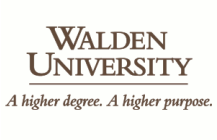

2019

Adhesive Transparent Chlorohexidine Gluconate Tegaderm™ Gel Dressing for Central Venous Catheter

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This is to certify that the doctoral study by

Peter Mwangi

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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2019

Abstract

Adhesive Transparent Chlorohexidine Gluconate Tegaderm™ Gel Dressing for Central Venous Catheter

by

Peter Kimiti Mwangi

MS, Walden University, 2016

BS, Jacksonville State University, 2012

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2019

Abstract

Central-line-associated bloodstream infections (CLABSIs) occur during the insertion or change of the dressing of the central venous catheter (CVC) and are reportable health-care-associated infections at the state and the national level. The purpose of this systematic review of the literature was to evaluate and synthesize available evidence to establish the effectiveness of using an adhesive transparent chlorohexidine gluconate (CHG) Tegaderm™ gel dressing for CVC in the prevention of CLABSIs. The logic model was used as a framework to guide the review of the literature to establish how an intervention that is not currently practiced can contribute to CVC prevention of infection. The practice question focused on gathering evidence to support the effects of CHG Tegaderm™ gel central-line dressing compared with the Biopatch® dressing. A total of 373 articles were retrieved and 16 met the inclusion for review and were graded according to the Melnyk and Fineout-Overholt hierarchy level of evidence and evidence synthesis broken down into the reduction of CLABSI, the cost-effectiveness and ease of use of the CHG Tegaderm™ gel. Findings from the systematic review supported the use of CHG gel dressing as a CLABSI preventative measure. The findings from the project support positive social change by reducing CLABSI and associated illnesses and saving the increased cost, mortality, and morbidity associated with CLABSIs.

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Dedication

My dedication to God for his continued strength despite some challenges, unshakable faith, courage and perseverance in the process of my Doctor of Nursing practice journey. Allegiances to my late dad who could have been proud to see me achieving my dream goals of becoming a scholar and a doctor in the nursing practice. I am thankful to my loving mum who never cease to pray and her generous support. Also, to my life partner who has been a shoulder to cry on, encourager, and always pushed me hard to continue striving and my siblings, nephews and nieces who view me as a role model to emulate. Finally, to my preceptor, Dr. Sharina, Arceneaux, DNP, RN-BC, NEA-BC. Sharina, I cannot pay you for everything you have done to make my dreams come true and may God bless you mightily.

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I want to thank Dr. Francisca Farrar, my committee chair, for your kind and continuous support and prompt feedback throughout the process of the DNP project. You have been a pillar, supporter, and encourager and always there when needed to see me succeed. I don't know what I can pay you with, but may God bless you abundantly and enlarge your territories and continue with that kind spirit of helping students achieve their life and professional dreams. To Dr. Rosaline Olade and Dr. Eileen Fowles who not only been part of the DNP committee and reviewer respectively, but I have learned from your feedback, and everything you have done towards my doctoral journey has not been in vain. To you both, you are highly appreciated for accepting to be part of my team in my doctoral journey. Thank you to my preceptor, Dr. Sharina Arceneaux who has been my mentor and my encourager as well. Sharina, you set the bar high as a young successful black woman to get your doctoral degree at a youthful age, and I have followed your footsteps. Thank you for your time, sacrifice and commitment. Thank you to my partner, my mother, siblings, nephews, nieces, cousins, friends, and colleagues for their continued words of encouragement and unwavering support and prayers. I could not have achieved this terminal degree without your support. Lastly, I dedicate this project to my mother and my late father who sacrificed their lives and luxury to see us through and who instilled the values of discipline, hard work, perseverance, determination and emphasized the importance of remaining humble regardless of the social status.

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Section 1: Nature of the Project

Introduction

A central line-associated bloodstream infection (CLABSI) occurs when germs enter the bloodstream through an inserted catheter in the large vein in the neck, chest, or groin to give medications or fluids or collect blood for medical tests. They are inserted in the major veins that are close to the heart and can remain in the place for weeks or months. Because of the proximity to the heart, they a have high likelihood of causing an infection known as a CLASBI. The infection of the central line can occur during the insertion of the central line or while caring for the central line site during the check or change of the dressing. CLABSI results in deaths of thousands of patients each year and billions of dollars are added to the United States health care cost burden. CLABSIs are deemed to be preventable nosocomial infections if guidelines, tools, and protocols are adhered to (Healthcare-Associated Infections, 2010). CLABSIs results in thousands of deaths each year resulting in the loss of lives and increase in the billions of dollars spent. To decrease the rate of CLABSIs, nurses and health care team need to address and have a quality improvement intervention that will be practical and efficient. Therefore, having an intervention that is tailored to the reduction of CLABSI will be beneficial in the fight of the deadly disease known as CLABSIs (Williamson, Neusbaum, & Messing, 2017).

Nature of the Doctoral Project

The practice problem involved the systematic review of the effectiveness of using the adhesive transparent chlorohexidine gluconate Tegaderm™ gel for adults older than 18 years admitted to the critical care unit with the central venous catheter. In my project,

I searched published literature for credible evidence to validate the use of adhesive transparent chlorohexidine gluconate Tegaderm™ gel for central venous catheter dressings as an evidence-based treatment modality to decrease the CLASBI rate. My project involved surveying the current literature to identify the empirical evidence available of how the use of the adhesive transparent chlorohexidine gluconate Tegaderm™ is superior for reducing the CLABSIs and make recommendations to the local acute hospital. I conducted a systematic literature review to validate the research question to recommend the findings of the evidence-based practice from published literature from credible databases and Google Scholar.

Positive Social Change

The recommendations of the Tegaderm™ CHG can have a positive impact on social change in the society and the healthcare at large. Patients are less likely to survive when they develop CLABSI, especially if there is an already a disease that has weakened the immune system. Having a dressing that will prevent central line infection will promote the well-being of the patients and decreases chances of mortality, hence saving lives. On the economic perspective, the Tegaderm™ CHG has economic benefits not only to the facility but also to the health care at large. When patients develop, an infection related to the central line catheter, the financial toll is passed to the hospital and the taxpayers. Reducing the amount of money that is spent on health-care-associated infections can be channeled to other social services that will improve citizens' lives, thus contributing to the positive social change that aligns with Walden's vision for positive social change (Walden 2020, n.d).

Problem Statement

Local Nursing Practice Problem

Central venous catheters are widely used in intensive care units and acute care to administer drugs or fluids. The populations in adult intensive care units are critically ill and susceptible to infection. When catheters are introduced into the patients' bodies, they become an easy port of bacterial entry if proper care is not taken. The use of Biopatch® with central line dressing has been widely used for years, but the CLABSIs rates are still high. There is a new intervention that has emerged using Tegaderm™ with CHG gel, which is transparent and adhesively secures the central line site and allows the clinicians to view the site. The dressing acts as a barrier against external contamination, and the gel pad has an antiseptic agent. The water-vapor-permeable CHG-impregnated gel pad is incorporated onto the adhesive side of a transparent polyurethane dressing, and the CHG-impregnated gel pad is applied directly over the insertion site at the time of catheter insertion or during follow up site care. The gel rapidly softens at skin temperatures and flows about the catheter, providing intimate contact of the CHG-impregnated surface with the entire insertion site. The gel also absorbs up to eight times its weight in fluid, preventing accumulation of moisture on the site. The integrated dressing tightly secures the catheter, preventing any positioning movement that can facilitate entry of microorganism into the insertion tract. (Maki, Stahl, Jacobson, & Pyrek, 2008). Patients who have central venous catheters or arterial line catheters are critically ill and are susceptible to developing CLABSIs due to microorganisms that can be formed during the insertion, during use, dressing change, or spread from another source. The use of CHG-

impregnated dressing placed during the time of CVC insertion and dressing changes ensures the dressing to release the chlorhexidine onto the skin for a 10-day period.

Local Relevance

The decrease in CLABSIs is essential for nursing practice especially with a facility that is aiming for magnet designation and to decrease the mortality and morbidity associated with CLABSI. Money that spent on treating CLABSI can be used to buy state of the art equipment that facilitates a favorable environment for nursing staff. Tegaderm™ CHG is easier to use and reduces the rate of infection. The local facility is targeting to transition from the standard CVC dressing with Biopatch® to the Tegaderm™ CHG gel if enough evidence exists to convince hospital leadership that the latter is better than the current dressing. Also, the goal of the local critical care unit is to have decreased numbers of CLABSIs per 1,000 central line days. The nursing goal is to provide a nurturing and healing environment that restores the well-being of the patients. The local hospital applies the 2011 Centers for Disease Control (CDC) guidelines with an aim in preventing the CLABSI. After the central line insertion or during the dressing change, a chlorhexidine impregnated sponge (Biopatch®) is applied at the site of insertion and covered with a sterile, transparent, semipermeable dressing per the 2011 CDC guidelines (CDC, n.d.). Despite adhering to the CDC guidelines on the care of central venous catheter, the facility continues to have high numbers of CLABSIs.

Significance to Nursing Practice

Decreasing the rate of infections is a paramount goal that each nurse and the whole nursing profession aim to increase the safety and health outcome. The doctoral

systematic review project yielded evidence-based data that can be implemented by the local critical care unit or other units in the local hospital and in the field of nursing practice. The systematic review was used to establish the validity of this proposed treatment modality to decrease CLASBIs. The completed extensive systematic review of the literature yielded the highest level of evidence to support the practice, thus build more trust and buy-in of the use of CHG Tegaderm™ in CLABSI prevention (Jenks et al., 2016). Nurses are at the forefront in implementing evidence-based practice in the improvement of patients care outcome and decrease the cost of health care. In this essence, the use of a dressing that is tailored in the reduction of CLABSI can have a significant influence in patients' safety and health care costs, and it can add knowledge to the body of nursing on the best intervention based on the available highest level of evidence to support the proposed treatment modality. By conducting this systematic review, the evidence obtained that is highly ranked on the hierarchy pyramid of evidence is clear that the use of evidence-based interventions is a pillar in the growth of nursing. Therefore, the evidence obtained clearly and strongly supports the proposed treatment modality (Stango, Runyan, Stern, Macri, & Vacca, 2014).

Purpose Statement

CLABSIs are one of the lists of diagnosis that are deemed by the Centers for Medicare and Medicaid Services' (CMS) as the list of nonpayable preventable hospital-acquired conditions. CLABSIs cases are costly with a case being estimated to cost $25,000 to $32,000. The cost burden is left on the healthcare organization to bear. Healthcare facilities continue to invest time and resources to reduce CLABSIs, and yet it

continues to be a challenge (Strickler, Gupta, Doucette, & Kohli-Seth, 2018). Approximately 250, 000 bloodstream infections occur annually with most of them related to intravascular devices. The CLABSI rates in the United States intensive care units are estimated to be 0.8 per 1000 of central line days (Jackson & Davies, 2015). The local critical care unit has current CLABSI rate of 0.962 and the whole hospital has a CLABSI rate of 1.232 for the current fiscal year starting October 1, 2017, to September 30, 2018. The critical care leadership in the local hospital has identified the following needs:

1. To decrease the numbers of CLABSIs per 1000 central line days.
2. To achieve the target goal 0.641 per fiscal year.

Despite the guidelines for central line insertion and central line maintenance, CLABSI rates remain a challenge in health care. Being one of the nonpayable hospital-acquired conditions, it is important for the hospitals to manage to eliminate the cases of CLABSIs if possible, to save dollars and lives. My purpose in this systematic review was to evaluate and synthesize the available evidence-based research on the use of adhesive transparent CHG Tegaderm™ in the reduction of CLABSIs in the central venous catheter. The anticipated outcome of conducting this systematic review was to yield evidence that will support the need of implementing the proposed treatment intervention with an aim in decreasing the rates of CLASBIs and to fill the gap in nursing practice on the best method or effective method to reduce CLABSIs cases.

Gap in Practice

The reduction of CLABSI is an area that many hospitals are still struggling to control. The local hospital still has struggles with CLABSIs with most time doing worse

than the national average. The critical care leadership team anticipates a decrease in the rate of CLABSIs with the introduction of CHG Tegaderm™ instead of the traditional Biopatch® dressing based on the available evidence to prove that the use of CHG gel dressing is superiors and economical to the use of standard dressing with Biopatch® as currently being used if approved by the administration. With increasing need to provide the highest quality and minimize the rate of central line infections, the gap in nursing on the reduction of CLABSIs still exists on the best highest quality method that can be used to decrease or have zero chances of CLABSIs. My purpose in this systematic review of the literature was to evaluate why the use of transparent IV dressing with CHG gel is essential to reduce the infection compared to the standard CVC dressing with Biopatch® during the insertion and dressing changes. The results of the systematic review will be essential to the facility and the nursing practice to contribute how the deadly disease can be prevented and how nurses can contribute to the quality improvement process of a hospital to improve patients' outcome. The results create wealth of knowledge in nursing practice through synthesizing of broad evidence for quick reference to back the implementation and provision of care guided by the current and strongest evidence from credibly published literature.

Practice-Focused Question

The practice-focused question in my study was: "Does the use of adhesive transparent chlorohexidine gluconate gel Tegaderm™ for adults above 18 years of age admitted to acute and critical care unit with the central venous catheter decrease the central line- CLABSIs rate?"

Addressing the Gap in Practice

By addressing this systematic review, the results of the review addressed the gap in the need of finding the best solution for decreasing the rate of CLABSI. The use of transparent intravenous (IV) dressing with CHG gel pad is considered superior to the standard transparent dressing with Biopatch® because it reduces the rate of infections, allows easy access to the insertion site, and is deemed to be easy to use by nursing staff. The evidence obtained has proven that for the facility to achieve the target of decreasing the rate of CLABSIs, the CHG gel dressing should be implemented together with other central line care bundles. Facilities that were using Biopatch® before conducting the studies of how effective the use of CHG gel is compared to the standard dressing or the use of Biopatch® revealed that the use of CHG gel can and will decrease the rate of CLABSIs compared with the other dressings. For instance, in a study that was done in a critical care unit for nine months of the use of CHG Tegaderm™ dressing, 70 of 81 subjects interviewed indicated that they prefer the dressing compared to the standard dressing (Karpanen et al., 2016). The staff also considered the dressing more straightforward to use, and 77 of the respondents in the survey recommended for future use compared to the standard dressing they were using before (Karpanen et al., 2016). The CDC and the CDC's Healthcare Infection Control Practices Advisory Committee (HICPAC) recently approved and recommended the use of Chlorhexidine-impregnated dressings for the central venous catheters because of their barrier to prevent bacterial penetration to catheter site preventing CLABSIs. The recommendation is based on the systematic review of the literature, quality of evidence, and infection rate. The dressing

should be for only adults 18 years and older. It should be chlorhexidine-impregnated dressings with a U.S. Food and Drug Administration (FDA)-cleared label as is indicated to reduce CLABSIs and recommended to protect the insertion site (Public Relations Newswire, 2017).

