Education-Based Simulation Training for Ultrasound Guided Anesthesia: Improving Confidence Among Anesthesia Providers

Rochelle Graf, BSN, RN, CCRN, SRNA

Cedar Crest College

Author Note

There is no known conflict of interest to disclose.

This paper is based on the ongoing DNP Project as partial fulfillment of the Doctor of Nursing Practice degree with the guidance and supervision of the following:

DNP Project Chair: Donna Martonik, DNP, ANP, AGACNP: Cedar Crest College

DNP Project Chair: Deborah Burnett-Olsen, DNAP, MSN, CRNA: Cedar Crest College

Correspondence concerning this paper should be addressed to Rochelle Graf, Cedar Crest College, 100 College Drive, Allentown, PA 18104. Email: rlgraf@cedarcrest.edu

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Abstract

Point-of-care ultrasound (POCUS) is an important clinical application that is used daily within the profession of anesthesia. Despite its frequent use, many current practicing CRNAs do not feel confident using POCUS and therefore refrain from using it altogether. Current literature recommends an educational-based simulation training in order to improve the confidence and competence of CRNAs using POCUS. Based on these recommendations, an educational intervention project will be implemented. An educational simulation day will be provided to current practicing CRNAs. Pre- and post-intervention surveys will be conducted to assess CRNAs self-perceived confidence levels before and after the intervention, and a two-month follow-up survey will be distributed to determine the extent of POCUS use post-simulation. This paper further describes the proposed educational intervention.

Keywords: anesthesia, ultrasound, simulation, education, confidence

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Chapter One: Introduction and Overview of Problem of Interest

Point-of-care ultrasound (POCUS) plays an important role in the practice of anesthesia. It is a clinical application that is used daily within the profession, both inside and outside of the operating room. Specifically, POCUS refers to the use of portable ultrasonography at the patient's bedside for therapeutic and procedural, as well as diagnostic purposes. It can be utilized for many procedures, such as central, arterial, and intravenous line insertions and regional anesthesia guidance. Other POCUS applications include airway, lung, abdominal, and focused cardiac ultrasound. Despite the frequent need to use POCUS in daily practice, many certified registered nurse anesthetists (CRNAs) do not feel comfortable or confident with its use. Therefore, an intervention is needed to ensure an increase in competency within this population.

Background and Significance

Ultrasound is considered to be the most commonly used non-invasive diagnostic tool in healthcare (Hani et al., 2019). Current evidence strongly supports the use of POCUS in the clinical area of anesthesia. In an emergent situation, POCUS can quickly aid in identifying an appropriate vein or artery for invasive line insertion. When performing regional anesthesia, POCUS will display a patient's anatomy in real-time, leaving little room for error. Evidence has been consistent that ultrasound guidance reduces potential complications such as vascular injury, local anesthetic systemic toxicity, pneumothorax, and nerve injury (Barrington & Uda, 2018). It has been demonstrated to improve success rates of regional anesthesia and invasive line insertion, as well as decrease complications and pain in patients (Gottlieb et al., 2017).

In order to successfully utilize POCUS, the clinician must first acquire an image and then correctly interpret the image, as well as the anatomy, depicted on the screen. Next, the needle must also be visualized on the screen and then guided to the desired target anatomy. The process often requires constant needle manipulation with simultaneous adjustments of the ultrasound transducer (Kim & Tsui, 2019). Performing POCUS examinations relies on fine motor skills as well as visual-cognitive skills. Proper motor skills are needed for the required hand-eye coordination between the ultrasound probe and the ultrasound image on the screen. According to the literature on learning motor skills, new learners initially have difficulties managing hand-eye coordination, but with time their movements become increasingly more effortless, smooth, and with fewer errors (Tolsgaard, 2018). It may take the learner some time to develop the hand-eye coordination needed to successfully use POCUS, which is why recent literature suggests the use of simulation-based training.

