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The Impact of an Online Educational Course on Vascular  
Nurses' Knowledge, Self-Confidence and Competence

Julio E. Santiago

Submitted as Partial Fulfillment for the Doctor of Nursing Practice Degree

Regis University

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## Abstract

In the United States, approximately 8 to 10% of patients admitted to an acute care facility receive venous access. Nurses that specialize in vascular access place approximately 3 million peripherally inserted central catheter (PICC) lines annually. There is a lack of standard minimum requirements for educating PICC nurses, especially on insertion techniques and maintenance.

The goal of the project was to enhance the preparation of nurses who place PICC lines in different healthcare settings in order to improve quality metrics such as CLABSI, UE DVT, and LOS, with a subsequent decrease in cost of care. A pilot study that utilized a quasi-experimental, one-group pre-posttest design with a convenience sample was performed using an online educational PICC course and certification process as the independent variable. The dependent variable, improved vascular access nurse's knowledge, competence and self-confidence, was measured by a pre-post intervention test and self-efficacy assessment. Collected data were analyzed to determine if a correlation existed between the intervention and dependent variables. The pretest and posttest results were statistically significant ( $t = -6.069, p = .000$ ), indicating that the participants had improved knowledge/competence post intervention. Results of the pre-post self-efficacy assessment showed that the nurses felt more confident following the program ( $t = -2.591, p = .011$ ). The primary investigator of this study recommends future implementation of a formal standardized orientation program, as well as a standardized validation/certification process for all vascular access nurses.

Key words: DNP Project, PICC Insertion, Orientation Process, Standards of Practice

## VASCULAR ACCESS NURSES'KNOWLEDGE

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# VASCULAR ACCESS NURSES' KNOWLEDGE

## The Impact of an Online Educational Course on Vascular Nurses' Knowledge, Self-confidence and Competence Executive Summary

### **Problem**

The vascular access field lacks standardized procedures and guidelines to orient new nurses leading to knowledge and competence deficits. This lack of consistency in training may lead to avoidable healthcare provider associated complications.

### **Purpose**

The purpose of this project was to evaluate if an online educational review program with a certification component would improve the vascular access nurse's knowledge, competence and self-confidence.

### **Goals**

One goal of the project was to enhance the preparation of nurses who place PICC lines in different healthcare settings in order to improve quality metrics such as CLABSI, UE DVT, and LOS, with a subsequent decrease in cost of care. The other goal was to advance the PICC nurse's understanding on how to provide quality care and safe care to those patients who require a peripherally inserted central catheter.

### **Objectives**

The objectives for this project were to 1) gather demographic data on participant's background history and work history as a nurse, 2) institute the process of validating the skill competency of line insertion, and 3) assess the knowledge base, competency level and self-confidence of practicing PICC nurses' pre-post Basic PICC Qualification Training Educational Program and online certification program.

### **Plan**

After obtaining International Review Board Approval, the PI conducted a quality improvement project as a pilot study that utilized a quasi-experimental one-group pre-posttest design that involved 20 vascular access nurses within the United States. Participants took an online PICC educational and certification program after they met pre-admission criteria. A pre-post intervention self-efficacy questionnaire and a pre-post proctored knowledge examination were administered. The PI performed quantitative analysis on the data using SPSS 23.

### **Outcomes and Results**

Twenty participants completed the project. Pre-posttest ( $t = -6.069, p = .000$ ) and pre-post self-efficacy assessment ( $t = -2.591, p = .011$ ) results were statistically significant. Overall, the results demonstrated an improvement in the participants' knowledge, competency, and self-confidence following an online educational certification program.

## VASCULAR ACCESS NURSES'KNOWLEDGE

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This journey would not have been possible without the support of my loving and supportive wife, Mary. Whether it was supporting my crazy notion to return back to school for the DNP, listening to my ideas, providing clinical expertise, or just taking the time to ask if I needed anything, she has been by my side every step of the way. To Kristofer, Jeremy, Megan, and Katie, my wonderful adult children, thank you for believing in me and offering words of encouragement every step of the way. To my colleague, mentor and good friend Dr. Leo Jurado, thank you for your guidance, support, encouragement, and motivation to return to school for the DNP degree.

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## VASCULAR ACCESS NURSES' KNOWLEDGE

### The Impact of an Online Educational Course on Vascular Nurses' Knowledge, Self-confidence and Competence

In the United States (U.S.), over 3 million peripherally inserted central catheter (PICC) lines are placed each year, and nurses that specialize in vascular access do the majority of the insertions. The lack of standardized training of the nurses placing the central lines makes it a challenge to ensure that nurses are following standards of practice with PICC insertions. A certification process is needed in order to validate clinicians' qualifications to perform ultrasound guided PICC placement, a highly valued procedure, but one that is also very invasive and potentially life-threatening (PICC Excellence, Inc., 2018).

The use of central venous catheters (CVC) has become commonplace for hospitalized patients to provide reliable venous access for medication administration, laboratory testing, and hemodynamic monitoring in the management of critically ill patients. "Despite their many benefits, CVCs are associated with important complications. Among these, central line-associated bloodstream infections (CLABSI) and venous thromboembolism are significant because they are difficult to detect, increase the cost of care, and are potentially life-threatening adverse events" (Chopra, Flanders & Saint, 2012, p. 1527). Chopra et al. (2012) and McMahon et al. (2014) report that "while increased use may reflect clinical advantages, such as safer insertion and the ability to continue intravenous therapy beyond the hospital setting, concerns regarding risk of complications, variation in use and even inappropriate use have emerged" (Krein et al., 2017, p. 29). This evidence-based project (EBP) was conducted to explore if vascular nurses are adequately prepared to care for patients at the bedside and to investigate if an online educational review program with a certification component would improve the nurses' knowledge, competence, and self-confidence. This paper defines the practice problem,

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significance and scope as well as underlying nursing theory. The primary investigator (PI) performed a systematic review of the literature and market analysis for the study. Lastly, the paper describes the project plan, evaluation, findings, and results.

### **Problem Recognition and Definition**

#### **Statement of EBP Project Purpose**

The purpose of this evidence-based quality improvement (QI) project was to evaluate if an online educational review program with a certification component would improve the vascular access nurse's knowledge, competence and self-confidence.

#### **Problem Statement**

The problem statement for this proposed research study was as follows: The current certification process does not truly measure the knowledge and competence of the practicing vascular access nurse that places vascular access devices at the bedside. The current certification process for vascular access nurses only measures the knowledge of the infusion nurse role or the knowledge of a vascular access nurse role, but not the knowledge and abilities required to insert vascular access devices. Consequently, there was a need to design a study to evaluate the impact of an educational program that focuses on the additional learning needs of vascular access nurses who will be providing direct bedside care or who will be inserting central lines (PICC/midline catheters). The Certified PICC Ultrasound Inserter (CPUI) certification process was created to validate clinicians' qualifications that perform ultrasound guided PICC placement test (PICC Excellence, Inc., 2018). See Appendix A for details of the credentialing process.

The CPUI credentials provide the vascular access clinician validation of a higher level of knowledge and practice in the field of PICC placement. Certification is a process by which an association grants recognition to an individual who has met predetermined standards specified by

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that association or agency. The CPUI certifies that the candidate has met certain standards of knowledge and training specific to PICCs as a credentialing process. The process requires that the participant perform a supervised insertion of the PICC line that meets established guidelines in order to validate their competence in performing the procedure since the competence cannot be measured by the examination (See Appendix B).

### **PICO/Practice Question**

This project utilizes the acronym "PICO," rather than stating a formal research hypothesis. The acronym stands for: Population or Disease (P), Intervention or Issue of Interest (I), Comparison group or Current Practice (C), and Outcome (O) and is usually framed as a question (Melnik and Fineout-Overholt, 2011, p. 31). The PICO for this quality improvement project will be:

P-Vascular access nurse

I- Online educational Review Course and Certified PICC Ultrasound Inserter (CPUI) certification

C- Comparison of the vascular access nurse knowledge, competence, and self-confidence before and after taking the online Basic PICC Qualification Training review program and the CPUI educational certification

O- Improved knowledge, competence, and self-confidence

The main questions this project addressed were:

- Are vascular access nurses adequately prepared with the knowledge, competence, and self-confidence to provide safe and appropriate care to the clients that are requiring vascular access at the bedside?

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- Does an online Basic PICC Qualification Training review program and the CPUI educational certification improve the knowledge, competence, and self-confidence of the vascular access nurse after completing the certification process?
- Is there a difference in the PICC nurse's knowledge, competence, and self-confidence based on their orientation program?

### **Project Significance, Scope, and Rationale**

**Project significance.** The Basic PICC Qualification Training review program and CPUI educational certification component can potentially improve the knowledge, clinical decision making, competence and self-efficacy of vascular access nurses after completing the certification process. Having the participant take the CPUI proctored examination will validate the knowledge base of the participant. Competence can be challenging to assess or measure. Sportsman (2010) identified "continuing education as a measure of continuing competence, but not the only approach currently being used. Certification, which typically involves successful completion of an examination addressing in-depth competence in a specialty area, is another approach to the validation" (p. 147). Sportsman (2010) goes on to explain that "achieving patient safety through validation of nurses' competence is mandatory; nurses who support this process provide leadership in a critical area of health care" (Sportsman, 2010, p. 148).

The Doctor of Nursing Practice (DNP) Essentials III state "scholarship and research are the hallmarks of doctoral education" (American Association of Colleges of Nursing, 2006, p. 12). It goes on to state that the "DNP program prepares the graduate to use analytical methods to critically appraise literature and other evidence to determine and implement the best evidence for practice.... while applying the relevant findings to develop practice guidelines and improve practice and practice environment" (p.12). This project explores options for making a change in



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vascular access nursing training and education that will positively impact practice, patient care outcomes, quality of care and cost associated with complications from central venous access line insertions. Terry (2018) states the “DNP prepares graduates to design and implement new healthcare policies that influence existing policies that significantly affect the financing of health care, practice regulation, access to health care, safety, quality of care, and patient care outcomes” (Location No. 480).

**Scope.** The scope of this project was a quality improvement project which was internal to a small group of Registered Nurses across the United States who completed an online educational Review Course and Certified PICC Ultrasound Inserter (CPUI) certification. The impact of this certification on the participant's knowledge, competence, and self-confidence was explored. The results of this project are not meant to generate new knowledge or be generalizable across settings but rather seek to address a specific population, at a specific time, in a specific field of nursing.

**Rationale.** A literature review indicated that central venous access is a commonly performed procedure in the United States with the majority of PICC lines inserted by vascular access nurses. The review of the literature demonstrated a correlation of this high risk, high-frequency procedure with an increase in complications, increase in healthcare costs and an increased length of stay. The primary investigator (PI) discovered that there is a lack of standard minimum requirements for educating PICC nurses, especially on insertion techniques and maintenance. Finally, evidence supported the use of an online educational program with a certification component to educate PICC nurses on best practices. Based on findings in the literature, the PI investigated whether an online educational review program with a certification

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component will improve the vascular access nurse's knowledge, competence, and self-confidence.

### **Theoretical Foundation for Project and Change**

Benner's Novice to Expert Nursing Theory was the theoretical framework used for the research project. Benner's theory proposes that nurses' learning progresses through five stages. "At the beginning of a nursing career, there tends to be a reliance on to-do lists, checklists, and specific policies or procedures because the nurse is attempting to apply abstract principles to real events" (Health Research Funding.Org, 2018). Benner goes on to explain that over time, the nurse's experience expands, and they can make individualized decisions for every patient. The nurse develops skills and competence as they progress through the novice to expert five stages (Davis & Maisano, 2016, p. 13). The vascular access nurse needs to perform their work at a competent level or higher. Performing high-risk procedures with a high frequency make it a priority for the nurse to be able to perform the procedures without putting the patients through unjustifiable risks. When the vascular access nurse is not practicing at a minimum of a competent level, their needs to be a support system in place that will provide the needed expertise in order to supervise and provide the needed guidance to help the nurse move successfully through the novice to expert stages.

Bandura's Self-Efficacy Theory was used in order to measure the self-confidence of the vascular access nurse related to inserting PICC/Midlines. Bandura (2017) believes that whatever other factors serve as guides and motivators, they are rooted in the core belief that one has the power to effect changes by one's actions. According to Bandura, "it's not enough for individuals to possess the requisite knowledge and skills to perform a task; they also must have the conviction that they can successfully perform the required behavior(s) under typical and,

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importantly, under challenging circumstances (as cited in Artino, 2012, p. 77)". The ability to measure the nurse's self-confidence will provide information to measure a vascular access nurse's self-awareness in performing their duties safely. Bandura's Self Efficacy Model helps to develop an individual's self-confidence, which leads to improved competence. The model involves four components that help to develop self-efficacy: enactive mastery – learning from prior experience and applying it to new ones; vicarious experience – learning from the success of others doing the role; verbal persuasion – encouragement by others; physiological arousal – the physical and emotional response from thinking about doing the new behavior (Brown, Malouff, & Schutte, 2009). See Appendix C for conceptual diagrams/charts of Benner's and Bandura's nursing theories.

### **Literature Selection/Systematic Process**

Review of the evidence was performed using various search engines including CINAHL, Medline, PubMed Clinical Queries and Cochrane Library. The inclusion criteria consisted of peer-reviewed articles, English, full text, and years 2012 to 2018. The PI selected some articles/studies older than 2012 as the information was still pertinent to the study. The search included the following keywords: vascular access, vascular access nurse, PICC Nurses, nurse training, vascular access nurse protocols, PICC line insertions, and PICC insertion orientation process. Additional keywords were CVC complications, vascular access nurse practice guidelines, PICC nurse practice guidelines, vascular access nurse training, and vascular access nurse protocols. A final set of keywords included evaluation of vascular access nurse knowledge, skills, competence, and self-competence, vascular access nurse certification, PICC nurse certification, Novice to Expert Theory, PICC nurse, vascular access nurse evaluation of self-confidence (self-efficacy), and effectiveness of online educational program. The initial search

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generated 3345 articles. The list was narrowed to 1,036 using exclusion criteria of central venous catheters and keywords: Removed Vascular Access, Removed “or” and used “and” PICC Nurse, PICC nurse training, PICC nurse orientation process, evaluation of PICC nurse knowledge, skills, competence, self-competence, PICC line and CVC Insertions, Online education, and certification articles. Twenty-six articles were selected using specific keywords related to vascular access practice and education of nurses to conduct the literature review.

### **Scope of Evidence**

By following Melnyk and Fineout-Overholt’s (2011) Levels of Evidence, the PI grouped the 26 articles into the categories below:

- Level III- evidence quasi-experimental study – 2
- Level IV- evidence from case-control or cohort study - 6
- Level V- evidence systematic review of descriptive and qualitative study – 6
- Level VII- evidence from expert opinion - 12

### **Review of Evidence**

#### **Background of the Problem**

The need for this DNP project came from observations noted in practice by employees hired by the vascular access company owned by the PI. Nurses employed by the company go through a thorough orientation process and field observation process to validate the new hire knowledge, competence, and self-confidence required for vascular access insertions and management. During that process, the supervisors observed that experienced vascular access nurses were not following standards of practice. The new hires were not adhering to the basics of maintaining a sterile field, not able to identify the name of the vein they were visualizing with the ultrasound machine, had insertion rates less than 80%, and did not know what the standard of

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practice was for specific patient conditions. These are all part of the basic standard of practice that every vascular access nurse should be accountable for when they are oriented to the process of becoming a vascular access nurse.

Currently, there is no accurate way of certifying that vascular access nurses are qualified to practice at the bedside inserting PICC lines. The Certified Registered Nurse Infusion (CRNI) certification focuses on nine core content areas of infusion nursing: Technology and Clinical Applications, Fluid and Electrolyte Balance, Pharmacology, Infection Control, Pediatrics, Transfusion Therapy, Antineoplastic Therapy, Parenteral Nutrition, and Quality Assurance (Infusion Nurses Certification Corporation, 2018). The requirements for the CRNI certification indicate, "Direct bedside care is not a requirement for certification" (p. 5). The Vascular Access-Board Certified (VA-BC) certification focuses on seven domains of practice, which include Vascular Access Devices, Vascular Access Device Maintenance, Complications and Interventions, Critical Thinking and Clinical Application, Communication/Patient Advocacy, Research/Quality Management, and Ethical and Legal Considerations of Vascular Access (Vascular Access Certification Corporation, 2017). The eligibility requirements for the VA-BC only require that the applicant work in the vascular access field assessing, planning, implementing, and evaluating the care and needs of patients that require vascular access (Vascular Access Certification Corporation, 2017); it does not require insertion of PICC lines for certification.