Nature of the Doctoral Project

Sources of Evidence and Approach

The systematic review involved reviewing evidence after a clear formulated clinical question was developed. The question helped to identify, select and appraise relevant published literature to collect data from the reviewed studies. The process that I used was a systematic approach to avoid any biases, random errors, arbitrariness, and personal opinions. The systematic review process involved setting clear objectives that had predefined eligibility criteria for the study after identifying a methodology for the study. The eligibility criteria were set to aid in the systematic search of the literature. I followed the systematic review steps as noted in the Walden DNP systematic review manual (Walden University Manual for Systematic Review, 2017). I used the Walden University manual for systematic review and used Walden University library and Google Scholar while conducting the systematic review of the literature for the above DNP project. I obtained researched articles from the sources such as Cochrane Database of Systematic Reviews (CDSR), National Library of Medicine (NLM), PubMed Health, Biomed Central, Cumulative Index to Nursing & Allied Health Literature (CINAHL), Joanna Briggs Institute EBP Database, ProQuest Nursing and Allied Health Source database, and Google Scholar. The search words used included *central venous catheter,*

Tegaderm™ CHG, standard intravenous dressing, adult critical care, bloodstream infection, chlorhexidine gel dressing, and *catheter-related bloodstream infection (CRBSI)*.

The inclusion criteria included only articles published within ten years and published in the English language, randomized controlled trials, and nonrandomized controlled clinical trials. All other research methods were excluded. The demographic characteristics of the population that qualified for inclusion included adults older than 18 years, adults admitted in acute and intensive care units, nurses taking care of the adult critically ill patients. The exclusion criteria were patients with already existing bloodstream infections and patients younger than 18 years.

Approach to Organize and Analyze the Evidence

I organized the evidence obtained after searching the literature in the Microsoft Word matrix table and created an evidence summary table from each selected study. I used the level of evidence using Melnyk-Fineouts' hierarchy pyramid (Melnyke & Fineout-Overholt, 2011) to grade the evidence obtained. I used the preferred reporting item for systematic reviews and meta-analysis (PRISMA) flowchart diagram to illustrate the procedure to select the articles (McInnes et al., 2018). The evidence that I obtained during the search of the literature was categorized based on the strength of evidence of the study. I further analyzed the evidence obtained based on the strongest level of evidence to answer the practice-focused question and explain why the use of CHG Tegaderm™ is superior in the prevention of CLABSI compared to the existing traditional Biopatch® dressing. The evidence helped to answer the clinical question and fill the gap

in the practice of controlling the high incidence rates of central line infections and provide a clear evidenced-based practice of using the adhesive CHG gel Tegaderm™ in the reduction of CLABSIs based on supporting evidence from the literature.

Significance

Stakeholders

The stakeholders that will be affected by addressing the aforementioned problem include but not limited to the patients, nurses, physicians, midlevel providers, infection control practitioner, hospital administrators. External stakeholders such as the CDC, government agencies and payers, health care organizations among others will be affected by the reduction of CLABSIs. Understanding the role and contribution of each stakeholder is an important part. To ensure full support of a project that involves different stakeholder, it essential to involve a multidisciplinary team when introducing new practice. For instance, CLABSIs being a nonrefundable event by Medicare, it is essential to involve the administration or management to have a buy-in in the change of practice if the rates of CLABSIs are going to be decreased or brought to zero cases. The physicians and the advanced practitioners are the ones who insert the central line. Therefore, involving them and teaching how the change of the current practice will impact their work and have the competence or knowledge of the new dressing when inserting the central line will increase the buy-in and ensure support of the new practice. Nurses are the one who change the dressing after it is inserted. Teaching them and providing facts and evidence-based prove that the dressing is superior and easy to use is important. All

stakeholders who will impact the new change should be involved directly to ensure the success of the new practice.

Contribution of the Doctoral Project to Nursing Practice

Doctoral prepared nurses contribute to the growth and improvement of patients' care by designing, implementing, and evaluating therapeutic interventions based on nursing science as is evidenced by the essentials of doctoral education for advanced nursing practice *Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice* and *Essential VIII: Advanced Nursing Practice* (American Association of Colleges of Nursing, 2006). With the increased need to improve patients' care, improve patients' safety and quality of life, the use of evidence-based practice continues to be the focus of providing patients' care in nursing practice. Conducting a systematic review of the use of CHG dressing to reduce the CLABSI rate yielded the highest evidence of why the intervention is superior compared to the general standard central line dressing. The project promoted the need for more application of evidence-based practices in the provision of care in nursing. The review provided a clear answer to why the dressing should be a priority if the cases of CLABSIs will be reduced or brought to zero. The project added knowledge to the healthcare providers and other stakeholders of why to advocate for practices that have been proved to be of high quality to increase patient safety (Connor, Paul, McCabe, & Ziniel, 2017**).**

Health care decisions making should be guided by the best available research evidence. By practicing using the best evidence-based medicine, the health care providers integrate their clinical expertise with the best available external clinical evidence from the

systematic literature review and patient's values and expectations. In this sense, the external clinical evidence was retrieved from the available literature, and the evidence was synthesized to answer the clinical question. The use of available evidence extracted from exploiting the medical research on how a particular intervention has been practiced obtaining an intended outcome and synthesize that information as a raw data are in a typical experiment and is essential when conducting a systematic review. The advantage of a systematic review in guiding the implementation of a particular intervention is that it provides the health care providers or facility with an easy to read summarized findings of all relevant individual studies over a health-related issue. The systematic review aims to identify, evaluate, and synthesize the results of all relevant individual studies and make the evidence available and easily accessible to decision-makers who may not have enough time to look at different articles while making decisions in their patients' care (Gopalakrishnan & Ganeshkumar, 2013).

Transferability to Similar Practices

Better patients care involves the integration of evidence-based practice that is obtained through research and the clinician expertise combined with best patient values to produce positive patients' outcome. The use of evidence-based practice has been effectively emphasized as the most and effective method for clinical decision making to improve patients' health and reduce health care cost. The evidence-based practice of reducing the CLABSIs can be used in other critical cares units or hospitalized patients with the central venous catheter. The results of this systematic review can be shared with other similar critical care units within the health care system, or in other patients with the

central venous catheter in the local city, state or at the national level. With the increasing need to have evidence-based practice in health care, having medical evidence based on credible literature and forms as a basis of clinical and policies decisions making is important. Those who contribute to the synthesis of evidence as in the case of systematic review should ensure that the information is accurate and unbiased. The systematic review is a form of research and therefore maintaining the integrity of evidence retrieval is an important ethical issue that should be considered. Bearing in mind that the evidence synthesized will be used to implement interventions that are meant to improve human care, the evidence obtained should be of high quality and the reviewer should be transparent in the systematic review process in a manner that can be reproducible, and results can be applied in other settings other than the local facility with the clinical problem. Any potential conflicts of interest should be declared to ensure that the reviewer was not influenced by certain individuals or companies to make recommendations based on the available published literature. All the information that was used to guide the systematic review was obtained from published literature, and there is no conflict of interest when conducting the systematic review to recommend the use of adhesive transparent CHG Tegaderm™ gel dressing (Wager & Wiffen, 2011).

Implications for Positive Social Change

Reducing the rate of unwanted and preventable deadly infections preserve life and save billion dollars that are spent to treat infections such as CLABSI. Having an intervention that is aimed in the prevention of CLABSI and is evidence-based supported

with the highest level of evidence will be applicable and contribute in filling the gap that exists to prevent CLABSI hence will add to positive change.

Summary

In section 1, I provided background information for the systematic review project. I outlined the project question, the use of the study, the nature of the study, and the importance of decreasing the CLASBIs. I explored the highest level of evidence to justify why the use of adhesive transparent chlorohexidine gluconate Tegaderm™ is superior in reducing the CLASBIs compared with the standard Biopatch® dressing. In the next section, I will explore the supporting framework and the background information to support the project.

Section 2: Background and Context

Introduction

The use of evidence-based practice is the best guide and framework of nursing practice to improve the patients care for optimum patients' outcome. The use of evidence-based is the new innovative approach in addressing the complex and needed daily needs of the patients served (McEwen & Wills, 2014). The focused practice question in my study was: "Does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to acute and critical care unit with the central venous catheter decrease the CLABSIs rate?" My aim in this doctoral project was to search, retrieve, analyze, synthesize and summarize the best evidence-based practice in the reduction of CLABSI in acute and critical care units.

CLABSIs infections are common in hospital settings, especially in acutely ill patients. CLABSIs are among the deadliest HAIs that occur daily and are considered as noncompensated incidences by Medicare and Medicaid. Chlorohexidine gluconate Tegaderm™ gel central line dressing has been shown to reduce the rate of CLABSIs in adult in critical care units, but it remains unused despite the supporting evidence. Therefore, in this section, I will discuss the practice-focused question and the use of the theoretical framework/model to guide the systematic review. I will also discuss the relevance of the project to nursing practice, the background information of the project, and my role as the Doctor of Nursing practice (DNP) student in the project.

Concepts, Models, and Theories

Theoretical Framework

The need to have evidence-based practice in the health care is to guide the health care professionals based on the latest evidence and scientific development based on research. The evidence-based in this project was the use of adhesive transparent chlorohexidine gluconate gel Tegaderm™ dressing to decrease the CLASBI rate. The practice-based evidence enables the clinicians or health care professionals to generate knowledge from practice and research. The practice-based concept enables the clinicians to integrate clinical experience and research evidence to make a sound clinical judgment when caring for patients with a central venous catheter to reduce the CLABSIs (McEwen et al., 2014).

Reducing the rate of health care-acquired infection is an essential aspect of nursing practice. Reducing HAI does not only avoid the health care burden but also reduce the mortality and morbidity of the patients. In this project, the logic model served as a theoretical framework toward the systematic review of how CHG Tegaderm™ gel central line dressing can reduce the rate of CLABSIs compared with the standard Biopatch® dressings. Logic model is also known as a roadmap, theory of change, or model of change, is a graphic depiction that represents the activities and the intended outcomes of the program (see Figure 1 in Appendix D). The use of logic model helped to articulate the current situation of CLABSIs and how a different intervention that is not currently being practiced can contribute to the reduction of CLABSIs (CDC, n.d.). The use of the logic model helped to provide a visual approach for the project by aiding in

identifying the flow of the project, the goals, resources or inputs to meet the goals of the project, the output needed to complete the goals, the project outcomes and the effects of the project (Kettner, Moroney, & Martin, 2017).

The advantages of using logic models in the systematic review of the literature are because they aid in helping the reviewer to think critically during the review process. It also assists in identifying the inclusion and exclusion criteria, and guide how to research the literature. Logic models aid in defining the outcomes of the review, identifying the mediating and moderating factors, and disseminate the findings once the study completed. The use of logic models in this systematic review of literature helped to articulate how the intervention of CHG Tegaderm™ dressing can help decrease the rate of CLABSI in the acutely ill patients. The model helped to explain how intervention affects a change (Kneale, Thomas, & Harris, 2015).

Concepts/Terms Used in Doctoral Project

1. *Tegaderm™*: A transparent medical dressing that is used to cover and protect wounds or catheter sites (Madhav, Matthew, & Edward, 2018).
2. *Biopatch®*: A protective Disk with CHG dressing for reducing infections and skin colonization of microorganisms (Nicholls, 2014).
3. Central venous catheter: An intravascular venous catheter that is placed at or close to the right side of the heart. The catheter is used in infusing medicine or blood, drawing blood, administering medications and antibiotics, administering fluids, and for hemodynamic monitoring (Bonne, Mazuski, & Schuerer, 2015).

4. *Health care-associated infection* (*HAI*): An infection that develops when a patient has cared in health care settings such as the hospital, outpatient clinic. The disease is associated with the care being delivered by a health care provider (Bonne et al., 2015).
5. *CLABSI*: A primary bloodstream infection that is associated by the presence of a central line or umbilical catheter within 48 hours before, onset of the infection, with no other source of infection evidence other than the catheter. The infection can happen any time regardless of the time the catheter is in place (Bonne et al., 2015).

Relevance to Nursing Practice

History of the Problem in Nursing Practice

The use of evidence-based practice to solve the problem is critical in the decision making in the health care and nursing practice. Many interventions in the care of the patients are now correlated with the recent evidence-based practice that has been proven to be effective. With the increase in the demand for better quality care in the provision of care, an increasing need exists for using evidence-based practice in the nursing field in the health care decision making. There is an increased need to use interventions based on the evidence-based practice. Many organizations that support high-quality patients' care and high level of nursing care such as the Magnet Recognition Program of the American Nurses Credentialing Center are dwelling on the use of evidence-based practice to be applied in the daily nursing practice. The Institute of Medicine recommends the use of

evidence-based practice to be integrated into the care of the patients or nursing practice by the year 2020 (Institute of Medicine. 2010).

Nurses play a crucial role in the prevention of infections especially nosocomial infections such as the CLABSIs. CVC have become indispensable in health care today because of their critical use in the management of patients' health such as the patients who are critically ill. CVCs help in hemodynamically monitoring of acutely ill patients, medication administration and delivering parenteral nutrition. When they are inserted, they break the skin integrity as the first line of defense for fighting infection among others. Thus, patients are exposed to the most frequent cause of nosocomial infections known as CLABSI. CLABSI is considered a National Patient Safety Goal by the Joint Commission of Healthcare Organization ("Hospital National Patient Safety Goals", 2017). Nurses as the frontline providers of care to their needy patients make a significant impact in reducing CLABSI and thus improves quality and safety of the patients' care and affect the financial stability of the health care organization.

The patients' safety challenges to reduce the number of preventable CLABSI that occur 4 days beyond the insertion of the central line are detrimental to the patients' lives and add hefty cost to the facility and the health care. When the facility spends money on unnecessary incurrence that could be prevented, it impacts the budget assigned to the unit, and this affects the nursing unit directly and indirectly. I remember working as a bedside staff nurse, and sometimes we were told that our budget was tight because our staffing, expenses are over the budget allocated to the unit. Cutting unit budget can affect

the nurses' morale, lack of equipment's to work with, and this will lead to poor service delivery.

Current Nursing Practice for Central Venous Catheter

Many facilities follow the central venous catheter bundles that incorporate evidence-based science into practice in the care of CVC. The bundles have guidelines that should be followed and the application of Biopatch® with standard central line dressing during CVC insertion and dressing changes. Despite these bundles and proper adherence, CLABSI incidences are still high. Having an intervention that can reduce the CLABSIs to almost zero is a significant intervention that can be applied to the hospital and contribute positively to the nursing practice. As caring professionals, nurses have always saddened if the patients die because of an infection that could have been prevented. The use of CHG Tegaderm™ has been proven to be useful in the prevention of CLABSIs. Therefore, the project will contribute positively to the nursing practice.

Previous Strategies

Despite the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) guidelines on caring for the central venous catheter, the rate of intravascular catheter-related infection such as CLABSI is still rampant. Many hospitals abide by the CDC and HICPAC's central lines guidelines and performance improvement strategies by implementing the central line bundle strategies as outlined by the CDC, but the rates of CLABSI are still high. Therefore, the review of the literature provided enough evidence to support the use of chlorohexidine gluconate Tegaderm™ gel.

How the Doctoral Project Advances Nursing Practice

CLABSIs are detrimental to the life of the already acutely ill patients whose their immune system is very fragile. Being a nosocomial infection, the issue of how a unit or a hospital can be able to prevent CLABSI completely to zero in 1000 days remains a challenge. The current bundles are applied to almost every hospital and emphasized each day on how to prevent this deadly disease. Despite these measures, CLABSIs are still rampant and contribute to mortality and morbidity of many citizens and contribute to a huge financial burden on the already burdened health care system. Therefore, conducting the systematic review on an evidenced-based practice that can be applied to reduce the cases of CLABSI filled the gap that already exists in the nursing practice on the best method or effective method to reduce CLABSI cases. The doctoral project shed light with an intervention that is evidenced-based backed with the highest evidence from the literature.