This training is essential for practicing CRNAs to master. Lack of confidence and/or competency with POCUS use can have negative patient outcomes, such as a delay in needed care or unsafe performance. Simulation-based training will allow the CRNA to practice POCUS techniques in a safe environment, that allows room for error. Recent evidence shows that simulation-based training can improve patient outcomes compared with didactic teaching alone (Chen et al., 2017).

PICO Question Guiding Inquiry

Point-of-care ultrasound has recently been added to the current doctoral standards for nurse anesthesia programs to accommodate the rapid escalation of its use in diagnostics, as well as for establishing vascular and regional access. Despite the increasing need for education in this area, many CRNAs have not been properly trained on POCUS use. Ultrasound requires not only

theoretical knowledge but also extensive practical experience (Hani et al., 2019). The PICO question that has been formulated for this specific DNP project is: For certified registered nurse anesthetists (CRNAs), does the use of education-based simulation training for ultrasound-guided anesthesia compared to no simulation training improve the knowledge, confidence, and incorporation of ultrasound use within the clinical practice setting?

System and Population Impact

An organizational gap analysis and needs assessment was conducted at the authors' clinical site at the time of initial project development. This clinical site is an acute care, Level I trauma center with various anesthesia providers, such as CRNAs, anesthesiologists, and resident anesthesiologists. A discussion was held with various anesthesiologists and CRNAs to determine the exact clinical needs of the organization. Many CRNAs, especially those who have been practicing for several years, stated that they had never received proper training on the use of POCUS and therefore do not feel comfortable using it. It was determined that an educational simulation day would be of benefit to current practicing CRNAs. Providing this education on POCUS will ensure that current CRNAs receive the most up-to-date and evidence-based training. This will be implemented at the Cedar Crest College nursing simulation center and feature different stations, each focusing on a different application of POCUS. The simulation center was chosen as the site of implementation in an effort to include CRNAs from other local health care institutions who may be interested in receiving this education.

Purpose

The purpose of this evidence-based project is to determine if the implementation of education-based simulation will improve anesthesia provider self-perceived confidence in their ability to perform POCUS. Since POCUS is a frequently used skill within the anesthesia

profession, it is imperative that CRNAs are comfortable with its use. Through this project implementation, anesthesia providers will have the opportunity to improve their POCUS skills. There will be three different skill opportunity stations for providers to receive hands on practice. After completing the education, the post-survey will determine if confidence levels have increased within this population.

Objectives

The goal of this proposed project is to use an educational simulation to improve anesthesia provider confidence in performing POCUS. Specific objectives of this project include:

1. CRNAs self-perceived confidence and knowledge levels in using ultrasound will increase after attending the educational-based ultrasound simulation, as indicated with the information provided by the pre-intervention and post-interventions surveys.
2. Incorporation of ultrasound use within the clinical setting will increase for CRNAs who attended the educational-based ultrasound simulation, as evidenced by data that is collected from the follow up surveys provided post-intervention.

Chapter Two: Review of Evidence/Literature

Search Methodology

A literature search was conducted within the electronic databases of PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Google Scholar. The search included the keywords “ultrasound”, “simulation”, “education”, and “anesthesia”. Additional literature was sourced from the reference lists of relevant original publications, if deemed to adequately answer the proposed PICO question. The PubMed search yielded 493 articles, CINAHL yielded 16 articles, and Google Scholar yielded 21,400 articles. The inclusion time frame range was set from 2017 to present time, in order to ensure current publications would result. The primary population included in the search criteria was anesthesia providers, but also included other health care providers who may use POCUS such as physicians, medical students, and ultrasound technicians. All research articles that did not properly address the PICO question were excluded. Non-research articles were also excluded from the search. Ultimately, five articles were selected from these results and examined for evidence that would assist in answering the PICO question. The studies chosen for this research were closely reviewed to determine if the results and/or outcome would adequately address the specific PICO question.