Much like a new graduate nurse that passes National Council Licensure Examination (NCLEX) with the understanding that they have minimal required knowledge and competence to practice as a generalist, the novice vascular access nurse is expected to do the same. The difference between the two is that the novice registered nurse (RN) attends college for two or

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four years to be educated in the classroom using theory, hands-on learning, and the schools certify that the graduating student meets eligibility to take the NCLEX. The NCLEX examination has been psychometrically developed by the National Council of State Boards of Nursing (NCSBN) to validate that the new registered nurse meets the minimal requirements for practice as generalist.

In contrast, the novice vascular access nurse takes an 8 to 16-hour course that incorporates classroom theory and "hands-on" training to learn how to become a vascular access nurse. As part of the process, a minimal of three supervised PICC insertions (usually less than ten supervised insertions) are performed to meet the requirement of validation (certified) to work as a vascular access nurse. The nurse is then able to practice independently, usually without any supervision or clinical support from a more senior nurse or experienced vascular access nurse.

### **Systematic Review of the Literature**

The PI performed a systematic review of the literature to assist in answering the research questions. See Appendix D for an example of the Literature Review process. By utilizing a thematic analysis, the PI identified five recurrent themes: Vascular Access Nurses; Complications Associated with PICC Placement; Lack of Consistency in Training/Education Leading to Lack in Knowledge, Competence, Skills, and Self-confidence; Online Training Program; and Need for Certification.

**Vascular access nurses.** Central venous access is a commonly performed procedure with approximately eight percent of hospitalized patients requiring central venous access during their hospital stay. In the United States, approximately 3 million PICCs are placed each year (The Joint Commission, 2012, p. V) and 4.3 million worldwide (Girgenti & Moureau, 2013, p. 219). Heffner (2017) reported a higher number of insertions, stating that more than five million central

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venous catheters are inserted in the United States annually. Krein et al. (2017) and Patient Safety Solutions (2014) reported that “vascular access nurses place the majority of PICCs in most U.S. hospitals, underscoring the important role of these providers in providing safe and effective care for patients” (p. 3, para 1). Findings from their survey suggest vascular nurses see themselves either as having the responsibility to insert PICC lines or as the experts who help manage the care of patients. This is significant and important because in one role the nurse’s focus is on the technical part of inserting the PICC lines, in the other role, the vascular access nurse has to be knowledgeable about the vascular access field in order to provide consultation to the staff managing the care of the patients. Although State Boards of Nursing require health care facilities to have written policies and procedures that ensure demonstration of competency by vascular access specialists, certification is not mandatory for practice (Chopra et al., 2017, p. 2).

**Complications associated with PICC placement.** In 1999 the Institute of Medicine (IOM) published a hallmark report, *To Err is Human: Building a Safer Health System*, which shined a light on patient safety in acute care hospitals (Committee on Quality of Health Care in America, 1999). The report made it clear that it would be difficult to make the system safe for patients. Poillon (1999) reported "health care organizations must develop a “culture of safety” such that their workforce and processes are focused on improving the reliability and safety of care for patients” (p. 4). Healthcare organizations continue to struggle to make healthcare safer 19 years later. The Institute for Healthcare Improvement (2014) stated that "healthcare struggles with applying best practice, and processes frequently fail despite the best intentions and highly skilled workforce. Our system, which intends to heal, too often does just the opposite, leading to unintended harm and unnecessary deaths at alarming rates” (para. 5). While many health care organizations around the United States have been making changes that improve care and reduce

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patient harm, it needs to happen 100% of the time at every institution in order to make an impact.

The evidence supports the idea that the cost of healthcare-acquired infections (HAIs) are preventable. The Johns Hopkins University School of Medicine, in conjunction with 100 intensive care units (ICUs) in Michigan, conducted a landmark safety study (The Keystone ICU Project), which "led to a 66% reduction in central line catheter-associated bloodstream infections (CLABSIs) and a median CLABSI rate of zero, with improvements sustained for 4 years" (Sawyer et al., 2010) p. S292). This study included summarizing evidence, using robust measurement and a change in culture in order to implement a quality and safety improvement initiative. The approach to implement the change was a departure from using the plan-do-study-act cycle; the traditional way hospitals implement change. The success of the study prompted the Agency for Healthcare Research and Quality (AHRQ) to provide funding to implement the program in all 50 states, the District of Columbia, and Puerto Rico. The evidence demonstrated that the cost of HAIs can be decreased, saving acute care hospitals billions of dollars each year, but more importantly, tens of thousands of lives can be saved by making changes to health care practices that put the hospitalized patients at risk for HAIs. Central lines, including PICC line insertions, constitute a significant risk to patients and are associated with CLABSIs. Barnes et al. (2015) go on to explain, "PICC nurses need to be well educated and skilled at aseptic insertion procedures. The risk of both central line colonization and infection have increased when inexperienced clinicians are allowed to insert central catheters" (p. 41).

PICC insertions are "associated with a more than two-fold increased risk of deep vein thrombosis, but not pulmonary embolism. PICC-related deep vein thrombosis was highest in patients who were critically ill and those with cancer, indicating the importance of patient-related



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risk factors” (Patient Safety Solutions, 2014, para. 3). The incidence of symptomatic PICC associated upper extremity deep vein thrombosis (UE DVT) is low, but given the number of PICCs placed each year, they account for up to 35% of all diagnosed UE DVTs. Larger-diameter PICCs and malignancy increase the risk for DVT, and further studies are needed to evaluate the optimal vein of the first choice for PICC insertion (Liem et al., 2012, P. 761). Pikwer, Akesson and Lindgren (2012) "found that the risks of tip malpositioning, thrombophlebitis, and catheter dysfunction favor clinical use of centrally placed catheters instead of peripherally inserted central catheters, and that the two catheter types do not differ concerning catheter-related infection rates" (p. 65).

**Lack of consistency in training/education.** The field of vascular access is continuously changing based on standards of practice, development of new products, use of electrocardiography (ECG) technology for tip confirmation and evidence-based studies that demonstrate a need for change. In 2013 over 60% of U.S. hospitals with more than 50 beds reported having designated nurse PICC teams, but “relatively little is known about the specific roles and responsibilities of these nurses or how they affect PICC use and management in hospitals nationwide” (Krein et al., 2015, p. 3). The Association for Professionals in Infection Control and Epidemiology (APCI, 2015), a group of multidisciplinary health care providers, created a report which highlights the need for further education of the PICC/Vascular access nurses and other providers of vascular access procedures (Krein et al., 2015).

Training for vascular access nurses varies in length of time and duration of supervision from an experienced nurse or educator. The traditional training lasts from 8 to 16 hours and includes didactic training (including online education), hands-on education in a simulation lab, observation of one to three PICC insertions, and performing a minimum of three to five

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insertions to be validated. Some novice nurses receive the same educational training as the traditional training and receive extended supervision at the bedside performing the procedures at the bedside, and it usually consists of less than ten successful procedures. The last type of training is similar to the other two types, but it includes an extended time with a mentor or educator at the bedside providing feedback and support for more than five insertions. See Appendix E for detailed description and values. Once the trainer has validated the novice nurses during the training process, the novice nurse starts performing procedures independently without supervision.

In 2013, an international evidence-based consensus task force was established through the World Congress of Vascular Access (WOCOVA) to provide definitions and recommendations for training and insertion of central venous access devices (CVADs). The task force found that determining clinical competence in vascular access nurses is challenging to do because there is no one standard method of assessing the competence of the vascular access nurse that has been developed. Some clinicians prefer to do a peer competence from an experienced practitioner that can validate the vascular nurse, but often this method is complicated to accomplish due to lack of clear objective outcomes (Moureau et al., 2013). Another way to determine competency is to have the vascular access nurse take a written examination where objective data can measure the cognitive level of the procedures. Moureau et al. (2013) stated that, "there is a lack of standard minimum requirements for the training of insertion techniques and maintenance of CVADs" (p. 347). The task force came up with recommendations for educating vascular access nurses that included "didactic or web-based teaching with insertion procedure, infection prevention, complications, care, and maintenance of devices, along with laboratory models and tools for simulation practice incorporating ultrasound" (p. 347). The consensus from the task force was clear

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regarding a need for standardized education, which includes simulation and supervised insertions.

A study done by Kun et al. (2017) demonstrated that “when nurses are exposed to specialty training to deepen their understanding of the physical structure of human blood vessels, normalize their manipulation, and make them have a new experience in PICC catheterization, the knowledge, attitude, and practice improves greatly” (p. 9146). Based on the data from the literature review, it is evident that there is a lack of standardized tools to assess the vascular access nurse’s knowledge and competence.

Chopra et al. (2017) conducted a web-based study in 47 Michigan hospitals to assess vascular access nurses experience, practice, knowledge, and beliefs related to PICC insertion and care. In the study, Chopra describes how hospitals in the United States have introduced vascular nursing teams, but little is known about the experience, practice, knowledge, and beliefs of vascular access nurses.

This knowledge gap is relevant for hospital medicine as (1) vascular access nurses increasingly represent a crucial partner in the care of hospitalized patients; (2) the knowledge and practice of these individuals directly affects patient safety and clinical outcomes; and (3) understanding experience, practice, and beliefs of these specialists can help inform decision making and quality-improvement efforts related to PICCs (p. 269).

Cotogni and Pittiruti (2014) performed a literature review on the benefits and complications of PICC insertions and found that the evidence is clear that “health-care professionals involved in the insertion or management of CVADs should know all potential risk factors of catheter-related complications (CRCs). This knowledge may yield to minimize complications and guarantee longevity to the CVAD” (p. 90).

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Based on the studies it is evident that complications and poor outcomes related to vascular access complications lead to the same conclusion that vascular access nurses play a vital role in minimizing complications. When the vascular access nurse can make a sound, clinical decisions based on the patient history, vascular access need and following appropriate insertion guidelines, the patient care outcomes are improved. Vascular access nurses can benefit from different types of educational approaches in order to improve clinical decision-making and patient safety. An essential part of the education of vascular access nurses is “the ability to assess the training through written exams or multiple-choice questions, though practical skills must continue to be learned through workshops initially, and after that over time under appropriate mentorship and supervision” (Hulse, 2013, p. 1013).

**Online training program.** Online education provides an alternative to training in medical training centers. Moureau et al. (2013) reported that online training methods could provide a useful alternative to face-to-face didactic lectures teaching procedural skills and can be as effective as traditional teaching methods (p. 7). Higgins, Keogh and Rickard (2015) looked at an online educational course for postgraduate nurses that wanted to be more proficient with peripheral intravenous catheter (PIVC) access and care. Their study used Infusion Nurses Society(INS) standards of practice for inserting PIV to create the online modules and they found that “the course succeeded in its aim of increasing knowledge and skills about safe, evidence-based PIVC insertion and care to RNs” (p. 38).

In a retrospective literature review, Chumley-Jones, Dobbie, and Alford (2002) observed that “online programs achieved changes similar to those attained with other methods. There is strong evidence that well-designed online programs can improve learners’ confidence, similarly to other educational methods” (p. S88). The study also found that most learners would use the

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online educational learning over conference, lectures and other forms of learning. Another literature review done by Hammoud et al. (2006) revealed “respondents identified anonymity and the ability to refer back to the online materials as a learning resource as additional advantages to the Web-based CME course. These findings demonstrate that the Internet and computer-mediated software can introduce new opportunities for providing effective continuing medical education (CME)” (p. 1067). A study performed by Chenkin, Lee, Huynh and Bandiera (2008) on emergency physicians (EPs) and junior emergency medicine (EM) residents with no ultrasound-guided vascular access (UGVA) experience, revealed that a Web-based tutorial was at least as effective as a traditional didactic lecture for teaching the knowledge and skills essential for UGVA. Participants expressed high satisfaction with this teaching technology.

**Need for certification.** Chopra et al. (2017) performed a survey on vascular access certification and found that there appears to be essential differences among PICC providers concerning their practices and views on vascular access since the certification is voluntary. The researchers concluded that there needs to be broader adoption of credentialing amongst vascular access nurses. They also found that "studies aimed at clarifying how certification influences thinking and practice in clinical settings are needed if we are to unlock the potential of this professional training" (p.12). Stobisnki (2017) stated that "credentials like VA-BC now exist within the greater context of current health care reimbursement mechanisms" (p. 111). Having nurses that are better prepared to practice by using evidenced-based practices will decrease complications associated with PICC lines insertions. Sportsman (2010) stated "the purpose of ensuring continuing competence is the protection of the public and advancement of the profession through the professional development of nurses" (p. 146). “The role of the nurse in today’s healthcare environment requires a nurse to function independently at a competent level”

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(p. 143). Benner (1984) indicated that reaching a level of competence normally takes a nurse two to three years to achieve. “Certification and the associated recertification processes constitute a mechanism to standardize levels of evidence-based care” (p. 112). Having nurses that are certified will help the hospital’s bottom line, by decreasing complications that cost the institution money due to the penalties enforced by the CMS Hospital-Acquired Condition Reduction Program.

### **Project Plan and Evaluation**

#### **Market/Risk Analysis**

A SWOT analysis was performed to identify strengths within the project, address potential threats or weaknesses, and comprehensively understand the areas the project can help improve in the vascular access field. The strength of the project was noticeable in the initial response to the invitation to participate in the project. Over 115 potential participants completed the initial survey to see if they qualified to participate in the project. Sixty-nine participants qualified to participate in the project and 20 completed the project. See the SWOT analysis of the proposed project in Table 1 for details.

Table 1

#### *SWOT Analysis of the Proposed Project*

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"><li>• Support from mentor and organization</li><li>• Experience as a vascular access nurse</li><li>• Strong community ties with vascular access nurses</li></ul>	<ul style="list-style-type: none"><li>• Practicing nurses may feel they do not have the time outside of work to participate in the project.</li><li>• Nurses may feel uncomfortable taking a proctored examination and participating</li></ul>

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<ul style="list-style-type: none"> <li>• A validated and reliable proctored examination that is currently being used to certify vascular access nurses will be used as the pre-examination and post-examination.</li> <li>• The project will be online, allowing the participants to participate from home. This will allow them some flexibility in completing the project and will make it easier for participants to complete the project.</li> </ul>	<p>in a project that validates their knowledge, competence, and self-confidence.</p> <ul style="list-style-type: none"> <li>• Limited access to a computer with a camera</li> </ul>
<p><b>Opportunities</b></p>	<p><b>Threats</b></p>
<ul style="list-style-type: none"> <li>• Will provide a way for facilities to certify that their nurse has the knowledge, competence and self-competence to practice safely</li> <li>• Other organizations could adopt online educational course as best practice for preparing vascular access nurses for certification</li> <li>• Mandating that all vascular access nurses be certified.</li> </ul>	<ul style="list-style-type: none"> <li>• INS Certification and AVA certification may feel that the CPUI certification is a threat to their business.</li> <li>• Practicing vascular access nurses may feel that they do not need a certification since they are certified to insert PICC lines.</li> <li>• Decreased number of participants that complete the online program</li> </ul>

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### **Driving and Restraining Forces**

After completing a literature review of vascular access nursing practice, it was evident that there are **driving forces** that are important to consider for the project. The education process for vascular access nurses lacks consistency across the field. Nurses that are new to the field of vascular access are not trained using a prescribed standardized orientation. The lack of a standardized orientation makes it a potential problem for a high risk, a high-frequency procedure that is performed by nurses that may not have the needed knowledge, skills, and competence to provide safe, appropriate care, and insertions. Complications associated with PICC line insertions continue to be costly and can be attributed to high-risk complications for the patients. The incidence of CLABSIs continues to be higher than what is expected, putting the patients at risk for adverse complications.

**Restraining factors** related to the problem were the cost of placing a PICC line. Hadaway et al., (2014) reports that the average cost of inserting a PICC line is \$400. When comparing the cost of placing the PICC line with the fact that there is no reimbursement for the procedure, other than the diagnosis-related groups (DRG) payment, it becomes a numbers game for the facilities. “The payment received by the hospitals is based on the value of a certain diagnosis as determined by Centers for Medicare & Medicaid Services (CMS) in the form of DRGs. DRGs make up a classification system that groups similar clinical conditions (diagnoses) and the procedures furnished by the hospital during the stay” (Cleverley & Cleverley, 2018, p. 103). In trying to save healthcare dollars, facilities take the path of least resistance when training nurses to become vascular access certified, and do not provide the needed time and number of insertions required to become proficient before they can practice independently.