Local Background and Context

Local Evidence on the Relevant of the Practice Problem

Decreasing CLABSIs is essential for nursing practice especially with a facility that is aiming for Magnet designation and to decrease the mortality and morbidity associated with CLABSI. Money that spent on treating CLABSI can be used to buy state of the art equipment that facilitates a favorable environment for nursing staff. Tegaderm™ CHG is easier to use and reduces the rate of infection and the evidence I obtained proved that the dressing is preferred in the clinical settings by the end users. The local facility is targeting to transition from the standard CVC dressing to the Tegaderm™

CHG gel if there is enough evidence to convince hospital leadership that the latter is better than the regular dressing. Also, the goal of the local critical care unit is to have less than five CLABSIs per 1000 central line days. Due to the increase in the number of CLABSIs in spite of the local critical care unit adherence to the CDC central venous catheter bundle guidelines, there is need to find solutions that can help improve the care of the CVCs in the hospitals. I formulated a practice-focused question to find the best evidence to back the recommendations of the use of an adhesive transparent chlorohexidine gluconate Tegaderm™ gel dressing on how it is superior to decrease the rate of CLABSIs. Therefore, my doctoral project involved conducting a systematic review of the literature to answer the practice-focused question of "Does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to acute and critical care unit with the central venous catheter decreases the CLABSIs rate?"

Institutional Context on the Relevant of the Practice Problem

The practicum site I carried the project is a critical care unit in a local acute care hospital in Dallas, Texas. The critical care unit has 64 beds in a hospital of more than 500 inpatient beds. The practice question was developed as a request by the critical care team leadership request to conduct a systematic review of the literature to find the available evidence that supports the impacts of CHG Tegaderm™ central line dressing compared to the traditional Biopatch® dressing. The local critical care unit has current CLABSI rate of 0.962 and the whole hospital has a CLABSI rate of 1.232 for the current fiscal

year starting October 1st, 2017 to September 30th, 2018. The critical care leadership in the local hospital had identified the need:

1. To decrease the numbers of CLABSIs per 1000 central line days.
2. To achieve the target goal 0.641 per fiscal year.

Nurses who work in the unit and have part-time jobs in other hospitals have explained how one of the hospitals in Dallas, Texas has implemented the use of CHG Tegaderm™ gel dressings and within 1000 hospital days, the unit had a lower rate of CLABSIs per 1000 central venous catheter days for a critical care unit with 50 beds. To convince the management to change the central line dressing from the standard Biopatch® dressing, the critical care unit needed enough evidence and investigation to prove that the CHG gel Tegaderm™ dressing is superior in reducing the CLABSIs. Therefore, I formulated the above practice question to investigate and reviewed literature for the evidence of how CHG Tegaderm™ is excellent in the reduction of the CLABSIs.

State and Federal Context of the Problem

CLABSIs are reportable health care-associated infections (HAIs) in both the state and the national level. The Texas Department of Health and Human Services requires health care facilities to report HAI through a reporting database called the National Healthcare Safety Network (NHSN), maintained by the Division of Healthcare Quality Promotion (DHQP) at the CDC. The standardized infection ratio (SIR) is a new method that is being used in summarizing HAI experiences across any number of health care facilities or any types. The advantage of SIR is that it can assess HAIs at a national, state, or local level. For adults in ICU, the CLABSI risk adjustment uses patients' care location,

bed size of the patients' care location and hospital affiliation with a medical school to determine the risk of acquiring an infection (Malapiedi, 2013). To calculate CLABSI-SIR, the total number of observed CLABSI events is divided by the predicted number of CLABSI events based on the national CLABSI rates. The predicted number of CLABSI events is calculated by multiplying the national CLABSI rate by the number of central line days that occurred in the hospital unit and divide by 1000. The CLABSI rate is per 1000 central line days. For instance, if the number of national CLABSI rate is five, and the number of CLABSI in the above facility is 10 in 1000 days, then the predicted number of CLABSI for this unit is,

$$\frac{\text{(Observed central line days)} * \text{(National rate)}}{1000} = \frac{(1000) * (5.0)}{1000} = 5.0$$

5.0 is the number of expected/predicted CLABSIs for this location at this hospital. Therefore, to calculate the SIR

$$\text{SIR} = \frac{\text{(Observed \# CLABSIs)}}{\text{(Predicted \# CLABSIs)}} = \frac{10}{5} = 2.0$$

If the SIR is greater than 1, it means that the health care facility has more HAI than the national baseline, meaning it is doing worse than the national experience and vice versa (Malapiedi, 2013).

Role of the DNP Student

Student Professional Context

I am currently practicing as an adult-gerontology acute care nurse practitioner at a correctional facility in a large city in Texas. Although my current role doesn't involve patients with central venous catheter, my previous nursing background was in critical care unit where I helped clinicians' insert central venous catheter and I directly was involved in assessing and changing the central venous catheter dressing. My practicum site was my former work place and therefore, I have experienced patients developing CLABSIs during my direct bedside nursing career at the practicum site. As a former critical care nurse, I have observed patients developing CLABSIs due to the infected central line catheter.

Role of the Student in the Doctoral Project

The American Association of Colleges of Nursing describes eight essentials that a doctoral-prepared nurse attains upon graduation from a doctoral program. The *Clinical Scholarship and Analytical Methods for Evidence-Based Practice (Essential III)* is one of the essential that I have applied in this doctoral project. Turning original research to evidence-based practice and use the evidence to solve the clinical problem is a significant hallmark of doctoral education (American Association of Colleges of Nursing, 2006). Doctoral prepared nurses should take the lead to foster changes at the organization level national level, nursing practice, and health care at large. With the skills, knowledge, and experience I have learned during the doctoral program, I have applied them while I

conducted a comprehensive systematic review of the literature to find answers to the question raised above. My role in this project was the primary sole researcher and evaluator of the highest level of evidence, identified the evidence attained, appraised the evidence for inclusion in the review and determined the quality of the evidence retrieved. I also synthesized the evidence obtained making easy to read and comprehend and more natural to be applied into practice to solve the clinical problem.

Motivation for the Doctoral Project

Throughout the doctoral program, the use of evidence-based practice has been emphasized in almost every class I have taken during my doctoral studies. As a doctoral prepared nurse, it is essential to always aspire to improve the knowledge and lead in the adoption of the evidence-based practice in our nursing practice as leaders and scholars. As an advanced nurse practitioner, it is my aspiration to improve the care of the patients and be a mentor to the novice nurses in the improvement of patients' care and how nursing is practiced. I am determined to find the best evidence that will support the clinical question in my endeavor as a scholar and practitioner. As a former critical care nurse, I have observed patients developing CLABSI due to the infected central line catheter. I have assisted clinician insert a central line and have changed the central line dressing multiple times. The Biopatch® used with the standard central line dressing is supposed to prevent central line infection, but because the material is opaque, it is hard to assess the site of the insertion. Failure to use it in the standard dressings leaves the site with no antibacterial coverage. Some facility such as a one unit I worked at had opted not to use the Biopatch® so the clinicians can have easy access to the insertion site. This is

not the best practice, because it leaves the site open for microbial organisms that are microscopic to view with bare eyes. The advantage of Chlorohexidine Tegaderm™ gel dressing is that it will enable the health care providers to assess the site at the same time having antimicrobial activity that helps protect the central line and the patients. To achieve zero or decreased numbers of CLABSI in 1000 central line days is at the heart of every nurse and the health care facilities and this is why finding the highest level of evidence to support this evidence-based practice is paramount.

Potential Biases

Biases can arise during a study and can be introduced at any point during a study. Sticking to the highest level of evidence and avoiding any opinions from stakeholders or non-expert ensured yielding better results in the systematic review of the literature. Also, ensuring that the systematic review is supported by the highest level of evidence such as meta-analysis and systematic review of randomized clinical trials randomized critical trails studies and non-randomized clinical trials ensured minimal bias of the studies. Ensuring that the process was transparent and indicating the process of retrieving and arriving at the selected articles to form the evidence to answer the clinical question ensured the process was clear and it is reproducible (Melnyk, & Fineout-Overholt, 2011).

Role of the DNP Project Team

The project team for this doctoral project is the critical care nursing leadership, practicum mentor, and the critical care unit-based council. After completion of the

doctoral project, I will present the findings to the critical care team. I solely conducted the systematic review of literature.

Summary

Section 2, I provided the theoretical framework that guided the project and I discussed the local background of the project and why I conducted it. I also identified the impact of the study in the nursing practice and the role I played in the development of the project. In the next section, I will reframe the question of the study and provide the literature support and the synthesis of the evidence.

Section 3: Collection and Analysis of Evidence

Introduction

The Problem and the Purpose

Central venous catheters are essential in the critical care unit because of the ability to administer fluids, blood, antibiotics, parenteral nutrition, and hemodynamic measurement. Due to their proximity to the heart, the chance of causing infection is very high. Biopatch® dressing has been widely used in many years as part of the central line management bundle, but the infection rate continues to rise or never been eliminated regardless of how thorough and sterile the insertion and dressing change of the central line is. The use of transparent Tegaderm™ with CHG is new and has been proved to be more superior to the traditional standard Biopatch® dressing. Due to the cost of treating CLABSI, which is considered as a hospital-acquired infection (HAI) and the morbidity and mortality associated with CLABSI, finding a solution on how to decrease the rate of CLABSIs or prevent them is crucial not only to the local health care facility but the nursing practice at large. The systematic review of the literature enabled retrieval of the highest evidence to support the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to critical care unit with a central venous catheter to prevent CLASBIs. My purpose in this doctoral project was to conduct a systematic review of the literature to find the highest level of evidence to fill the gap that still exists in preventing CLABSIs in acute and critical care settings. In section 3, the focus will be on the practice-focused question, source of evidence, systematic review methodology, and the analysis of evidence (Jenks et al., 2016).

Practice-Focused Question

The Local Problem, Gap in Practice and Focused Question

Central venous catheters are widely used in intensive care units to administer drugs or fluids. The use of Biopatch® with central line dressing has been widely used for years, but the CLABSIs rates are still high. Recently, there is a new intervention that is using Tegaderm™ with CHG gel, which is transparent, and adhesively secures the central line site and allows the clinicians to view the site. The water-vapor-permeable CHG-impregnated gel pad is incorporated onto the adhesive side of a transparent polyurethane dressing, and the CHG-impregnated gel pad is applied directly over the insertion site at the time of catheter insertion or during follow up site care. The gel rapidly softens at skin temperatures and flows about the catheter, providing intimate contact of the CHG-impregnated surface with the entire insertion site. The gel also absorbs up to eight times its weight in fluid, preventing accumulation of moisture on the site. The integrated dressing tightly secures the catheter, preventing any positioning movement that can facilitate entry of microorganism into the insertion tract (Maki et al., 2008). The dressing acts as a barrier against external contamination, and the gel pad has an antiseptic agent. The use of CHG-impregnated dressing placed during the time of CVC insertion and dressing changes ensures the dressing to release the chlorhexidine onto the skin for a 10-day period. The reduction of CLABSI is an area that many hospitals are still struggling to control.

The local hospital is still struggling with CLABSIs with most time doing worse than the national average despite application of the central line bundles guidelines in the

care of the central venous catheter. The critical care leadership team anticipates a decrease in the rate of CLABSIs with the introduction of CHG Tegaderm™ gel instead of the traditional Biopatch® dressing if approved by the administration and after having clear strong supporting evidence. With the increasing need to provide the highest quality and minimize the rate of central line infections, the gap in nursing on the reduction of CLABSIs still exists on the best highest quality method that can be used to decrease or have zero chances of CLABSIs. The purpose of this systematic review of the literature was to evaluate why the use of transparent IV dressing with CHG gel is essential to reduce the infection compared to the standard CVC dressing with Biopatch® during the insertion and dressing changes. The result of the systematic review will be crucial to the facility and the nursing practice to contribute to how the deadly disease can be prevented. The systematic review of the literature allowed gathering evidence from different sources. The evidence was broken down from the highest level to the lowest level to answer the practice-focused question and only the level 1-3 according to the Melynk and Overholt's hierarchy of evidence (2011) were included in the review to minimize any risk of bias in the studies.

The practice question that guided this systematic review of literature is: Does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to acute and critical care unit with the central venous catheter decrease the CLABSIs rate?

Clarifying the Purpose

My aim of conducting this doctoral project was to evaluate and synthesize the available evidence-based research on the use of adhesive transparent chlorohexidine gluconate Tegaderm™ and find why it is superior in the reduction of CLABSIs compared to the traditional Biopatch® dressing. The approach to collect the evidence was guided by the practice-focused question of "does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to critical care unit with the central venous catheter decrease the CLABSI rates?" My aim was to gather data with the strongest highest level of evidence to answer the practice-focused question and support the use of adhesive transparent chlorohexidine gluconate Tegaderm™ as an intervention that will be implemented in the clinical setting to solve the problem of CLABSIs.

Sources of Evidence

The motive of conducting this project was to find, retrieve, evaluate, and synthesize the best available published literature as evidence relevant to the new CHG gluconate gel integrated transparent Tegaderm™ in the care central venous catheter that is determined to be superior to the CHG Biopatch®. Due to the nature of the project, only the published literature was used to answer the practiced focused question as the source of data and evidence. The systematic review was guided by the practice-focused question of, "does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of age admitted to critical care unit with the central venous catheter decrease the CLABSIs rate?" The aim of conducting this literature review was to

evaluate and synthesize the best available evidence that was relevant to the use of adhesive transparent chlorohexidine gluconate Tegaderm™ in the prevention of the CLABSI rate. The source of evidence that I used to address and answer the practiced focused-question came from the primary and secondary sources of peer-reviewed journal articles from the databases mentioned below and the google scholar. I conducted a comprehensive literature review using online databases and the Google scholar. The following databases were used for the search of the current literature: Cochrane Database of Systematic Reviews (CDSR), PUBMED, EMBASE, Cumulative Index to Nursing & Allied Health Literature (CINAHL) and Medical Literature Analysis and Retrieval System Online (MEDLINE) combined search, ProQuest Nursing and Allied Health Source database, and Google Scholar. The search was exhaustive and comprehensive. The inclusion criteria were articles published within a period of 10 years old from 2008 to 2018 focusing on central line infections, full articles published in English, full articles, and focus on adults. Articles older than ten years were excluded from review, non-English articles and articles dealing with pediatrics or younger than 18 years of age.

