Walden University

College of Health Sciences

This is to certify that the doctoral study by

Misty Cooper

has been found to be complete and satisfactory in all respects,
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Abstract

Improving Nurses' Knowledge of Central Line-Associated Bloodstream Infection

by

Misty Cooper

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Central line-associated bloodstream infections (CLABSI) are usually attributable to suboptimal line insertion, care, or maintenance and are associated with poor patient outcomes. Nursing plays a pivotal role in preventing CLABSI, because nurses are generally responsible for the routine care and maintenance of central lines. The purpose of this project was to determine if CLABSI nursing education and demonstration-based competency could improve nurses' knowledge on a neurology unit as compared to current practice of an annual e-learning module as the sole source of nurse education. This project was informed by Lewin's planned change theory and involved changing behaviors, attitudes, and practices of nurses via a conducive approach consisting of three phases: unfreezing, movement, and refreezing. To have a foundation in evidence, expert literature supports the project. Participating nurses attended an educational session consisting of a presentation and demonstration-based competency of central line dressing change technique. A pre- and post-test were administered; the mean pretest score was 72.1% and the mean posttest score was 94.1%. Comparison of pre- and post-test scores reflect a 22% increase in test scores, therefore, this program increased knowledge. This project can contribute to positive social change by improving nursing practice through increasing nurses' knowledge of proper care and maintenance of central lines, which can translate into evidence-based practice changes and improve patient outcomes.

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Section 1: Introduction

Introduction

Florence Nightingale, the matriarch of modern nursing, recognized the potential for the healthcare system to cause additional illness for the already compromised patient. One common, modern example of this is hospital-acquired infections (HAI). One in every 25 patients will develop a HAI when admitted to a U.S. hospital (Magill et al., 2014). A common source of HAI is central line-associated blood stream infections (CLABSI); CLABSI accounts for approximately 9% of all HAIs (Patchen, 2016). CLABSI is an infection that occurs when organisms, usually bacteria, enter into the bloodstream from a catheter line inserted for medical care. CLABSIs can result in death, extended hospital stays, and added costs to the hospital. Although they can be preventable, CLABSIs continue to be a problem for many hospitals.

This doctoral project was focused on improving nursing knowledge of CLABSI in a neurology unit in a large urban medical center. The project site has consistently experienced higher than expected rates of CLABSI, with the neurology unit having CLABSI rates of 4.58% in 2015 and 3.55% in 2016. The goal is a rate of zero, which has been attained in some settings. This hospital reports CLABSI incidence to the National Healthcare Safety Network (NHSN) reporting database for the Centers of Disease Control and Prevention (CDC); however, the neurology unit does not meet the requirements for mandatory inclusion into this database. For this reason, organizational efforts, including education, to decrease CLABSI rates have focused on reportable units

that may affect reimbursement, though efforts have not been focused on the neurology unit despite having the highest rates of all nonreporting areas in the medical center.

Positive social change implications for this project include increasing nursing knowledge and improving patient care. Innovative and solution-oriented change agents and front-line nurses can affect positive social change by implementing and sustaining efforts that result in improved patient outcomes (Altman & Brinker, 2016). This project resulted in increased nursing knowledge related to the care and maintenance of central lines and the organizational policies in place. According to the scientific underpinnings for advanced nursing practice set forth by the American Association of Colleges of Nursing (2006), changes in nursing practice to promote positive change should be a focus of the doctoral-prepared nurse, which this doctoral project aligns with.

Problem Statement

The nursing problem that was the focus of this doctoral project is improper care and maintenance of central lines leading to CLABSI. Central lines—also called central venous catheters or central venous access devices—are long catheters that are inserted into a vein until the tip reaches a larger vein near the heart. Central lines include peripherally inserted central catheters, tunneled catheters, and implanted ports. Central lines are preferred over peripheral intravenous catheters in emergency situations when medications need to work quickly, when patients are receiving frequent infusions of intravenous medications or frequent blood samples are being collected, when the peripheral intravenous access cannot be obtained, or when the intravenous medication regimen is expected to be needed for weeks or months rather than days (CDC, 2010).

Central lines are a common source of bloodstream infection if not inserted and maintained using sterile technique to avoid contamination. Sixty-five to 70% of CLABSIs could be avoided by following evidence-based practices (Association for Professionals in Infection Control and Epidemiology [APIC], 2016). Nurses play a vital role in patient safety and reducing the incidence of CLABSI. However, prevention policies are not always adhered to in many hospitals (Infection Control Today, 2013). Nursing actions and compliance with best practices have a direct impact on outcomes (Smith, Kirksey, Becker, & Brown, 2011). Nurses spend more time with patients than other health care providers and are responsible for care and maintenance of the central lines. Educational interventions addressing adherence to set guidelines may improve compliance and reduce the incidence of HAIs including CLABSI (Flodgren et al., 2013). An educational program to emphasize the importance of proper central line care and maintenance with review of proper technique can improve adherence to policy and impact CLABSI incidence.

The project facility has a goal of zero CLABSIs; however, the neurology unit has had a higher rate of CLABSIs than desired. In 2015 and 2016, the neurology unit had the highest rate of CLABSI of all units that are not critical care units. One CLABSI incidence has occurred on the neurology unit in the first quarter of 2017, with second quarter data still being analyzed. Strategies are needed to improve the care patients with central lines receive on the neurology Unit.

Addressing the problem of CLABSI is also a national concern. According to the NHSN report of 2014 data published in 2016, although the national baseline has

decreased, 10% of hospitals that report to NHSN had significantly higher rates of CLABSI than was expected (CDC, 2016a). In most cases, HAIs including CLABSI are preventable; therefore, a high incidence of HAIs indicates poor quality of care (World Health Organization, 2002). One of the national patient safety goals from The Joint Commission is to reduce the risk of HAIs (The Joint Commission, 2017). Furthermore, the U.S. Department of Health and Human Services identified HAIs as a priority and created the Federal Steering Committee for the Prevention of Health Care-Associated Infections to decrease HAIs including CLABSI (Office of Disease Prevention and Health Promotion, 2013). It is important to decrease HAIs for better patient outcomes, as CLABSI is associated with increased mortality; a meta-analysis of 18 studies suggested that the odds ratio for hospital mortality related to CLABSI was as high as 2.75 (Ziegler, Pellegrini, & Safdar, 2015). National and local efforts are necessary to impact the incidence of CLABSI across the country, and nursing knowledge is a key factor.

This project can contribute to nursing knowledge of the problem and evidence-based interventions to address CLABSI. For instance, the Office of Disease Prevention and Health Promotion (2013) has identified gaps in knowledge and practice including optimal central line insertion strategies, care and maintenance, line removal, and barriers to implementation of CLABSI bundles. Nurses can influence the incidence of CLABSI; nurses can educate, motivate others, provide feedback, and implement interventions to influence change that can improve patient outcomes (Dumont & Nesselrodt, 2012). This project is significant for nursing in that nursing practice changes can have direct effects on CLABSI rates and on patient lives.

Purpose

The purpose of this project was to address a gap in education regarding the CLABSI bundle in combination with demonstration-based competency. The development and use of care bundles—specific actions that improve outcomes when taken together—have been shown to decrease the risk of HAIs (DeMuro, McNeils, Hanna, & Thekkel, 2012). The project site has a CLABSI bundle policy, but it is not being followed consistently and no formal education regarding the policy takes place to ensure nurse understanding. Education to address this gap in practice can influence outcomes and decrease the incidence of CLABSI.

Nurses at the project site are required to complete an annual e-learning module related to CLABSI, but no hands-on demonstration of skills related to central line care is required upon or hire or at any time thereafter. Further education can increase nurse knowledge and improve patient outcomes, as indicated by research that showed a 84.5% reduction in the CLABSI rate after medical residents underwent education and demonstration-based competency evaluation related to the topic (Barsuk, Cohen, & Feinglass, 2009). Education and competency are also foundational elements of the States Targeting Reduction in Infections via Engagement program, which has been successful in decreasing HAI rates in hospitals with persistently elevated rates (APIC, 2016). Additionally, knowledge can be evaluated with online modules and testing, but application of that knowledge and evaluation of skill can be better assessed with hands-on demonstration (Dickerson & Chappell, 2016). Addressing this gap can improve the care nurses provide to patients with central lines on the neurology unit. Nurse education

coupled with demonstration-based competency has been successful in decreasing the CLABSI rates in other organizations and may offer a solution to the problem at the project site.

The practice-focused question this project aimed to address is whether nursing education regarding use of the CLABSI bundle and demonstration-based nurse competency can improve registered nurse (RN) knowledge on the neurology unit as compared to current practice of an annual e-learning module as the sole source of nurse education for CLABSI. A pretest regarding CLABSI care was administered to all RNs on the neurology unit. Subsequently, the nurses attended a session consisting of an educational presentation and each nurse demonstrated central line dressing change technique. Afterword, the nurses completed a posttest. Descriptive statistics via percent difference pretest compared to posttest revealed the change in nursing knowledge regarding evidence-based care and maintenance for patients with a central line to prevent CLABSI.

Nature of Doctoral Project

Sources of evidence and data pertinent to this project include national and expert agencies that contribute to evidence-based practice and/or monitor data relevant to CLABSI. These include the Institute for Healthcare Improvement (2017), the CDC, O'Grady et al. (2011), The Society for Healthcare Epidemiology of America, Marschall et al. (2014), and APIC (2015). These sources were used in the development of the medical center policy and CLABSI bundle created by the Infection Prevention department at the project site. Other professional organizations and journals applied

include the Agency for Healthcare Research and Quality, the World Health Organization, the NHSN, the Infectious Diseases Society of America, Infection Control & Hospital Epidemiology, The Joint Commission, and the *American Journal of Infection Control*.

The RNs on the neurology unit participated in education including a presentation and a demonstration-based competency. RNs from the float pool occasionally work on the neurology unit, so float nurses were invited to participate as well. An evidence-based pre- and post-test was administered before and after the education based on Dr. Joy Humphrey's (2015) pre- and post-test. Comparing the outcomes of the pre- and post-test revealed if the project had the intended impact of improving nursing knowledge regarding central line care to prevent CLABSI. The result is that this project addressed the gap in nursing knowledge regarding care and maintenance of central lines to improve patient outcomes.

Significance

There are many stakeholders who may be impacted by this project. Priority involvement should be considered for stakeholders who increase credibility of the project, are responsible for any part of project implementation, will advocate for or can authorize necessary project changes, or who will finance or authorize project continuation or expansion (CDC, 2012). The patients being cared for at the medical center experience better patient outcomes when care is provided by competent staff. The nurses who participated in the training are stakeholders, as they are actively involved in implementation of the project and bridging the gap in practice. The infection prevention department at the medical center is also a stakeholder, as this project affects a problem

for which they monitor. The medical center itself is a stakeholder because it is the project site in addition to the fact that CLABSI influences financial reimbursement from payers. All of these stakeholders can benefit from this project.