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Training of novice vascular access nurses was a restraining force. Novice vascular access nurses are trained by clinicians that are employed by the PICC line suppliers, and the service is free of charge to the facilities that are using their product. The training is usually limited to three to five days, including the two-day didactic and classroom training. This leaves a limited amount of time at the bedside for the new nurse to have supervised insertions and to become proficient at placing PICC lines in approximately three days or less. The last restraining force is that nurses are validated in order to become vascular access nurses by taking an 8 to 16-hour training, but certification as a vascular access nurse by a national organization is not mandated.

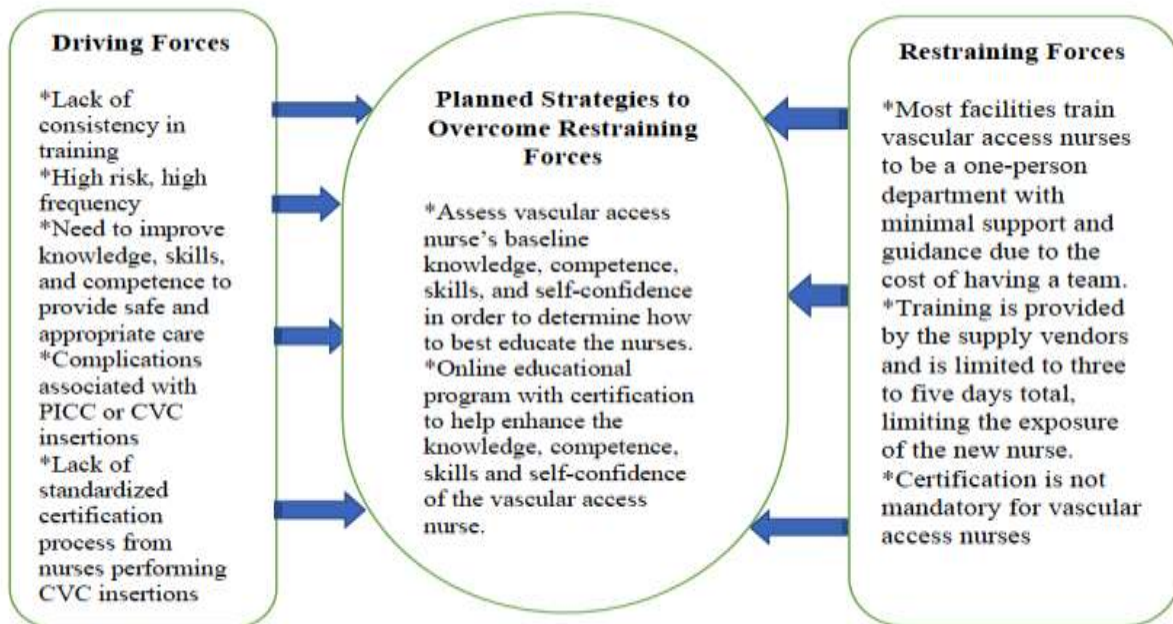


Figure 1. Diagram of Driving Forces

### Needs, Resources, and Sustainability

**Needs.** Based on findings in the literature review, one significant need of the project was to enhance the education of vascular access nurses. Another need was to validate the vascular access nurse's knowledge and competence of PICC line insertions.

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**Resources.** Resources available for the project included: PICC Excellence, Inc.'s willingness to share their online Basic PICC Qualification Training program and CPUI educational certification review material and test. See Appendix F for Letter of Intent details. IV.Therapy.Net was also instrumental in providing access to their email list serve in order to be able to promote the study to potential participants. Vascular Access and Infusion Specialist Facebook site also helped promote the project by posting announcement of the project on their site. SurveyMonkey® was used to provide information to the participants, evaluate if they met the criteria to participate, and deliver the demographic survey and pre/post self-efficacy assessment tool.

**Sustainability.** Sustainability of the project can be achieved by providing the participants with an online educational program, to support their learning needs, assessment of their baseline knowledge and competence, and receiving the CPUI certification leading to improved knowledge, competence and self-confidence. This in turn will help the nurses improve their ability to provide safe and effective care that can lead to decrease catheter related complications (CRC), CLABSIs, DVTs, and improved patient care outcomes. Results of this study will be shared with the PICC Excellence, Inc. leadership. The PI plans to disseminate results through future publications and professional presentations to emphasize the importance of providing a standardized process to prepare vascular nurses for PICC line insertions.

### **Feasibility/Risks/Unintended Consequences**

**Feasibility.** The implementation of this evidence-based quality improvement project was feasible with the support of the PICC Excellence, Inc., which provided access for a fee to deliver the online education and testing of knowledge and competence. The PI covered the fee of the study.

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**Risks.** There were no risks of harm to human participants participating in the online course, completing the demographic questionnaire, or taking the examinations or self-efficacy assessment. There were no vulnerable/at-risk populations targeted in this study.

**Unintended consequences.** Unintended consequences included possible mild psychological distress that could occur from taking a proctored pre and post examination. The subject burden was described in the information letter (consent) and participants were informed of the time it would take to complete the Basic PICC Qualification Training review and the online certification program and assessments/testing. The participants spent 15-20 hours to complete the study. Spending this much time could have interfered with work and personal time. No other unintended consequences were identified during the study.

### **Stakeholders and Project Team**

The stakeholders are practicing vascular access nurses in the United States. The facilities that hire vascular access nurses, organizations that certify vascular access nurses and patients that receive the procedures will benefit by having vascular access nurses that are knowledgeable, skilled and competent at placing PICC lines and midlines. The care will improve while decreasing complications associated with the procedures.

The project team included Julio Santiago, DNP Student; Dr. Kathleen Whalen, DNP Project Chair; and Dr. Leo Jurado, DNP Student Mentor. Additional members of the team that are content experts are Dr. Nancy Moureau, vascular access expert and owner of PICC Excellence, Inc. and Project Coordinator; Denise Thunberg, BSN, RN, Nurse Clinician at AngioDynamics, Inc.; and Mary Santiago, RN, CRNI, VA-BC, vascular access expert and owner of Priority PICC Solutions, LLC.

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### **Cost-Benefit Analysis**

Healthcare-associated complications are preventable events that can be minimized by using established standards of care and having practitioners that have the knowledge, skills, competence, and self-confidence to practice safely. The cost of one CLABSI can range from \$21,400 to \$110,800” (Barnes et al., 2015, p. 6). When comparing the cost of Basic PICC Qualification Training of \$395/participants and the CPUI of \$245/participant for a total of \$640, it is clear that the cost of one CLABSI can save a significant amount of money to the healthcare facility that employs vascular access nurses that are certified. The certification process validates the knowledge, competence, and skills of the practice vascular access nurse. Certification can lead to safer and improved care at the bedside. It is not always easy to account for potential cost benefits when talking about cost related to complications. Complications associated with CLABIs are responsible for 5,520 to 20,239 deaths annually that can be prevented with best practice implementation (Barnes et al., 2015, p. 6). If the cost of one adverse event is estimated at \$21,400 to \$110,800 for a health care facility, the \$640 cost of an online educational program and certification will pay for itself several times over for just one event. See Appendices G and H for Cost/Benefits table and Cost to Replicate Study, respectively.

### **Mission/Vision/Goals**

The overall mission was to improve the knowledge, competence, and self-confidence of practicing vascular access nurses by using an online Basic PICC Qualification Training program and CPUI educational certification. The vision of the project was to integrate evidence-based research in developing a standardized approach to educating and certifying vascular access nurses in order to improve patient care and outcomes related to vascular access nursing procedures. The main goal of this project was to evaluate if an online educational review

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program with a certification component will improve the vascular access nurse's knowledge, competence, and self-confidence

### **Process/Outcome Objectives**

The project objectives for this project were to:

- Provide a demographic survey to identify trends related to the participant's background history and work history as a nurse as it relates to knowledge, competence, and self-confidence
- Institute the process of validating the skill competency of line insertion before registering participants in the online education program by Fall 2018
- Institute the intervention of the online certification program for vascular access nurses by Fall 2018
- Assess the knowledge base and competency of practicing PICC nurses before and after taking the online certification program (proctored pre-post examination)
- Assess the self-confidence of practicing PICC nurses prior and after taking the online certification program (pre-post self-efficacy assessment)

In order to meet these time-sensitive outcome objectives, the PI followed a specific project timeline as shown in Appendix I

### **Logic Model**

The PI of this project used the Logic Model to identify resources/inputs, activities, outputs, short and long-term outcomes, and impacts (See Appendix J). Resources for the project included vascular access nurses and experts in the field, vascular access organizations including the Infusion Nurses Society (INS), Association for Vascular Access (AVA), and the World Congress of Vascular Access (WOCOVA) to name a few. Activities involved creating a self-efficacy

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assessment tool and delivering an online educational courses and proctored exams. A significant output was the assessment of knowledge deficits of vascular access nurses. One major outcome was to create standards for an orientation model for vascular access nurses. The impact on practice will be to pave the way for organizations to develop a standardized training program for vascular access nurses that considers, face-to-face training, online education, supervised insertions at the bedside for novice vascular access nurses, and a certification process that includes knowledge, skills, and activities to practice safely.

### **Appropriateness for Objectives and Research Design**

The PI used a quantitative research design to answer the PICO questions for this quality improvement project. A Quasi-experimental study using a one-group pretest-posttest design was conducted using a convenience sample to test descriptive hypotheses about the cause and effect of two variables. Terry (2018) states that a Quasi-experimental study is used when research subjects are not randomly assigned to study groups. Quantitative studies are used to establish correlational and causal relationships between variables. "When the researcher is able to analyze statistics and test a theoretically derived hypothesis using a quantitative research design, he or she can present logical outcomes that have scientific validation (Terry, 2018, Location No. 2266-2270)". This research approach allowed this PI to compare pre-post educational test results and pre-post self-efficacy assessment results to evaluate if an online educational and certification program improved the participants' knowledge, competence and self-confidence of vascular access nurses.

### **Population/Sampling Parameters.**

This study included a convenience sample of 20 PICC Registered Nurses who worked in healthcare facilities across the United States that received access to complete the online

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educational program on a computer of their choice. The administrator of IV-Therapy.Net using the organization's listserv accessed potential participants. Invitations were also posted on Vascular Access and Infusion Specialist Facebook site. The PI of this quality improvement study sent out over 4000 emails to recruit potential participants (see Appendix K). An informational letter (see Appendix L) with a detailed description of the study (DNP project) was included in the recruitment email and posting. The plan was to admit the first 40 participants that registered and met the requirements for participation in the project, but only 20 participants applied to participate. Reminder emails and posting were sent out during the first six weeks after the initial email, and an informational letter was sent out to participants to participate in the study. The online program is owned and managed by PICC Excellence, an educational service for clinicians located in Hartwell, Georgia (See Appendix M, Site Approval Letter). In collaboration with PICC Excellence, Inc., the PI of this study determined that the inclusion criteria for this study would consist of:

- Practicing vascular access nurses that work in healthcare facilities or as independent contractors in the United States.
- Vascular access nurse must be actively placing PICC lines
- Proof of Basic PICC Insertion training in the Modified Seldinger Technique (minimum of 8 hours of training).
- Documented proof of a current supervised insertion using a competency checklist to confirm adherence to industry standards and guidelines.
- Minimum of 25 successful ultrasound-guided PICC insertions, documented by the signature of a supervisor.
- Current professional license for a Registered Nurse.

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Exclusion participant criteria in this study included vascular access nurses who had performed fewer than 25 successful insertions and anyone who was placing PICC/midlines and was not a Registered Nurse.

Terry (2018) states that sample size is based on the type of research and the practical issue of the sampling process. "The more homogeneous the individuals in a population are, the smaller the sample required to be representative of that population" (Location No. 3554). Vascular access nurses across the country are a homogeneous group that is trained using didactic classroom and hands-on training in a similar manner, use ultrasound equipment, use the same supplies to place the PICCs or midlines, follow established guidelines by Infusion Nurses Society (INS), and the majority of them work in a hospital environment placing lines in acute care patients.

The goal was to have a sample size of approximately 35 to 40 participants for the project. The sample size of 35 was recommended based on the availability of participants, consultation with vascular access clinical experts, and education experts. Based on a medium effect size sampling for a dependent sample, two-tailed t-test, "a sufficient sample size using an alpha of 0.05, a power of 0.80, a medium effect size ( $d_z = 0.5$ ) (Faul et al., 2013) would require a sample size of 34" (Statistics Solutions, 2013, para. 3).

### **Appropriateness of the Setting for the EBP Project**

Participation in the research project was through remote computer access. The participants used a personal computer to access examinations and online education. The computer required a webcam that can be accessed, and Windows XP or later or a Mac Computer running OSX 10.6 (Snow Leopard) or OSX 10.7 (Lion). The participants were aware of the requirements before agreeing to participate in the project. Each participant completed a supervised PICC insertion at his or her place of employment as part of the PICC Excellence requirement to participate in the



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project.

### **EBP Design Methodology**

This quality improvement DNP project ran as a pilot study and used a quasi-experimental, one-group pretest-posttest design. The dependent variables were improved knowledge, competence, and self-confidence of the vascular access nurse, which were measured using a proctored pre-and post-examination as well as a pre-and post-self-efficacy assessment, (see Appendices N and O, respectively). The results of the participants who successfully finished the online educational program were tracked based on the orientation process they completed as new vascular access nurses. Demographic variables were also assessed.

### **Protection of Human Rights**

The study received Institutional Review Board (IRB) approval from Regis University under Exempt status, Categories 1 and 2. PICC Excellence accepted Regis University's IRB decision and granted permission to conduct this quality improvement project. As stated previously, there were no risks of harm to human participants. The PI disclosed all aspects of the study to participants in the informed consent. The PI was blinded to a participant's identity. The PI de-identified collected data and reported results as aggregate data. Lastly, the PI completed the CITI training course (See Appendix P).

### **Instrumentation Reliability/Validity and Intended Statistics**

Terry (2018) states that in order for a study to have reliability and validity, "the results generated can be generalized to the larger population, and scores received from participants are consistent over time" (Location No. 3290). "When the researcher can analyze statistics and test a theoretically derived hypothesis using a quantitative research design, he or she can present logical outcomes that have scientific validation" (Terry, 2018, Location No. 2267). Bolarinwa

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(2015) defines validity as the degree to which a measurement measures what it purports to measure and reliability refers to the degree to which the results obtained by measurement and procedure can be replicated (p. 195). Descriptive statistics (frequencies and percentages) were to be used to describe data collected from the demographic information, self-efficacy questionnaire and proctored examinations. The PI planned to use inferential statistics to understand data collected from the self-efficacy questionnaire and proctored examinations. Planned tests included paired t-test, chi-square statistical analysis, dependent sample t-Test with two tails, and a p-value <0.05. The data dictated what other data analysis will be conducted with assistance from the research faculty at Regis University.

The participants completed a **demographic form** created by the investigator via SurveyMonkey® that provided basic data (see Appendix Q). The data points included age, gender, region where they reside in the United States, professional license, years practicing as a nurse, years practicing as a vascular access nurse, where they practice (hospital radiology department, hospital PICC team, independent contractor, other), and type of certification, and type of orientation they received to become a vascular access nurse. The demographic questionnaire took an average of five minutes or less to complete.

The **Supervised Insertion Competency Checklist** is a nationally established checklist developed by the CDC (2018) and INS for vascular access practitioners in order to have a detailed process that provides guidelines that need to be followed in order to place a PICC line successfully. Permission was not needed for the study; the CDC allows practitioners to use the checklist tool as an open source to improve their practice (CDC, 2018). A PICC insertion that was supervised by their current supervisor was needed in order to assess the participant's ability to insert a PICC line using a standardized competency checklist successfully. PICC Excellence,

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Inc. collected all documents, including this checklist, in order to verify that the participant met the criteria to participate in the online educational review program and CPUI.

The **Basic PICC Qualification Training Educational Program** provided the participant with the complete education required to meet the requirements of minimal training established by the World Congress Vascular Access (WOCOVA) (Moureau et al. 2013) Taskforce. The course began with the definition of PICCs. Comprehensive information was then provided regarding all aspects of PICCs including indications and contraindications for use, device selection, anatomy, vein anatomy, vessel health, vein selection, insertion preparation, step-by-step insertion procedure, complications, care and maintenance and legal aspects (PICC Excellence, Inc., 2018). The program was interactive, with videos, audio, and practice-oriented in order to help the learner meet the objectives. See Appendix R for full details. The use of the Basic PICC Qualification Training Educational program was provided to the research participants in order to have a consistent delivery method of education that uses multiple modalities. Participants received reminder emails from PICC Excellence staff to remind to complete the educational program study within 30 days of having access to the material.