Relationship of the Evidence to the Purpose of the Project

After searching the literature, 249 articles from databases and 124 from google scholar were obtained and 211 articles were left after removing the duplicates. The abstracts and references of the remaining 211 articles were screened and 165 articles were excluded as they did not meet the inclusion criteria, or they were found to be irrelevant to the study. Twenty-seven full articles were selected and 16 met the inclusion criteria for the final inclusion and 11 articles were excluded with reasons given as

detailed in the exclusion table (see Table 3 in Appendix C). The inclusion criteria for this systematic review included (a) articles addressing adults older than 18 years in acute or critical care hospital with the central venous catheter that has CHG Tegaderm™ dressing, (b) full-text articles, and (c) articles published between 2008 and 2018 and in the English language. The evidence obtained after an extensive search of literature helped to connect the purpose of this doctoral project to evaluate why the use of transparent IV dressing with CHG gel is an evidence-based recommendation to reduce the infection compared to the standard CVC dressing with Biopatch® during the insertion and dressing changes. The comprehensive and exhaustive search process resulted in 16 full articles that met the inclusion criteria and were used in this systematic review. The initial search of the literature started in the CINHAL with MEDLINE combined with the initial word used was the central venous catheter. The results of the systematic review will be essential to the facility to help meet the core measures as a quality indicator and reduce the unnecessary costs to treat CLABSI infections. The review will also be significant to the nursing practice to contribute to how the deadly disease can be prevented. The evidence retrieved from the literature is strong to validate the use of adhesive transparent chlorohexidine gluconate Tegaderm™ in reducing CLABSIs as the best practice that is supported by the literature and superior to the tradition Biopatch® dressing.

Evidence to Address the Practice-Focused Question

The collection and analysis of the evidence helped to answer the practice-focused question of the doctoral project. The articles selected were those retrieved after the search words were used in the databases identified above and the google scholar and those that

met the inclusion criteria established before the collection of data from the online published literature. The search words used to retrieve data were: the central venous catheter, Tegaderm™ CHG gel, adult critical care, bloodstream infection, CHG dressing, and the CLABSIs, and CHG Tegaderm™ gel. After collecting the evidence and the articles that met the criteria were selected, Fineout-Overholts hierarchy of evidence was used to synthesize and critically appraise the evidence obtained to answer the practice-focused question. The evidence table covers the type of evidence, levels of evidence, and the description of evidence (Melnyk & Fineout-Overholt, 2011). The collection and analysis of the obtained evidence helped to address the benefits and effectiveness of using CHG gel Tegaderm™ dressing in the central venous catheter in the reduction of CLASBIs.

Research Method

The research method was a systematic review of the literature to retrieve evidence from published literature from online databases and google scholar. The pre-defined practice focused question guided the finding of the evidence and retrieving the evidence based on the inclusion criteria defined by the practiced focused question. After approval by the university review board to collect data for the doctoral project, I used different databases using the Walden University Library and Google Scholar to retrieve articles using the search terms such as the central venous catheter, Tegaderm™ CHG, standard intravenous dressing, adult critical care, bloodstream infection, chlorhexidine gel dressing, and central-line related bloodstream infection (CLABSI). I used different databases such as the Cochrane Database of Systematic Reviews (CDSR), National

Library of Medicine (NLM), PubMed Health, Biomed Central, Cumulative Index to Nursing & Allied Health Literature (CINAHL), Joanna Briggs Institute EBP Database, ProQuest Nursing and Allied Health Source database and Google scholars to search the evidence.

Published Outcomes and Research

Databases and Search Engines

I assessed articles to answer the practice-focused question from the following databases: Cochrane Database of Systematic Reviews (CDSR), PUBMED, EMBASE, Cumulative Index to Nursing & Allied Health Literature (CINAHL) and Medical Literature Analysis and Retrieval System Online (MEDLINE) combined search, ProQuest Nursing and Allied Health Source database, and Google Scholar. I used Walden University online library and search engines such as the Google Scholar to assess the articles that met the criteria for the practice focused question.

Key Search Terms

The search terms and word combinations that used included a central venous catheter, Tegaderm™ CHG gel, standard intravenous dressing, adult critical care, bloodstream infection, chlorhexidine dressing, and CHG gel Tegaderm™, and CLABSIs.

The Scope of the Review

My aim of conducting an extensive literature search was to find and gather relevant information that is related to the use of transparent IV Tegaderm™ dressing with CHG gel to reduce the CLABSIs. The inclusion criteria were articles published within ten years (between 2008-2018) and published in English language, meta-analysis articles,

randomized controlled trials, controlled clinical trials, and non-randomized controlled trials before and after studies. The demographic characteristics of the population who qualified for inclusion were adults above 18 years of age in acute and critical care units and clinicians working in acute and intensive care units. The Exclusion criteria were patients with already existing bloodstream infections and under the age of 18 years of age.

Exhaustive and Comprehensive Search

Searching for the literature was exhaustive as I used different databases by using different terms and phrase combinations that covered the practice-focused question and the population of patients above age 18 years. The articles that I selected were read in full to find which one met the inclusion criteria and exclusion criteria. I conducted an exhaustive search and retrieval of literature in that after removal of duplicates I read all abstracts and references of the articles to make sure there was no chance of missing important information during the search for the best highest level of evidence to answer the practice question.

Institutional Review Board

The systematic literature review does not have direct involvement of human subjects, and therefore, the issue of human rights did not apply in this doctoral project. Furthermore, after approval of the proposal oral defense by the committee chair and members, I contacted the Walden University institutional review board to obtain an authorization to conduct the systematic review of the literature to ensure that all rights were protected. The data of the study was from the published literature. As the study

project was an institutional review board pre-approved for DNP Systematic Literature Review, the IRB approved the implementation of the proposal with approval number **09-12-18-0572544.**

Analysis and Synthesis

Systems to Record, Track, Organize and Analyze the Evidence

After retrieving the articles, those that met the criteria were reviewed thoroughly, evaluated and analyzed using the Melynyk and Fineout-Overholt (2011) seven levels of evidence (see Table 1). I manually organized and recorded the evidence obtained from the search of the literature in a Microsoft Word Matrix table (see Table 2 in Appendix A). Articles were organized into various columns by the year of publication and the name of the author(s), the title of the articles and the purpose of conducting the study, the research design used the sample size of the subjects and settings, the findings of the study or outcomes and the level of evidence. Each article was weighed against each level of evidence below and categorized accordingly. The findings of the articles are summarized in the finding section within each level for illustration and individual summary of the articles.

Table 1

Levels of Evidence

Levels	Rating system for the hierarchy of evidence
1	Systematic reviews and meta-analysis of randomized controlled trials (RCTs).
2	Evidence from well-designed RCTs.
3	Evidence obtained from well-designed controlled trials without randomization.
4	Case-control and cohort studies.
5	Systematic review of descriptive and quantitative studies.
6	Single descriptive and quantitative studies.
7	Expert opinion.

Note: Melynyk and Fineout-Overholt (2011) designed this level of evidence hierarchy

The preferred reporting item for systematic reviews and meta-analysis (PRISMA) flowchart diagram was used to illustrate the procedure to select the articles (McInnes et al., 2018) (see Figure 2 in Appendix D).

Analysis Procedure

The evidence that I obtained during the search of the literature was categorized based on the strength of evidence of the study. The highest or the most substantial level of evidence was used to propose the use of adhesive transparent chlorohexidine gluconate

central line dressing in the reduction of CLASBIs. The data analysis obtained was used to recommend the use of adhesive transparent chlorohexidine gluconate central line dressing.

Summary

The aim of conducting this systematic review project was to provide the recommendation that can yield significant help in addressing the gap that still exists in the prevention of CLABSIs. The results of conducting this systematic review shed light on the advantages of using the adhesive transparent chlorohexidine gluconate central line dressing compared to the traditional Biopatch® dressing in the prevention of CLABSI to improve patient care quality and reduce the mortality and morbidity associated with CLABSIs. The outcomes of the study will benefit the local facility and the nursing practice as well as improve the patients' care outcomes in adult in both acute and critical care units. The adhesive transparent chlorohexidine gluconate central line dressing project has the potential to decrease the numbers of CLABSI in acute and critical care units that will improve the patient safety and clinical outcome in health care organizations when the recommendation is implemented. In this section I discussed the practice-focused question, the source of evidence, the Walden University institutional review board process, and the analysis and synthesis of the evidence that was obtained. In the next section, I will discuss the introduction of section four, the findings and implications of the extensive search of the literature, recommendations, strength, and limitations of the systematic review.

Section 4: Findings and Recommendations

Introduction

Central venous catheters are widely used in intensive care units and acute hospitals to administer drugs or fluids. The populations in adult intensive care units are critically ill and susceptible to infection. When catheters are introduced into the patients' bodies, they become an easy port of bacterial entry if proper care is not taken. The CDC requires health care facilities to use the CDC guideline issued in 2011 for the prevention of CLABSI. The CDC requires the health care facilities to:

1. Educate and train health care personnel who insert and maintain catheters.
2. Use maximal sterile barrier precautions during central venous catheter insertion.
3. Use a > 0.5% CHG preparation with alcohol for skin antisepsis.
4. Avoid routine replacement of central venous catheters as a strategy to prevent infection.
5. Use antiseptic/antibiotic impregnated short-term central venous catheters and chlorhexidine-impregnated sponge dressings if the rate of infection is not decreasing despite adherence to other strategies (i.e., education and training, maximum barrier precautions, and > 0.5% chlorhexidine preparations with alcohol for skin antisepsis).
6. Perform improvement by the implementation bundled strategies, and documenting and reporting rates of compliance with all components of the bundles as benchmarks for quality assurance

(Adapted from the Center for Disease Control and Prevention (2011).

Evidence-based practices are essential to inform the practice and care that nurses provide to patients each day. The absence of the best central line dressing in caring for adults' patients with the central venous catheter has led to the increase of the CLABSIs despite adherence to the CDC (2011) guidelines. The local hospital applies the 2011 CDC guidelines with an aim in preventing the CLABSI. After the central line insertion or during the dressing change, a chlorhexidine-impregnated sponge (Biopatch®) is applied at the site of insertion and covered with a sterile, transparent, semipermeable dressing per the 2011 CDC guidelines (CDC, 2011). There is a central venous catheter dressing called adhesive transparent chlorohexidine gluconate Tegaderm™ gel. The dressing is new in the market and has proved to be superior to the current standard dressing used (CHG Biopatch®/Sponge/Disk), but little is known about it. The need to have clear and robust evidence to propose the change of dressing for the local facility to decrease the rates of CLABSI prompted the decision to conduct a systematic review of the literature to find the evidence of why the proposed dressing is superior to the one currently being used. The gap in nursing practice still exists on the best method or best dressing for the central venous catheter to control CLABSIs. The purpose of this systematic review of the literature was to synthesize evidence relevant to the use of Adhesive Transparent Chlorohexidine Gluconate Tegaderm™ Gel Dressing to improve the control of CLABSI when implemented with the CDC 2011 guidelines for the central venous catheter.

The practice-focused question that guided the DNP project was: "Does the use of adhesive transparent chlorohexidine gluconate Tegaderm™ for adults above 18 years of

age admitted to acute and critical care unit with the central venous catheter decrease the CLABSI rate?" Articles from databases such as CINHAL, MEDLINE, PubMed, EMBASE, and Google Scholar were used as evidence to support the systematic literature review. Only articles that met the criteria were included for the review, and those that didn't meet the criteria were excluded with the reason for exclusion as is indicated in the table of exclusion (See Table 3 for Full Articles Excluded, in Appendix B).

With the need to provide current evidence-based quality of care, it is imperative for doctoral prepared nurses to be in the front line to have projects that are guided to improve how care is being delivered to have an impact to the patients, health care providers, facility, and the nursing practice. As a doctoral student, I embarked on a systematic review project on the use of adhesive transparent CHG Tegaderm™ gel dressing for the central venous catheter that has been proved to be superior compared to the chlorhexidine Biopatch® in decreasing the central-line associated bloodstream infections. The project involved formulating a research question that guided the search words, the inclusion criteria, retrieval and synthesis of the findings to form the evidence to answer the clinical question. Health care decisions making should be guided by the best available research evidence. By practicing the best evidence-based medicine, the health care providers integrate their clinical expertise with the best available external clinical evidence from the systematic literature review and patient's values and expectations. In this essence, the external clinical evidence was retrieved from the available literature, and the evidence was synthesized to answer the clinical question. The systematic review involves conducting an extensive published literature search, evaluate

the evidence, and synthesize the evidence to be used as supporting evidence to guide nursing practice. The advantage of a systematic review in guiding the implementation of an intervention that a health care provider or facility is intending to implement the intervention is that it provides quickly summarized findings of all relevant individual studies over a health-related issue. The aim of the systematic review is to identify, evaluate, and synthesize the results of all relevant individual studies and make the evidence available and easily accessible to decision-makers who may not have enough time to look at different articles while making decisions in their patients' care (Gopalakrishnan & Ganeshkumar, 2013).

The search terms and word combinations I used to search for evidence included the central venous catheter, Tegaderm™ CHG, adult critical care, bloodstream infection, chlorhexidine dressing, CHG gel Tegaderm™, and CLABSIs. The only data included are from those articles that met the criteria predefined before the search. After the appraisal of the articles using the Melynk and Fineout-Overholt's (2011) guide on the hierarchy of evidence-based studies, I used the Microsoft Word Matrix Table to record the articles selected. I later organized the articles into various columns by the year of publication and the name of the author(s), the title of the articles and the purpose of conducting the study, the research design used, the sample size of the subjects and settings, the findings of the study or outcomes and the level of evidence (see Table 2, in Appendix A.). The purpose of conducting this systematic review of the literature was to search, retrieve, record and analyze the highest level of evidence available to answer the clinical question formulated

before the start of the project and make recommendations for the local facility and to the nursing practice.

To comply with the Walden University IRB, approval was obtained to collect data with approval number 09-12-18-0572544.

In Section 4, I will discuss the synthesis and summary of the findings. Articles that made through the inclusion criteria and evaluation are broken down in the level of evidence and summary explained. The implications of this systematic review are discussed, and recommendations are well defined. The strength and limitations of the systematic review are identified and discussed in this section.

Findings and Implications

The literature search resulted in 249 articles from database and 124 from google scholar based on the search terms. After removing duplicate, the 211 articles were left, and their abstracts and references were fully screened. One hundred and sixty-five articles were excluded as they did not meet the inclusion criteria, or they were found to be irrelevant to the study. Twenty-seven full articles were selected and reviewed, out of which 16 met the criteria for the final inclusion (See Table 2, Appendix A) and 11 articles were excluded with the reasons given as detailed in the exclusion table (see Table 3. Appendix B). The analysis resulted in (n= 16) articles that met the relevant review criteria (see Appendix A). Eleven articles were excluded with the reason for exclusion explained (see Table 3, Appendix B). The inclusion for this systematic review included (a) articles addressing adults' older than18 years of age in acute or critical care hospital

with the central venous catheter that has CHG Tegaderm™ dressing, (b) full-text articles, (c) articles published between 2008 and 2018 and in the English language.

The evidence obtained after an extensive search of literature helped to connect the purpose of this doctoral project to evaluate why the use of transparent IV dressing with CHG gel is an evidence-based recommendation to reduce the infection compared to the standard CVC dressing with Biopatch® during the insertion and dressing changes. The comprehensive and exhaustive search process resulted in 16 articles that met the inclusion criteria and are used in this systematic review. The initial search of the literature started in the CINHAL with MEDLINE combined with the initial word used was the central venous catheter. The results of the systematic review will be essential to the facility to help meet the core measures as a quality indicator and reduce the unnecessary costs to treat CLABSI infections. The review will also be significant to the nursing practice to contribute to how the deadly disease can be prevented. The evidence retrieved from the literature is strong to validate the use of adhesive transparent chlorohexidine gluconate Tegaderm™ in reducing CLABSIs as the best practice that is supported by the literature and superior to the tradition Biopatch® dressing.