This doctoral project involved development and planning for staff education, which contributes to nursing practice. It is an expectation of the Doctor of Nursing Practice (DNP) to facilitate quality initiatives that improve safety, efficiency, and outcomes, thereby advancing nursing practice (American Association of Colleges of Nursing, 2006). The Institute of Medicine Future of Nursing report points out the importance for nurses to take on leadership roles to improve healthcare and outcomes (Institute of Medicine, 2010). This project aligns with that notion and uses evidence to make practice changes. Furthermore, this project supports the goal of Healthy People 2020 to prevent, reduce, and eliminate HAIs (Office of Disease Prevention and Health Promotion, 2017). Implementing an initiative such as this DNP project contributes to nursing professionalism and supports the aims of these expert bodies.

This project will improve nursing practice on the neurology unit and can impact the quality of care throughout the medical center. Nurse turnover has been an issue on the neurology unit and float nurses frequently work on this unit, possibly impacting the incidence of CLABSI. Therefore, this project included the nurses hired onto the neurology unit, and the float nurses who frequently work on this unit were invited to participate as well. As these float nurses are disseminated to assignments on a variety of units, the knowledge and skill gained from this project can be transferred and impact the entire medical center.

This project can create positive social change by advancing nursing knowledge and improving patient outcomes. When nurses are knowledgeable and adhere to best practices, they impact the incidence of CLABSI. Fostering positive social change involves making a positive impact on society and solving problems to affect lives (Walden University, 2017). This project contributes to the knowledge that strengthens evidence-based practice in healthcare. As such, this project can support similar actions to be taken in other settings, bridging the nursing knowledge gap and improving patient outcomes in a more significant way.

Summary

This doctoral project was focused on improving the nursing knowledge of central line care and CLABSI prevention on the neurology unit at a large medical center. CLABSI is linked with poor patient outcomes and poor quality of care. This project aimed to improve nursing knowledge on the neurology unit through education and demonstration-based competency validation of the RNs who provide care and maintenance of central line devices. Currently at the project site, nurses are required to complete an annual e-learning module related to central line care, but there is no requirement for hands-on demonstration during the orientation period or any time thereafter. The medical center has a CLABSI bundle policy informed by literature from expert organizations; however, observations for the infection prevention department have found that the policy is not consistently followed. This project combined education and demonstration-based competency validation to bridge this gap in practice.

RNs employed on the neurology participated in education regarding CLABSI and proper care and maintenance, followed by demonstration by each of proper central line dressing changes using sterile technique. An evidence-based pre- and post-test was administered to evaluate if learning occurred. Pre- and post-test outcomes statistics were compared before and after education was provided to determine the impact on nursing knowledge. Results of this project are transferrable to other areas and other hospitals and contribute to evidence-based practice for central lines, impacting positive social change. The results of this project contribute to the body of evidence that guides nursing practice to reduce the incidence of CLABSI. Likewise, evidence and established concepts informed this DNP project. Section 1 detailed the nature of this doctoral project. Section 2 includes relevant literature that supports this project.

Section 2: Background and Context

Introduction

This project addresses a gap in RN knowledge related to care and maintenance of central lines. The practice-focused question was whether nursing education regarding use of the CLABSI bundle and demonstration-based nurse competency can improve nursing knowledge on a neurology unit as compared to current practice of an annual e-learning module as the sole source of nurse education. Central lines may be an essential part of the patient's care, with nursing having responsibility for the use and maintenance of these devices. CLABSI is a problem not only in the project site, but nationally with many state and federal regulations in place to address this issue supported by expert recommendations. Lewin's change theory guided this doctoral project, and evidence on CLABSI was reviewed and applied to implement evidence-based interventions to decrease the CLABSI rate on the neurology unit.

Concepts, Models, and Theories

Concepts, models, and theories support evidence-based practice initiatives by providing a framework for insight into the successes and failures of implementation. Using models or theories promotes translation of research into practice, assessment of factors that influence outcomes, and evaluation of implementation (Nilsen, 2015). One of the key theories that facilitated this project was Lewin's change theory. Lewin's theory is a conducive approach to evidence-based practice and consists of three phases: unfreezing, movement, and refreezing (McEwen & Wills, 2014). The unfreezing stage occurs when it is determined that the change must occur. During the moving stage,

driving and restraining forces are assessed. Driving forces facilitate movement toward the goal, while restraining forces impede movement. The refreezing stage occurs when the change is integrated into the system and stabilization has taken place, making the change a part of the status quo. This project required a change in nursing behavior and actions, which fit with Lewin's theory.

Lewin's (1947) change theory was developed because, as he claimed, change is often short-lived and a planned process is required to facilitate a group change. Unfreezing prepares the group to make the change, moving is the process of reaching the change state, and freezing (or refreezing) integrates the change into routine practice. Lewin proposed that movement among these levels is determined by force fields, and these force fields can facilitate change or resistance. Although Lewin's theory is based in social psychology, it has been successfully used to guide many projects in healthcare to transition from knowledge to practice (Manchester, Gray-Miceli, & Metcalf, 2014).

Operational Definitions

For this project, *staff nurse* referred to any RN who could provide direct patient care the patient admitted to the neurology unit. Although the medical center does employ licensed practical nurses, they do not provide primary care and are not permitted to assess or maintain central venous access devices and were not a part of this project focus.

The definition of CLABSI is the definition used by the CDC and the NHSN (CDC, 2016b). CLABSI is deemed present if a patient has had a central line greater than 2 days and has a blood culture positive for organism growth not related to another infection site. CLABSI is also present if a patient has had a central line greater than 2

days and has symptoms of a fever greater than 38 degrees Celsius (100.4 degrees Fahrenheit), chills, or hypotension, and blood cultures positive for organism growth of the same common commensal on two consecutive blood tests. A third definition exists for CLABSI for patients who are 1 year or less of age, but this project included only adult patients. These definitions are complex and multifactorial, involving communications with the NHSN in some instances for clarification. The infection prevention specialist at the project site collaborates with the NHSN to determine the incidence of CLABSI.

Relevance to Nursing Practice

Central lines are an important and necessary part of care for some patients to deliver medications and facilitate blood withdrawal for laboratory testing. The two most common opportunities for bacterial contamination with a central line are during insertion and during maintenance (Jones, Stewart, & Roszell, 2015). Insertion is generally a physician responsibility, whereas maintenance is primarily a nursing responsibility. Though it was once a common belief that some patients would inevitably develop CLABSI, a study at Johns Hopkins in Baltimore indicated that the incidence of CLABSI could be impacted by specific interventions—many of which were nursing-focused (Johns Hopkins Medicine, 2009). The Keystone Project applied these findings to other hospitals and decreased the rate of CLABSI significantly in 103 intensive care units in Michigan, decreasing the rates by 66% after 18 months. One of the most notable outcomes of this project was the development of checklists to ensure caregiver compliance with expert recommendations which later evolved into the CLABSI bundles used today. Nurses play a pivotal role in patient safety, compliance with the CLABSI

bundle, and educating patients and families to decrease the incidence of CLABSI (Infection Control Today, 2013). Noncompliance with the CLABSI bundle due to behaviors or lack of knowledge can negatively impact patient outcomes.

The current state of nursing practice related to decreasing CLABSI is one of improving engagement and empowerment. There is sufficient evidence to support the use of a CLABSI bundle. However, nurses must be compliant with the recommendations. Some of the barriers to reducing or eliminating CLABSI are lack of a culture of safety and inadequate nurse training and competency (The Joint Commission, 2013). The role nurses play in CLABSI prevention depends on knowledge and engagement with reduction strategies. Important initiatives to improve practice include staff education and engagement and improving the safety culture (Perin, Erdmann, Higashi, & Sasso, 2016).

There are multiple expert agencies with recommendations and guidelines to address CLABSI. One of the most impactful strategies to decrease the incidence of CLABSI has been the development of CLABSI bundles. The adoption of guidelines from the CDC, Institute for Healthcare Improvement, Agency for Healthcare Research and Quality, and others to create CLABSI bundles has led many hospitals to attain rates of zero CLABSIs (The Leapfrog Group, 2011). As a result, one of the national patient safety goals requires that hospitals implement policies and practices congruent with evidence-based standards set by these expert agencies and follow checklists and standardized protocols to reduce the risk of CLABSI (The Joint Commission, 2017). There is much data to support the use of a bundle to decrease CLABSI rates.

Despite the benefits of bundles, it is important that staff comply with its policies. Computerized e-learning modules have been found to be effective at increasing nursing knowledge (The Joint Commission, 2013); however, e-learning does not address skills application. A successful train-the-trainer approach has been used in which a team of nurses is trained to audit and monitor CLABSI bundle compliance and intervene as needed (Yaseen et al., 2016). Additionally, the States Targeting Reduction in Infections via Engagement project, led by the CDC, suggests competency-based training as a strategy to address the compliance issue, recommending a combination of education and application as an ideal method (APIC, 2016). An observed competency has been shown to significantly increase bundle compliance (Robel & Venditti, 2017). A combination of didactic education and demonstration-based competency can address both knowledge and skill.

This project addressed the gap in nursing practice of nurse knowledge and compliance with the CLABSI bundle through identification of a strategy to improve nursing knowledge and compliance, thereby impacting the care nurses provide. Lack of nursing knowledge can hinder adherence to evidence-based practices (Labeau et al., 2007). For instance, a study of nursing knowledge related to CLABSI found that the nurses aged 36 to 50 were less likely to know about expert recommendations than other nurses, but 83.7% of nurses in the study felt the need for additional education (Esposito, Guillari, & Angelillo, 2017). This project filled the gap by providing education for front-line nurses to enhance compliance with the CLABSI bundle.

Local Background and Context

Due to the critical nature of many patients upon arrival to the neurology unit, it is common for the patients on this unit to have central lines in place. The neurology unit required intervention to improve nursing knowledge and compliance, since the unit had the highest number of all noncritical care units for the past two years. However, because the unit does not meet the requirements for NHSN reporting, HAI reduction efforts in the hospital have been focused on reporting units, especially critical care units, where reimbursement is more of a concern.

The project site was a 393-bed hospital in Huntington, West Virginia, which is the largest in the county and one of the largest in the state. The hospital is a Catholic-based organization, embracing a Christ-centered mission to provide care that focuses on God-given dignity and the sacredness of life (St. Mary's Medical Center, n.d.). The project facility is a level II trauma center with a designated neurotrauma unit, which often transfers patients to the neurology unit. The project unit was the neurology unit – a 29 bed unit with the capability to convert many private rooms into semi-private rooms during times of high census to accommodate more than 29 patients. The neurology unit is divided into stroke center and a spine center. Patients admitted to this unit may have a variety of diagnoses including but not limited to stroke, spine surgery, epilepsy, altered mental status, brain cancer, and head trauma. The incidence of CLABSI has been an issue throughout the organization. The medical center joined the States Targeting Reduction in Infections via Engagement project in 2017, which focuses on HAI reduction in hospitals with consistently elevated rates (APIC, 2016). However, the States Targeting

Reduction in Infections via Engagement initiatives have been focused on only the NHSN-reporting units. Since the neurology unit does not report to NHSN, the nurses on this unit have once again been left out of the educational interventions. All patients - regardless of what unit they are admitted to - deserve optimal, evidence-based care.