The **CPUI Online Certification Review Course** was a study guide to prepare the participants to take the CPUI certification. The participant was able to view the study guide online or print it out. The study guide was divided into 22 topics that correlate to the CDC (2018) and INS (2016) guidelines (See Appendix S for list of topics covered and Appendix T for Certification process). It was geared to provide the participant with the knowledge needed to insert a PICC line safely. The study guide took an average of three to five hours to complete. PICC Excellence, Inc., the study site, provided the online educational review program and CPUI certification. This company provided permission to use their online course in this quality

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improvement project (See Appendix M for Site Approval letter). Participants received reminder emails from PICC Excellence staff to complete the online certification course within 30 days of having access to the material. Due to the proprietary nature of the CPUI examination and review material only a brief description of the 22 topics are provided.

The **Online Proctored Pre-post Examination** consisted of 100 questions for the pretest and 200-questions for the proctored post-examination. PICC Excellence, Inc. developed the exams to validate the knowledge of practicing vascular access nurses and provide the CPUI certification. An example of the test is provided in Appendix N. The participant had one and a half hours to complete the 100-question proctored pre-examination and three hours to complete the 200-question proctored post examination. PICC Excellence, Inc. used *Remote Proctor Now*, an independent Exam Proctoring Service to offer the examination.

The reliability and validity of the proctored examination was assessed by PICC Excellence, Inc. using established guidelines for certification testing to provide vascular access clinician validation of a higher level of knowledge and practice in the field of PICC placement. The statistical data on the examination was difficult to obtain due to the proprietary nature of the examination. PICC Excellence, Inc. used an expert panel to create the test framework around eight domains of practice needed by the vascular access provider:

- Preparation
- Insertion
- Vein Assessment
- Infection Prevention
- Care and maintenance
- Anatomy

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- Ultrasound
- Legal Aspects & Consent

The examination was used to measure baseline knowledge and if there was a change in knowledge/competence after taking the online educational program.

The **pre-post self-efficacy questionnaire** (See Appendix O) consists of seven questions related to the practice of the vascular access nurse. It evaluated the self-confidence of the vascular access nurse inserting PICC lines, using the ultrasound machine to insert the PICC lines, providing care and maintenance to vascular access catheters, and managing complications of the PICC lines. The PI of the study created the self-efficacy assessment/questionnaire study. A literature review was performed, and a content expert panel assessed content validity of the self-efficacy tool. The tool was developed using Albert Banduras Self-Efficacy Theory (Bandura, 1977). The self-efficacy questionnaire took an average of 10 minutes or less to complete.

### **Data Collection and Treatment Procedure Protocol**

The protocol for this project required that the PI adhered to the following steps:

- After IRB approval was obtained, a recruitment/informational email was sent to a minimum of 400 potential participants. The goal was to have 40 participants in the research project.
- If the participants were interested in participating, they were directed to a SurveyMonkey® link that asked for verification of these six questions as required by PICC Excellence:
  - Verification of PICC Experience
    - Minimum of 25 successful ultrasound-guided PICC insertions, documented by the signature of a supervisor verifying performance

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- Completion of a supervised Insertion Competency Checklist
- Copy of Basic PICC Training Certificate (Minimum 8-hour training)
- Copy of Professional License
- Certified PICC Ultrasound Inserter – CPUI Application (This is the application to online educational review course with certified component used in this study)
- If the participant met the qualifications to participate in the CPUI, they were asked to complete the demographic information questionnaire and the Self-Efficacy assessment on Survey Monkey®. Steps “A” through “C” timeframe – Up to 6 weeks and approximately two to four hours to complete.
- Once the above was completed, the participant received a link to the CPUI pre-proctored online examination. Time to take examination was one and one-half hours.
- Once proctored online examination was completed, the participant had access to the online Basic PICC Qualification Training educational program and had 30 days to complete the course. Estimated time to complete course was five to eight hours.
- Once step “E” was completed, the participant had access to the CPUI online review program and certification for an outline of course) and had 30 days to complete all course modules and the post-proctored online examination. Estimated time to complete course and testing is five to eight hours.
- The last step for the participant was to complete the post-Self-Efficacy assessment on SurveyMonkey® immediately after completing the post-proctored examination.

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- If the participant met the cut-off score of 80% on the post-proctored examination, he or she received the 2-year CPUI certification. See Figure 2 for an overview of the Flow Diagram of Project Design that guided this PI with this research study.

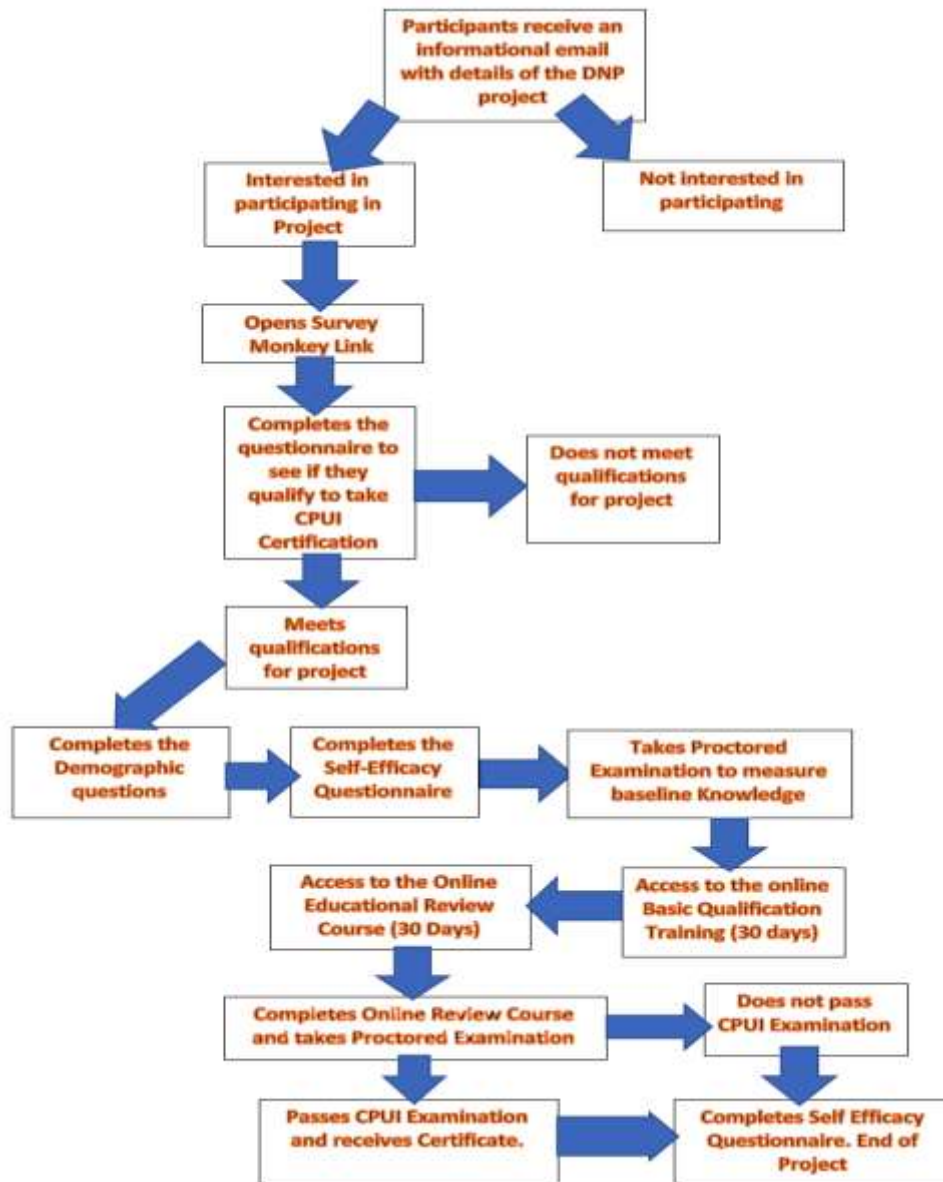


Figure 2. *Flow Diagram of Project Design Methodology*

As stated previously, all data collected and reported by the PI was de-identified and reported as aggregate data. Blinding was utilized in this study. Participants created an access username on SurveyMonkey® that was only known to them and not the PI. Participants were

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instructed on how to create a username by using the date of birth of their mothers (example: February 28, 1955, equals 02/28/55 – six-digit numerical value) at the start of the process in the introduction email in order to maintain blinding. Once the participant had met the criteria for participation in the project, they were given an email address or a phone contact to register with PICC Excellence by directly contacting the Certification Administrator. The Certification Administrator at PICC Excellence registered the participants under their personal information, but the data was de-identified to the PI by only using the numerical username. In other words, all data was processed under the username and not under the participant's name. PICC Excellence needed to have the participant's information in order to verify that they meet the criteria, match the participant's data with test results and provide the participants with the certification once they complete the CPUI examination and meet the passing criteria.

### **Project Findings and Results**

#### **Objective I: Demographic Survey**

The first objective was to create a demographic survey to identify trends related to the participant's background history and work history as a nurse, as it relates to knowledge, competence, and self-confidence. An n of 69 participants responded to the initial survey. Figure 3 presents a detailed description of the results of the data collected. Key findings from the survey were:

- 81% Participants could demonstrate proof of training validation certificate
- 93% Demonstrated proof they could provide documentation to meet criteria to participate in the study
- Gender: 78% were female



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- Age group: 7 % age range 25-35 years; 30% age range 36-50 years; 62% age >51 years
- Geographic location: 18 % from Northeast; 26% Midwest; 41 % South; 15% West
- Place of employment: 83 % worked in acute care setting; 9% outsource company; 7% other
- Years Employed as Vascular Access Nurse: 6% < 2 years; 23% 2-5 years; 19% 6-10; 51% > 10 years
- Orientation Process: 18% Performed 5 or less PICC insertions during orientation; 41% Performed less than 5-10 insertions during orientation; 18% Performed 11-25 insertions during orientation; 24 % Performed >25 insertions during orientation
- Certification: 38% VA-BC Certified; 15% CRNI Certification; 37% No Certification (53% Percentage had a specialty certification for vascular access)

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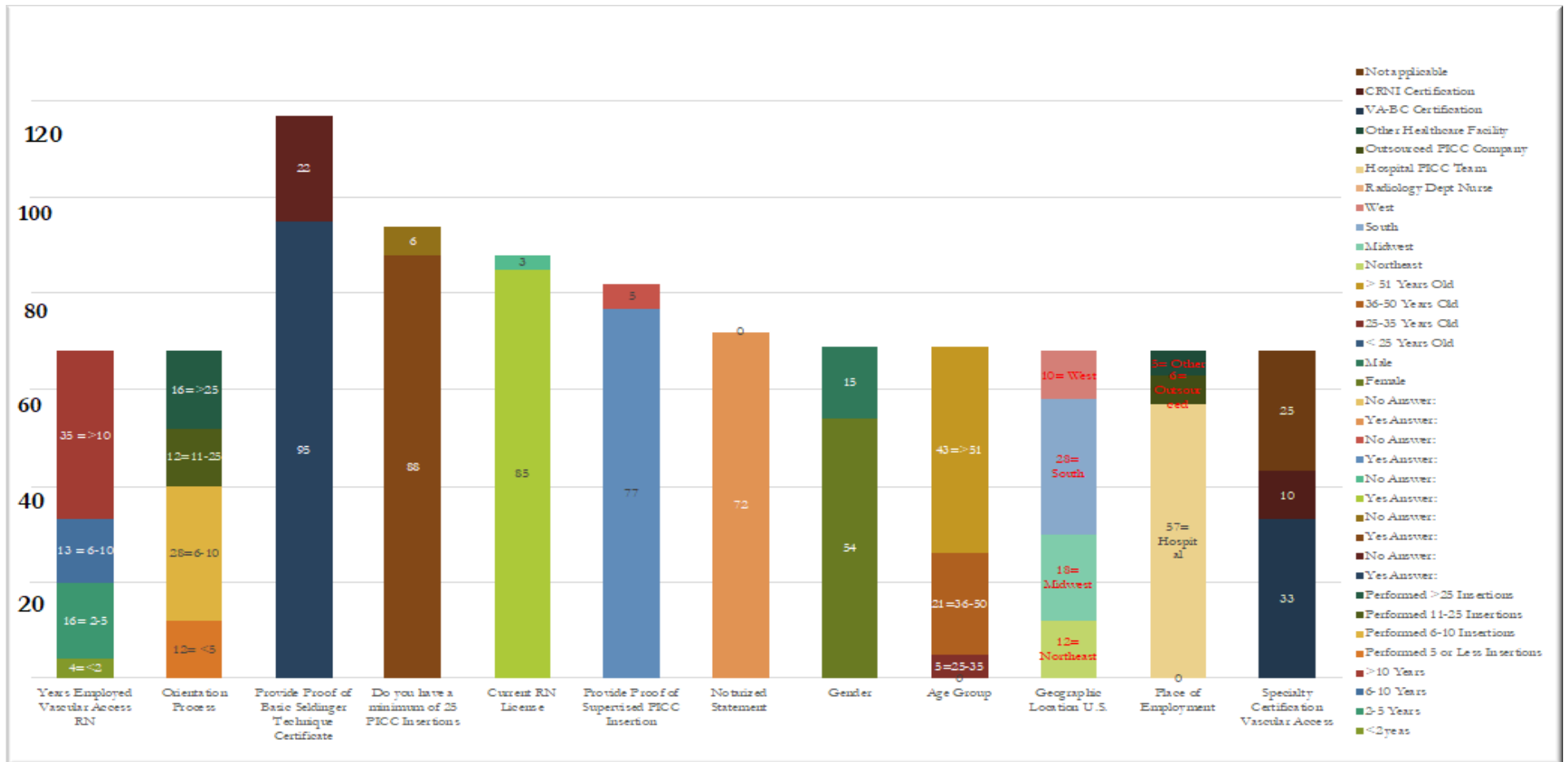


Figure 3

Demographic Data

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### **Objective II: Validation of Skill Competency**

The second outcome objective was to institute the process of validating the skill competency by direct observation of a line insertion before registering participants in online education. A nationally established Peripherally Inserted Central Catheter (PICC) Supervised Insertion Competency Checklist was used to validate the competency of the participant's ability to safely place a PICC line. Twenty-six participants completed the supervised PICC insertion skills competency checklist and met the criteria to participate in the study.

### **Objective III: Implementation of Basic PICC Qualification Training and Online Certification Program**

The PI instituted the intervention of the online Basic PICC Qualification Training and online certification program for vascular access nurses from November 1, 2018 to March 30, 2019. Twenty-six nurses were eligible to participate; 20 nurses completed the online training course.

### **Objective IV: Assessment of Knowledge and Competency of Practicing PICC Nurses**

For objective four, the PI assessed the knowledge base and competency of practicing PICC nurses before and after taking the online certification program (proctored pre-post examination). The PI determined internal consistency of the pre-posttests by performing a Cronbach's Alpha. The Cronbach's Alpha was .886, which demonstrated a strong test reliability. This was determined using Tavakol and Dennick (2011) recommendations that a reliability between .7 and .95 is recommended, but less than .90 is the recommended maximum.

After achieving a score on the posttest of >80%, N=20 passed the proctored posttest examination, thus receiving their CPUI certification. Accurate measurement of the participants' baseline knowledge and competence was achieved by testing the participants with a 100-question

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pretest comprised of the eight domains of practice. The 200-question posttest also included the 8 domains of practice and 100 of the test questions were the same as the pre-test. The 100 questions that matched between the pre- and posttest were used to validate the participants' knowledge/competency pre-post online educational intervention.

A paired samples t-test was performed on the pre- and posttest results. The t-test showed that the number of correct responses increased from a mean score of 1.89 in the pre-test to a mean score of 1.94 in the post-test, for an increase in the overall mean score by 0.05. As shown in Table 2, results were statistically significant ( $t = -6.069, p = .000$ ) and indicate that there was an improvement in the participants' knowledge/competency before and after the online educational intervention. In addition, an effect size (Cohen's  $d$ ) of 0.15 was calculated. Using Cohen (1988) recommendations of a  $d$  index of .20 being small and .50 medium, the sample was classified as having a small effect size.