After retrieving the articles, I graded them using the Melynk and Finehout-Overholt system of grading evidence and grouped them based on their level of evidence. The summary of the articles will be discussed below, and the complete literature review table is found in Table 2, Appendix A.

Level 1 of Evidence

In the Melynk et al., (2011) hierarchy of evidence the level 1 is considered as the highest level of evidence and most powerful to provide the substantiate evidence with minimal bias. The level 1 included in this literature review is the meta-analysis of multiple randomized controlled trials.

Safdar et al., (2014) conducted a meta-analysis of multiple randomized controlled trials to assess the efficacy of a chlorhexidine-impregnated dressing compared with conventional dressing for prevention of catheter colonization and Cather-related bloodstream infection. Only studies that were prospective randomized trials comparing a chlorhexidine-impregnated dressing with conventional site care were considered for selection. Nine randomized controlled trials met the criteria for inclusion in the meta-analysis. The studies enrolled 6,067 patients with a total of 11,214 catheterizations. A total of 2,984 patients with 5,586 catheters received a chlorhexidine-impregnated dressing and 3083 patients with 5628 catheters received conventional site care. A total of 361 of 5,586 catheters (6.5%) were colonized in the CHG gel group compared with 743 of 5,628 (13.2%) in the comparator group. The study concluded that the use of chlorhexidine-impregnated dressing is beneficial in the prevention of catheter colonization and catheter-related bloodstream infection and should be used in patients that are at high risk for catheter-related bloodstream infection (Safdar et al., 2014).

Maunoury and colleagues (2015) conducted a meta-analysis of a multicenter randomized controlled trial of 1,879 adults above 18 years admitted to 12 French ICUs in seven universities and four general hospitals from 31st May 2010 to 29th July 2011 who

required intravascular catheterization for 48 hours. A total of 4,163 catheters and 34, 339 catheter-days were studied. The objective of the study was to conduct a cost-effectiveness analysis to determine the impact of the use of antimicrobial CHG-containing securement dressing compared to non-antimicrobial transparent dressing for the reduction of CLABSIs and other cost related to the CLABSIs. The analysis revealed a ratio of 1 to 5 for the average number of CLABSIs occurred between CHG and non-CHG dressings groups respectively with 3 CLABSIs occurred in CHG group and 14 in the standard group. The difference in the numbers of CLABSIs was highly statistically significant (Maunoury et al., 2015).

Level 2 of Evidence

Level 2 is considered the second most powerful level of evidence in the hierarchy of evidence according to Melynk et al., (2011). This level includes well-designed, quantitative, randomized controlled trials. Timsit et al., (2012) conducted a multicenter randomized controlled trial in 1,879 subjects with 4,163 central venous catheters in adults above 18 years of age in patients in 12 ICUs in France that were required catheterization for 48 hours between May 31st, 2010 to July 29th, 2011 to determine if chlorhexidine-impregnated Tegaderm™ and strongly adherent dressings decrease catheter colonization and catheter-related infections. The study is considered as the landmark study that evaluated and supported the use of transparent chlorhexidine impregnated gel dressing with high holding power and reinforced border. Patients were randomized to one of the three dressings: (1) a CHG dressing (Tegaderm™ CHG); (2) a highly adhesive dressing; and (3) a standard breather bale, hypoallergenic dressing. These multiple randomized

clinical trials found that the addition of 3M Tegaderm™ CHG I.V. Securement Dressing in institutions already following routine infection control techniques led to a reduction in catheter colonization and catheter-related infections. 21/941 (2.2%) patients in the control group were found to have Infection with 1.29 infections per 1000 Catheter days while in the CHG dressing group 9/938 (0.96%) of the patients had infections comprising 0.52 infections/1000 catheter days. The study revealed that there was a 57% reduction in patients with infections and 60% reduction of infections per 1000 Catheter for the patients using the CHG gel dressing (Timsit et al., 2012).

Pedrolo, Danski, and Vayego (2014) conducted a randomized clinical trial from October 2011 to May 2012 to assess the effectiveness of the chlorhexidine antimicrobial dressing in comparison to the gauze and tape dressing in the use of central venous catheter in 85 severe clinical and surgical adults in intensive care and adult semi-intensive care units of a university hospital in south of Brazil. Forty-three patients were randomized in the intervention group (chlorhexidine antimicrobial dressing) and 42 in the control group (gauze and tape dressing). The study did not find any statistical difference in the reduction of primary bloodstream infections, local reactions to the dressing and dressing fixation between the two dressings (Pedrolo et al., 2014).

Dolci, Margatho, Silveira, and deCampos (2017) conducted a randomized clinical trial to identify the frequency of change of chlorhexidine-impregnated gel dressings applied in central venous catheter insertions sites in critically ill patients. Fifty two patients above 18 years of age with the short-term central venous catheter and using chlorhexidine-impregnated gel dressing in a high complexity intensive care unit in a

teaching hospital in the state of São Paulo in Brazil were eligible for the study. Thirteen nurses of the ICU participated in the training and data collection. The nurses who participated in the study completed training and practice on application and removal of the dressing using a mannequin with a CVC. A sterile gauze fixed with adhesive tape as a dressing was used during the first 24 hours after the CVC insertion until the local bleeding has seized. The chlorhexidine-impregnated gel dressings followed and changed after seven days or as needed. Data were collected on a daily basis between April and December 2014. The researchers assessed the dressing and when the dressing had been changed and verified the reason for the change. A total of 64 catheters were analyzed with a total of 159 dressings used with a mean frequency of change being 3.04 days (*SD* = 1.917). A total of 95 changes occurred among the 159 utilized dressings. Among the 64 CVCs, 25 were applied in a single dressing, without replacement of the dressing, and in 39 catheters there was no need to apply a new dressing after removal of the last one. Considering the interruption of use of the catheter by the patients, 87% (83) dressings were unscheduled due to detachment and were from CVC in the subclavian vein, and 13% (12) were scheduled changes. The study concluded that the frequency of dressing changes was less than seven days, resulting in more significant quantities of dressings per patient caused by the detachment of the dressings (Dolci et al., 2017).

Karpanen et al., (2016) conducted a prospective comparative non-blinded single-center clinical study to determine the antimicrobial efficacy of CHG (CHG) gel dressing used in patients with a CVC. Two hundred and seventy three adults above 18 years of age who required a CVC as part of their clinical management admitted to critical care unit in

a large university hospital with 75 critical care beds divided into four units between January 2013 and October 2014. One hundred and thirty seven patients were randomized to standard dressing (3M Tegaderm™ IV dressing containing no antimicrobial) group and 136 patients in chlorhexidine dressing (an adhesive, semipermeable, transparent polyurethane film dressing incorporating a transparent gel pad containing 2% CHG) group. The non-antimicrobial standard dressing study phases were divided into two study periods, before and after the CHG dressing phase. The standard dressing was the part of routine dressing for the CVC care in the hospital before the study. The first phase included recruiting half of the standard dressing group patients, and then the CHG introduced. After the CHG phase, the standard dressing was reintroduced and studied. The study revealed a significant reduction in the number of microorganisms recovered from the CHG gel pad when implemented with standard CVC site care compared to the standard dressing (Karpanen et al., 2016).

Biehl and colleagues (2016) conducted an open-label, randomized, multicenter trial to investigate the effects of CVC dressings with CHG-containing gel pads in the setting of high-risk neutropenic patients. This was the first known randomized trial to evaluate a transparent CVC dressing with a chlorhexidine gel pad in neutropenic patients. The trial was done in 10 German hematological departments comparing the safety and efficacy of chlorhexidine-containing gel pad transparent CVC dressing with an advanced transparent CVC dressing without antimicrobial gel pad between February 2012 and September 2014. A total of 613 patients met the inclusion criteria to participate in the ten study sites. 307 patients were randomized to the CHG group (n= 307) and 306 patients to

the Control group (n= 306). The study revealed that the application of chlorhexidine containing catheter securement dressings reduces the incidence of definite or probable central line related bloodstream infections in neutropenic patients. The infections dropped overall from 17.3% to 10.4% (p= 0.014) and within 14 days of CVC placement from 11.15 to 6.5% (p= 0.047) (Biehl et al., 2016).

Olson and Heilman (2008) conducted a single-center randomized controlled trial to evaluate a new CHG catheter dressing, 3M Tegaderm™ CHG IV Securement Dressing for its practicality of use in clinical practice on central venous access devices compared to the non-CHG Tegaderm™ dressing. Sixty three patients between the age of 28-88 admitted in Allina Hospitals requiring a central venous catheter with a peripherally inserted central catheter, intrajugular central venous catheter, subclavian venous catheter, or femoral venous catheter and expected to remain in place for at least three days were included in the study. Thirty three patients were randomized to the CHG dressing group and 30 in the control group. The clinicians assessed the dressing based on the catheter securement, satisfaction with the dressing, ability to see the insertion site, ease of applying a dressing and the ease of using the dressing correctly, dressing adherence, skin stripping, maceration, erythema, and edema. The study revealed that the new 3M Tegaderm™ CHG gel dressing was as easy to use as the standard of care (non-antimicrobial transparent adhesive dressing) and offered many advantages over standard dressing such as antimicrobial activities, handles moderate bleeding and remains transparent and appear to provide greater catheter securement than the standard dressing and conformed well to the catheter (Olson & Heilman, 2008).

Eyberg and Pyrek (2008) conducted a controlled randomized prospective comparative pilot study to evaluate the ease of use and easier of training of application between a transparent CHG dressing versus a CHG disk (Biopatch®) in healthy volunteers. Twelve healthy intravascular therapy health care professionals above age 18 years specializing in vascular access and infusion therapy with experience in applying and changing IV dressings in their practice were involved in the evaluation. The clinicians had not used the CHG gel before but had used the CHG disk in their practice. Dressings were applied randomly to the subjects' locations in the right and the left side of the neck and left and right arms and the subjects were asked to remove them. A total of 24 CHG gel dressing and 24 CHG gel disks were applied. The study concluded that the CHG gel dressing was significantly better in overall performance ($p<0.0001$) compared to the CHG disk. All the 12 clinicians rated the CHG gel dressing better or much better, easier to apply, ease of removing, ability to see the IV site, ease of training another clinician to use, and more intuitive to use compared to the CHG disk (Eyberg & Pyrek, 2008).

Bashir, Olson, and Waters (2012) conducted a randomized controlled trial to compare the performance of the antimicrobial polyurethane film dressing to two CHG-containing insertion site dressings concerning the abilities of the CHG-containing dressings to suppress bacterial regrowth over a seven days' time frame in the healthy adult. Thirty-two healthy male and female above 18 years of age with no dermatological conditions participated in the study. At the beginning of the study, four baselines samples of normal flora were collected from each subject. Two samples on the upper back and

two on the lower back. The subjects' skin was prepped with a 2% CHG/70% isopropyl alcohol antiseptic. The three dressings (Tegaderm™ transparent films dressing, CHG gel and CHG disk) were placed on the prepped skin in a randomized design. Samples of bacteria were collected using the cup scrub method. The skin under the dressings was sampled by quadrant on days 1, 4, and 7. The suppression of the regrowth of bacteria was compared using an adjusted paired *t*-test. The study revealed that skin flora was not wholly eradicated during antisepsis, and regrowth occurred post antisepsis. The use of CHG gel dressings helped sustain a reduced bacterial count on the skin, and the continuously releasing CHG gel maintained suppression to a greater extent that the CHG disk at seven days ($P = .01$) (Bashir et al., 2012).

Maki et al. (2008) conducted a prospective comparative randomized controlled trial to compare two novel CHG-impregnated dressings (CHG Tegaderm™ gel and sponge) in healthy volunteers to assess the immediate and long-term surface cutaneous antimicrobial activity of the two CHG (Tegaderm™ CHG gel and Biopatch®) dressings and a control non-medicated transparent dressing in healthy subjects. 48 healthy adults aged between 25 to 70 years without primary skin disorder or known allergy to CHG participated in the regrowth study on prepped subclavian sites at a Hilltop Research in Miami Ville in Ohio and 29 subjects participated in the trial assessing killing of normal flora on unprepped skin in research conducted in the Medical Division Laboratory of 3M Company in St. Paul Minnesota. The study was conducted by evaluating the antimicrobial activity of the two CHG dressing against normal cutaneous microflora on the back of the subjects by measuring the flora counts under the dressings after 1,2,4,7

and 10 days on sites that were not prepped with an antiseptic at the outset. Each of the two test areas, one on the right and other on the left were randomly sampled for sample counts on day zero. The 2 CHG dressings were randomly applied to the two remaining sites. By random assignment, one of each test CHG dressings was removed from each side on study days 1, 2, 4, 7, and 10 and quantitative skin cultures were obtained. The study concluded that the newly integrated CHG gel dressing showed powerful bactericidal activity against diverse nosocomial species, and both CHG dressings studied showed excellent immediate and especially, long-term cutaneous floral suppression and were tolerated. The new integrated transparent CHG impregnated gel dressing is easier to apply and less vulnerable to improper application, reliably secures the catheter, permits continuous inspection of the insertion site, and obviates the need for every-other-day site care (Maki et al., 2008).

Rupp et al., (2008) conducted a prospective, randomized controlled single-center clinical trial in a 689 bed at Nebraska Medical Center, a University-associated, tertiary care center to assess the clinical performance of an innovative CHG Tegaderm™ dressing containing CHG gel pad in minimizing the growth of microbes at the catheter insertion site. 60 adults' patients with the central venous catheter that was likely to remain in place at least three days participated in the study. Tegaderm™ CHG containing gel dressing and the transparent, semipermeable polyurethane dressings were randomly assigned to the insertion site. Dressings were evaluated daily for adherence, catheter securement, transparency, and skin condition, the presence of moisture or blood, and patient comfort. At day seven, the microbiologic assessment was done for subjects with

catheters seven days of continuous study dressing wear by collecting a swab culture at the catheter insertion site. The study revealed that the Tegaderm™ CHG dressing containing a chlorhexidine gel pad is an innovate means to minimize catheter-associated bloodstream infection potentially. The Tegaderm™ CHG dressing is well-tolerated and judged to be superior to the comparator dressing with regard to catheter securement and overall satisfaction (Rupp et al., 2008).

Level 3 of Evidence

Level 3 in the hierarchy of evidence is the evidence obtained from well-designed controlled trials without randomization (Melynk et al., 2011). Zehrer, Smith, and Deschneau (2010) conducted a multicenter clinical trial to compare the performance of a new transparent CHG gel pad dressing versus a CHG disk (plus transparent dressing). A total of 321 clinicians from 16 US hospitals were enrolled to evaluate the application of 500 new CHG gel pad dressings. The 16 hospitals were using the CHG disk (Biopatch®) before the clinical evaluation. During the time of the study, the nurses only applied the new CHG gel dressing and completed a written questionnaire after the study to compare the two products. 80.6% (95% lower CI: 76.2%) of evaluators recommended replacing their current product with the transparent CHG gel pad dressing ($p=0.0178$) (Zehrer et al., 2010).

