified set of activities designed to put into practice an activity or program of known dimensions that currently is not being used within the single entity (i.e. patient care unit, clinic, or service area). (National Implementation Research Network, 2014).

Quality Improvement Project (QI):

A project designed to evaluate changes that will lead to better patient outcomes (health), better system performance (care), and better professional development (Quality and Safety in Healthcare, 2007) within a single entity (i.e. patient care unit, clinic, service area). Outcomes are not **generalizable** beyond the single entity. (This may be a screening tool, educational intervention, or change in procedure)

EBP/QI Project:

A combination of implementation with guideline development or implementation project, then evaluating the changes as a Quality Improvement Project overtime.

Guideline Project:

Statements that include recommendations intended to optimize patient care informed by the literature (IOM, 2011, p.15)

Appendix H

Script for Training About the Project Study

The introduction of my topic: A CLABSI Guideline for Healthcare Personnel during a Pandemic. CLABSI is one of the significant causes of hospital-acquired infections (HAI)). It must be considered a considerable factor in infections in healthcare organizations, especially during the Pandemic. If the rate increases and adequate care is not taken, it becomes compromised, which could lead to increased mortality (Alotaibi et al., 2023). During the last Pandemic, the number of individuals affected in America with COVID-19 was 192,775,054 (WHO, 2023). In the last quarter of 2020, the CLABSI rate overall US was 47% (CDC, 2020). This is one of the reasons why I was fascinated with using CLABSI for the project study.

Central line-associated bloodstream infections (CLABSI) will be limited in the healthcare organization and during the Pandemic if the healthcare organizations policy for CLABI is followed by healthcare personnel because the guidelines are modified to observe the standard guidelines of the Agency for Healthcare Research and Quality (AHRQ2018). This is one of the essentials of my project, using evidence-based literature reviews to develop recommendations that would be implemented to the standard guidelines of AHRQ for use as a guideline during the Pandemic.

For the study, the project lead reviewed seventy-four literature articles and developed fourteen recommendations, ten basic standard guidelines as written by AHRQ, 2018, and four new recommendations. The project lead first graded the fourteen recommendations using the evidence level of hierarchy. The project lead sent the recommendations to the stakeholders for grading. The statistician analyzed the results of the grading and the project lead

recommendations statistically. The analysis result identified that the stakeholders graded the new recommendations with a high score, indicating the P value < .05. Statistically, indifference explains that the leadership of healthcare organizations can implement the recommendations.

Appendix I

UTA Protecting Human Research Participants Training