Table 2

*Paired Samples Test Pretest and Posttest Data*

<b>Paired Samples Test</b>										
		<b>Paired Differences</b>					t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	PreTest - PostTest	-.044	.324	.007	-.058	-.030	-6.069	1999	.000	

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The individual domains were further tested to identify the correlation using a Paired Sample Test between the pretest and posttest results. Results of four of the domains demonstrated there was a statistical correlation between the pre- and posttest. The domains included Infection ( $t = -4.038, p = .000$ ), Preparation ( $t = -2.350, p = .020$ ), Vein assessment ( $t = -3.754, p = .000$ ) and Anatomy ( $t = -3.531, p = .001$ ). See Table 3 for details.

Table 3

### *Paired Samples Test Eight Domains of Practice Pretest and Posttest*

Domains			Paired Differences					t	df	Sig. (2-tailed) P value
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
						Lower	Upper			
Infection	Pair 1	Pretest - Posttest	-.090	.386	.022	-.134	-.046	- 4.038	299	.000
Preparation	Pair 1	Pretest - Posttest	-.045	.271	.019	-.083	-.007	- 2.350	199	.020
Vein Assessment	Pair 1	Pretest - Posttest	-.060	.277	.016	-.091	-.029	- 3.754	299	.000
Insertion	Pair 1	Pretest - Posttest	-.022	.287	.014	-.051	.006	- 1.570	399	.117
Legal	Pair 1	Pretest - Posttest	-.013	.250	.020	-.052	.027	-.631	159	.529

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Anatomy	Pair 1	Pretest - Posttest	-.100	.358	.028	-.156	-.044	- 3.531	159	.001
Ultrasound	Pair 1	Pretest - Posttest	-.025	.376	.024	-.073	.023	- 1.029	239	.304
Care and Maintenance	Pair 1	Pretest - Posttest	-.025	.398	.026	-.076	.026	-.973	239	.331

### Objective V: Assessment of Self-Confidence of Practicing PICC Nurses

The last objective was to assess the self-confidence of practicing PICC nurses prior and after taking the online certification program (pre-post self-efficacy assessment). The self-efficacy assessment consists of seven questions using a Likert scale from one to five, one being “Never” and five “All the time”. Cronbach's Alpha was measured at .847, indicating strong reliability of the Self-Confidence (Efficacy) tool.

A Paired Samples T-Test was performed on the pre and post Self-Efficacy assessment results N=15. The Paired Sample T-Test showed that the mean number of correct responses increased from a mean of 4.81 in the pre-test to a mean of 4.91 in the post-test, for an increase in the overall mean score of 0.10. As shown in Table 4, this increase is statistically significant ( $t = -2.591, p = .011$ ). These results indicate that there was an improvement in the participants’ self-confidence pre-post online educational intervention. In addition, an effect Size (Cohen’s d) of 0.29 was calculated, indicating a small effect size.

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Table 4

*Paired Samples Test Pre and Post Self-Efficacy*

		<i>Paired Differences</i>					<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
		<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>	<i>95% Confidence Interval of the Difference</i>				
					<i>Lower</i>	<i>Upper</i>			
<i>Pair 1</i>	<i>Preeff - Posteff</i>	<i>-.105</i>	<i>.414</i>	<i>.040</i>	<i>-.185</i>	<i>-.025</i>	<i>-2.591</i>	<i>104</i>	<i>.011</i>

The results were further evaluated to see if there was a correlation between the seven self-efficacy questions. Table 5, Inter-Item Correlation Matrix Self-Efficacy, demonstrates a strong correlation between the answers of individual questions compared to the pre- and post-assessment. R-values that are closest to +1 or -1, with a p value < .05, have the strongest correlation.

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**Table 5**

*Inter-Item Correlation Matrix – Pearson Correlation Coefficient*

		Pre-Ability to Place Line	Pre-Standards of Practice	Pre-Appropriate Access	Pre-Evaluating Necessity	Pre-Recommend Removal	Post-Ability to Place Line	Post-Standards of Practice	Post-Evaluating Necessity	Post-Recommend Removal
Pre-Ability to Place Line	Pearson Correlation	1	.100	.533*	.378	.707**	.555*	.400	.139	.378
	Sig. (2-tailed)		.723	.041	.165	.003	.032	.140	.622	.165
	N	15	15	15	15	15	15	15	15	15
Pre-Appropriate Access	Pearson Correlation	.533*	.213	1	.443	.829**	.650**	.533*	.207	.443
	Sig. (2-tailed)	.041	.446		.098	.000	.009	.041	.459	.098
	N	15	15	15	15	15	15	15	15	15
Pre-Evaluating Necessity	Pearson Correlation	.378	.378	.443	1	.535*	.681**	.378	.681**	-.071
	Sig. (2-tailed)	.165	.165	.098		.040	.005	.165	.005	.800
	N	15	15	15	15	15	15	15	15	15
Pre-Recommend Removal	Pearson Correlation	.707**	.354	.829**	.535*	1	.784**	.707**	.294	.535*
	Sig. (2-tailed)	.003	.196	.000	.040		.001	.003	.287	.040
	N	15	15	15	15	15	15	15	15	15
Post-Ability to Place Line	Pearson Correlation	.555*	.555*	.650**	.681**	.784**	1	.555*	.423	.681**
	Sig. (2-tailed)	.032	.032	.009	.005	.001		.032	.116	.005
	N	15	15	15	15	15	15	15	15	15
Post-Standards of Practice	Pearson Correlation	.400	.400	.533*	.378	.707**	.555*	1	.555*	.378
	Sig. (2-tailed)	.140	.140	.041	.165	.003	.032		.032	.165
	N	15	15	15	15	15	15	15	15	15
Post-Evaluating Necessity	Pearson Correlation	.139	.555*	.207	.681**	.294	.423	.555*	1	-.105
	Sig. (2-tailed)	.622	.032	.459	.005	.287	.116	.032		.710
	N	15	15	15	15	15	15	15	15	15
Post-Recommend Removal	Pearson Correlation	.378	.378	.443	-.071	.535*	.681**	.378	-.105	1
	Sig. (2-tailed)	.165	.165	.098	.800	.040	.005	.165	.710	
	N	15	15	15	15	15	15	15	15	15

\*Correlation is significant at the 0.05 level (2-tailed)

\*\*Correlation is significant at the 0.01 level (2-tailed)



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### **Study Question: Assessment of PICC Nurse’s Knowledge, Competence and Self-Confidence Based on Orientation Program**

The PI was also interested in investigating whether or not there was a difference in the PICC nurse’s knowledge, competence and self-confidence based on the number of insertions during the orientation process. An ANOVA test was performed to check for a correlation between the four different types of orientations based on number of insertions required during orientation and the pretest scores. In Table 6, the ANOVA results,  $F= 4.304$ ,  $p= .005$ , demonstrated that there was a correlation between the four groups of orientation process and pretest results.

Table 6

*ANOVA Orientation Process and Pretest*

#### **ANOVA**

Pretest – Orient Process

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.407	3	.469	4.304	.005
Within Groups	141.139	1295	.109		
Total	142.547	1298			

A further drill down of the data was conducted by performing a One Sample test on the four individual groups of orientation and the pretest results. The results ( $P =.000$ ) for all the individual groups compared to the pretest demonstrated significant correlations. When comparing the mean, mean difference, and confidence intervals of each of the groups, no direct correlation could be made about the difference in knowledge between the four groups. The question, to explore if there was a difference in the PICC nurse’s knowledge, competence and

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self-confidence based on their orientation program, could not be answered based on the statistical analysis. See Table 7 for details.

Table 7

### *One-Sample Test Orientation Process*

Orientation Process		Test Value = 0					
		t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
<5 Insert	Pre Test	55.955	398	.000	.887	.86	.92
6-10 Insert	Pre Test	50.806	499	.000	.838	.81	.87
11-25 Insert	Pre Test	43.370	99	.000	.950	.91	.99
>25 Insert	Pre Test	50.041	299	.000	.893	.86	.93

### **Limitations, Recommendations, Implications for Change**

#### **Limitations**

One limitation of the study was the difficulty in matching participants' demographics, pre-post self-efficacy assessments and pre-post proctored certification tests when using a confidential identifier. In some instances, the participants forgot their confidential identifier from

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one activity to the next making it difficult to find the data that corresponded to the participant. One hundred twenty participants accessed SurveyMonkey®, 20 completed the pre/posttest, but the PI was only able to match up 15 participants' demographics and pre/post self-efficacy data.

Another limitation was the small sample size and the use of a convenience sample instead of a true random sample. It is unclear if the true effect of the interventions being tested is what made the difference in the post-test and post self-efficacy assessment. The improvement in the results may have resulted from extraneous variables outside of the PI's purview or control. In addition, the PI was not able to answer the question on whether or not there is a difference in the PICC nurse's knowledge, competence and self-confidence based on their orientation program, due to the small sample size and inconclusive evidence.

The extended time to complete the study may have been a dissatisfier and prevented participants from registering in the online course. It could take up to two months to complete the study from start to finish. Based on the required time to complete the inclusion criteria for Basic Online CPUI certification, Basic PICC Qualification Training, and online educational Review Course and Certified PICC Ultrasound Inserter (CPUI) certification the participants spent 15-20 hours to complete the study.

### **Recommendations**

Based on the pilot study, the recommendation would be to replicate the study using a larger sample size and possibly a control group to compare the pre/post data. Another recommendation would be to exclude participants that are VA-BC certified or CRNI Certified from the study. A prior certification process provides nurses with a validated higher level of knowledge that could have affected the results of the study. The last recommendation would be to use another method to identify the participants for consistent matching purposes.

### **Implications for Change**

Having knowledgeable and well-qualified PICC nurses is vital in the practice of vascular access nursing. Implications for change would be to implement a standardized orientation process for novice vascular access nurses. The process should include the eight domains of practice and hands-on training that provides supervision and mentoring until the novice vascular nurse performs at the competent level. The PI plans to promote the use of educational courses that are online or face-to-face that include content on the use of ultrasound, anatomy, preparation, and insertions. The PI also intends to disseminate study findings through publications and professional conferences.

### **Conclusion**

The purpose of the project was to evaluate if an online educational program would have an impact on the nurse's knowledge, competence and self-confidence. Results from the study showed that participants did improve their posttest score and self-efficacy assessment scores after the implementation of an online educational and certification program. Based on the demographic data results, it is clear that the process for orienting novice vascular access nurses needs standardization across the specialty. Knowing that approximately 10% of patients receive a venous access device during their hospital stay, the vascular access nurse should have a well-rounded knowledge of their practice as it relates to the eight domains of practice for vascular access nurses. Even a 1% rate of infections or complications can lead to tens of thousands of patients being affected and cost facilities in the millions of dollars to treat. The WOCOVA (2013) task force created a list of recommendations in order to help standardize the practice of vascular access nurses. The governing certification organizations need to make a bigger effort to

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mandate that novice and practicing vascular access nurses be evaluated on an ongoing basis in order to make sure that standards of practice are being followed.

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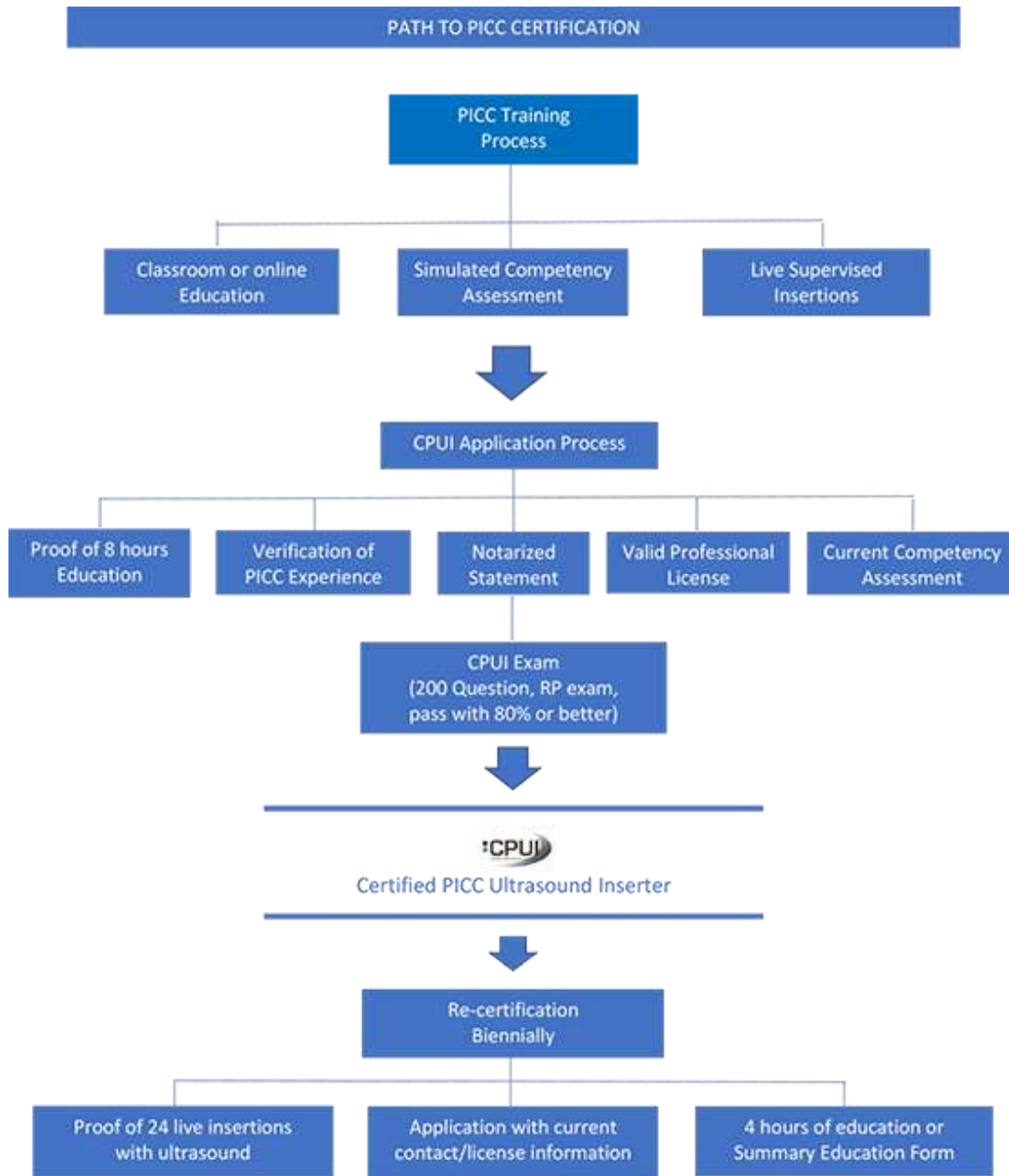
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Vascular Access Certification Corporation (2017). *Vascular access certification and recertification candidate handbook*. Atlanta, GA, U.S.A.