Pfaff, Heithaus, and Emanuelsen (2012) conducted a quality improvement observation study in an adult medical-surgical intensive care unit in a 20 beds critical care unit in at Staten Island University Hospital in New York in 2009. The objective was to compare the effectiveness of the use of a new 1-piece CHG transparent gel dressing

with a chlorhexidine patch (Biopatch®) in maintaining the low rate of catheter-related bloodstream infections in the intensive care unit and to evaluate nurses' satisfaction with and cost of the new dressing. All patients who were admitted in the critical care unit requiring central catheters had a CHG gel pad dressing applied. Sixty-two nurses participated in placing the CHG gel dressing, and 30 responded to the survey. The study revealed that eliminating the Biopatch®, the new CHG gel dressing will have cost saving of $3.42 per dressing change. During the study period of 1881 device days, the infection rate dropped from 0.052 per 1000 device days in 2008 to 0.0051 per 1000 days in 2009. Nurses preferred the new dressing compared to the old dressing, and the new dressing had a total cost savings of $3807. Therefore, the new dressing can lead to a lower rate of catheter-related bloodstream infections, increase nurses' satisfaction, and contribute to cost savings (Pfaff et al., 2012).

Karpanen et al., (2015) conducted a clinical trial to evaluate the introduction, performance, and clinical staff perceptions of the standard transparent intravenous dressing in comparison to the transparent film intravenous line dressing with a CHG gel pad at the insertion site of short-term central venous catheters and vascular access catheters for dialysis in adult critical care patients. The evaluation involved 273 patients in 75 critical care beds in a University Hospital at the city of Birmingham in the UK. CHG dressing, (n= 136) and Standard dressing (n= 137). 71 nurses and ten clinicians responded to the survey. The staffs were trained and were competent to handle central venous catheter per the hospital policy. Questionnaires were used as a form of evaluation after 12 months of the use of standard transparent dressing (dressing used in throughout

the hospital) and after nine months use of the IV dressing incorporating a CHG gel pad. The anonymous questionnaires that were returned in sealed boxes after completion was directly distributed to the trained nurses in the critical care and anesthetist in the operating theaters who had experience with CVC insertion and competency. The majority of the clinical staff (70 out of 81 respondents) considered the performance of the IV dressing containing a CHG gel pad better or much better than the standard dressing. Seventy seven out of 78 respondents recommended continuing its use. Both types of dressing performed better well when applied to the insertion site of IV catheters in the internal jugular, subclavian, and femoral care patients (Karpanen et al., 2015).

Guclu et al., (2014) conducted a before (SP-1) and after clinical trial (SP-2) to investigate the efficacy of chlorhexidine-impregnated gel dressings in reducing the catheter-related bloodstream infections (CRBSI). The study was conducted between January 2010 and December 2011 in a six-bed intensive care unit of a tertiary care hospital involving 991 adult patients (521 patients in sterile dry gauze before the study and 470 in chlorhexidine-impregnated gel dressings after the study). In the first trial part of the study (between January 2010 and December 2010), sterile gauze was used as a catheter side dressing and changed every two days unless the dressing became saturated or loosened and in the second part of the study period (January 2011 and December 2011), 2% chlorhexidine-impregnated gel dressings (Tegaderm™ 3M) were used and changed every seven days unless needed to be changed before the time. The infection control nurse and the infectious disease specialist evaluated patients for hospital-acquired infections every morning. Ninety four central venous catheters were inserted for the first

study (823 catheter days) and 53 central venous catheters were inserted for the second part of the study (560 catheter days). Six and five central-line related bloodstream infections were observed in SP-1 and SP-2 respectively ($p>0.05$). The study concluded that although there were decreased numbers of CVC inserted on the SP-2, the incidences of CRBSIs between the two periods did not differ ($p>0.05$) (Guclu et al., 2014).

Moureau, Deschneau, and Pyrek (2009) conducted a clinical evaluation to statistically validate the performance of a new CHG gel dressing in the clinical setting by skilled IV nurses and to compare the new CHG gel dressing to the CHG disk in six United States hospitals from different states. Sixty four IV nurse's evaluators participated in the clinical evaluation with a total of 500 new CHG gel dressings applied during the evaluation period for 73 days. Study sites were selected based on their current use of a CHG antimicrobial absorptive foam disk (CHG disk/Biopatch®). Nurses' evaluators used an integrated transparent absorbent CHG gel dressing in place of their current CHG disk plus transparent dressing. Each site participated for a period of minimum 14 days, and the nurse evaluators completed the questionnaires at the end of the evaluation period. The evaluation questions were in 16 levels striated into four performance groups: ease of application, gel dressing performance, securement function and other. The new CHG gel dressing was rated significantly better than the comparative CHG disk plus transparent dressing in overall performance ($p<0.0001$); 90.5% of evaluators rated the new dressing as equal to or better than, the comparative dressing. The new CHG gel dressings were evaluated significantly better in all dimensions of performance studied. The study concluded that the CHG gel dressing provides antimicrobial activity at the insertion site

in an integrated dressing that is easy to use and has a higher level of clinical performance and less chance for application error that would lead to better compliance to established standards of practice (Moureau et al., (2009).

Evidence Synthesis

Reduction of CLABSIs. Different studies demonstrated the efficacy of CHG Tegaderm™ gel in the reduction of CLABIs. A meta-analysis of randomized control trials study by Safdar and colleagues (2014) reviewed that the use of chlorhexidine-impregnated dressing results in the reduction of the prevalence of CLABSI. Similarly, multiple randomized controlled trials conducted by Timsit et al., (2012) indicated that the use of CHG Tegaderm™ gel results in significant reduction of CLABSI counting to 57% reduction of the patient with infections and 60% reduction of infection per 1000 catheter days while using the CHG gel dressing. In a prospective randomized clinical trial done by Karpanen and colleagues (2016) to evaluate the antimicrobial efficacy of the CHG gel in patients with CVC, the study revealed a significant reduction of the number of microorganisms recovered from CHG gel compared to the standard dressing. In a study done by Biehl et al., (2016) to evaluate the efficacy of CHG gel in neutropenic patients with CVC, the randomized multicenter trials revealed that the application of CHG gel dressing reduces the CRBSI indefinitely. Pedrolo and colleagues (2014) in their randomized clinical trial to assess the effectiveness of the chlorhexidine antimicrobial dressing in comparison to the gauze and tape dressing revealed no significant differences between the two dressing regarding the occurrence of CLABSIs, local reactions to the dressing and dressing fixation. Bashir et al., (2012) in their randomized clinical trial study

to compare the CHG gel with CHG Biopatch® (disk) revealed that the use of CHG gel is essential in the reduction of CLABSI because of the ability to maintain suppression of regrowth of bacteria after antisepsis during the central line insertion because the CHG gel ensures continuous releasing of CHG. Rupp and colleagues (2008) in their prospective randomized single-center controlled trial to assess the clinical performance of innovative CHG Tegaderm™ dressing containing CHG gel pad in minimizing the growth of the microbes at the catheter insertion site revealed that the use of CHG gel helps to mitigate the CLABSI. The Mourea et al., (2009) in their non-randomized clinical trial to evaluate the clinical performance of the CHG gel revealed that the dressing provides antimicrobial activity at the insertion site compared to the CHG disk. Maki and colleagues (2008) in their comparative analysis between CHG Tegaderm™ gel and CHG Biopatch® in a non-randomized clinical trial revered that the CHG gel dressing provides superior prevention of floral regrowth on prepped sites and progressive kill of the cutaneous microflora on unprepped sites compared to the CHG sponges (Biopatch®).

Cost-effectiveness. To assess the cost-effectiveness of the CHG gel, different studies were identified that yield the benefit of how economical the CHG gel is in the cost reduction. In the meta-analysis study done by Mauoury et al., 2015) using multicenter randomized controlled trials, the CHG gel is considered more cost-effective than the standard antimicrobial dressing because of the ability to reduce the numbers of CLABSI hence reduce the cost associated with CLABSIs. Heiman and colleagues (2012) in their clinical controlled trial to evaluate the health economic analysis on the use of CHG gel compared to non-CHG dressings revealed that although the overall direct costs

of using both dressings are the same, the CHG dressing provides better antimicrobial coverage that leads to lower rate of probable CLABSIs that will lead to decreased costs. Pfaff et al., 2012 in their quasi-experimental studies to compare the effectiveness of CHG gel compared to the CHG Biopatch® revealed that the use of CHG gel is cost-effective in the reduction or elimination of CLABSIs compared to the CHG Biopatch®.

Easiness of use, application, view of the insertion site, and staff satisfaction. The use of CHG gel is supported with evidence on the easiness of use, easiness of application, easier to view the insertion site and staff satisfaction on its use. For instance, Olson and colleagues in their randomized control trial to evaluate the new CHG gel Tegaderm™ dressing for its practicality of use in clinical practice on central venous devices revealed that the dressing is easy to use in central venous catheter care as the standard dressing and it offers more advantages compared to the standard non-antimicrobial dressing. In their study to evaluate the ease of use of a transparent CHG gel dressing versus the CHG disk (Biopatch®), Eyberg and colleagues (2008) using a randomized prospective comparative study revealed that the CHG gel dressing is better compared to the Biopatch® in regard to its ease of application, ease of applying correctly, ease of removal, ability to visualize the insertion site, and ease of training others on how to use the CHG gel dressing as a one-step dressing compared to the use of CHG disk together with transparent dressing as a two-step dressings. Rupp et al., 2008 in their randomized controlled trials to assess the clinical performance of CHG gel dressing concluded that the CHG gel dressing is well-tolerated well by the patients with a central venous catheter, has better securement and clinicians judge the dressing as more superior

and more satisfaction of using it compared to the CHG Biopatch®. Karpanen et al., 2015, in their clinical trial to evaluate the performance of the CHG gel dressing in clinical environment revealed that the CHG gel is well tolerated and patients whose dressing were applied performed excellently in the critical care environment. By evaluating the clinical performance of the CHG gel transparent dressing, Mourea et al., 2009 in the experimental study concluded that the CHG gel has a more significant clinical performance and less chance for application error that would lead to better compliance to established standards of practice compared with CHG disk. Maki et al., 2008 in their prospective comparative clinical study revealed that the use of CHG gel dressing is more superior and advantage to using compared to the CHG Biopatch® in that it is easier to apply, secures the catheter and permits continuous inspection of the insertion site because it is transparent compared to the Biopatch® which is opaque. Zehrer and colleagues (2010) in their clinical trial to of clinicians evaluating the performance of CHG gel to the CHG disk (Biopatch®) revealed that clinicians recommended the CHG gel pad dressing over the CHG disk due to ease of use and ability to visualize the IV site. Pfaff and colleagues (2012) in their experimental study to compare the effectiveness of the CHG gel dressing with Biopatch® concluded that the nurses who used the CHG gel were more satisfied and preferred using the dressing than using the CHG Biopatch®.

Impacts on the Findings

The primary goal of this systematic review was to find whether there is enough substantial evidence that can support the intervention of using an adhesive transparent CHG gel in the prevention of central-line associated bloodstream infections (CLABISs).

Based on the above findings, this systematic review has answered the clinical question or practice-focused question formulated before the start of this systematic review because they indicated that the adhesive transparent CHG Tegaderm™ gel dressing for the central venous catheter is superior compared to the chlorhexidine Biopatch® in decreasing the central-line associated bloodstream infections.

The review of the meta-analysis of the randomized controlled trials, and randomized controlled trials, and the non-randomized clinical trials yielded enough evidence to support the use of CHG Tegaderm™ gel in place of Biopatch® for the central venous catheter. Unlike the Biopatch® that require two steps dressing (Biopatch® film/disk covered with transparent adhesive dressing) the CHG Tegaderm™ gel dressing is a one-way dressing that incorporates the gel and the dressing, and it makes it easier to apply and to use. Unlike the Biopatch® that is opaque and makes it difficult to view the insertion site, the use of CHG Tegaderm™ gel makes it easier to see the insertion site and makes it easy to monitor in case of any signs of infection.

The articles reviewed indicated that the use of CHG will be economical because it can decrease the rates of CLABSIs that result to cost burden to the patients, facility, and the health care at large. Different studies such as meta-analysis of multiple randomized trials conducted by Safdar and colleagues (2014) found that the CDC gel has a high prevalence of reducing the CLABSIs. Numerous randomized clinical trials such as Timsit and colleagues (2012), Karpanen and Colleagues (2016), Biehl and Colleagues (2016), Pfaff and colleagues (2012), Eyberge and colleagues (2008), Rupp et al., (2008), and Bashir and Colleagues (2012) found that the use of CHG gel is significant in the

reduction of CLABSIs compared to the standard antimicrobial transparent dressing, gauze or chlorhexidine disk (Biopatch®). Also, different clinical trials such as Moureau et al., (2009) found that the use of CHG gel dressing provides antimicrobial activity at the insertion site in an integrated dressing that is easy to use. The CHG gel has a more significant clinical performance and less chance for application error that would lead to better compliance with established standards of practice compared to the CHG disk (Biopatch®).

Clinical trials such as Heimann et al., (2018) found that although the use of CHG gel dressings is expensive, the expenses are outweighing by a lower rate of probable/definite CLABSIs and reduced associated costs. Karpanen et al., 2015 while evaluating the clinical performance of chlorhexidine gel containing dressing in clinical environment found that the CHG gel CVC dressing was well tolerated by patients and performed excellently in the critical care environment. Other studies such as a clinical trial conducted by Zehler et al., (2010), Olson et al., (2008) to evaluate the performance of using CHG gel revealed that clinicians recommended the CHG gel pad dressing over the CHG disk due to ease of use, ability to visualize the IV site, and the ability to absorb fluid.

The cost impact of using the CHG gel was also evaluated and multiple studies such as the meta-analysis conducted by Maunoury and colleagues (2015) revealed a significant decrease in the number of CLABSI using CHG gel that led to the lower cost of patients' care associated by CLABSIs and CLABSIs related conditions. The study by Pfaff et al., (2012) revealed that the use of CHG gel was cost-effective compared to the

chlorhexidine Biopatch® and it reduces or eliminates the incidence of catheter-related bloodstream infections and nurses preferred using the dressing gel compared to the chlorhexidine Biopatch®.

Therefore, the included studies in this systematic review discussed the impact of chlorhexidine on the reduction of CLABSIs, its cost-effectiveness, the easiness of its use, the ability to continually assess the site of insertion, and the ease to teach others to apply the CHG gel. The dressing is widely recommendations by nurses who have previously used the CHG disk (Biopatch®) to switch to CHG gel as the dressing is user-friendly and more economical.

Implications for Social Change

The purpose of conducting this systematic review was to gather, analyze and synthesize evidence that will lead to decrease in the numbers of CLABSIs for acute or critically ill patients that cause mortality, morbidity, and cost burden to the patients, facility and the health care at large. Through the evidence obtained, there is clear understanding that implementing the findings of the systematic review and adopting the use of CHG Tegaderm gel dressing and other central line care, the number of CLABSIs will decrease compared to the use of CHG Biopatch®. The use of CHG Tegaderm gel dressing has proven to not only prevents the rates of CLABSI but it is cost effective compared to other dressings due to the ability to avoid CLABSIs that can cause huge cost burden to the patients', facility and the health care. By decreasing the rates of CLABSIs, the chances of mortality and morbidity that can eliminate the productive members of the society are reduced and therefore, it is not only contributing to improve health care, but it

is also contributing to the economic aspect of a nation or humankind. The use of this systematic review will have a social implication in the local facility if implemented because of the already struggling need to reduce the number of CLABSIs despite the adherence to the CDC 2011 central line care bundles. By implementing this systematic review, the local facility can reach their target of reducing the number of CLABSIs from the current rate hence save health care dollars and lives.