Demonstration-based competency: A system of evaluating learner competence by learners demonstrating that they possess the expected level of knowledge and skill to perform a task in compliance with set standards.

Device days: the number of patients in a particular location with a specific device (CDC, 2018). For this project, device days refers to the number of patients with central lines on the neurology unit.

Patient days: the number of patients on the unit during the specified time period (CDC, 2018). For this project, patient days refers to the number of patients on the neurology unit during a time specified by the Infection Prevention department for analysis purposes.

West Virginia state regulations are in place related to CLABSI. In 2009, the project site was among several other hospitals in the state of West Virginia that pledged to devote resources to ensure implementation of Society for Healthcare Epidemiology of America and Infectious Diseases Society of America guidelines to prevent CLABSI in accordance with the state's Healthcare Associated Infection Plan (West Virginia Department of Health & Human Resources, 2017). Furthermore, according to Title 64 Series 7 Legislative Rule for West Virginia, healthcare associated infection data are collected by the West Virginia Healthcare Authority and reported to the Bureau for

Public Health in the Office of Epidemiology and Prevention Services (West Virginia Secretary of State, 2013). One of the strategies recommended in the West Virginia Healthcare Authority's Healthcare-Associated Infection Public Reporting Program is to promote compliance with evidence-based practices through education (West Virginia Healthcare Authority, 2016), which is the foundation of this doctoral project.

Federal regulations are also in place to affect the incidence of CLABSI. The Patient Protection and Affordable Care Act emphasized the importance of reducing CLABSI with the Centers for Medicare & Medicaid Services Hospital Inpatient Quality Reporting Program which requires reporting to NHSN for full reimbursement (Association of State and Territorial Health Officials, 2011). Value-based purchasing and pay-for-performance strategies influence these outcomes. Healthy People 2020 is a national agenda that aims to decrease the CLABSI rate and supports the federal steering committee for the prevention of healthcare-associated infections (Office of Disease Prevention and Health Promotion, 2017). State and federal initiatives and regulations support this project and the goal of improving nursing knowledge, which impacts the incidence of CLABSI.

Role of the DNP Student

As a doctoral-prepared nurse, it will be this project director's responsibility to translate research into practice to improve patient outcomes (American Association of Colleges of Nursing, 2006). As a DNP student, this project is preparing the student for that role. In my current role as nursing faculty for an associate degree nursing program, I educate future nurses about the care and maintenance of central lines and how to prevent

CLABSI. In a previous role, I led a project at another organization related to care and maintenance of central lines in order to obtain Lean Practitioner certification. I have always felt that the strong link between nursing care and CLABSI warrants attention in order to address this often-preventable complication.

My role in this doctoral project was to lead the initiative to educate nurses and evaluate the impact this education has on nursing knowledge on the neurology unit. I have worked closely with the Infection Prevention department to assist with CLABSI education efforts in the critical care areas of the medical center, but no focus had been aimed at the neurology unit prior to this project. The school of nursing for which I teach is owned by the medical center. I facilitate clinical experiences for students on the neurology unit, which was the focus area of this project. As a result, I have developed a strong professional relationship with the Infection Prevention department and with the staff nurses and nurse manager of the neurology unit.

My motivation to undertake this project was my desire to improve nurse knowledge on the neurology unit and eventually throughout the medical center. As previously discussed, I have had great interest and involvement in central line initiatives in the past and I facilitate clinical experiences for students on the neurology unit. The neurology unit was found to have the highest incidence of CLABSI of all units that do not report to NHSN. Because the prevalence of CLABSI on this unit is not reported to NHSN, efforts to decrease CLABSI had been directed toward the units that are reported. The neurology unit cares for a very vulnerable population and this patient population has the right to the same evidence-based care as patients admitted to critical care units.

One potential for bias in this project involved my role as faculty for students providing patient care on the focus unit. I strive to always encourage students to provide the very best care. However, it may be possible that I am more conscientious of the care being provided for patients with central lines when this project begins, knowing that the project could be affected. A major component of central line care that can contribute to CLABSI is sterility during the central line dressing change. Students do occasionally perform this skill as part of patient care, but always under the guidance of the instructor. To avoid the potential of unconsciously assigning or avoiding assigning patients with central lines to students, the charge nurse of the neurology unit assisted in making the patient assignments without indicating to me if the patient has a central line until other factors have deemed the patient either suitable or unsuitable for assignment to a student.

Role of the Project Team

The project team consisted of myself, the nurse manager of the neurology unit, the nurse manager of the Resource Team, the Director of Infection Prevention, and the Infection Prevention Specialist overseeing CLABSIs. Because of their leadership roles, all of these were already aware of the upcoming project to impact nurse education. When the project formally began, a meeting was held to discuss the project, timeline, each team member's role, key activities, and expected outcomes. Additional meetings were to be held to discuss progress, successes, and challenges as the project progressed and at completion.

The nurse manager of the neurology unit was responsible for providing time for her staff nurses to attend the training and encouraging participation. She shared her

expertise about the culture and receptiveness of her nurses. The Infection Prevention Director and Infection Prevention Specialist provided data regarding the past CLABSI rates and what has been done in the past to address the issue within the organization, including educational initiatives. The Infection Prevention Specialist was responsible for validating my central line dressing technique to ensure that I was evaluating the demonstration-based competencies appropriately. Validating competencies for nurses on other units has been one of her responsibilities in the past. The team collaborated to allow all levels of expertise to inform the project and facilitate success.

Within two weeks of project approval, the team met to determine dates for educational sessions to take place as determined by the nurse managers and myself. As anticipated, all educational sessions took place over the course of two to four weeks and were delivered by me. The Infection Prevention Director and the Infection Prevention Specialist are experts and were responsible for providing approval of the education and demonstration-based competencies to ensure compliance with hospital policy. After project completion, the team reconvened to discuss the outcomes and provide feedback. The team was aware that impromptu meetings may have been called throughout the project as needed to address concerns or progress.

Summary

Adherence to the CLABSI bundle has been recognized as a gap in practice. Interventions to address this problem were implemented and outcomes measured to compare for effectiveness. An educational session including demonstration-based competency validation for central line dressing change was provided for RNs on the

neurology unit. Comparing the pre- and post-test statistics revealed if the project had the intended impact and learning had taken place for the nurses on the neurology unit. Improving nurses' knowledge of CLABSI prevention can contribute to decreased incidence. Section three reveals the sources of evidence used to support the project and the procedure for data collection and analysis.

Section 3: Collection and Analysis of Evidence

Introduction

Nurses who do not have adequate knowledge to provide proper care and maintenance for central lines may inadvertently contribute to CLABSI. CLABSI negatively impacts patient outcomes and has financial implications for the hospital. Therefore, this project addressed the impact of education coupled with demonstration-based competency to improve nursing knowledge on a neurology unit. Pre- and post-test analysis determined the effects of the intervention and if learning had taken place.

The success of this project depended on improvement in the nurses' knowledge regarding appropriate care and maintenance of central lines. One of the key strategies to preventing CLABSI is adherence to a CLABSI bundle, which includes maintaining sterility during dressing changes. The facility has an evidence-based CLABSI bundle within its policy, but adherence can be improved. Education from this project was focused on the CLABSI bundle and a demonstration-based competency validation consisting of a central line dressing change was performed by each nurse participating in the education. Federal and state regulations encourage hospitals to implement evidence-based initiatives that decrease the incidence of HAIs such as CLABSI. Nurses and the care they provide based on their knowledge impacts these initiatives.

To determine the effectiveness of the doctoral project, pertinent data were collected and analyzed. This section includes the sources of evidence that contributed to the project, such as expert entities and scholarly sources. The process for data collection and analysis is also explained, including the role of the infection prevention specialist and

the process used to collect pertinent data within the project site. Protection of patient and participant privacy are necessary considerations for this project and these strategies are discussed in greater detail. This section provides a summary of the process for data attainment, organization, and analysis.

Practice-Focused Question

This doctoral project was focused on nurses' lack of knowledge related to proper care and maintenance of central lines. The project site does have a CLABSI bundle policy, but it is not being followed consistently and no formal education regarding the policy takes place to ensure nurse understanding. The project facility has a goal of zero CLABSIs; however, the neurology unit has had a higher rate of CLABSIs than desired. In 2015 and 2016, the neurology unit had the highest rate of CLABSI of all medical-surgical units. Thus, this project was focused on education regarding the CLABSI bundle in combination with demonstration-based competency. The practice-focused question this project was whether nursing education regarding use of the CLABSI bundle and demonstration-based nurse competency can improve nursing knowledge in nurses working on a neurology unit as compared to current practice of an annual e-learning module as the sole source of nurse education.

The purpose of this project was to examine the effects of education coupled with competency validation on nursing knowledge on the neurology unit when nurses receive face-to-face education and perform demonstration-based competencies. Evidence supports that using a CLABSI bundle can decrease the incidence of CLABSI—a common complication as a result of improper nursing care—and that demonstration-based

competency can be used to evaluate both understanding and skill. One of the key nursing components of the CLABSI bundle is maintaining sterile technique during central line dressing changes, which was demonstrated by each nurse after education had taken place. This approach aligns with the practice-focused question by evaluating nursing knowledge via pre- and post-test comparison before and after education and competency demonstration had been completed.

Sources of Evidence

This project consisted of education, including demonstration-based competency, and administration of a pre- and post-test. Sources of evidence collected to answer the project question were the pre- and post-test data. Comparison of pre- and post-test scores provided data to show if learning occurred. Pre- and post-test comparison can establish a benchmark and provide evidence of value-added which can be useful in measuring knowledge and learning (Skidmore College, n.d.). Improving nursing knowledge can impact the incidence of CLABSI. Increased posttest scores reflect that learning has occurred and the nurses are better prepared to provide care and maintenance for patients with central lines.

The purpose of this project was to determine the effects of education and demonstration-based competency on nursing knowledge on the neurology unit. The evidence supports a CLABSI project outside of the critical care area, focused on nursing and consisting of education regarding CLABSI and the CLABSI bundle with a demonstration-based competency component. The education provided to the nurses and the standards by which competency was evaluated were evidence-based. Examining such

resources and analyzing the literature for development of education and evaluation criteria supports the validity of the education being provided and the project's contribution to evidence-based practice.