# Appendix A

## Path to PICC Certification



(PICC Excellence, Inc., 2018)

(Available online at company's website)

Appendix B

Peripherally Inserted Central Catheter (PICC) Supervised Insertion Competency Checklist

CLINICIAN NAME \_\_\_\_\_

ASSESSMENT DATE \_\_\_\_\_

This is to verify that the clinician named above has successfully completed a simulated insertion of a PICC including all of the following steps. **Supervisor should initial each step as clinician correctly performs the procedure.**

**ASSESSMENT:**

- \_\_\_\_\_ 1. Verify MD order, creatinine level (must be under 2.0), diagnosis, medications, reasons for PICC, pertinent patient history, use of blood thinners.
- \_\_\_\_\_ 2. Ensure all supplies needed for procedure are readily available including PICC insertion kit with, gloves, saline, ultrasound sterile cover and gel, anesthetic as needed, additional drapes, gauze, syringes, universal protection equipment.
- \_\_\_\_\_ 3. Wash hands and apply clean gloves.
- \_\_\_\_\_ 4. Perform time out to confirm patient ID (two forms of identification).
- \_\_\_\_\_ 5. Complete patient education and informed consent.
- \_\_\_\_\_ 6. Cleanse table surfaces with disinfecting solution. Place supplies on table. Set bed to correct height for comfort of the inserter; ensure ultrasound unit is positioned for easy visualization.
- \_\_\_\_\_ 7. Have an observer present to complete insertion checklist throughout the procedure, monitoring adherence to aseptic technique and providing an enhanced degree of safety for the patient.
- \_\_\_\_\_ 8. Perform vein assessment. Locate veins, arteries and nerves (basilic, median, cephalic, brachial) with ultrasound. Select most appropriate vein based on size and vein health. Consider vein size in comparison to catheter French size with/without a tourniquet (Don't exceed 1:3 ratio). Mark site.
- \_\_\_\_\_ 9. Apply fresh gel to probe head in preparation for insertion procedure.
- \_\_\_\_\_ 10. Estimate catheter length using external tape measure technique (insertion site, clavicular area, right third intercostal) or use fluoroscopy for exact wire measurement. Measure upper arm circumference and document baseline.
- \_\_\_\_\_ 11. Wash hands using surgically thorough scrubbing action, 3-5 minutes.
- \_\_\_\_\_ 12. Establish sterile field either around patient's arm or separate from the patient.
- \_\_\_\_\_ 13. Open tray; fold back outer wrap. Using sterile technique, add additional items not in kit including flushes lidocaine and extra supply items onto sterile field.
- \_\_\_\_\_ 14. Place poly-lined pad under patient arm.
- \_\_\_\_\_ 15. Don cap, mask, shield, sterile gown and sterile gloves in a sterile fashion.
- \_\_\_\_\_ 16. Prep a large area (8-10 inches or more) around vein selected using Chlorhexidine. Use back and forth fictional scrub for 30 seconds or more. Do NOT wipe off; allow to air dry.
- \_\_\_\_\_ 17. Drape arm and body with sterile, full body drapes. Turn patient head away from insertion site or provide patient with a mask to prevent breathing on field

## VASCULAR ACCESS NURSES' KNOWLEDGE

- \_\_\_\_\_ 18. Apply sterile cover to ultrasound probe in sterile fashion. Secure with included rubber bands or sterile tape. Have sterile gel ready for insertion procedure on sterile field.
- \_\_\_\_\_ 19. Arrange catheter and supplies in a sterile, organized fashion for easy reach and access, keeping items toward center of the sterile field.
- \_\_\_\_\_ 20. Draw up flushing solution(s) or use prefilled syringes marked for sterile field use.
- \_\_\_\_\_ 21. Pre-flush to confirm patency.
- \_\_\_\_\_ 22. Apply tourniquet now or with an assistant later.
- \_\_\_\_\_ 23. Prepare ultrasound probe with sterile cover and gel. Position on skin and scan area to identify selected vein.
- \_\_\_\_\_ 24. Administer subcutaneous anesthetic.
- \_\_\_\_\_ 25. Using ultrasound guidance, access vein with a small (21g) introducer needle or cannula. With ultrasound, angle of insertion is acute (60-90 degrees) depending on depth indicated by ultrasound assessment. Watch for needle penetration into vein on ultrasound screen. Look for dimpling, then penetration of vessel. Do not advance needle through back side of vein.
- \_\_\_\_\_ 26. Confirm blood return/flashback in hub.
- \_\_\_\_\_ 27. Advance short guidewire through introducer needle approximately 10-20cm, maintaining control of wire at all times. Wire should slide easily into vein. Do NOT retract wire back through steel needle.
- \_\_\_\_\_ 28. Remove tourniquet.
- \_\_\_\_\_ 29. Remove introducer needle by sliding out of skin and off wire while stabilizing guidewire.
- \_\_\_\_\_ 30. Inject anesthetic subcutaneously into skin around the wire if not previously performed. If necessary, use blade to nick skin (.5-1cm) and expand cutaneous puncture site. Slide blade into insertion hole approximately 1-2cm with sharp side facing outward away from guidewire.
- \_\_\_\_\_ 31. Slide sheath/dilator over the wire and into vein using a firm twisting motion. Maintain control of wire at all times. Remove dilator by unlocking leur connector and sliding back on wire.
- \_\_\_\_\_ 32. Remove the wire (sheath and wire may be removed together). Begin threading catheter immediately to reduce blood loss and prevent air emboli. Cover with thumb if necessary.
- \_\_\_\_\_ 33. Thread the catheter through the introducer slowly. Turn patient head toward insertion site as catheter is advanced into chest. Advance catheter to predetermined level. If using navigation or EKG positioning, follow manufacturer's steps to confirm P wave elevation.
- \_\_\_\_\_ 34. Aspirate each lumen to check for blood return. Flush all lumens with 10-20mL normal saline.
- \_\_\_\_\_ 35. Pull sheath from insertion site and gently peel apart. It may be necessary to thread catheter to final position.
- \_\_\_\_\_ 36. Check each lumen again for brisk blood return and flush with 10-20mL normal saline for injection. Apply needleless connectors. Flush again.
- \_\_\_\_\_ 37. Using ultrasound, assess for internal jugular tip malposition using a longitudinal view (not necessary if EKG or navigation system used).
- \_\_\_\_\_ 38. Disinfect skin again if blood is present and allow to air dry.
- \_\_\_\_\_ 39. Secure catheter and apply sterile, occlusive pressure dressing.
- \_\_\_\_\_ 40. If tip positioning system was not used, order radiographic confirmation of terminal tip position prior to use.
- \_\_\_\_\_ 41. Document entire procedure and patient reaction to procedure in patient record.

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***By signing this document, you have viewed the simulated insertion and confirm the participant's performance of each individual competency. Inadequate performance by the participant requires a repeat of the simulated insertion.***

**Name of Preceptor** \_\_\_\_\_

**Signature of Preceptor** \_\_\_\_\_

**License or Social Security #** \_\_\_\_\_

**Phone** \_\_\_\_\_ **Employer** \_\_\_\_\_

**Signature of Performer** \_\_\_\_\_

(PICC Excellence, Inc. (2018) (Available online at company's website)

Appendix C

Conceptual Diagrams

Benner's Novice to Expert Model

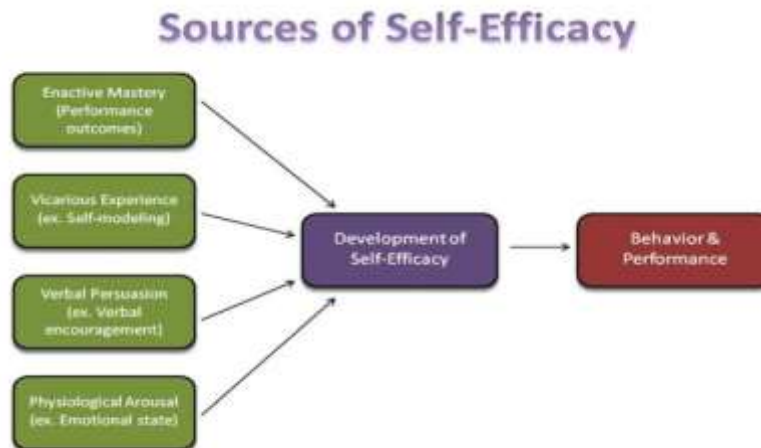
**Benner's Stages of Clinical Competence**

In the acquisition and development of a skill, a nurse passes through five levels of proficiency: novice, advanced beginner, competent, proficient, and expert.

<p><b>Stage 1: Novice</b></p> <p>The Novice or beginner has no experience in the situations in which they are expected to perform. The Novice lacks confidence to demonstrate safe practice and requires continual verbal and physical cues. Practice is within a prolonged time period and he/she is unable to use discretionary judgement.</p>
<p><b>Stage 2: Advanced Beginner</b></p> <p>Advanced Beginners demonstrate marginally acceptable performance because the nurse has had prior experience in actual situations. He/she is efficient and skillful in parts of the practice area, requiring occasional supportive cues. May/may not be within a delayed time period. Knowledge is developing.</p>
<p><b>Stage 3: Competent</b></p> <p>Competence is demonstrated by the nurse who has been on the job in the same or similar situations for two or three years. The nurse is able to demonstrate efficiency, is coordinated and has confidence in his/her actions. For the Competent nurse, a plan establishes a perspective, and the plan is based on considerable conscious, abstract, analytic contemplation of the problem. The conscious, deliberate planning that is characteristic of this skill level helps achieve efficiency and organisation. Care is completed within a suitable time frame without supporting cues.</p>
<p><b>Stage 4: Proficient</b></p> <p>The Proficient nurse perceives situations as wholes rather than in terms of chopped up parts or aspects. Proficient nurses understand a situation as a whole because they perceive its meaning in terms of long-term goals. The Proficient nurse learns from experience what typical events to expect in a given situation and how plans need to be modified in response to these events. The Proficient nurse can now recognise when the expected normal picture does not materialise. This holistic understanding improves the Proficient nurse's decision making. It becomes less laboured because the nurse now has a perspective on which of the many existing attributes and aspects in the present situation are the important ones.</p>
<p><b>Stage 5: The Expert</b></p> <p>The Expert nurse has an intuitive grasp of each situation and zeroes in on the accurate region of the problem without wasteful consideration of a large range of unfruitful, alternative diagnoses and solutions. The Expert operates from a deep understanding of the total situation. His/her performance becomes fluid and flexible and highly proficient. Highly skilled analytic ability is necessary for those situations with which the nurse has had no previous experience.</p>

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice*. Menlo Park: Addison-Wesley, pp. 13-34.

Bandura's Self Efficacy Model



Bandura's Self Efficacy Model (iEdunote (2017))



# VASCULAR ACCESS NURSES'KNOWLEDGE

## Appendix D

### Literature Review

**Systematic Review Evidence Table Format** [adapted with permission from Thompson, C. (2011). Sample evidence table format for a systematic review. In J. Houser & K. S. Oman (Eds.), *Evidence-based practice: An implementation guide for healthcare organizations* (p. 155). Sudbury, MA: Jones and Bartlett.]

Article Title and Journal	Does Certification in Vascular Access Matter? An Analysis of the PICC1 Survey/ American Journal of Nursing
Author/Year	Chopra, V., Kuhn, L., Vaughn, V., Ratz, D., Winter, S., Moureau, N., Meyer, B., Krein, S./2017
Database and Keywords	certification, peripheral catheterization, peripherally inserted central catheter, vascular access specialist
Research Design	Survey instrument consisted of 76 questions on PICC policies and procedures at the inserters' facilities, the use of technologies for PICC insertion, device management (including management of complications), inserters' perceptions about PICC use, and inserters' relationships with other health care providers. Information about respondents, such as number of years in practice, certification or noncertification status, and the primary practice setting, was also collected. The survey instrument made use of skip logic, allowing respondents to skip questions that were contingent on a prior response.
Level of Evidence	Level 6 - Survey and Literature review
Study Aim/Purpose	The purpose of this study was to gather information regarding whether certified and noncertified PICC inserters differ with respect to their practices and views about PICC use.
Population Studied/Sample Size/Criteria/ Power	8,386 members of the AVA and the INS. Of these, 2,762 accessed the survey and 1,698 (61%) indicated that they inserted PICCs and were eligible for participation in the study. Of those eligible, 1,450 (85%) provided data regarding certification and made up the final cohort used for analysis. Of these, 1,007 (69%) reported being certified and 443 (31%) indicated they were not certified.
Methods/Study Appraisal/ Synthesis Methods	National survey of vascular access specialists, identifying certified PICC inserters as those who had received board certification from the Association for Vascular Access, the Infusion Nurses Society, or both. The 76-item survey asked about PICC policies and procedures at respondents' facilities, use of insertion technologies, device management, and management of complications, perceptions about PICC use, and relationships with other health care providers. Additional data about respondents, including years in practice and primary practice settings, were also gathered. Bivariable comparisons were made using $\chi^2$ tests; two-sided $\alpha$ with $P \leq 0.05$ was considered statistically significant
Primary Outcome Measures and Results	Certified inserters were more likely to use certain evidenced-based practices that reduce complication risks, including using ultrasound to evaluate catheter-to-vein ratios, using ECGs to guide PICC placement and receiving assistance from another team member during insertion.
Author Conclusions/ Implications of Key Findings	Certification in vascular access appears to be associated with important differences among PICC inserters with regard to their practices and views. Encouraging broader adoption of this credential—which is currently often voluntary—may be warranted. Studies aimed at clarifying how certification influences thinking and practice in clinical settings are needed if we are to unlock the potential of this professional training
Strengths/ Limitations	Strengths: In general, it seems reasonable to presume that providers with certification will be more likely to use evidence-based practices than their noncertified counterparts. Our analysis of data from the PICC1 survey supports this in part. Limitations: Data was collected from a survey that targeted vascular access specialists belonging to two large professional organizations, selection bias might affect our findings. Observed differences in practice patterns cannot attribute these differences solely to this characteristic.
Funding Source	No Funding Identified from outside sources or conflict of interest identified.
Comments	A substantial body of evidence suggests that specialty certification is associated with several improved patient outcomes. Exploring ways to further enable PICC inserters to apply evidence to practice, communicate such knowledge to physicians, and act as vanguards for patient safety is paramount. In general, it seems reasonable to presume that providers with certification will be more likely to use evidence-based practices than their noncertified counterparts. Our analysis of data from the PICC1 survey supports this in part.

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Appendix E

Context-Specific Database/Data Dictionary

Variable Name	Description of Values	Values
Sex		1= Female
		2 = Male
Participants Age	Age Groups	1= < 25
		2= 25-35
		3 =36-50
		4 = >50
United States Region	Geographic Region	1 = Northeast
		2 = Midwest
		3 = South
		4 = West
Licensed		Registered Nurse
		Other- Identify
Number of Years as a nurse		1=<2
		2= 2-5
		3= 6-15
		4= >15
Vascular Accesses Orientation Process	<p>*Orientation included minimum 8 to 16-hour course – classroom theory and hands on component.(Simulation, hands on use of ultrasound equipment)</p> <p>*Observed one to two insertions at the bedside by a qualified vascular access nurse.</p> <p>*Performed five or less PICC insertions at the bedside and was certified to be a vascular access nurse.</p>	1 = Five or less supervised PICC insertions before being able to practice independently
	<p>*Orientation included minimum 8 to 16-hour course – classroom theory and hands on component.(Simulation, hands on use of ultrasound equipment)</p> <p>*Observed one to two insertions at the bedside by a qualified vascular access nurse.</p> <p>*Performed 6 to 10 PICC insertions at the bedside and was certified to be a vascular access nurse.</p>	2 = 6-10 supervised PICC insertions before being able to practice independently

## VASCULAR ACCESS NURSES' KNOWLEDGE

	<p>*Orientation included minimum 8 to 16-hour course – classroom theory and hands on component.(Simulation, hands on use of ultrasound equipment)</p> <p>*Observed one to two insertions at the bedside by a qualified vascular access nurse.</p> <p>*Performed 11 to 25 PICC insertions at the bedside and was certified to be a vascular access nurse.</p>	3 = 11 – 25 supervised PICC insertions before being able to practice independently
	<p>*Orientation was less than an 8-hour course – did not include both classroom theory and hands on component.(Simulation, hands on use of ultrasound equipment)</p> <p>*Observed one or less insertions at the bedside by a qualified vascular access nurse.</p> <p>*Performed 1 or 2 PICC insertions at the bedside and was certified to be a vascular access nurse.</p>	4 = Other - Please provide details.
Vascular Access National Certification	Certified Registered Nurse Infusion (CRNI)	1 = CRNI
Add third	Vascular Access-Board Certified (VA-BC)	2 = VA-BC
Number of years Practicing as a Vascular Access Nurse	Years of practice	1= 0-1
		2 = 2-5
		3 = 6-10
		4 = >10
Place of Employment	Hospital	1 = Radiology Nurse
		2 = PICC Team
	Independent Contractor	3 = Contracted Services
		4 = Other

Appendix F

Letter of Intent

**DNP Project Letter of Intent**

**To:** Nancy L. Moureau, RN, PhD, CRNI, CPUI, VA-BC

**From:** Julio Santiago DNP Student

**Subject:** DNP Research Project

**Date:** 8/2/2018

I am writing to obtain permission to conduct a quantitative research study with a quality improvement initiative in your facility with the purpose of assessing vascular access nurses' knowledge, competence and self-confidence by using the online educational review course and CPUI certification by Fall semester 2018. This study will be done to fulfill requirements for completion of the Doctor of Nursing Practice degree at Regis University, Denver, CO. The following information will review the study:

This project will employ a **Population-Intervention-Comparative-Outcome (PICO)** format for development of the research question to be investigated:

**Population:** Vascular access nurse

**Intervention:** Online Educational Review Course and Certified PICC Ultrasound Inserter (CPUI) Certification

**Comparative:** Comparison of the vascular access nurse knowledge, competence and confidence prior to and after taking the online education review program

**Outcome:** Improved knowledge, competence and self-confidence

**Research Questions:**

- **Primary Project Questions:** Are vascular access nurses adequately prepared with the knowledge, competence, and self-confidence to provide safe and appropriate care to the clients that are requiring vascular access at the bedside, and does an online educational review course with a certification component improve the knowledge, competence, and self-confidence of the vascular access nurse after completing the certification process?
- **Secondary Project Question:** Is there a difference in the PICC nurse's knowledge, competence and self-confidence based on their orientation program?