Recommendations

The products of this systematic review provide a clear evidence that can be implemented as a quality improvement project in the care of central venous catheter in a facility that is struggling in the reduction of the central-line related bloodstream infections. The recommendations are after careful analysis and synthesis of the researched articles that proved that the proposed treatment modality (adhesive transparent CHG Tegaderm gel dressing) is superior to the use of CHG Biopatch® covered with an adhesive transparent dressing. The use of adhesive transparent CHG gel dressing is useful when implemented with other central venous catheter care bundles as indicated by the CDC 2011 guidelines. The CHG gel dressing provides a clear view of the insertion site that is important to monitor when patients have the central venous catheter. For the CHG gel dressing to yield results compared to the CHG disk, the usual care and central venous standard bundles should be followed as outlined earlier in this study. For the intervention to be implemented the management and the leadership should look at the different strategies of how to provide clear teaching and enough practices to the end users on how to apply for the intervention to be deemed sufficient to achieve the targeted results of

reducing the CLABSIs. After implementation, the facility should compare one year before the implementation and one year after the implementation regarding cost for the dressing, nurses' evaluation on the usefulness and performance of the dressing and the rate of CLABSIs compared with the previous standard dressing used.

Strengths of the Findings

The study included larger numbers of randomized controlled trials, clinical control trials, and two meta-analyses and excluded levels 4-7 of the Melynk's et al., (2011) hierarchy of evidence. Levels 1 and 2 articles are considered the highest level evidence, and few articles are level 3 that are clinical trials. The advantages of using level 1 and 2 are that they have fewer risks of bias because the patients have equal chances to be in the intervention and control group due to randomization. Therefore, having multiple studies that included either one or multiple randomized controlled trials are clear evidence that the intervention is well supported and had been studied and proved to work through clinical trials. By use of this systematic review, the local facility and the nursing practice can use the study as the guide of evidence and have confidence that changing the chlorhexidine Biopatch® to chlorhexidine gel in addition to the standard central line bundles care can lead to decrease or lead to zero numbers of CLABSIs. Lowering the numbers of CLABSIs will save the health care costs and reduce mortality and morbidity associated with CLABSIs or CLABSIs-related illnesses.

Limitations on Findings

There is no systematic review found that met criteria for inclusion in this systematic review and only two meta-analyses of the randomized controlled trials that

were available were included in the study. Only studies that were in the English language were included in the study. Studies that were in foreign language and could have contributed to this systematic review were excluded due to lack of translator or inability to translate. Also, only online published literature was used as a source of evidence for the study. Probably some articles in the paper format could have contributed to the study, but they were excluded. Articles that were not clear or not discussing the chlorhexidine gel dressing were excluded to reduce bias. Articles with a level of evidence 4-7 according to the Melynk et al., (2011) were excluded from the studies. The selected number of full articles that qualified for the review outnumbered the non-supportive articles, and therefore, the impact of non-supportive articles was little on the systematic review. The study only included one reviewer that was involved in the whole process of the systematic review such as retrieving, reviewing and selecting articles unlike the traditional method of more than one reviewer in the systematic review and this could create bias.

My aim of conducting this systematic literature review was to find, retrieve, analyze and synthesize the best available evidence to support the use of CHG gel dressing in the reduction of central-line associated bloodstream infections in adults in acute or critical care units. In this section 4, I identified the method of articles selection, the number of articles selected and those that met the inclusion criteria. I also summarized the articles identified and discussed the strength and limitations of the study discussed. Also, the recommendation for the study was included. Based on the findings, the intervention proposed is well supported by the evidence from the meta-analysis,

randomized controlled trials, and non-randomized clinical trials. Based on the results of this study, there is enough confidence that the management and nursing leadership at the local facility can use these findings as the basis for changing the current use of Biopatch® covered by adhesive transparent dressing to a dressing that integrates the CHG gel to the adhesive transparent dressing. The findings provide enough evidence that it reduces the rate of CLABSIs, is cost-effective, is rated high as more effective, easy to use, easy to apply and remove and easy to teach others on the use of CHG gel as it is a one-step dressing compared to the two steps in the CHG Biopatch®.

Section 5: Dissemination Plan

The gap on the best method to prevent the CLABSIs in patients with central venous catheter admitted to the acute and critical care units remains. The purpose of this systematic review was to find, retrieve, analyze and synthesize the best available evidence from the current published literature that will support the use of adhesive transparent CHG gel dressings in the prevention of CLABSIs. The systematic review was guided by the logic model that acted as a blueprint by steering in the formulation of the practice-focused question, set the inclusion criteria, conduct in the retrieval of evidence, summarize them and make the conclusion of whether the evidence answered the practice-focused question to achieve the desired outcomes.

The results of this systematic review indicated that there is clear evidence that the use of the proposed treatment modality, if implemented besides other central line care bundles, will drastically reduce the rate of CLABSIs. It will also lead to a decrease in the highest cost that the facilities bare when a CLABSI is diagnosed as it is considered a non-reimbursed nosocomial infection. Not only does it reduce the unnecessary costs to the facility but will also reduce the health care cost burden and save lives. This review will be provided to the local facility nursing leadership for evaluation and dissemination. The review will include the background information, evidence from literature, the summary of the evidence and the recommendations. The information in this review will be presented through a power point presentation, handouts or printouts to the appropriate management and leadership and the nursing services. The implementation of the proposed treatment intervention will be recommended so that the organization can

receive the benefits and the goal target of reducing the CLABSIs rate. Due to the highest level of evidence obtained and having clinical trials and randomized clinical trials conducted in different settings both nationally and internationally, the potential for other health care organizations to use the data from this systematic review could also provide insights and benefits in the reduction or bring to probable zero the deadly hospital-acquired disease called CLABSI. Also, further research or systematic review and meta-analysis on the application of CHG gel dressing could bear more fruits in future.

Audiences and Venues Appropriate for Dissemination

My purpose of conducting this integrative review was to search and retrieve an extensive literature to support a treatment modality that is considered superior in the prevention of CALBSIs in acute and critical care units. Due to the needs of daily use of the CVC for medications, food, fluid or hemodynamic monitoring, the risk of patients developing CLABSI increases. As a dressing that is not widely being used, proper audiences to disseminate and present the findings of the systematic review will be local acute and critical care units and other nursing organizations such as the American Association of Critical Care nurses and doctors, as well as the American Nurses Association during their conferences.

Analysis of Self

My journey through the DNP program at Walden University began in May 2017 as a continuation of my Master of Science in nursing to achieve my lifetime dream goals. The journey has not been easy, but with the aspiration, hardworking, perseverance and determination I can testify that everything is possible once you set your eyes on it. During

the process of conducting this systematic review, my knowledge on how to turn research into evidence has been harnessed. My hopes for the future are to be a significant contributor in the field of nursing as a scholar and a mentor to others going through the process of the doctoral studies. As a previous staff nurse in the critical care unit, I have taken care of patients diagnosed with CLABSI despite the meticulous application of the 2011 CDC guidelines in the care of central venous catheter, and some led to mortality or increased hospital stay, and this broke my heart. Therefore, having a project that is tailored to the prevention and decrease of the rate of CLABSIs is both personally and professionally fulfilling. As a doctoral prepared nurse, the hallmark of the doctoral education is demonstrating the ability to critically appraise available literature and evidence and implement it as an evidence-based practice. I articulated that by conducting this extensive integrative literature review, I have mastered the American Association of Colleges of Nursing DNP *Essential III: Clinical Scholarship and Analytical Methods for Evidence-based Practice* (American Association of Colleges of Nursing, 2006).

As a doctoral-prepared nurse, I will be at the forefront to use the skills attained during my doctoral studies. By conducting this systematic review, the findings will be used to support facilities and nursing practice in the quality improvement programs to improve patients' outcomes. As a result of conducting this doctoral project, I have harnessed my knowledge and ability in searching and retrieving evidence from literature and analyzing the evidence to solve simple and complex clinical problems. Moreover, my professional goals have been tailored to be a scholar, mentor, and educator. I will use my

knowledge and experience gained during this doctoral journey to improve nursing practice and my professional growth.

Summary

CLABSI is an infection that occurs within 48 hours of central line placement. CLABSIs are considered the costliest HAIs. CLABSIs are preventable if the right care and measures are taken. The CDC has CVC care guidelines, but the guidelines are not rigid on the dressing to be used during the CVC care. Traditionally, the CHG Biopatch® covered with adhesive transparent dressing has been used as CLABSI prevention measures together with the CDC guidelines. In spite of facilities adhering to the CDC guidelines in addition to the use of Biopatch® covered with an Adhesive transparent dressing, the rate of CLABSI continues to rise.

In Section 1 of this doctoral review, I discussed the nature of the project by identifying the project question, the nature of the study, and the importance of the proposed treatment modality. In this case, the purpose of this systematic review was to conduct an integrative review of the literature on the use of adhesive transparent CHG Tegaderm™ dressing in the prevention of CLABSI. The dressing is a new one method dressing which is composed of an adhesive transparent Tegaderm™ with CHG gel that releases the CHG continuously and allows the view of the insertion site, unlike the Biopatch® which is opaque and requires the disk to be covered by an adhesive transparent dressing making it a two way process. A predefined PICOT question was formulated that guided the review as well as the inclusion and exclusion criteria.

In Section 2, I discussed the background the context of the doctoral project. A framework that guided this systematic review was logic model, which is considered as a roadmap and guided the whole systematic review from identifying the inclusions criteria

to retrieving the evidence and determine the outcomes from the findings if implemented. The role of the project in the nursing practice was discussed and how the student as a project manager contributed from the start to finish of the review. The reason why the project is carried due to the needs at the local facility was discussed and how the findings will impact the care and improve patients' outcome locally and in nursing practice.

In Section 3, the review discusses how the evidence was collected and synthesized. The review discusses the steps to conduct the retrieval of evidence by first contacting the university review board, and after the approval as a preapproved for DNP project; the student conducted an extensive data search. Different databases such as the Cochrane, PUBMED, EMBASE, CINAHL, MEDLINE, ProQuest Nursing, and Google Scholar were used to find and retrieve the published literature to support the hypothesis of the predefined practice question. By thoroughly and extensively searching the above databases and google scholar, 373 articles were retrieved and assessed fully to identify the articles that met the criteria based on the predefined inclusion criteria. A total of 16 articles qualified for the final review by meeting the criteria and 11 full articles assessed did not meet the criteria. The articles that met the criteria were graded using the Melynk and Fineout-Overholt hierarchy level of evidence.

In Section 4, I discussed the findings and the recommendation of the systematic review of the literature. I broke down the evidence synthesis into how effective the CHG gel Tegaderm™ is effective in the reduction of CLABSI, how economical is the CHG gel Tegaderm™ and how easier it is to use the CHG gel Tegaderm™ compared to the Biopatch® with an adhesive transparent dressing. Based on the findings of the literature

review, the use of CHG gel dressing is core in the fight to reduce the rate of the deadly CLABSIs. Due to the strength of findings from meta-analysis and single and multiple randomized controlled trials, the use of CHG Tegaderm™ gel is well supported by the literature as an effective method of controlling CLABSI, reducing health care burdens and reducing mortality and morbidity associated with CLABSI or CLABSI-related illnesses.

In Section 5, I discussed the dissemination plan. I explained the appropriate audiences that will benefit from the findings of the review such as the local acute care critical care units, National nursing associations such as the American Association of Critical care Nurses and the American Nurses Association.

In conclusion, the process of conducting this review has been personally and professionally fulfilling. The doctoral program and the process of conducting this systematic review have helped me to improve on how to turn research into practice in solving complex nursing issues and how to improve patients' outcomes. It is my plan to continue building my professional journey as a mentor, teacher, scholar, and practitioner.

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Appendix A: Table of Evidence

Table 2

Analysis and Synthesis of Evidence

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Safdar et al., 2014	To assess the efficacy of a chlorhexidine-impregnated dressing compared with conventional dressings for prevention of central venous catheter-related colonization and CRBSI using meta-analysis.	A meta-analysis of prospective randomized controlled trials (RCTs)	Nine RCTs with 6067 patients and (11214 catheters) were included in the analysis. 2984 patients and 5586 catheters received chlorhexidine-impregnated dressings while 3083 patients and 5628 catheters received the standard dressing	The use of chlorhexidine-impregnated dressing resulted in reduced prevalence of CRBSI	I
Maunoury et al, 2015	A cost effectiveness analysis to determine the impact of the use of impact of antimicrobial chlorhexidine gluconate-containing securement dressing compared to non-antimicrobial transparent dressing for the reduction of CRBSI and other cost related to the CRBSI.	Meta-analysis of a multicenter randomized controlled trial	Multicenter randomized controlled trials of 1879 adults above 18 years admitted to 12 French ICUs in seven universities and four general hospitals from 31 May 2010 to 29 July 2011 who required intravascular catheterization for 48 hours	The chlorhexidine gluconate dressing is more cost-effective than the referencing dressing	I

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Timsit et al., 2012	To determine if chlorhexidine gel dressing and strongly adherent dressings decrease catheter colonization and catheter related infections rates.	Multicenter Randomized Controlled Trial done in May 2010 to July 2011	1879 Adults above 18 years of age admitted in 12 ICUs in France who required intravascular catheterization for 48 hours. Patient assigned randomly to one of the 3 types of dressings Intervention: Chlorhexidine-gel impregnated dressings (938 patients and 2108 catheters) Control: Highly adhesive dressings (465 patients and 988 catheters) Standard dressings (476 patients and 1067 catheters)	21/941 (2.2%) patients in the control group were found to have Infection with 1.29 infections per 1000 Catheter while in the CHG dressing group 9/938 (0.96%) of the patients with had infections comprising 0.52 infections/1000 catheter days. There was a 57% reduction in patients with infections and 60% reduction of infections per 1000 Catheter for the patients using the CHG gel dressing.	II
Dolci, Margatho Silveira & deCampos, 2017	To identify the frequency of change of chlorhexidine-impregnated gel dressings applied in central venous catheter insertions sites in critically ill patients	Clinical randomized trial	52 Adult above 18 years old in ICU in a complexity teaching hospital in the state of Sa Paulo, Brazil in April 2014 to December 2014	159 dressings were applied to 64 central venous catheters with a mean frequency change of 3.04 days There is more frequency of dressing change in CHG gel dressing with dressing change being less than seven days due to detachment wetness, soiling, and loss of dressing	II