Published Outcomes and Research

Evidence necessary to address the practice-focused question came from current research and established guidelines. Strategies to obtain the evidence needed to complete the project included literature searches primarily using the Walden Library databases, including but not limited to Medline, CINAHL, EBSCOhost, and ProQuest. Search terms included *CLABSI, CLABSI bundle, central line infection, central line bundle, CVAD, CVAD bundle, hospital-acquired infection, demonstration-based competency,* and *competency validation*. Boolean search strings included *central line and infection, CVAD and infection, CLABSI and bundle, CLABSI and competency, CVAD and bundle,* and *CVAD and competency*. To review pertinent literature that contributes to the evidence for this project, scholarly, peer-reviewed sources were explored. Primarily, sources used were published within the past 5 years; however, some older publications were referenced. For example, the use of a CLABSI bundle is not a concept that has been established within the past 5 years, but it is still relevant to the basis of the project.

Most literature reviewed was articles available online, which provided many journal articles, expert publications, and even similar doctoral projects. Using various databases and search terms resulted in a comprehensive review. This literature review entails over 40 scholarly sources. CLABSI is a common problem addressed in health care. As a result, thousands of articles are available that address CLABSI. However,

critical appraisal found 44 articles that were appropriate to support the project. This review presents evidence to support a CLABSI prevention program focused outside of the critical care area, which has typically been the focus for CLABSI education. Furthermore, the evidence supports a concentrated effort to educate nurses due to their role and its impact on the incidence of CLABSI. A key component of the education was adherence to the CLABSI bundle. The evidence to support the impact of nurse adherence to the CLABSI bundle is abundant. Another important piece of this project was demonstration-based competency, in which the nurses were required to demonstrate central line dressing change technique on a mannequin. The evidence is presented to support this method for nurse education. This literature review supports the project to improve nursing knowledge related to central line care and maintenance.

Evidence to support CLABSI education outside of critical care. Like many other organizations, the project site has focused most education efforts on the critical care units. This doctoral project focused on education for nurses on the neurology unit, which is not a critical care unit. The rate of CLABSIs is typically higher in critical care areas; however, the majority of CLABSIs occur outside of the critical care units (APIC, 2015; Marschall et al., 2014). A greater number of central lines are inserted in critical care areas, contributing to the higher incidence, but access is often maintained for a longer period while patients are admitted to noncritical care units (Jones et al., 2015). It is estimated that up to two-thirds of the total days in which a patient has a central line are accumulated outside of the critical care units (Zingg et al., 2014). This project was aimed at improving the knowledge of nurses on the neurology unit. As previously noted, nurses

from the float pool were also invited to attend the education sessions. An increased number of "pool nurses" has been found to contribute to a higher incidence of CLABSI (O'Grady et al., 2011). Usage of float pool nurses is common on the neurology unit. Thus, education focused on the neurology nurses and float pool nurses was needed in order to impact patient outcomes related to CLABSI.

Evidence to support the role of the nurse in CLABSI prevention. Nurses play a pivotal role in the prevention of CLABSI. Central line insertion presents a major risk, but appropriate nursing care and maintenance are key to CLABSI prevention efforts (Marschall et al., 2014). Nurses can have the largest impact, as they have a responsibility to be experts in central line care (Dumont & Nesselrodt, 2012; Infection Control Today, 2013; Kumari, Devi, & Narayani, 2016; McAlearney & Hefner, 2014; Office of Disease Prevention and Health Promotion, 2013). Each time a central line is manipulated or a central line dressing changed, the nurse must adhere to the evidence-based guidelines that protect the patient from infection. Ensuring nurses are knowledgeable and compliant is key to a successful CLABSI prevention program (Barsuk et al., 2015; Perin et al., 2016; World Health Organization, 2002). The goal of this project was to improve nursing knowledge which will impact the crucial care these nurses provide.

Nursing compliance with established guidelines is a challenge to CLABSI prevention efforts. Whether related to lack of knowledge or another factor, adherence to evidence-based standards is a recognized problem that contributes to the incidence of CLABSI (Flodgren et al., 2013; Jones et al., 2015; Sacks et al., 2014; Valencia et al., 2016). CLABSI prevention efforts are a major concern for many organizations and a

effort is commonly directed toward this issue. However, the methods are not always sufficient to ensure adequate nursing knowledge which could influence compliance (Esposito et al., 2017). For example, a meta-analysis of 96 studies of CLABSI prevention programs indicated that adherence to established guidelines was only measured in about one-third of the studies, but compliance was suboptimal in every study in which it was addressed (Ista et al., 2016). This doctoral project not only educated nurses regarding the existing evidence-based guidelines but focused on the importance of the nurse and adherence to these guidelines to prevent CLABSI.

Evidence to support the CLABSI bundle. Ensuring compliance with established CLABSI prevention strategies includes adherence to the CLABSI bundle. A bundle consists of several interventions that have shown to improve outcomes when implemented together (APIC, 2015; Dumont & Nesselrodt, 2012; Marschall et al., 2014). Many organizations follow the CLABSI bundle set forth by the Institute for Healthcare Improvement (2017), which consists of proper hygiene and sterile barriers, skin antisepsis, appropriate vein selection, daily review of line necessity, and prompt line removal (Casey & Elliott, 2010; The Leapfrog Group, 2011). These interventions are supported by level I evidence to reduce the incidence of CLABSI (Barsuk et al., 2015; Institute for Healthcare Improvement, 2017). For instance, the CLABSI bundle components were implemented in 103 intensive care units in Michigan and led to a 66% decrease in infection rates, which was estimated to save 30,000 lives annually (Johns Hopkins Medicine, 2009). In another study, education regarding the CLABSI bundle resulted in one hospital obtaining a CLABSI rate of zero in 2014 and maintaining this

throughout 2015 (Yaseen et al., 2016). Yet another hospital saw a decline in CLABSI rates from 7.9 to 1.7 after implementing a program to teach the bundle and compliance (Sahni et al., 2017). Another hospital implemented the bundle in the Surgical Intensive Care Unit and CLABSI incidence decreased by 68% (Sacks et al., 2014). Therefore, the use of the CLABSI bundle is supported as an evidence-based strategy to decrease central line infections (Agency for Healthcare Quality and Research, 2013; The Joint Commission, 2013; Perin et al., 2016). Adherence to the bundle can improve patient outcomes by reducing or even eliminating the incidence of CLABSI.

The doctoral project site has adopted the CLABSI bundle as policy. However, the policy is not consistently followed. Thus, education regarding the CLABSI bundle was a component of the nursing education provided in this project. Compliance has been identified as an issue that requires additional education (The Joint Commission, 2013; Thom et al., 2014).

Evidence to support the effectiveness of CLABSI education. Evidence supports education of health care personnel as a key factor for compliance and infection prevention, which is supported by level I evidence (APIC, 2015; Dumont & Nesselrodt, 2012; Marschall et al., 2014; Sacks et al., 2014). A category IA recommendation from the Healthcare Infection Control Practices Advisory Committee for successful CLABSI prevention programs is to educate all staff and only allow those who demonstrate competence to provide care and maintenance for central lines (O'Grady et al., 2011). A study of four hospitals with very low or zero CLABSI incidence revealed a commonality that all four organizations required CLABSI education beyond a standard orientation

(The Leapfrog Group, 2011). The education provided in this doctoral project included a pre- and post-test to evaluate if learning had occurred. Comparing pre- and post-test results is a valid method to show that education has been effective (Humphrey, 2015; Kumari et al., 2016). Including staff in continuous education and reeducation are facilitators to infection prevention program success (McAlearney & Hefner, 2014; World Health Organization, 2002). The use of a pre- and post-test and education of staff are well-supported by evidence and are necessary to improve CLABSI prevention efforts at the project site.

Evidence to support demonstration-based competency. In addition to didactic education, nurses participating in this doctoral project underwent demonstration-based competency validation by performing a central line dressing change on a mannequin. Competency-based training is considered to be a foundational element for the States Targeting Reduction in Infections via Engagement initiative to decrease HAIs (APIC, 2016). Demonstration-based competency involves skill performance or simulation of an actual patient situation in order for competence to be evaluated. Knowledge does not always equal competence (Schilling, 2012). The nurse should possess both. It is highly recommended that nurses have documented competency before being permitted to provide care for patients with central lines (APIC, 2015; Barsuk et al., 2015; Marschall et al., 2014; O'Grady et al., 2011; Pham et al., 2016). Having both didactic and skill-based educational components to the doctoral project ensured a comprehensive program.

Implementing both lecture and demonstration-based competency education has been shown to decrease the incidence of CLABSI. The Asia Pacific Society of Infection

Control (APSIC) recommends ongoing education including skills competency to address the CLABSI problem (Ling et al., 2016). Repetition of such skills has been identified by staff members as necessary for CLABSI prevention (McAlearney & Hefner, 2014). Educational interventions that are multimodal, including both theory and demonstration or simulation, are most effective (Barsuk, Cohen, & Feinglass, 2009; Dickerson & Chappell, 2016; Flodgren et al., 2013; Latif, Halim, & Pronovost, 2015; Xu, 2016). One hospital included demonstration of central line dressing changes as part of their improvement plan for CLABSI and rates decreased significantly over the following five years (Jones, Stewart, & Roszell, 2015). Another article describes that when simulation was used for education of central line access, care, and maintenance, nurse competence increased 16.9% and the CLABSI rate decreased from 5.86 to 3.43 (Page, Tremblay, Nicholas, & James, 2016). CLABSI rates were reduced by 84% in another study when nurses and physicians participated in training including simulation (Zingg et al., 2014). Similarly, another study found a decrease in CLABSI rates from 6.47 to 2.44 after physicians attended educational sessions including simulation Burden et al., 2012). An important study described by APIC (2015) found that when simulation training was added to the central line dressing change protocol for 524 nurses, CLABSI rates decreased from 5.3 to 2.9. Evidence supports utilizing both traditional lecture and demonstration-based competency to improve nurse knowledge and impact CLABSI prevention efforts.

Evidence Generated for the Doctoral Project

Participants. The doctoral project to improve knowledge related to CLABSI for

nurses on the neurology unit began with Institutional Review Board (IRB) approval (approval no. 07-03-18-0038526). After approval was obtained, the nurses on the neurology unit were invited via a notice on the nursing unit and personal communication.

The neurology unit employs 32 RNs. All RNs employed on this unit were invited to participate. RNs are responsible for the care and maintenance of central lines, so the education did not include other disciplines including licensed practical nurses or patient care assistants. Resource team (float pool) RNs were invited to attend the sessions as well. The Resource Team employs 40 RNs. The maximum participant count for the project was 72 nurses. The neurology unit has had a higher than expected CLABSI rate and had not been the focus of education related to central line care and maintenance. Thus, this education was valuable for the nurses on this unit.