Findings

All of the selected studies used ultrasound simulation as the intervention. The systematic review by Chen et al. (2017) examined the effectiveness of simulation-based education for the acquisition and maintenance of competence in ultrasound guided regional anesthesia. The other four studies implemented simulation-based training programs for various healthcare providers with the goal of improving confidence and competence in POCUS use. The studies by Chen et al. (2017) and Le et al. (2019) compared simulation training to non-simulation training to

evaluate knowledge acquisition of the participants involved. Both studies found that the groups who received education by way of simulation training had significantly better outcomes. In particular, Chen et al. (2017) found that simulation-based POCUS training was significantly more effective than alternative teaching methods or no intervention. Additionally, simulation-based training improved patient outcomes as compared to didactic teaching (Chen et al., 2017). In the study by Hani et al. (2019), participants agreed that the ultrasound simulation provided a realistic setting and that it allowed for training and identification of pathologies. Lastly, Zawadka et al. (2019) found that one day of POCUS training integrated into an anesthesia program curriculum improved performance in the post-training test scores and improved the confidence scores of the participants. A full evidence synthesis table can be found in Appendix A.

Limitations

There were several limitations identified within the literature review. Limited studies were found which specifically targeted anesthesia providers. Many of the studies included other healthcare providers, such as medical students and doctors. Despite this, the studies can still be used since POCUS is a skill that many medical professionals are required to have, no matter what their background may be. Other identified limitations include small sample sizes, early discontinuation, and participation drop out. Since these limitations are minor, they will not have a significant effect on the project.

Conclusions

All of the selected studies were in agreement that ultrasound-based simulation education is an effective learning tool for increasing proficiency with POCUS. For the CRNA population, an educational intervention is needed to ensure an increase in competency within this population. Current evidence supports using simulation-based training to increase provider confidence in

performing POCUS. This evidence-based project will provide CRNAs will a safe practice environment, ultimately increasing their skills and confidence with POCUS use.

Chapter Three: Organizational Framework of Theory

The framework selected to guide this project is the Iowa Model for Sustainability Framework. This framework involves seven evidence-based steps. They include identifying an issue or opportunity, stating a purpose, forming a team, synthesizing the body of evidence, designing and piloting the practice change, integrating and sustaining the practice change, and finally, dissemination (Cullen et al., 2022). This framework was chosen because of its applicability to this specific DNP project.

First, the authors assessed current clinical practice of CRNAs, including any issues or opportunities for improvement. It was determined that education was required in the area of POCUS and therefore the purpose of this DNP project would focus on educating CRNAs on POCUS use. Next, a team was formed which consists of DNP chair members and a total of three DNP students. Evidence was synthesized, which included research articles that demonstrate increased provider knowledge, confidence, and use of POCUS in the clinical practice setting.

Through the implementation of this project, an intervention will occur, which is the planned educational simulation day. Lastly, outcomes will be evaluated by way of post-intervention surveys and data analysis. The POCUS simulation will be an educational intervention project. Through simulation education, this project intends to improve the confidence of CRNAs when performing POCUS.

Since POCUS is a required skill for the profession, it is imperative that CRNAs are fully educated on this topic (Tolsgaard, 2018). As previously stated, a pre-intervention and post-intervention survey will be completed by the participants in order to assess self-perceived confidence and knowledge in performing this skill. Additionally, a two-month follow-up survey will be sent out to determine the extent of incorporation of POCUS into the clinical practice

setting, which will also illustrate whether the practice change was integrated and sustained in the daily practice of CRNAs.

Chapter Four: Project Design

After the discussion with key stakeholders regarding initial project ideas, it was decided to create an evidenced-based education simulation regarding the use of POCUS. With the support of clinical leaders at the authors' clinical sites, along with the faculty at the Cedar Crest College School of Nursing, a plan was formed for an educational day to be held at the nursing simulation center. Since the project will be implemented at Cedar Crest College, rather than a specific clinical site, institutional review board (IRB) approval would only need to be obtained from Cedar Crest College's IRB, instead of a hospital's IRB.