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Karpanen et al., 2016	To determine the antimicrobial efficacy of a chlorhexidine gluconate (CHG) gel dressing used in patients with a CVC	Prospective Comparative, single-center randomized clinical study	273 adults above 18 years of age admitted to critical care unit in a large university hospital with 75 critical care beds divided into 4 units between January 2013 and October 2014. Standard dressing group (n= 137), Chlorhexidine dressing group (n= 136).	Significant reduction in the number of microorganisms recovered from the CHG gel pad compared to the standard dressing. Significant reduction in the number of microorganism in the CHG dressing group (n=136) compared to the standard dressing (n=137)	II
Biehl et al., 2016	To investigate the effects of CVC dressings with CHG-containing gel pads in the setting of high-risk neutropenic patients	An open-label, randomized, multicenter trial	613 patients in 10 hematology center in German from February 2012 to September 2014. CHG group (n= 307), and Control group (n= 306).	Application of chlorhexidine containing catheter securement dressings reduces the incidence of definite or probable CRBSI in neutropenic patients	II
Olson & Heilman, 2008	To evaluate a new chlorhexidine gluconate catheter dressing, 3M Tegaderm CHG IV Securement Dressing for its practicality of use in clinical practice on central venous access devices	A Single center randomized controlled trial	63 patients' adults Male and female aged 28- 88 years old. 36 with peripherally inserted central catheters (PICCs), 20 with intrajugular insertions, and 7 with subclavian insertion catheter in acute hospital. CHG dressing group (n= 33), and control group (n= 30).	The new 3M Tegaderm CHG IV Securement Dressing was found to be as easy to use in central venous catheter care clinical practice as the standard of care non-antimicrobial transparent adhesive dressing and offered many advantages over standard dressings.	II

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Eyberg & Pyrek, 2008	To evaluate the ease of use of a transparent chlorhexidine gluconate gel dressing versus a chlorhexidine gluconate disk in healthy volunteers.	A controlled randomized prospective comparative single site, pilot study	12 healthy health care professionals above age 18 years specializing in vascular access and infusion therapy with experience in applying and changing IV dressings in their practice.	12 out of 12 clinicians rated the CHG gel as better compared to Biopatch regarding ease of application, ease of applying correctly, ease of removal, ability to visualize the insertion site, and ease of training another clinician to apply the dressing.	II
Pedrolo, Danski & Vayego, 2014	To assess the effectiveness of the chlorhexidine antimicrobial dressing in comparison to the gauze and tape dressing in the use of central venous catheter	A randomized clinical trail	85 adults in intensive care and adult semi intensive care units of a university hospital in south of Brazil. 43 patients in the intervention group (chlorhexidine antimicrobial dressing) and 42 in control group (gauze and tape dressing) conducted from October 2011 to May 2012	No statistically significant differences found between both dressings regarding the occurrence of primary bloodstream infections, local reactions to the dressing and dressing fixation.	II
Bashir, Olson, & Waters, 2012	To compare an non Antimicrobial polyurethane film dressing to CHG gel and CHG disk with respect to CHG-containing dressings to suppress bacterial regrowth over a 7-day time frame in healthy adults and to compare the relative performance of CHG gel against CHG disk	Randomized controlled trial	32 healthy adults above the age of 18 years old in a study at research facility.	The use of CHG gel ensures continuous releasing of CHG to maintain suppression of regrowth of bacterial after antisepsis during the central line insertion.	II

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Rupp et al., 2008	To assess the clinical performance of an innovative CHG Tegaderm dressing containing CHG gel pad in minimizing growth of microbes at the catheter insertion site	Prospective randomized controlled single center clinical trial	60 adults' patients with central venous catheter that was likely to remain in place at least 3 days in 689 be Nebraska Medical Centre, a university-associated tertiary care center.	The Tegaderm CHG dressing containing a chlorhexidine gel pad is an innovative means to potentially minimize CRABSI and is well-tolerated and judged to be superior to the comparator dressing regarding catheter securement and overall satisfaction.	II
Heimann et al., 2012	Health economic analysis to analyze the economic effect of using CVC dressings with a chlorhexidine-containing gel pad compared to non-chlorhexidine control dressings	Clinical controlled trial	356 patients 178 patients in CHG group and 178 patients in control group in University Hospital of Cologne a 1500 bed hospital in Germany	Similar results in overall direct treatment costs and although CHG chlorhexidine dressings are expensive, the expenses are outweighing by a lower rate of probable/definite CRBSI and reduced associated costs.	III
Karpanen et al., 2015	To evaluate the performance of a chlorhexidine gel containing CVC dressing in a clinical environment.	Clinical controlled trial	273 patients in a 75 critical care beds in a University Hospitals Birmingham in UK. CHG dressing, (n= 136) and Standard dressing (n= 137). 71 nurses and 10 clinicians responded to the survey	The CHG gel CVC dressing was well tolerated by patients and performed effectively in the critical care environment.	III

Study, Author/Year	Study Objective	Study Design	Participants	Findings	Level of Evidence
Guclu et al., 2014	To evaluate the efficacy of chlorhexidine-impregnated gel dressing (CGDs) in reducing catheter related bloodstream infections (CRBSIs).	Clinical trial	991 patients in a six-bed intensive care unit of a tertiary care hospital in a before-and after study conducted between January 2010 and December 2011. (521 patients in sterile dry gauze before the study and 470 in chlorhexidine-impregnated gel dressings after the study.	CGDs did not decrease the incidence of CRBSIs and the incidence of CRBSIs between before and after study did not differ	III
Moureau Deschneau, & Pyrek 2009	To evaluate the clinical performance of a chlorhexidine gluconate antimicrobial transparent dressing and compare the new CHG gel dressing to the CHG disk (Biopatch).	Quasi Experimental Design	64 IV nurse evaluators from six hospitals in U.S. participated in clinical evaluation of 500 new CHG gel dressing applied during the evaluation period of 14 days in each hospital.	The new CHG dressing provides antimicrobial activity at the insertion site in an integrated dressing that is easy to use. The CHG gel has a greater clinical performance and less chance for application error that would lead to better compliance to established standards of practice compared to the CHG disk.	III
Zehrer, Smith., & Deschneau, 2010	An evaluation to compare the performance of a new transparent CHG gel pad dressing versus a CHG disk	Clinical trial	321 clinicians from 16 US hospitals to evaluate the application of 500 new CHG gel pad dressings	At least 75% (95% confidence) of the clinicians recommended the CHG gel pad dressing over the CHG disk due to ease of use, ability to visualize the IV site, and ability to absorb fluid.	III

Appendix B: Excluded Studies

Table 3

Tables of Excluded Full Articles

Author	Title	Reason for Exclusion
Thokala et al., 2016	Economic impact of Tegaderm chlorhexidine gluconate (CHG) dressing in critically ill patients	Not a clinical trial
Heimann et al., 2018	Chlorhexidine-containing dressings in the prevention of central venous catheter-related bloodstream infections: A cost and resources utilization analysis	Cohort study
Ullman et al., 2015	Examining the role of securement and dressing products to prevent device failure	Systematic review on CVAD securement dressing; not specific on the CHG gel dressing
Ruschulte et al., 2008	Prevention of central venous catheter related infections with chlorhexidine gluconate impregnated wound dressings: a randomized controlled trials	Using CHG sponges (Biopatch) instead of CHG gel
Reyes et al., 2017	Prevention of central venous line associated bloodstream infections in adult intensive care units: a systematic review	The study looking at different methods of preventing CLABSIs. Not specific reviewing the use of CHG gel.
Karpanen et al., 2011	Antimicrobial activity of a chlorhexidine intravascular catheter site gel dressing	Using *in vitro* studies
Jeans & Bitmead, 2015	Reducing bloodstream infection with a chlorhexidine gel IV dressing	Using case studies
Kamoski et al., 2017	Reduction in central line-associated bloodstream infections correlated with the introduction of a novel silver-plated dressing for central venous catheters and marinated for 6 years.	Assessing the novel silver-plated dressing in comparison to chlorhexidine gluconate-impregnated sponge dressing for CVC
Ruschulte et al., 2008	Prevention of central venous catheter related infections with chlorhexidine gluconate impregnated wound dressings: a randomized controlled trial	Evaluating the effectiveness of chlorhexidine-impregnated sponges (Biopatch) for reducing CLABSIs.
Scheithauer et al., 2014	Reduction of central venous line-associated bloodstream infection rates by using a chlorhexidine-containing dressing	Not clear whether the chlorhexidine dressing evaluated is CHG gel or CHG Biopatch (Sponge).
Hensler, Schwab, Oslon, & Palka-Santini, 2009	Growth inhibition of microorganisms involved in catheter-related infections by an antimicrobial transparent IV dressing containing chlorhexidine gluconate (CHG)	Using in *vitro* instead of human

Appendix C: Logic Model

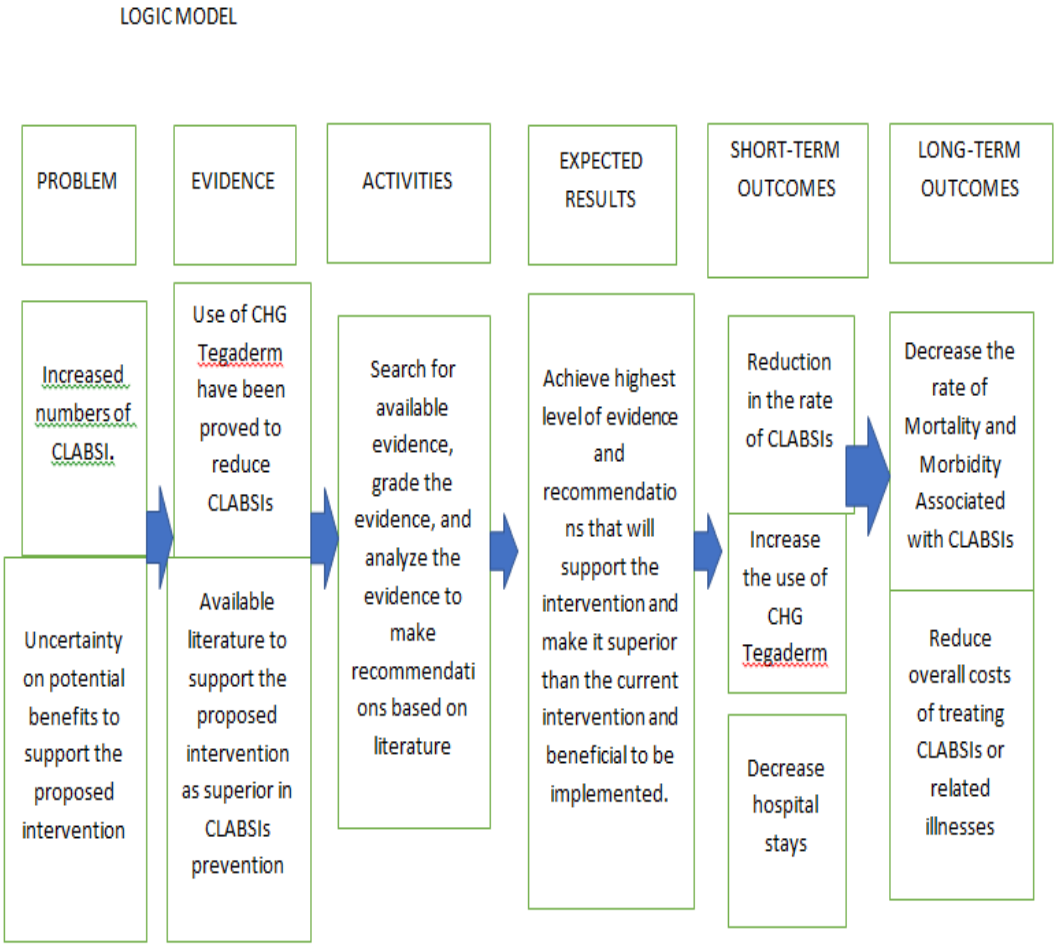

Figure 1. Appendix A

Appendix D: Prisma Flow Diagram

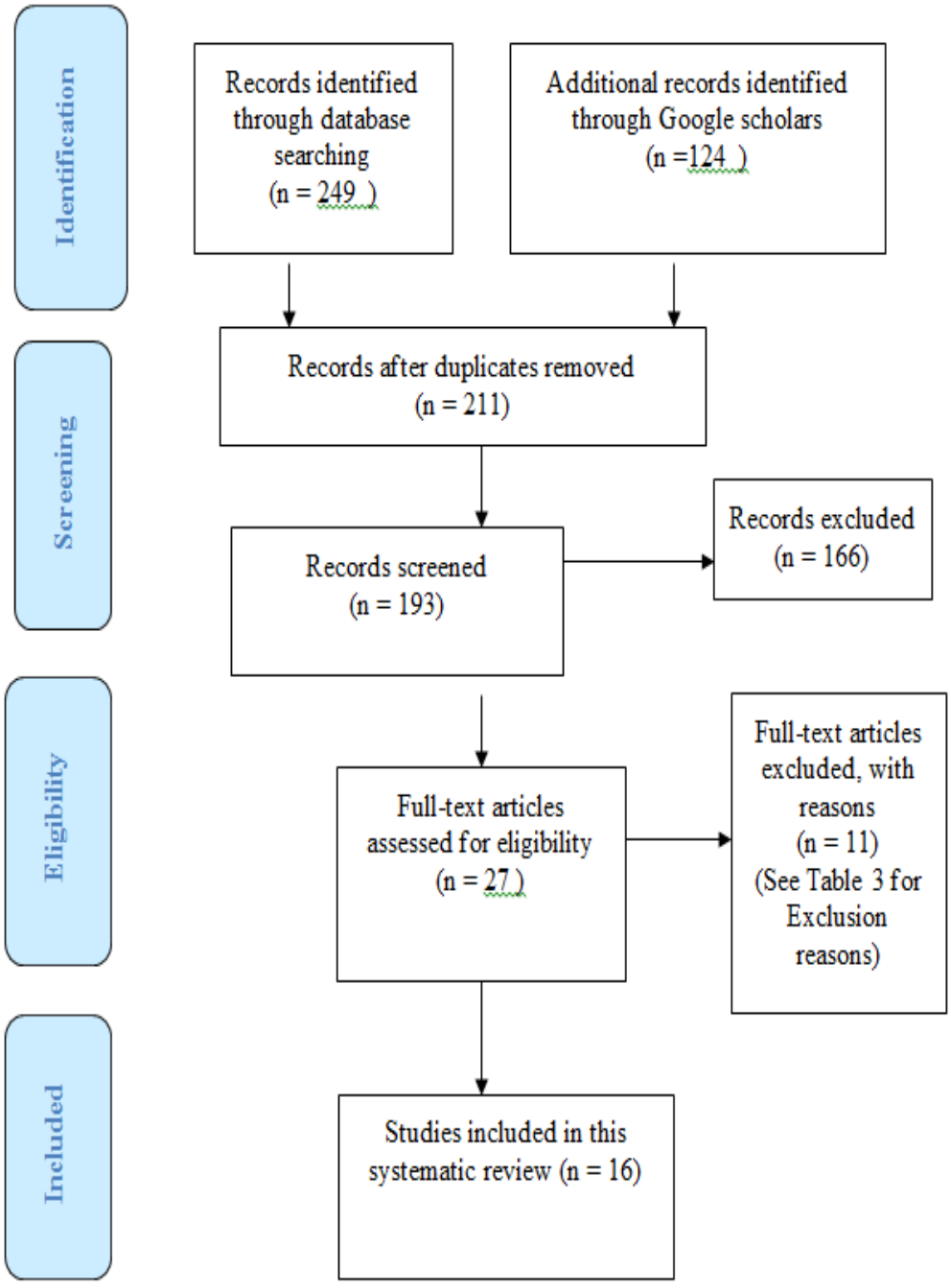

Figure 2. Prisma Flow Diagram