**Project Significance:**

- Improved knowledge, competence, and self-confidence of PICC nurses who practice at the bedside
- Decreased risk of PICC line associated complications
- Decreased cost related to multiple sticks and cost associated with complications

**Type of Study:** Quasi-experiment, one-group pre-examination/post-examination design using a convenience sample

## VASCULAR ACCESS NURSES' KNOWLEDGE

**Participant Requirement:** The participants will be adult practicing vascular access nurses that are currently employed to place PICC and midlines at the point of care in hospitals and other healthcare facilities in the United States. An information sheet about the project will be disseminated to all potential participants. In order to receive certification, the participant must complete the online educational program and pass the post-test. Participation in the research study is voluntary. Participants are encouraged to complete the pre-test, demographic survey, and pre-post self-efficacy assessment in order to provide data that will improve the field of vascular access nursing.

**Risks, Cost, and Benefits:** There are no identified risks to the participants. Participants and data will be de-identified. There is no cost to the participants. The projected cost for the DNP project will be \$1,000 per month to cover the fees associated with 40 participants taking the online proctored examination. Having certified vascular access nurses will improve patient vascular access needs and patient care outcomes associated with the procedures.

### **Project Goals and Objectives:**

- A. The major goal of this project is to evaluate if an online certification program will improve knowledge, competence and self-confidence of the vascular access nurse.
- B. The project objectives include:
  - a. Provide a demographic survey to identify trends related to the participant's background history and work history as a nurse as it relates to knowledge, competence and self-confidence.
  - b. Institute the process of validating the skill competency of line insertion prior to registering participants in the online educational program by Fall 2018.
  - c. Institute the intervention of the online certification program for vascular access nurses by Fall 2018.
    - i. Assess the knowledge base and competency of practicing PICC nurses prior to and after taking the online certification program (Proctored pre-post examination).
    - ii. Assess the self-confidence of practicing PICC nurses prior to and after taking the online certification program (Pre-post self-efficacy assessment).
  - d. After DNP Capstone defense, share results of QI project with leadership at site of study

Permission is requested to conduct this research study at PICC Excellence, Inc, 1905 Whippoorwill Tr. Hartwell, GA 30643. I have included a template for the brief site approval letter that is required on letterhead from you. Thank you for your assistance with completing my DNP Project.

Sincerely,



Julio Santiago, DNP Student

# VASCULAR ACCESS NURSES' KNOWLEDGE

## Appendix G

### Cost/Benefit Analysis

<b>Costs</b>	<b>Benefits</b>
Cost of CPUI = \$245/employee	Improved knowledge, competence and confidence as a vascular access nurse
Cost of Basic PICC Qualification Training = \$395/Employee	Improved knowledge, competence and confidence as a vascular access nurse
Hospital Reimbursement negatively affected by hospital acquired complications. High performing hospitals 3% bonus and the Lowest-performing hospitals 1% penalty (Advisory Board, 2017, para 3).	Improved quality of care and safety of patients. Facilities could receive up to a 3% bonus from CMS for being a high performing hospital
Cost of patient death related to complications associated with HAC	5,520 to 20,239 lives would be saved annually with best practice implementation” (Barnes et al., 2015, p. 6).
Central Line-Associated Bloodstream Infection (CLABSI), Surgical Site Infection (SSI) and Methicillin-resistant Staphylococcus aureus (MRSA) bacteremia cost \$21,400 to \$110,800 per event (Barnes et al., 2015, p. 6)	Decreased cost and incidence of CLABSI/CRC/DVT \$21,400 to \$110,800 per event (Barnes et al., 2015, p. 6)

# VASCULAR ACCESS NURSES' KNOWLEDGE

## Appendix H

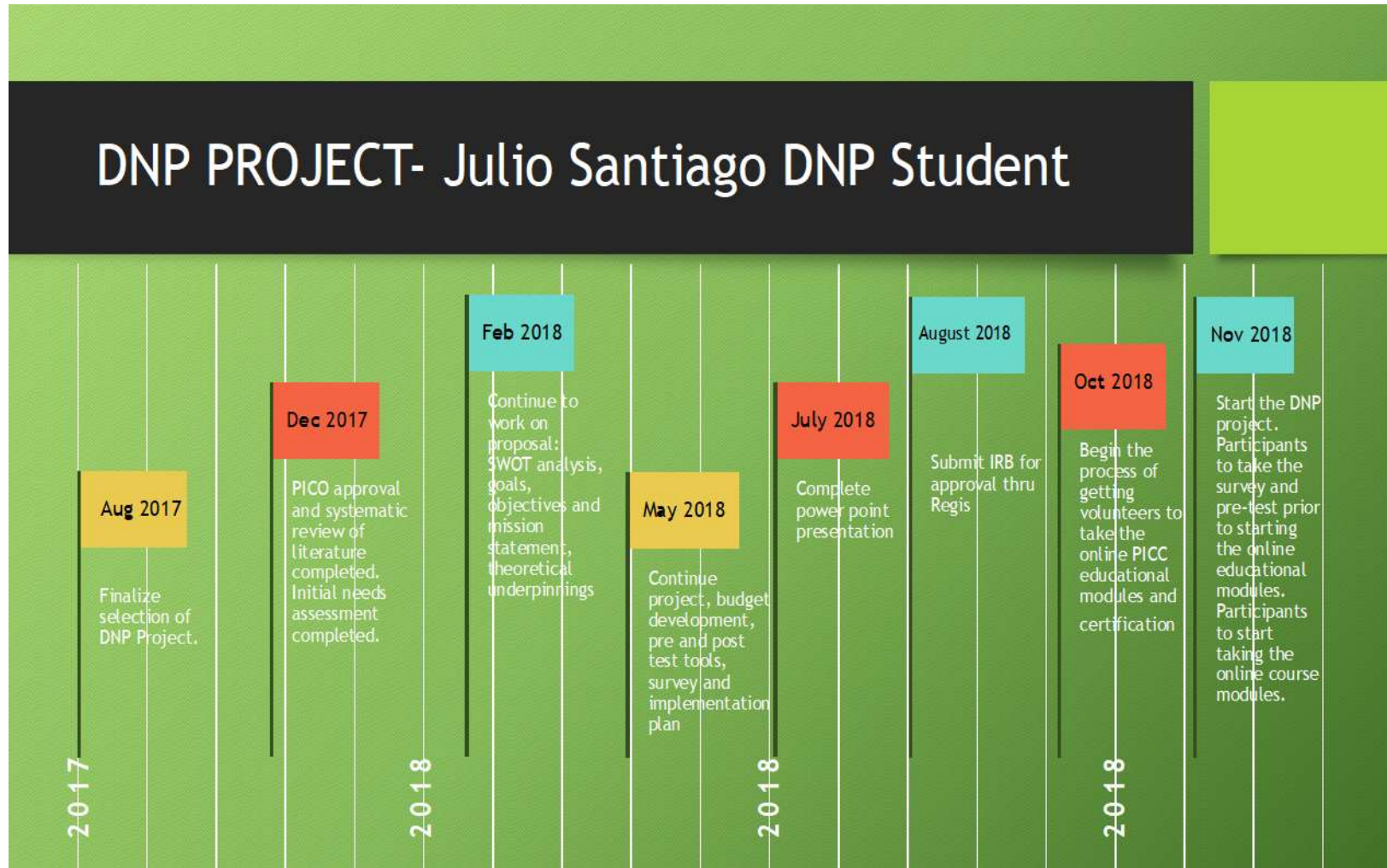
### Budget to Replicate Study

<b>Research Cost</b>	
Survey Monkey	\$35 X 6 = \$210
Online Education Review Course and CPUI Certification (N = 20)	\$1000 X 5 Months = \$5,000
Cost of Basic PICC Qualification Training	\$0 Included in the cost of the CPUI
<b>Total</b>	<b>\$5,210</b>

<b>Cost to Replicate</b>	
Survey Monkey	\$35 X 6 = \$210
Online Education Review Course and CPUI Certification (N = 20)	\$ 245/Person X 20 = \$4,900
Cost of Basic PICC Qualification Training	\$ 395/Person X 20 = \$7,900
<b>Total</b>	<b>13,010</b>

Appendix I

Timeline





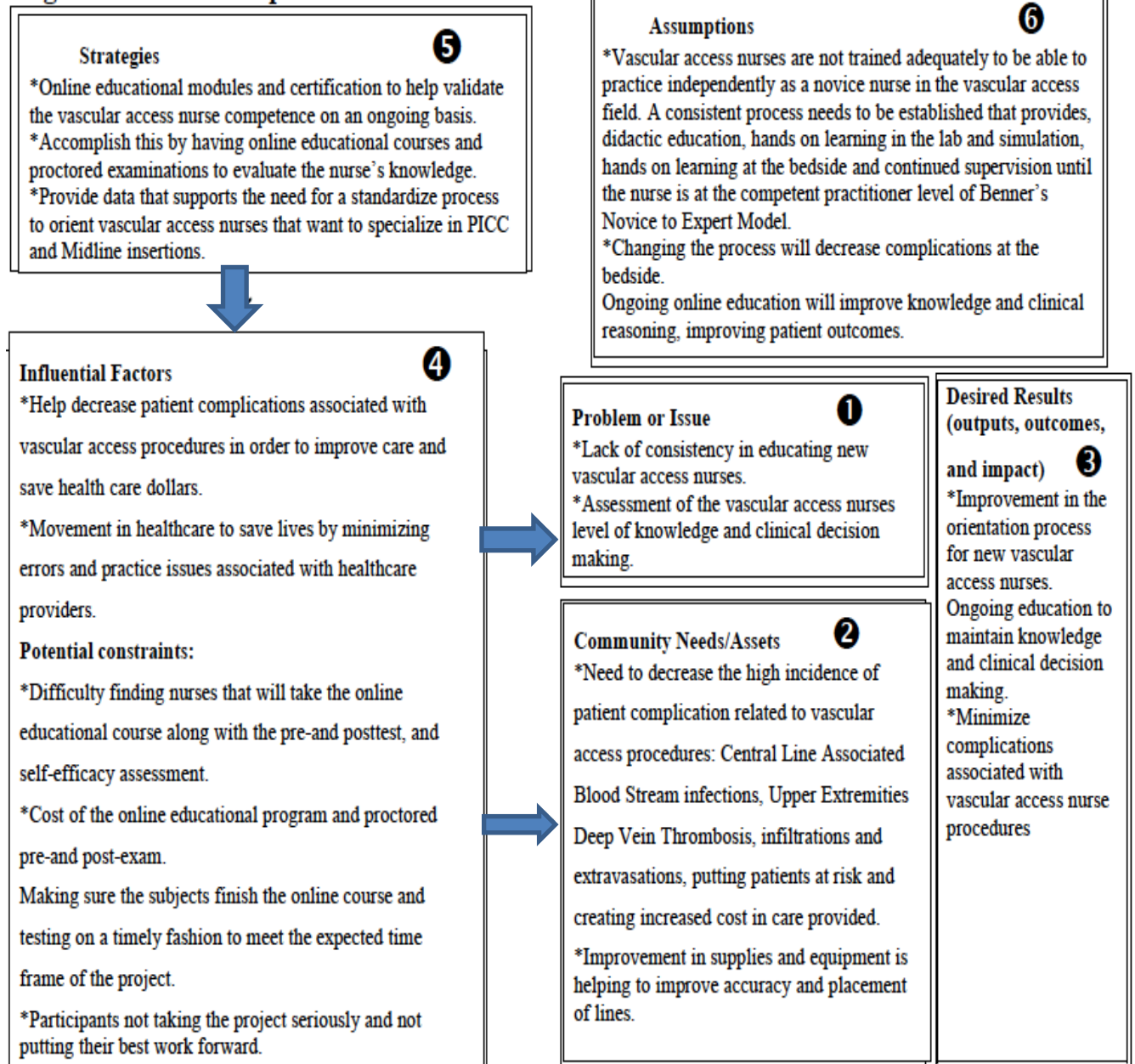
## DNP Project-Julio Santiago DNP Student



## Appendix J

### Logic Model Development

#### Logic Model Development



# VASCULAR ACCESS NURSES'KNOWLEDGE

## Appendix K

### Recruitment Letter

Dear Colleagues,

My name is Julio Santiago, a Doctor of Nursing Practice (DNP) student at Regis University. I am conducting a research study which is required for my degree. My research study, which is a quality improvement initiative (QI), will seek to validate practicing vascular Access Nurses Knowledge, Competence, and Self-Confidence pre and post taking an online educational review program and Certified PICC Ultrasound Inserter (CPUI). This survey is designed to validate practicing vascular access registered nurses that are currently working placing PICC lines and midlines and have a minimum of 25 insertions, all others will be excluded. Your participation in this Quality Improvement project will take **approximately 15 hours to complete**. Participation in the Quality improvement project and successful completion of the project will earn the participants a two-year Certified Ultrasound PICC Inserted Certification at no cost to the participant. Survey access is through [SurveyMonkey \(←Click Here\)](#). Your access to the quality improvement project is confidential, and participation will be an anonymous pooled database. The results of the quality improvement project will be used to better understand practicing vascular access nurses.

Your participation in this effort is greatly appreciated. Please feel free to contact me if you have any questions about the research project.

Warm regards,

Julio Santiago, MSN, RN, CCRN, VA-BC DNP Student Regis University 630-417-9451 cell  
JSantiago001@Regis.Edu

Appendix L

Information Sheet (Informed Consent)



**Informed Consent to Participate in Research**

The Impact of an Online Educational Course on Vascular Nurses' Knowledge, Self-confidence and Competence

You are asked to participate in a research study conducted by Julio Santiago, a Doctor of Nursing Practice (DNP) student from the Loretto Heights School of Nursing at Regis University. Your participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand before deciding whether or not to participate. If you decide to participate, you will be asked to sign this form, and it will serve as a record of your agreement to participate.

**PURPOSE OF THE STUDY**

I am conducting a research study which is required for my degree. My research study, which is a quality improvement initiative (QI), will seek to validate practicing vascular Access Nurses Knowledge, Competence, and Self-Confidence pre and post taking an online educational review program and Certified PICC Ultrasound Inserter (CPUI). The online educational review program and CPUI certification is provided by PICC Excellence, Inc., located in Hartwell, Georgia which is the study site. I am asking you to participate because you are a vascular access nurse who inserts PICC lines.

**PROCEDURES**

If you volunteer to participate in this study, you will be asked to do the following things: **First**, in order to qualify you will need to access the SurveyMonkey® link and complete a brief survey that will ask qualifying questions to see if you meet the pre-requisites as listed below. Please note that you will have a maximum of 3 weeks to complete the prerequisites (total hours to complete approximately 2-4 hours). Further details are provided when you access the survey link:

- a. Verification of PICC Experience
- b. Minimum of 25 successful ultrasound guided PICC insertions, documented by the signature of a supervisor verifying performance
- c. Supervised Insertion Competency Checklist
- d. Copy of Basic PICC Training Certificate (Minimum 8-hour training)
- e. Copy of Professional License
- f. Complete CPUI Application

**Next**, I will be conducting the study by asking you to complete a demographic survey, along with a self- efficacy (self-confidence) questionnaire prior to participating in the program. You will then be directed to take an online proctored 100-question examination prior to having access to the online *Basic PICC Qualification Training review educational program and Certified PICC Ultrasound Inserter (CPUI) review program*. In order to receive certification, you must complete the online educational program and pass the online proctored 200-question post-

## VASCULAR ACCESS NURSES'KNOWLEDGE

examination. At the end of the program, you will be asked to take the online post-self-efficacy questionnaire. Your participation in this study will take approximately 13 to 17 hours and you will have approximately 8 weeks to complete the entire program.

For the pre and post proctored exams you will need a web cam on your computer. PICC Excellence, Inc. uses Remote Proctor Now, an independent Exam Proctoring Service. The system works by capturing a full video recording of what is being displayed on the test-takers computer. The video capture is uploaded and made available to a team of Certified Review Specialists to conclusively determine whether anything other than the exam was accessed during the exam. The pictures and video are only made available to PICC Excellence, Inc. if the participant video is flagged for potential violations

In addition, the cost of the online program and certification exam which is offered and managed by PICC Excellence, Inc. will be waived for the first 40 participants who meet the qualifications and are registered in the program and who participate in this quality improvement project. Once 40 participants have qualified, this quality improvement project will be closed to new participants.

### **POTENTIAL RISKS AND DISCOMFORTS**

There are no known risks to you for participating in this project. We believe that the risk from participation is no greater than that encountered in everyday life. You will have the flexibility to complete the study on your own computers and location of choice. The participant will have a total of 14 weeks to complete the online program and take the pre- post examinations.