Institutional Review Board (IRB) Approval

Institutional review board approval was sought to ensure the safety and rights of the participants will be protected. An application was submitted by the DNP group members to Cedar Crest College's IRB for review and project approval. This application included the objectives of research, methods to be used, recruitment procedures, requirements for participation, possible risks and benefits, assurance of anonymity and confidentiality, and security of data. An informed consent form for participants was also included with the application. The IRB application was initially submitted on September 23rd, 2022. It was determined that there were revisions required before the application could be approved, so these changes were made, the application was resubmitted, and final IRB approval was granted on October 25th, 2022.

Implementation Plan

The POCUS simulation will be an educational intervention project, implemented at the School of Nursing Simulation Center at Cedar Crest College in Allentown, Pennsylvania. Due to its centralized location, Cedar Crest College was deemed an appropriate place to host the

educational simulation day. The simulation center was chosen instead of a specific hospital clinical site because it already features much of the equipment and materials needed for this event. The tentative date for implementation is January 7th, 2023.

An informational flyer will be displayed in Reading Hospital's break room to create awareness of this educational simulation and provide information regarding how CRNAs can sign up for the simulation day. The sign-up will have a limited number of slots available, to ensure all the necessary education can be covered in a timely manner. On the day of the simulation, participating CRNAs will be given an informed consent form to read and sign. Following this, a pre-intervention survey will be filled out. The day will begin with a brief PowerPoint presentation regarding different ultrasound techniques. After the presentation, the CRNAs in attendance will rotate through three different ultrasound stations including one with a hands-on experience with the Blue Phantom ultrasound simulator, intravenous catheter placement, and arterial line catheter placement. Finally, a post-intervention survey will be completed by all participants.

Data Collection Tools

Through simulation education, this project intends to improve the confidence of CRNAs when performing POCUS. Since this is a required skill for the profession, it is imperative that CRNAs are fully educated on this topic. As previously stated, a pre-intervention and post-intervention survey will be completed by the participants in order to assess self-perceived confidence and knowledge in performing this skill. Additionally, a two-month follow-up survey will be sent out to determine the extent of incorporation of POCUS into the clinical practice setting.

There is currently no specific existing tool that can measure provider confidence after POCUS simulation. Therefore, a self-efficacy scale will be used. Self-efficacy is defined as the participant's personal perceived ability to perform a target behavior, which in this case is POCUS (Williams & Rhodes, 2016). The self-efficacy scale by Bandura (2006) will be used for this project. This measurement instrument utilizes a scale of 1-100, on which participants can rank their levels of self-confidence in performing POCUS.

The authors are planning to use the SPSS v.25 software to perform the data analysis after collection is complete. Statistics will be also utilized to determine the mean self-reported confidence level of participants before and after the intervention. Depending on the final sample size of the participants, a nonparametric (Wilcoxin) or parametric (paired t-test) test will be used for data analysis. If the final sample size is small, the Wilcoxin test will be used. If it is on the larger size, the paired t-test would be more appropriate.

Resources Needed

Most of the materials required for this project are already available. For example, the Blue Phantom, practice mannikins, and large ultrasound machines are currently located in the nursing simulation center. In addition, the authors already possess Butterfly iQ handheld ultrasounds which can also be utilized on the day of the simulation. The intravenous and arterial catheters needed for practicing may need to be purchased, depending on the availability of them within the simulation center and the total amount of participants in attendance. Other miscellaneous items needed include gloves, cleaning wipes, and hand sanitizer.

Budget Justification

The total cost of the needed materials is estimated to be approximately $100 per group member, which would equate to $300 total. This is dependent on the total number of CRNA

participants in attendance. As previously stated, the nursing simulation center has much of the needed materials, so the only items that would need to be purchased are the intravenous and arterial catheters along with the miscellaneous items. Additionally, whenever possible, the DNP group team members will repurpose expired or sample materials from their clinical sites that would be appropriate for a simulation.