Nurses on the neurology unit and in the resource team were emailed, an informational flier was posted, and personal communication took place to recruit participants to attend the education sessions. The education provided consisted of a paper pretest administered immediately prior to the education sessions. The pretest consists of 15 questions and took no more than 10 minutes to complete. This took place in the same location as the education session. A brief PowerPoint presentation with lecture followed the pretest. The project director provided the didactic education, which took approximately 15 minutes. Demonstration-based competency from the nurses followed, with each nurse demonstrating a central line dressing change. Finally, the opportunity to ask questions was provided, and a posttest completed. The posttest consisted of the same questions as the pretest. The entire education session including pretest, lecture,

demonstration-based competency, and posttest took less than 1 hour. The neurology unit contains 3 private staff areas, one of which, depending on availability, was used for the education sessions to allow them to take place in a location convenient for the nurses. Sessions took place over the course of 3 weeks at varying times to best accommodate the nurses' schedules. Those who did not score at least 80% on the demonstration-based competency and/or the posttest were to undergo immediate re-education consisting of a review of the material by the project director. The nurse manager provided the nurses' schedule so that the education sessions could be presented at the most convenient times for the nurses and most efficient times to reach the greatest number of nurses. Multiple offerings were necessary. Consent to participate in the project was obtained prior to the start of each education session when all participants had arrived. The purpose of the project, protection of privacy, and voluntary participation were emphasized.

Procedures. The tools used to collect evidence were a pre- and post-test and a central line dressing change skills rubric. The tool used to evaluate nursing knowledge was the pre- and post-test developed by Dr. Joy Humphrey for her evidence-based publication in the Journal of the Association for Vascular Access (Humphrey, 2015; See Appendices A & B). Permission from Dr. Humphrey to use this test was obtained. The test was administered prior to the education sessions and demonstration-based competencies, then administered after the sessions to determine if learning had taken place. This test was found to be statistically significant to evaluate nursing knowledge in Dr. Humphrey's study, having a *P* value of .0001 with a paired, 2-tailed *t* test significant at the .05 level (Humphrey, 2015). The pretest mean score was 4.6 and the post-test

mean score was 8.4 (Humphrey, 2015). These tests remained mostly as Dr. Humphrey developed them, with only organization-specific modifications (See Appendices C & D). For example, question number 5 in the tests asks the nurse in which unit they work the most. The neurology unit was added as an option for this question, as that was the focus area for this project. Additionally, question 11 was removed, as the issue this question addresses is not in current hospital policy. Another modification made was to question 14 with the answers being modified to reflect hospital policy. Finally, a typo on Dr. Humphrey's original tests was corrected. The options for question number 9 were listed as a, b, and d, instead of a, b, and c. Other than these minor modifications, the tests were largely unchanged from Dr. Humphrey's original versions. These changes were appropriate and do not affect the validity of the tool.

The tool used for the educational demonstration-based competency of central line dressing change was the Central Venous Catheter: Maintenance and Dressing Change checklist (Appendix E). This checklist was developed by the Simulation Coordinator for St. Mary's School of Nursing and is used for nursing students' skills and education. The validation checklist includes key components of the CLABSI bundle. The Infection Prevention Specialist at the project site reviewed this skills rubric for compliance with institutional policies. Combining this hands-on demonstration-based competency with the oral presentation results in an active learning strategy that can improve information retention for nurses (Xu, 2016). The validation checklist was not a tool that was used to show improvement, but instead was used to reinforce proper technique. After didactic education had taken place, each RN privately demonstrated the technique for central line

dressing change. The rubric was used to evaluate the skill. Any deviations from the rubric were discussed with the nurse at that time. Any nurse scoring less than 80% would require re-education including follow-up repeat of skills demonstration

Protections. This project involved educating the nurses on the neurology unit and performing demonstration-based competencies. Information about the nurses who participated in the education sessions was protected. A notice regarding the educational offerings was posted on the unit. The project director and the nurse manager also had personal communication with the nurses to explain the purpose and benefits of the project. Consent to participate was obtained from those attending each session prior to the start of that session. The participants were given a consent that detailed the purpose of the project, the protection of privacy, and voluntary participation. Any information from those who did participate was kept on the project director's personal, password-locked laptop computer. The pre- and post-tests contain demographic questions including highest level of education, years of experience as a RN, primary shift the nurse typically works, employment status (full-time, part-time, contract), and what unit the RN most often works. Information, including collected data, was de-identified. Demographic questions are included in the pre- and post-test, both of which allow the nurse participants to remain anonymous. Each participant was given a pretest and a posttest with the same test number. Ensuring that each participant receives the same numbered pretest and posttest that is unique to that person allowed the tests to be compared on an individual basis. The protection and privacy of all those involved was a priority throughout this project.

Protection and privacy of participant information was ensured throughout the project. The paper data including pretests, posttests, and skills rubrics is maintained in a locked drawer in the project director's work or home office to which only she has a key. Only the project director had access to this information. This information will be kept until completion of the project and subsequent article publication has taken place. At that time, the paper information will be destroyed using a commercial shredding company. Any computerized data will be maintained on the project director's personal, password-protected computer until completion of the project and subsequent article publication as well. The project organization requires all data to be retained for at least 3 years after project completion. Walden University requires data retention for 5 years. Thus, all data will be retained for at least 5 years after the project is complete.

This project required IRB approval prior to implementation. The project was submitted for IRB approval from Walden University for a primary data analysis. In addition to IRB and facility approval before any project related activities began, the project site required an additional form to be completed wherein all leaders from any area within the medical center impacted by the project attested that they were aware of and supported the endeavor. For this project, that included the Director of Infection Prevention, the neurology unit nurse manager, the float pool nurse manager, and the Director of Organizational Learning and Development.

Analysis and Synthesis

The following provides detail regarding the analysis of data for this project. The data that were analyzed as a result of this project were the comparisons of the pre- and

post-tests administered before and after the educational sessions and demonstration-based competencies. The pre- and post-tests contain demographic and content knowledge questions, which were coded to maintain privacy and facilitate analysis. This data was collected, maintained, and analyzed. Mean scores were compared from the pre- and post-tests to show if improvement occurred. Demographic data was also analyzed via mean, medium, and frequency distribution to determine the potential impact of these factors and to characterize the program sample. The results were coded as described in the project tests. Coding was consistent with the coding used for Dr. Humphrey's (2015) post-test in her project, which is detailed in Appendix B., wherein correct answers are coded as 1 and incorrect answers are coded as zero. Demographic data was also coded according the provided response. IBM SPSS Statistics 21 was used for data analysis to determine if learning occurred and evaluate for percent difference. Any missing data would have been removed and only the present data would have been analyzed. Although this can affect statistical power, it is the recommended approach for the SPSS program (Kwak & Kim, 2017). Outliers were identified prior to analysis process. Winsorization is a process that replaces outlier values with either the largest or second smallest values otherwise found and is an appropriate approach to address outliers (Kwak & Kim, 2017). The results of the analysis align with the practice-focused question to evaluate if education and demonstration-based competency improve nursing knowledge regarding central line care and maintenance for RNs on the neurology unit.

Summary

This evidence-based doctoral project aimed to determine if education and demonstration-based competency could improve nursing knowledge related to care and maintenance of central lines on a neurology unit. Sources of evidence to support this project included national and expert agencies, several of which were referenced when the project site developed their CLABSI bundle and policy. A comprehensive review of published research using a variety of databases and search terms revealed scholarly literature that was the foundation of this project. The evidence supports that nurse education and demonstration-based competency influence the incidence of CLABSI.

To determine the effectiveness of an intervention, pertinent data must be collected and analyzed. The IBM SPSS Statistics 21 program was used to analyze the project data. Every effort was made to ensure participant and patient privacy and to maintain ethical standards. The pre- and post-tests administered before and after the education sessions were compared to evaluate the effectiveness of the intervention. Section 4 of this document reports the findings of the project including analysis of data collected during the project.

Section 4: Findings and Recommendations

Introduction

Nurses who do not have adequate knowledge to provide proper care and maintenance for central lines may inadvertently contribute to CLABSI. The neurology unit at the project medical center has experienced a higher than expected CLABSI incidence. Up to 70% of CLABSIs could be prevented if nurses followed established evidence-based practices (APIC, 2016), including obtaining competence to care for central lines. This project involved examination of the impact of education coupled with demonstration-based competency to improve nursing knowledge on a neurology unit. Improved nursing knowledge can contribute to better patient outcomes.

This project was conducted over a 3-week period, from July 31, 2018 to August 18, 2018. Nine education sessions were offered at various times, including nights and weekends. The nurses completed a pretest, listened to an educational presentation, participated in a demonstration-based competency for central line dressing changes, and completed a posttest. Pre- and post-test scores were compared using descriptive statistics to determine if learning occurred.

Findings and Implications

Twenty-three RNs participated in the study to improve nurses' knowledge of CLABSI through education and demonstration-based competency as measured by comparison of pre- and post-test scores. The first 7 questions on the pre- and post-tests were demographic questions. Most participants held an associate degree (87%), whereas the remainder held a bachelor's degree (13%). There were no participants whose highest

degree was a diploma, master's, or doctorate. Seventeen percent of the nurses had less than 1 year of experience, 17% had 1 to 5 years of experience, 17% had 5 to 10 years of experience, and 48% had greater than 10 years of experience. Given the high nurse turnover rate, the high number of participants with greater than 10 years of experience was unexpected. Most of the participants (78%) worked day shift to evening shift (7 a.m. to 7 p.m.), and only one participant (4%) worked day shift (7 a.m. to 3 p.m.); whereas the remainder (17%) worked evening to night shift (17%). All but 1 participant was employed full-time (96%). Further demographic questions were not asked due to the limited diversity in the sample and the ability to determine specific participants based on that data, which would subsequently affect participant anonymity.

The education sessions were intended for RNs on the neurology unit and from the resource team. Sixty-five percent (n = 15) of the RNs who attended were from the neurology unit and 35% (n = 8) were from the resource team. Nurses were asked how many hours each shift they spent assessing and monitoring intravenous sites, administering intravenous medications, and interpreting lab data related to intravenous infusions. In response, 57% selected 1 to 2 hours, 26% selected 3 to 4 hours, 9% selected 5 to 6 hours, and 9% selected greater than 6 hours. Seventy percent of participants identified that they had attended an in-service in the past 12 months related to institutional policy regarding central line maintenance whereas 30% had not. The term *in-service* was not further defined and was a source of confusion for some participants.

The answers to nondemographic questions on the pre- and post-tests were compared and analyzed (Table 1). The mean score on the pretests was 72.1% with scores

ranging from 64.3% to 92.9%. The mean score on the posttests was 94.1%, with scores ranging from 78.6% to 100%. All participants' posttest scores were higher than their pre-test scores. The comparison of pre- and post-tests revealed a mean improvement of 22% (Table 2), which answered the project question and supports that nurse education and demonstration-based competency did improve nursing knowledge of CLABSI.