### **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

By completing the pre-examination and post-examination, demographic survey, and pre-post self- efficacy assessment you are providing data that can guide practice and contribute to a better understanding of practicing vascular access nurses.

### **PAYMENT FOR PARTICIPATION**

There is no monetary compensation for your participation. For the first 40 participants who qualify and register for the program and who complete the survey and pass the post-examination you will receive a two-year complementary CPUI certification.

### **CONFIDENTIALITY**

Confidentiality will be maintained for all study participants, and all proctored examination results, demographic questionnaire results and self-efficacy (confidence) assessment data will be de-identified to this principle investigator and faculty advisor and reported as aggregate data. I will be using a numerical code for your data that can't be identified with you. Only PICC Excellence, Inc. staff will have access to your identity in order to provide you with a CPUI Certification after successful completion of the post-proctored examination. The documents collected by PICC Excellence Inc. are kept in a secure location on their premises and only designated staff have access to the records. De-identified shared data will be stored on a password secure computer for up to 3 years following the study.

This research is being conducted by a student at Regis University. Therefore, records that identify you and the consent form signed by you may be looked at by others. They are:

## VASCULAR ACCESS NURSES'KNOWLEDGE

- Regis IRB that protects research subjects like you
- Officials at Regis University who are in charge of making sure that we follow the rules of research
- Any faculty members who are advising on this project

### **PARTICIPATION AND WITHDRAWAL**

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer. In addition, by consenting to participate in the project, you are agreeing to maintain confidentiality of the study and the assessment tools. There are no unforeseen circumstances whereby the PI would terminate the participant's participation. The only exemption that will cause a termination of the participant's participation is if PICC Excellence, Inc. makes the decision to terminate the participant's participation in the online certification program due to possible violations during testing, the termination will impact the participant's participation in this quality improvement project.

### **IDENTIFICATION OF INVESTIGATORS**

If you have any questions or concerns about this research, please contact: Julio Santiago DNP Student at [JSantiago001@Regis.Edu](mailto:JSantiago001@Regis.Edu) or 630-417-9451 cell or my DNP Capstone Chair, Dr. Kathleen Whalen, at [kwhalen@regis.edu](mailto:kwhalen@regis.edu) or contact her at 303-458-3599 with any questions/concerns regarding the project.

### **RIGHTS OF RESEARCH SUBJECTS**

If you have any questions about your rights as a research subject, you may contact the Regis University Institutional Review Board (IRB) which is concerned with the protection of volunteers in research projects. You may contact them by any of the methods below:

Mail: Regis University

Center for Scholarship and Research, B-12 3333 Regis Boulevard  
Denver, CO 80221

Phone: (303) 458-4188 Email: IRB at [IRB@regis.edu](mailto:IRB@regis.edu).

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with Regis. The IRB has reviewed and approved this study.

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I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

---

Printed Name of Subject

---

Signature of Subject Date

---

Signature of Investigator Date

Appendix M

PICC Excellence, Inc. Site Approval Letter



**PICC Excellence, Inc.  
1905 Whippoorwill Trail  
Hartwell, GA 30643**

**Letter of Agreement**

*August 4, 2018*

To Regis University Institutional Review Board (IRB):

I am familiar with Julio Santiago's research project entitled Evaluation of the value of Certification. I understand PICC Excellence, Inc.'s involvement to be coordination of the Certification process for up to 40 identified and qualified clinicians, maintaining blinded information to the researcher and instructions to the participants as needed.

I understand that this research will be carried out following sound ethical principles and that participant involvement in this research project is strictly voluntary and provides confidentiality of research data, as described in the proposal. PICC Excellence does not have an institutional review board and as such will accept Regis University IRB decisions and oversight.

Therefore, as a representative of PICC Excellence, Inc., I agree that Julio Santiago's research project may be conducted at and through our agency/institution.

Sincerely,

A handwritten signature in black ink, appearing to read "Nancy L. Moureau", written over a horizontal line.

**Nancy L. Moureau**

**CEO**

**PICC Excellence, Inc**

**[Nancy@piccexcellence.com](mailto:Nancy@piccexcellence.com)**

**706-614-8021**

Appendix N

**CPUI Sample Exam Questions**

1. According to INS standards and CDC recommendations, steps for site preparation for the insertion of a peripherally inserted central catheter include all the following except:
  - A. Use of maximum drapes.
  - B. Establishment of a sterile field with recommended chlorhexidine prepping.
  - C. Use of personal protective equipment including head cover, sterile gloves, sterile gown, and mask.
  - D. Use of protective footwear.
2. When prepping the arm for insertion, how large of an area should be prepped?
  - A. A 2X2 square directly around the intended insertion site.
  - B. A large area, 8-10 inches or more directly around the insertion site, halfway down the arm and high near the shoulder.
  - C. Prep the entire body. You never know what you may need to touch.
  - D. A 4X4 square directly around the intended insertion site
3. When is it necessary to do an x-ray confirmation of the terminal tip placement of a PICC?
  - A. When the PICC is initially placed.
  - B. Following the repositioning of a catheter if fluoroscopy is not used.
  - C. Whenever the tip position is questioned.
  - D. All of the above



Appendix O

**Vascular Access Nurse Self-Efficacy Questionnaire  
(Pretest and Posttest)**

**Please read each statement and circle the number that best defines your confidence related to the statement.**

**1= Never 2 = Sometimes 3 = Around half the time 4 = Most of the time 5= All the time**

1. I am confident in my ability to place a PICC on the first attempt.

1 2 3 4 5

2. I implement the established CDC Guidelines and INS Standards of Practice when placing a PICC.

1 2 3 4 5

3. I am confident detecting complications when assessing a PICC line.

1 2 3 4 5

4. I am confident managing potential complications when assessing a PICC line.

1 2 3 4 5

5. I am comfortable discussing with the "ordering" health care provider the most appropriate venous access device for a patient based on their diagnosis, medical history, vascular access device history, clinical assessment, and prescribed medication.

1 2 3 4 5

6. I am confident in evaluating a PICC or midline for continued necessity.

1 2 3 4 5

7. I am confident recommending prompt removal of a PICC or midline if no longer needed.

1 2 3 4 5

Appendix P

CITI Certificate



# VASCULAR ACCESS NURSES' KNOWLEDGE

## Appendix Q

### Demographic Survey

User Name: \_\_\_\_\_ (For confidentiality of the project, please only use your user name created on the Survey Monkey.)

Please complete the demographic survey. Please choose the best answer for each question.

1. Gender of participant
  - a. Female
  - b. Male
2. Age of participant
  - a. Younger than 25 years old
  - b. 25 to 35 years old
  - c. 36 to 50 years old
  - d. Older than 56 years old
3. Geographic region where you live in the United States
  - a. Northeast
  - b. Midwest
  - c. South
  - d. West
4. Number of years working as a vascular access nurse/PICC nurse
  - a. Less than 2 years
  - b. 2 to 5 years
  - c. 6 to 10 years
  - d. More than 10 years
5. Type of orientation process completed to become a vascular access nurse/PICC nurse?  
Orientation included minimum 8 to 16-hour course – classroom theory and hands on component. (Simulation, hands on use of ultrasound equipment). Observed one to two insertions at the bedside by a qualified vascular access nurse.
  - a. Performed **five or less PICC insertions during the orientation process** at the bedside and was certified to be a vascular access nurse.
  - b. Performed **6 to 10 PICC insertions during the orientation process** at the bedside and was certified to be a vascular access nurse.
  - c. Performed **11 to 25 PICC insertions during the orientation process** at the bedside and was certified to be a vascular access nurse
  - d. Performed **more than 25 PICC insertions during the orientation process** at the bedside and was certified to be a vascular access nurse
6. Place of employment as a vascular access nurse:
  - a. Working as a vascular access nurse in the radiology department of a Hospital.
  - b. Working as a vascular access nurse as part of a PICC team placing PICC lines at the bedside.
  - c. Working as a vascular access nurse for a contracted service or outsourced PICC company.
  - d. Other: \_\_\_\_\_
7. Vascular access certified?
  - a. VA-BC
  - b. CRNI
  - c. N/A

## Appendix R



### **Basic PICC Qualification Training**

This course addresses everything you need to know to begin placing PICCs under supervision. After completion of the program and the post test, you will perform a supervised simulated insertion at your facility or at a training facility. **NOTE:** For the purpose of the DNP Quality improvement Project all participants have met the requirements of PICC insertions.

#### **About the Education Component of the Training:**

This course provides you with the complete education to meet the didactic requirements of minimal training established by the WOCOVA taskforce publication. The course begins with the definition of PICCs. Comprehensive information is then provided regarding all aspects of PICCs including: indications and contraindications for use, device selection, anatomy, vein anatomy, vessel health, vein selection, insertion preparation, step-by-step insertion procedure, complications, care and maintenance and legal aspects.

#### **Program Objectives**

- Examine the definitions of PICC and midline catheters and discuss the indications and contraindications for use
- Identify the veins of upper arm and chest; explain vein selection based on vessel health
- Present brief overview of ultrasound scanning for assessment
- Provide detailed, step-by-step insertion procedure instructions including infection prevention
- Review the common complications associated with PICCs including how to prevent these complications and what to do if a complication is suspected
- Describe basic care and maintenance procedures including daily site assessment and management of catheter flushing for optimal PICC function
- Review legal aspects of intravenous therapy specific to PICCs

#### **About the Additional Component of the Basic Training:**

Simulation and supervised insertions are additional components of training. It is designed to establish patient safety, confirming the clinician has reached competency in the insertion procedure. Simulation is provided as part of a hands-on workshop that you may attend or cover with your supervisor. While there is no set number of supervised insertions required prior to independent placement, it is recommended that you perform enough that you and your supervisor feel you are completely competent and confident to handle a variety of situations. No two insertions are the same. **NOTE:** For the purpose of the DNP Quality improvement Project all participants have met the requirements of PICC insertions.

PICC insertion is considered an advanced level of practice requiring a higher level of knowledge and expertise and is to be performed only by those who have reached the level of specialist, specifically trained for the procedure. A supervisor for PICC insertion observation is qualified through licensure, as with a medical doctor or registered nurse, and through demonstrated successful PICC experience. The purpose of a PICC supervisor is to spot sterile technique, manage any complications that may arise, help the inserter learn from his experiences and allow the insertion to be successful if difficulties arise.

Education and competency are necessary prior to independent PICC insertion. Overall medical liability is reduced with proof of education and competency for a specific procedure. We recommend using the competency forms and Global Rating Scale included as resource material in the course to document your competency as verified by your supervisor.

#### **The Steps:**

- Successfully complete this course and the 50-question post test

## VASCULAR ACCESS NURSES'KNOWLEDGE

- Print your continuing education certificate to use as proof of successful completion of a basic PICC Training program.
- Begin your supervised, simulated insertion (**NOTE:** For the purpose of the DNP Quality improvement Project all participants have met the requirements of PICC insertions.
- Followed by supervised insertions on patients to the point of competency, comfort and confidence. (**NOTE:** For the purpose of the DNP Quality improvement Project all participants have met the requirements of PICC insertions.)

PICC training is a process and includes not just one course, but many courses. Continue to seek out educational opportunities including but not limited to ultrasound training, complication management, and tips and tricks in a variety of areas. **NOTE:** Completion of this course meets and exceeds the requirements of all state, national and international groups specific to PICC didactic training. (PICC Excellence, Inc., 2018)

(PICC Excellence, Inc. (2018) (Available online at company's website)

# VASCULAR ACCESS NURSES' KNOWLEDGE

## Appendix S

### CPUI Review Topics

<ul style="list-style-type: none"><li>• Definition of PICCs</li><li>• Indications for use of a PICC</li><li>• Contraindications</li><li>• Benefits of PICCs</li><li>• Patient Selection</li><li>• Anatomy of Veins and Valves: Vein Selection</li><li>• Anatomy of Veins and Valves: Structure of Veins</li><li>• Pre-medications</li><li>• Informed Consent and History Assessment</li><li>• Infection Control: Universal Precautions</li></ul>	<ul style="list-style-type: none"><li>• Measurements</li><li>• Preparation for Insertion</li><li>• Modified Seldinger Technique</li><li>• Insertion Procedure</li><li>• Documentation of PICC Insertion</li><li>• Radiological Tips</li><li>• Power Injection</li><li>• Potential Complications and Concerns</li><li>• Care and Maintenance</li><li>• Catheter Removal</li><li>• Understanding Ultrasound</li><li>• Vein Selection Guidelines</li><li>• Conclusion</li></ul>
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(PICC Excellence, Inc. (2018))

Appendix T



Certified PICC Ultrasound Inserter – CPUi

[info@piccexcellence.com](mailto:info@piccexcellence.com)

**888 714-1951 toll free**  
**1905 Whipoorwill Tr., Hartwell, GA 30643**

[www.PICCExcellence.com](http://www.PICCExcellence.com)

<p><b>Pre-Requisites:</b></p>	<p>Approved CPUi PICC Certification application</p> <ul style="list-style-type: none"> <li>▪ Proof of Basic PICC Insertion training in the Modified Seldinger Technique (min of 8 hours)</li> <li>▪ Minimum of 25 successful ultrasound guided PICC insertions, documented by the signature of a supervisor</li> <li>▪ Documented proof of a current supervised insertion using competency checklist to confirm adherence to industry standards and guidelines</li> <li>▪ Successful completion of the CPUi PICC Certification Final Exam. The exam is taken from home using a remote proctor service</li> <li>▪ Current professional license</li> </ul>
<p><b>Course Descrip:</b></p>	<p>After registering for the CPUi program, the Applicant prints and completes the application turning it in to PICC Excellence, Inc for approval via email, USPS or fax. When you purchased the CPUi PICC Certification Program you created an online account on the PICC Excellence website. When the application is approved, the CPUi PICC Certification program is automatically added to your online account along with the Practice Exam. Please verify these items are present in your account. If you do not hear from us within 7 days, email us at <a href="mailto:info@piccexcellence.com">info@piccexcellence.com</a> .</p> <ul style="list-style-type: none"> <li>▪ Application for CPUi PICC Certification™ - requests personal information (name, address, etc. ) and requires a copy of a professional license</li> <li>▪ Verification of PICC Experience - requires a record of PICC training history, PICC experience and a list of courses and conferences the candidate has attended and received CE credit. This form requires a notarized signature by an employer or supervisor attesting to the validity of the information and the candidate's identity.</li> <li>▪ Supervised Insertion Competency Checklist - requires the candidate to perform a supervised insertion allowing the preceptor to assess specific step-by-step procedures to ensure candidate is following current guidelines as established by INS and CDC. Both the preceptor and candidate must sign the form upon completion of the assessment.</li> </ul>

## VASCULAR ACCESS NURSES' KNOWLEDGE

	<ul style="list-style-type: none"> <li>▪ Checklist of forms - lists all required forms for submission before application can be processed. This form requires signature of the applicant attesting to the fact that all forms are valid, true, accurate, and are an honest representation of the information provided.</li> <li>▪ PICC Certification™ Study Manual - this is the manual the candidate can use as a study guide prior to taking the 200-question certification exam.</li> </ul>
<b>Course Objective:</b>	The <b>Certified PICC Ultrasound Inserter (CPUI)</b> credentials (PICC Certification™ Program) provide the vascular access clinician validation of a higher level of knowledge and practice in the field of PICC placement. Certification is a process by which an association grants recognition to an individual who has met predetermined standards specified by that association or agency. The CPUI™ does NOT verify competency; rather, PICC Excellence™ is certifying that the candidate has met certain standards of knowledge and training specific to PICCs as a credentialing process.
<b>Note:</b>	The CPUI PICC Certification is not complete until the remote proctor has examined their recording and the written portion of the Final Exam is completed at 80% or better. The Certification Administrator will mail you a letter with a wallet card and a certificate showing you are now a CPUI Certified PICC Ultrasound Inserter. We also send a professional pin for you to wear on your uniform.
<b>Req Textbook:</b>	CPUI PICC Certification Study Guide (included with program)
<b>Course Cost:</b>	\$245.00
<b>Renewal:</b>	Use of the CPUI is valid for two years from the date of issue. Your CPUI PICC Certification must be renewed every 2 years with proof of 6 hours of education and 24 insertions completed over the two-year period.
<b>Renewal Cost:</b>	\$65.00
<b>Method of Eval</b>	200 question Remote Proctored Exam that must be passed with 80% or better.

(PICC Excellence, Inc. (2018) (Available online at company's website)