Chapter Five: Implementation Procedures and Processes

Population

A needs assessment was conducted at the authors' clinical site at the time of initial project development to gauge interest in potential project ideas. This clinical site is an acute care, Level I trauma center with various anesthesia providers, such as CRNAs, anesthesiologists, and resident anesthesiologists. A discussion was held with numerous anesthesiologists and CRNAs to determine the exact clinical and educational needs of the organization. Many CRNAs, especially those who have been practicing for several years, stated that they had never received proper training on the use of POCUS and therefore do not feel comfortable using it in clinical practice. It was determined that an educational simulation day would be of benefit to current practicing CRNAs.

The authors of this projected decided that the inclusion criteria of this educational DNP project would be current practicing CRNAs above 18 years of age. Due to the needs expressed in previous discussions with current CRNAs in the clinical setting, it was decided that they would be the focus of this educational intervention. The authors did consider including other anesthesia providers, such as physician anesthesiologists and student registered nurse anesthetists (SRNAs), but ultimately decided to only include CRNAs, since they were identified to have the most education need in the clinical area of POCUS.

Setting

This will be implemented at the Cedar Crest College nursing simulation center and feature different stations, each focusing on a different application of POCUS. The simulation center was chosen as the site of implementation due to its central location and as an effort to include CRNAs from other local health care institutions who may be interested in receiving this

education. Awareness of this DNP project educational simulation day was communicated to staff CRNAs by way of informational flyers that were posted within the clinical site's breakroom. These flyers provided information about the educational simulation day, such as the purpose of the project, date and time, location, and instructions on how to sign up electronically via a QR code.

Procedures

Participants will be able to sign up on the website until all spots have been filled. Also included within the electronic sign-up page is an informed consent form to read and agree to. Participants will be advised to read the consent in its entirety and if they agree to participate, they will electronically sign the consent form. Completion and submission of this is an indication of their consent to participate in this study. Following this, a pre-intervention survey will be filled out via a link on the sign-up page.

On the day of the simulation training at Cedar Crest College, a 15-minute educational PowerPoint presentation about POCUS and the various simulation stations will be shown to all participants. Following the presentation, the participants will begin to rotate through the various skill stations. The skill stations offered include hands-on training with an ultrasound simulator, intravenous catheter insertion, and arterial line insertion. Each CRNA will have the opportunity to then rotate through each simulation station, lasting approximately 30 minutes each, and practice the skills demonstrated on the PowerPoint. Finally, a 15-minute debriefing will be held, and the post-intervention survey will be completed by all participants at the conclusion of the educational simulation day.

The collected electronic survey data will then be placed on a password protected computer where the password is known only to the researchers and faculty sponsors. All copies

of the raw electronic data will be encrypted with a similar password. The data will only be accessible to the DNP group members. The authors are planning to use the SPSS v.25 software to perform the data analysis after data collection is complete. Statistics will be also utilized to determine the mean self-reported confidence level of participants before and after the intervention. Depending on the final sample size of the participants, a nonparametric (Wilcoxin) or parametric (paired t-test) test will be used for data analysis. If the final sample size is small, the Wilcoxin test will be used. If it is on the larger size, the paired t-test would be more appropriate.

Providing this education on POCUS will ensure that current CRNAs receive the most up-to-date and evidence-based training. Current evidence supports using simulation-based training to increase provider confidence in performing POCUS (Tolsgaard, 2018). This project will provide CRNAs with a safe practice environment, ultimately increasing their skills and confidence with POCUS use. The results of this DNP project will be disseminated at Cedar Crest College in the spring of 2023. Additional options for project dissemination may include hosting additional workshops to provide a safe environment for CRNAs and SRNAs to practice POCUS or making the information available to a larger audience on an online platform.

Chapter Six: Evaluation and Outcomes

Demographics

The attendees who participated in the simulation education day consisted of eight CRNAs. Ten CRNAs had originally signed up, but two were unable to make it for personal reasons on the day of the simulation. A pre-intervention survey was administered to and completed by all participants prior to the simulation education. This survey evaluated years of anesthesia experience, current ultrasound usage, and confidence levels as they relate to various aspects of ultrasound usage. The experience between the participants varied from one year to greater than 26 years of experience. Some of the participants had never used an ultrasound in the past, while others frequently utilize it within their anesthesia practice.