Table 1

Pretest and Posttest Correct Answer Frequencies

	Pretest		Posttest	
Question	*n*	%	*n*	%
8. What is a central line associated blood stream infection (CLABSI)?	8	35	21	91
9. Which of the following is the most common site for CLABSIs?	13	57	21	91
10. What is the most effective intervention you can do to decrease the chance of CLABSI?	21	91	23	100
11. Which type of IV connector (not the name brand) do you use in your facility?	3	13	23	100
12. Which statement best describes proper flushing of the IV connector used in your facility?	7	30	18	78
13. According to your institution's policy, which of the following best describes the procedures for flushing IV catheters?	7	30	15	65
14. Please list two complications related to improper maintenance of IV connectors used by your facility.	7	30	2	9
14a: RN could list 1complication				
14b: RN could list 2 complications	12	52	21	91

Note. IV = intravenous

Table 2

Pretest and Posttest Scores with Percent Difference

	Pretest score %	Posttest score %	Percent difference
	71.4	100	28.6
	78.6	92.9	14.3
	85.7	100	14.3
	71.4	85.7	14.3
	78.6	92.9	14.3
	71.4	100	28.6
	64.3	100	35.7
	71.4	100	28.6
	64.3	100	35.7
	78.6	92.9	14.3
	64.3	92.9	28.6
	71.4	85.7	14.3
	64.3	92.9	28.6
	64.3	92.9	28.6
	71.4	92.9	21.5
	92.9	100	7.1
	64.3	92.9	28.6
	64.3	92.9	28.6
	78.6	100	21.4
	78.6	85.7	7.1
	64.3	92.9	28.6
	78.6	100	21.4
	64.3	78.6	14.3
Mean	72.1	94.1	22.0

Question 8 on the tests evaluated the participants' understanding of the definition of CLABSI. Most of the participants (65%) answered this question incorrectly before the education, whereas 91% answered this question correctly after the education. Question 9 on the tests related to the most common CLABSI site. A little more than half of the nurses (57%) were able to correctly identify the femoral site as having the highest risk for CLABSI on the pretest, but 91% answered correctly on the posttest. Question 10 had nurses identify the most effective intervention to decrease the risk of CLABSI. Most of the nurses (91%) answered correctly on the pretests, and this question was answered correctly by 100% of participants on the posttests. Question 11 asked the nurses to

identify the type of intravenous connector used in the facility. Only 3 nurses (13%) were able to correctly answer this question on the pretests, but 100% answered this question correctly on the posttests. Question 12 related to proper flushing of the intravenous connector. Only 30% of nurses answered this correctly on the pretests, compared to 78% on the posttests. Question 13 asked nurses to describe proper flushing procedure. Test scores for this question increased from 30% on the pretests to 65% on the posttests. The final question on the tests asked nurses to list 2 complications related to improper line maintenance. 17% were unable to correctly identify any complications, 30% were able to correctly identify 1 complication, and 52% correctly identified 2 complications on the pretests. On the posttests, every participant was able to correctly identify at least 1 complication, with most (91%) correctly identifying 2 complications. Every question was answered correctly more frequently on the posttests than on the pretests, indicating that learning did occur.

Limitations can affect the strength of a study. One of the most identifiable limitations in this study was the small sample size. The maximum participant count was expected to be 72 nurses. However, only 23 nurses participated. The nurse turnover rate on the neurology unit has been of concern, and fewer nurses were available. The only nurses from the resource team to participate were those who were assigned to the neurology unit on the days sessions were being offered. Another limitation was the lack of diversity among participants. All participants held either an associate's or bachelor's degree, only 4 participants worked a shift other than day to evening, and all but 1 participant was a full-time employee. This affected the ability to determine the impact of

certain demographic factors on CLABSI knowledge. An additional limitation was the lack of a definition of "in-service" provided on the pre- and post-tests. The facility recently purchased a new brand of central line dressing. All RNs were required to attend a training session to learn about the new dressing. This training session included information about proper central line dressing change technique. Through dialogue it was found that some participants considered this to be an in-service while others did not, which would affect the usefulness of this question on the pre- and post-tests. These limitations should be considered if a follow-up study were to be conducted.

Implications from the findings of this study include the potential to improve patient outcomes and save lives. CLABSI is the costliest hospital-acquired infection, is associated with an increased risk of death, and is most often preventable if health care workers provide proper care and maintenance (Haddadin & Regunath, 2017). Improving nurses' awareness of CLABSI and knowledge of their impact on this problem can decrease the incidence. Nurses who recognize an issue exists and understand the benefits of changed behavior are more likely to support new interventions (Peyrot & Rubin, 2007). Many of the participants in this study voiced concern and surprise that they knew so little about CLABSI when taking the pretest. This new knowledge can improve the care these nurses provide, thereby improving outcomes within the community they serve.

From an institutional and systems perspective, this study could have far-reaching effects. Although this project involved only neurology and resource team nurses, it could be generalized to other units within the organization. Furthermore, the resource team nurses are not assigned to specific units and can impact CLABI incidence on a multitude

of units to which they float. Krein et al. (2010) found that the outcomes of infection prevention efforts varied based upon specific organizational characteristics even when the same interventions were implemented. The success of this project on 1 unit indicates a high likelihood that it would be successful on other units as well. A high incidence of CLABSI is associated with a perception of poor quality of care being provided (World Health Organization, 2002). Decreasing the rate of CLABSI throughout the organization may improve the perception of the organization within the community. Furthermore, CLABSI is a very costly complication. The approach used with this project is a cost-effective way to impact the CLABSI incidence and potentially save the organization thousands of dollars or more. This project could improve outcomes from many perspectives.

Implications from this project could affect positive social change. Positive social change implications for this project include increasing nursing knowledge and improving care the patients receive. Innovative and solution-oriented change agents and front-line nurses are in positions to affect positive social change by implementing and sustaining efforts that result in improved patient outcomes (Altman & Brinker, 2016). This project resulted in validation of and increased nursing knowledge related to the care and maintenance of central lines and the organizational policies in place. Nurses have been named the most trusted profession for the past 16 years according to the annual Gallup polls (American Hospital Association, 2018). Improving care and decreasing complications when possible is an ethical obligation when a profession holds the social standing and responsibilities of nursing.

Recommendations

Recommendations can be made to potentially address the gaps in practice identified and informed by this project. There are no specific products that need to be addressed, but policies and protocols should be examined. A common finding throughout this project was that participants either could not find the organizational policy regarding central line care and maintenance or could not understand it. Pieces of applicable information were found in multiple policies rather than one comprehensive and user-friendly policy. The policies are evidence-based and current, but one recommendation would be to re-evaluate the policies to make them more accessible, understandable, and eliminate any ambiguity.

Another recommendation would be to include additional training regarding CLABSI in the RN onboarding process. The participants verbalized that very little emphasis was placed on CLABSI education for newly-hired nurses. Level I evidence from the Healthcare Infection Control Practices Advisory Committee supports that competency should be demonstrated before nurses are permitted to provide central line care and maintenance (O'Grady et al., 2011). Most standard hospital orientations are not sufficient for nurses to learn what they need to know to provide competent care. The education process used in this study should be utilized throughout the organization and incorporated into the onboarding and orientation process to improve knowledge and competence for experienced and newly-hired nurses.

Implementation of these recommendations would require resources but could easily be accomplished. The infection prevention department is responsible for

developing the central line care and maintenance policies. Re-evaluation and consolidation of these policies would be the responsibility of this department with input from stakeholders. Incorporating the education methodology used in this study into hospital-wide and onboarding education would be a joint effort and require collaboration between the infection prevention department and the organizational development and learning (ODAL) department. The ODAL department is responsible for educational initiatives within the organization including hospital orientation. The resources used for this project could easily be incorporated into annual and initial RN education.

Contribution of the Doctoral Team

The project team consisted of myself, the nurse manager of the neurology unit, the nurse manager of the resource team, the director of infection prevention, and the infection prevention specialist overseeing CLABSIs. Overall, the project ran smoothly with no unforeseen challenges or complications. The nurse manager of the neurology unit assisted with determining optimal dates and times most convenient for staff to participate and securing a space on the unit for the sessions to be held. She encouraged the RNs from her unit to participate in the project. Likewise, the nurse manager from the resource team encouraged RNs from his team to attend. Prior to its start, the project details were discussed with the director of infection prevention and the rubric used to evaluate central line dressing change technique was validated by the infection prevention specialist. The team worked well together to produce a successful project and will continue to work together to plan for expansion to other nursing units.

Strengths and Limitations of the Project

As anticipated, this project had both strengths and limitations. One of the greatest strengths of this project was the collaboration that took place with leaders and with staff. Having a strong professional relationship and mutual respect fostered a sense of collegiality among those involved. Another strength is the strong foundation in evidence-based practice that supports this project. An abundance of high-level literature exists relating to CLABSI as it is such a common problem among hospitals. Finally, one strength that made data analysis much simpler and stronger was the lack of absent data. Participants completed all components fully with no missing data left to be assumed or determined by other means. These strengths should be considered when planning for future projects such as this.

Limitations did exist as previously discussed. The small sample size was a limitation but given the turnover rate on the neurology unit and the voluntary nature of the project, this may have been unavoidable. The lack of diversity among participants was another limitation. Again, the small sample size contributed to this and a larger sample size in future projects may yield different results. The lack of diversity made it impossible to infer if any of the demographic factors assessed contributed to low pretest scores which would indicate lack of knowledge prior to the education sessions. Finally, the lack of a definition for the term *in-service* was ambiguous and may have affected the usefulness of the question on the tests which asked if participants had attended in-services related to central lines within the past 12 months. These limitations may be

easily addressed if the project were to be generalized and repeated on other units throughout the hospital.

Summary

This project contributes to existing evidence that supports nurse education coupled with demonstration-based competency to improve nurses' knowledge of CLABSI. The improvement from pretest to posttest scores reflects that the intervention of nurse education had the intended effect and learning did occur. This supports similar findings in the literature. Improving nurses' knowledge can improve patient outcomes and save lives. Section 5 will detail the plan for dissemination of the project results to fulfill the purpose of the project.

Section 5: Dissemination Plan

Introduction

This project to improve nurses' knowledge of CLABSIs was focused on the neurology unit at a large hospital. Dissemination of findings is a critical component of the project process and may begin at a local level and expand as appropriate (Abramson et al., 2018). Dissemination of findings for this project will begin with presentation at a staff meeting on the neurology unit. The nurse manager is supportive of this method and has agreed to allot designated time into a scheduled staff meeting for the presentation when requested. RNs from the resource team will be invited to attend this portion of the neurology staff meeting. During the education sessions for the project, it was explained to participants that they would have the opportunity to see the results and ask questions. Many were excited to be a part of a project that could impact practice within the unit, the organization, and potentially influence change on a larger scale.

After the presentation on the unit, the project will be presented to the infection prevention department. As part of the project team, they have been instrumental in the success of the project. Recommendations including revisions to the central line policies will be discussed. It has been suggested by the infection prevention department that the project be highlighted at the infection team meeting, which takes place quarterly. This meeting is led by the infection prevention department and is attended by infectious disease physicians, pharmacists, nursing leadership, human resources leadership, the organizational development and learning team, and external parties of interest. This

would allow the project results to be disseminated not only organization-wide but also to local parties outside of the hospital.

Publication of the project in a professional nursing journal would be an appropriate venue to reach the broader nursing profession. In addition to publication in ProQuest, publication will be sought in the *Journal of the Association for Vascular Access*, which is the same journal that the test instrument by Dr. Joy Humphrey was published in. The journal is published quarterly and reaches thousands of multidisciplinary subscribers including nurses, physicians, pharmacists, and manufacturers. The nature of the project is appropriate for this target audience.

Analysis of Self

The completion of this project presents an opportunity to reflect on myself throughout the process and to set goals for the future. I feel that these endeavors are emblematic of my commitment to lifelong learning and advancing the nursing profession. Throughout my nursing career, I have been interested in learning about various central lines and have led hospital-based projects to improve care and maintenance of central lines. I expected this project to be similar to the project I completed to obtain lean practitioner certification for process improvement, but I found myself surprised at the detail involved. I have a new appreciation of the difference between process improvement and evidence-based practice and the level of commitment required to ensure evidence-based practice changes are well supported and valid.

The doctoral project has contributed to my growth as a practitioner. I am faculty at a school of nursing and am not primarily responsible for providing bedside patient

care. However, I do still take nursing students into the hospital and facilitate their clinical experiences. One of the activities incorporated into my course's curriculum is an evidence-based practice project. I believe it is vital for nurses—no matter their educational level—to seek out, understand, and at a minimum advocate for implementation of evidence-based practice. I have not found evidence-based practice projects to be common in associate degree nursing programs such as the one I teach. However, bedside nurses should incorporate evidence-based practice into their care to influence positive patient outcomes. Although I may no longer provide direct patient care, my students will. My hope is that these nurses of the future will have a greater appreciation of the importance of providing competent, evidence-based care.

This project and the DNP program overall have fostered my development as a scholar. The American Association of Colleges of Nursing DNP Essential III suggests that the translation of evidence into practice is a key scholarly activity necessary for the advanced practice nurse (American Association of Colleges of Nursing, 2006). My ability to critically evaluate literature and to analyze project data have improved as a result of the doctoral program and project. This is an important skill to possess in my current role as a nursing professor where the literature I examine to support what I teach can influence future generations of nurses. Prior to the DNP program, I felt that my previous scholarly experience was sufficient for my faculty role. I intend to stay in my current role after obtaining the DNP, but I now appreciate that the knowledge I have gained can influence a significant improvement in my delivery of information to nursing students and care of patients in the acute care setting.

My role as a project manager has shifted as a result of this program and the DNP project. I have found that I am more confident in my leadership abilities. Furthermore, I am recognized and respected by leaders throughout the organization. When I began the DNP program, I had been in my role for less than one year. The school of nursing for which I am faculty is hospital-owned and I had not worked as a nurse in this hospital. The DNP program and doctoral project presented multiple opportunities for me to network with leadership in the organization and to learn the processes therein. Now, having worked closely with many leaders in the organization to complete the DNP program and project, I am often included in facility-wide initiatives and my opinions are valued. I am involved in many projects that I am certain I would not be were it not for the DNP program and doctoral project. I find it very satisfying to use my position to influence positive change and intend to continue to seek out opportunities to be involved in change projects.

The completion of the doctoral project was a long and arduous process. However, I feel the overall process went smoothly without many unforeseen challenges. The biggest barrier I encountered was finding time in my own busy schedule to devote to the process. I have a new appreciation of the level of commitment required for a successful evidence-based project. Another challenge was participation of the nurses in the study. For ethical reasons, participation could not be made mandatory and leadership would not pay nurses for their time if they attended. Therefore, I attempted to schedule the education sessions on dates and at times when the most nurses could be available while still having convenient opportunities for all shifts. Only the nurses who were already

working when an education session was offered attended. Even then, the nurse manager and I would make rounds on the unit and encourage the nurses who were working to participate. Offering no incentive to participate and asking nurses to give up time during their workday to attend contributed to lower participation than I had anticipated. If the education sessions were to implemented organization-wide, I would like to see them incorporated into the annual skills days the nurses are already scheduled to attend. These challenges were a testament to the importance of good planning. The scholarly journey takes strategic planning, collaboration, leadership, and commitment. I will be proud to wear the title of DNP with the quality knowledge I have gained obtaining it contributing to the advancement of my profession.

Summary

CLABSI is an often-preventable complication resulting from improper care and maintenance of central lines. Nurses are primarily responsible for these activities and contribute to the incidence of CLABSI. This study aimed to determine if an education session coupled with demonstration-based competency would improve nurses' knowledge of CLABSI. Improving nurses' knowledge can advance the care nurses provide, thereby decreasing the incidence of this life-threatening complication and enhancing patient outcomes.

RNs from the neurology unit and the resource team were invited to participate in educational sessions and perform demonstration-based competency. Pre- and post-tests were administered to determine if learning had occurred. The education sessions focused on evidence-based practice including utilizing a central line bundle, proper flushing

technique, hand hygiene, needleless connectors, and identification of complications. Each participant demonstrated a central line dressing change and was evaluated based upon an established rubric. Comparison of pre- and post-test scores revealed that learning occurred and the project had its intended effect. When nurses embrace evidence-based practice, they are ensuring that the patients they serve receive optimal care. The nurses who participated in this project can now translate what they have learned about central lines into the care they provide and impact positive outcomes. CLABSI is a devastating complication that can often be avoided. The nurses in this project now possess the knowledge to bridge the practice gap that puts their patients at risk.

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Appendix A: Dr. Humphrey's Pretest

Pretest

1. What is your highest nursing degree/diploma/certificate?

   a) 1 Associate
   b) 2 Diploma
   c) 3 Bachelor
   d) 4 Master
   e) 5 Doctorate

2. How many years of experience do you have as a RN?

   a) 1 ≤ 1 year
   b) 2 ≤ 5 years
   c) 3 ≤ 10 years
   d) 4 > 10 years

3. Which shift is the primary shift you work?

   a) 1 Day (7 a.m.-3p.m.)
   b) 2 Day-Evening (7a.m.-7p.m.)
   c) 3 Evening (3p.m.-11p.m.)
   d) 4 Evening-Night (7p.m.-7a.m.)
   e) 5 Night (11p.m.-7a.m.)

4. What is your time commitment for your primary position at the current facility?

   a) 1 Part-time
   b) 2 Full-time
   c) 3 Flex/contract

5. In which hospital unit do you rotate most often (work > 50% of the time)?

   a) 1 CVICU
   b) 2 NICU
   c) 3 STICU
   d) 4 MICU
   e) 5 CCU
   f) 6 CV step down
   g) 7 PACU
   h) 8 Not assigned to a specific unit

*CV step down and PACU is included in the number of nurses in MCCG ICU but not originally on test.

6. How many hours, on average per shift, do you spend assessing and monitoring your IV
site, administering IV medications, and interpretation of lab data related to IV infusions?

a) 0 hrs
b) 1-2 hrs
c) 3-4 hrs
d) 5-6 hrs
e) Greater than 6 hrs

7. Have you had the opportunity to attend in-services within the last 12 months on your
Institution's policy in regards to maintenance of Central lines?

a) Yes
b) No

8. What is a central line associated blood stream infection (CLABSI)?

a) 1 A primary Blood Stream Infection (BSI) in a patient who had a central line within the 48-hours period before the development of the BSI and is not bloodstream related to an infection at another site.
b) 0 A secondary BSI in a patient who had a central line within the 48-hours period before the development of the BSI and is bloodstream related to an infection at another site.
c) 0 Any BSI infection that involves a central line
d) 0 I do not know

9. Which of the following is the most common site for CLABSIs?

a) 1 Femoral
b) 0 Subclavian
d) 0 Jugular

10. What is the most effective intervention you can do to decrease the chance of CLABSI?

a) 0 Evaluate the catheter insertion site daily
b) 0 Use the upper-extremity site for catheter insertion
c) 1 Hand hygiene
d) 0 Use a >0.5% chlorhexidine skin preparation with alcohol for antisepsis

11. When is it appropriate to use Chlorhexidine bathing for your patient?

a) 0When the patient does not feel like taking a shower
b) 0When the patient is on bed rest
c) 1On every patient who has a central line
d) 0When the patient has an allergy to the bath soap/wash

12. Which type of IV connector (not the name brand) do you use in your facility?

a) 0Positive
b) 0Negative
c) 1Neutral
d) 0Zero
e) 0 I do not know

13. Which statement best describes proper flushing of the IV connector used in your facility?

a) 0Flush and keep pressure on syringe. Close the clamp and remove syringe from injection port
b) 0Flush, remove syringe from injection port, and clamp
c) 1Either a or b
d) 0 I do not know

14. According to your institution's policy, which of the following best describes the procedures for flushing IV catheters?

a) 0Flush with preservative-free normal saline whenever accessed; before and after drawing blood; and before and after administering IV medications/infusions

b) 1Flush with preservative-free normal saline every shift per MAR; before and after drawing blood; and before and after administering IV medications/infusions

c) 0Flush with preservative-free normal saline every shift per MAR

d) 0 I am not sure

15. Please list two complications related to improper maintenance of IV connectors used by your facility.
a) __Infection_____
b) __Occlusion_____

Appendix B: Dr. Humphrey's Posttest

Posttest

1. What is your highest nursing degree/diploma/certificate?

   a) 1 Associate
   b) 2 Diploma
   c) 3 Bachelor
   d) 4 Master
   e) 5 Doctorate

2. How many years of experience do you have as a RN?

   a) 1 ≤ 1 year
   b) 2 ≤ 5 years
   c) 3 ≤ 10 years
   d) 4 > 10 years

3. Which shift is the primary shift you work?

   a) 1 Day (7 a.m.-3p.m.)
   b) 2 Day-Evening (7a.m.-7p.m.)
   c) 3 Evening (3p.m.-11p.m.)
   d) 4 Evening-Night (7p.m.-7a.m.)
   e) 5 Night (11p.m.-7a.m.)

4. What is your time commitment for your primary position at the current facility?

   a) 1 Part-time
   b) 2 Full-time
   c) 3 Flex/contract

5. In which hospital unit do you rotate most often (work ≥ 50% of the time)?

   a) 1 CVICU
   b) 2 NICU
   c) 3 STICU
   d) 4 MICU
   e) 5 CCU
   f) 6 CV step down
   g) 7 PACU
   h) 8 Not assigned to a specific unit

*CV step down and PACU is included in the number of nurses in MCCG ICU but not originally on test.