Evaluation

The pre-intervention and post-intervention surveys consisted of the same seven questions related to self-perceived confidence when using ultrasound. All survey responses were anonymous. The data analysis from both surveys was then completed using statistics. A paired t-test was used to compare the pre-intervention confidence levels to the post-intervention confidence levels. An alpha value of $p < 0.05$ was used to test for statistical significance. The resulting data cannot be ruled statistically significant due to the small sample size, but according to the following p-values it can be determined to be clinically significant.

Confidence in knowledge, experience, and training regarding ultrasound

The first survey question determined the participating CRNAs self-perceived confidence in their overall knowledge, experience, and training regarding ultrasound. The mean score of the pre-intervention survey results was 2.25 and the mean score of the post-intervention survey results was 4.38, with a resulting p-value of 0.003.

Comfort while using the ultrasound machine

The second survey question assessed the participants' comfort level with using the ultrasound machine. The mean score of the pre-intervention survey results was 2.5 and the mean score of the post-intervention survey results was 4.38, with a resulting p-value of 0.008.

Comfort with obtaining ultrasound images

The third survey question assessed the participants' comfort level with obtaining ultrasound images. The mean score of the pre-intervention survey results was 2.5 and the mean score of the post-intervention survey results was 4.5, with a resulting p-value of 0.007.

Comfort with interpreting ultrasound images

The fourth survey question assessed the participants' comfort level with interpreting the obtained ultrasound images. The mean score of the pre-intervention survey results was 2.63 and the mean score of the post-intervention survey results was 4.5, with a resulting p-value of 0.008.

Comfort with incorporating ultrasound into clinical practice

The fifth survey question assessed the participants' comfort level with incorporating ultrasound into clinical practice. The mean score of the pre-intervention survey results was 2.88 and the mean score of the post-intervention survey results was 4.63, with a resulting p-value of 0.009.

Confidence choosing the correct orientation of the ultrasound probe

The sixth survey question assessed the participants' confidence when choosing the correct orientation of the ultrasound probe. The mean score of the pre-intervention survey results was 2.75 and the mean score of the post-intervention survey results was 4.5, with a resulting p-value of 0.009.

Confidence when adjusting the gain and depth to maximize picture quality on the ultrasound machine

The seventh and final survey question assessed the participants' confidence when adjusting the gain and depth to maximize picture quality on the ultrasound machine. The mean score of the pre-intervention survey results was 2.63 and the mean score of the post-intervention survey results was 4.63, with a resulting p-value of 0.002.

Outcomes

As previously discussed, the purpose of this evidence-based project was to determine if the implementation of education-based simulation will improve anesthesia provider self-perceived confidence in their ability to perform ultrasound. Through hands-on education simulation, this project provided current practicing CRNAs the ability to improve their ultrasound skills. Based on the results of the pre-implementation and post-implementation surveys, it was discovered that through the implementation of this project, the self-confidence levels of the CRNAs in attendance significantly increased after attendance of this simulation education. Therefore, the desired outcomes of this implementation have been achieved.

Discussion

This simulation education helped to ensure that current CRNAs received the most up-to-date and evidence-based training. As previously stated, current evidence supports using simulation-based training to increase provider confidence in performing POCUS (Tolsgaard, 2018). Many CRNAs, especially those who have been practicing for many years, have not received training in POCUS. This project provided CRNAs with a safe practice environment, which ultimately lead to an increased confidence level with POCUS use. Despite the smaller sample size, there was an overall high satisfaction and confidence level increase self-reported by

the CRNAs who attended the simulation education day. This is proof that even small interventions such as these can make a significant impact in the patient population in any given setting.