6. How many hours, on average per shift, do you spend assessing and monitoring your IV site, administering IV medications, and interpretation of lab data related to IV infusions?

a) 0 hrs
b) 1-2 hrs
c) 3-4 hrs
d) 5-6 hrs
e) Greater than 6 hrs

7. Have you had the opportunity to attend in-services within the last 12 months on your Institution's policy in regards to maintenance of Central lines?

a) Yes
b) No

8. What is a central line associated blood stream infection (CLABSI)?

a) 1 A primary Blood Stream Infection (BSI) in a patient who had a central line within the 48-hours period before the development of the BSI and is not bloodstream related to an infection at another site.
b) 0 A secondary BSI in a patient who had a central line within the 48-hours period before the development of the BSI and is bloodstream related to an infection at another site.
c) 0 Any BSI infection that involves a central line
d) 0 I do not know

9. Which of the following is the most common site for CLABSIs?

a) 1 Femoral
b) 0 Subclavian
d) 0 Jugular

10. What is the most effective intervention you can do to decrease the chance of CLABSI?

a) 0 Evaluate the catheter insertion site daily
b) 0 Use the upper-extremity site for catheter insertion
c) 1 Hand hygiene

d) 0 Use a >0.5% chlorhexidine skin preparation with alcohol for antisepsis

11. When is it appropriate to use Chlorhexidine bathing for your patient?

a) 0When the patient does not feel like taking a shower
b) 0When the patient is on bed rest
c) 1On every patient who has a central line
d) 0When the patient has an allergy to the bath soap/wash

12. Which type of IV connector (not the name brand) do you use in your facility?

a) 0Positive
b) 0Negative
c) 1Neutral
d) 0Zero
e) 0 I do not know

13. Which statement best describes proper flushing of the IV connector used in your facility?

a) 0Flush and keep pressure on syringe. Close the clamp and remove syringe from injection port
b) 0Flush, remove syringe from injection port, and clamp
c) 1Either a or b
d) 0 I do not know

14. According to your institution's policy, which of the following best describes the procedures for flushing IV catheters?

a) 0Flush with preservative-free normal saline whenever accessed; before and after drawing
blood; and before and after administering IV medications/infusions

b) 1Flush with preservative-free normal saline every shift per MAR; before and after drawing blood; and before and after administering IV medications/infusions

c) 0Flush with preservative-free normal saline every shift per MAR

d) 0 I am not sure

15. Please list two complications related to improper maintenance of IV connectors used by your facility.
a) Infection_____
b) Occlusion_____

Appendix C: DNP Project Pretest

Pretest

1. What is your highest nursing degree/diploma/certificate?

   a) 1 Associate
   b) 2 Diploma
   c) 3 Bachelor
   d) 4 Master
   e) 5 Doctorate

2. How many years of experience do you have as a RN?

   a) 1 ≤ 1 year
   b) 2 ≤ 5 years
   c) 3 ≤ 10 years
   d) 4 > 10 years

3. Which shift is the primary shift you work?

   a) 1 Day (7 a.m.-3p.m.)
   b) 2 Day-Evening (7a.m.-7p.m.)
   c) 3 Evening (3p.m.-11p.m.)
   d) 4 Evening-Night (7p.m.-7a.m.)
   e) 5 Night (11p.m.-7a.m.)

4. What is your time commitment for your primary position at the current facility?

   a) 1 Part-time
   b) 2 Full-time
   c) 3 Flex/contract

5. In which hospital unit do you rotate most often (work > 50% of the time)?

   a) 1 Neurology
   b) 2 Critical Care
   c) 3 Not assigned to a specific unit
   d) 4 Other

6. How many hours, on average per shift, do you spend assessing and monitoring your IVsite, administering IV medications, and interpretation of lab data related to IV infusions?

   a) 0 hrs
   b) 1-2 hrs

c) 3-4 hrs
d) 5-6 hrs
e) Greater than 6 hrs

7. Have you had the opportunity to attend in-services within the last 12 months on your institution's policy in regard to maintenance of Central lines?

a) Yes
b) No

8. What is a central line associated blood stream infection (CLABSI)?

a) 1 A primary Blood Stream Infection (BSI) in a patient who had a central line within the 48-hours period before the development of the BSI and is not bloodstream related to an infection at another site.
b) 0 A secondary BSI in a patient who had a central line within the 48-hours period before the development of the BSI and is bloodstream related to an infection at another site.
c) 0 Any BSI infection that involves a central line
d) 0 I do not know

9. Which of the following is the most common site for CLABSIs?

a) 1 Femoral
b) 0 Subclavian
c) 0 Jugular

10. What is the most effective intervention you can do to decrease the chance of CLABSI?

a) 0 Evaluate the catheter insertion site daily
b) 0 Use the upper-extremity site for catheter insertion
c) 1 Hand hygiene
d) 0 Use a >0.5% chlorhexidine skin preparation with alcohol for antisepsis

11. Which type of IV connector (not the name brand) do you use in your facility?

a) 0Positive
b) 0Negative
c) 1Neutral
d) 0Zero
e) 0 I do not know

12. Which statement best describes proper flushing of the IV connector used in your facility?

a) 0Flush and keep pressure on syringe. Close the clamp and remove syringe from injection port
b) 0Flush, remove syringe from injection port, and clamp
c) 1Either a or b
d) 0 I do not know

13. According to your institution's policy, which of the following best describes the procedures for flushing IV catheters?

a) 0Flush with preservative-free normal saline whenever accessed; before and after drawing blood; and before and after administering IV medications/infusions

b) 1Flush with preservative-free normal saline per policy; before and after drawing blood; and before and after administering IV medications/infusions

c) 0Flush with preservative-free normal saline every shift

d) 0 I am not sure

14. Please list two complications related to improper maintenance of IV connectors used by
your facility.

a) __Infection_____
b) __Occlusion_____

Appendix D: DNP Project Posttest

Posttest

1. What is your highest nursing degree/diploma/certificate?

   a) 1 Associate
   b) 2 Diploma
   c) 3 Bachelor
   d) 4 Master
   e) 5 Doctorate

2. How many years of experience do you have as a RN?

   a) 1 ≤ 1 year
   b) 2 ≤ 5 years
   c) 3 ≤ 10 years
   d) 4 > 10 years

3. Which shift is the primary shift you work?

   a) 1 Day (7 a.m.-3p.m.)
   b) 2 Day-Evening (7a.m.-7p.m.)
   c) 3 Evening (3p.m.-11p.m.)
   d) 4 Evening-Night (7p.m.-7a.m.)
   e) 5 Night (11p.m.-7a.m.)

4. What is your time commitment for your primary position at the current facility?

   a) 1 Part-time
   b) 2 Full-time
   c) 3 Flex/contract

5. In which hospital unit do you rotate most often (work ≥ 50% of the time)?

   a) 1 Neurology
   b) 2 Critical Care
   c) 3 Not assigned to a specific unit
   d) 4 Other

.6. How many hours, on average per shift, do you spend assessing and monitoring your IV site,
administering IV medications, and interpretation of lab data related to IV infusions?

a) 0 hrs
b) 1-2 hrs
c) 3-4 hrs
d) 5-6 hrs
e) Greater than 6 hrs

7. Have you had the opportunity to attend in-services within the last 12 months on your
Institution's policy in regards to maintenance of Central lines?

a) Yes
b) No

8. What is a central line associated blood stream infection (CLABSI)?

a) 1 A primary Blood Stream Infection (BSI) in a patient who had a central line within
the 48-hours period before the development of the BSI and is not bloodstream related to an infection at another site.
b) 0 A secondary BSI in a patient who had a central line within the 48-hours period before the development of the BSI and is bloodstream related to an infection at another site.
c) 0 Any BSI infection that involves a central line
d) 0 I do not know

9. Which of the following is the most common site for CLABSIs?

a) 1 Femoral
b) 0 Subclavian
c) 0 Jugular

10. What is the most effective intervention you can do to decrease the chance of CLABSI?

a) 0 Evaluate the catheter insertion site daily
b) 0 Use the upper-extremity site for catheter insertion
c) 1 Hand hygiene
d) 0 Use a >0.5% chlorhexidine skin preparation with alcohol for antisepsis

11. Which type of IV connector (not the name brand) do you use in your facility?

a) 0Positive
b) 0Negative
c) 1Neutral

d) 0Zero
e) 0 I do not know

12. Which statement best describes proper flushing of the IV connector used in your facility?

a) 0Flush and keep pressure on syringe. Close the clamp and remove syringe from injection port
b) 0Flush, remove syringe from injection port, and clamp
c) 1Either a or b
d) 0 I do not know

13. According to your institution's policy, which of the following best describes the procedures for flushing IV catheters?

a) 0Flush with preservative-free normal saline whenever accessed; before and after drawing blood; and before and after administering IV medications/infusions

b) 1Flush with preservative-free normal saline every shift per policy; before and after drawing blood; and before and after administering IV medications/infusions

c) 0Flush with preservative-free normal saline every shift

d) 0 I am not sure

14. Please list two complications related to improper maintenance of IV connectors used by your facility.
a) __Infection_____
b) __Occlusion_____

Appendix E: Deep Line Dressing Change Rubric

St. Mary's School of Nursing
Final Skills Test Criteria
Topic: Deep Line Dressing Change (25 points)

	Satisfactory	Unsatisfactory
1. Gather supplies	1	0
2. Introduces self to patient		
3. Washes hands		
4. Confirms identity of patient		
5. Explains procedure to patient		
6. Opens subclavian dressing change kit maintaining sterile field	1	0
7. Applies mask to self and clean gloves	2	0
8. Instructs patient to turn head away from dressing or places mask on patient if patient won't turn away	1	0
9. Carefully removes old dressing in the direction of the catheter insertion	2	0
10. Inspects site for signs of infection	1	0
11. Removes gloves, discards, performs hand hygiene, and dons new sterile gloves	2	0
12. cleanses insertion/exit site for 30 seconds in a back and forth motion for a 3 inch diameter with chlorhexidine	2	0
13. Allows chlorhexidine to dry completely	2	0
14. Covers with a sterile, transparent dressing	2	0
15. Secures excess catheter tubing, if needed	1	0
16. Changes Ultra Site Valve (end caps) of each lumen		
• Clamps the line or has the patient perform the valsalva maneuver to prevent air embolism	1	0
• Using aseptic technique opens end cap package(s) and primes with saline flush(es) without any air bubbles	1	0
• Remove(s) the old valve(s) and cleans the outside of the catheter hub(s) with an alcohol wipe	1	0
• Attaches a new sterile valve to each catheter hub and unclamps the line or instructs patient to stop performing the Valsalva maneuver	1	0
• Flushes each lumen with 10mL of normal saline utilizing a pulsating flush technique	1	0
• Clamps line(s), removes flush syringe, and attaches a green cap to valve(s)	1	0
17. Puts date, time, and initials on the new dressing	1	0
18. Verbalizes documentation of the dressing change	1	0