Chapter Seven: Implications for Nursing Practice

Implications for Practice

Through the educational simulation provided on POCUS, CRNAs were able to receive current, evidence-based training. The simulation day allowed the CRNAs to practice in a safe, non-stressful environment, which ultimately increased their skills and confidence with POCUS use. The goal of this project was to improve the confidence level of current practicing CRNAs when performing POCUS. The outcomes were achieved by the end of the simulation day. Implications for future nursing practice could include anesthesia departments adopting this educational simulation day outline thus providing this extra confidence to their anesthesia staff. Additionally, anesthesia departments could include this within their yearly educational trainings, to ensure all staff is receiving the same level of education on a regular basis, which will increase provider confidence levels overall.

Strengths of the Project

This project had many strengths, which were evident on the day of the simulation education. The participants stated that they appreciated the multiple, hands-on stations which allowed for a variety of POCUS skills to be practiced. The skill stations offered included hands-on training with an ultrasound simulator model, intravenous catheter insertion, and arterial line insertion. The participants were able to use different ultrasound machines to develop comfort and dexterity skills, as well as to obtain and interpret ultrasound images. Additionally, the participants received education on adjusting the gain and depth to maximize picture quality on the ultrasound machine, which most of them had stated they were unfamiliar with in the pre-survey results.

Other strengths of the project include the usage of technology throughout this project implementation. A project website was created which consisted of the informed consent form, demographic survey, pre-intervention survey, and post-intervention survey. All of these forms were located in one place and easily accessible by the scanning of a QR code from the individual participant's personal device, making the data collection process efficient and secure.

Limitations of the Project

The main limitation of this project was the small sample size. Due to the requirements of the project, the authors were limited in how many participants could attend. This was due to the small space size of the hosting location, as well as the amount of time required for rotating through each skill station. A total of eight participants attended the simulation day, limiting the power of the statistical significance. Despite the smaller sample size, there was a self-reported high satisfaction and confidence level increase by the CRNAs who attended the simulation education day. This demonstrates that small interventions such as this can still make a significant impact, despite not having a large sample size.

Linkage to DNP Essentials

The Doctor of Nursing Practice (DNP) Essentials are the competencies required for DNP education and practice. In order for DNP programs to meet accreditation requirements, these eight essential elements must be incorporated into the educational curriculum. Throughout the creation and implementation of this project, all eight essentials were met and addressed. Further detail and discussion will follow.

Essential I: Scientific Underpinnings for Practice

The first DNP essential states that the scientific underpinnings of this education reflect the complexity of practice at the doctoral level. One focus of this essential is nursing actions or

processes that lead to positive change (AACN, 2006). An evidence-based literature review was conducted in order to recognize areas of nursing that are in need of change, and it was determined that many CRNAs have not received training in POCUS. This collected information led to the creation of this project.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

The second DNP essential focuses on organizational and systems leadership. The DNP-prepared nurse must be skilled in working within organizational and policy arenas and in the provision of patient care by themselves or others. This includes understanding principles of practice management, including conceptual and practical strategies for balancing productivity with quality of care (AACN, 2006). This essential was met by evaluating and then developing care delivery approaches that meet current and future needs of patient populations based on scientific findings. A needs assessment was conducted for current CRNAs, which recognized a decreased confidence in performing POCUS. Stakeholders were met with to determine how to correct this need.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

The third essential recognizes that scholarship and research are key features of a DNP education. Doctoral programs in nursing are designed to prepare graduates with the research skills necessary for discovering new knowledge in the discipline (AACN, 2006). Existing literature and other evidence were evaluated to determine and implement the best evidence for current anesthesia practice. The educational simulation day was created based on this evidence to promote safe, patient-centered care.

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

The fourth DNP essential focuses on using information systems and technology to support and improve patient care and healthcare systems. Knowledge and skills related to information systems and technology, as well as patient care technology, prepare the DNP graduate to apply new knowledge and assess the efficacy of patient care technology (AACN, 2006). Technology was used throughout this project, from the creation of it to its implementation. A project website was created for signing up, which consisted of the informed consent form, demographic survey, pre-intervention survey, and post-intervention survey. Technology was also used for communication with group members and participants through the entirety of the project.

Essential V: Health Care Policy for Advocacy in Health Care

The fifth essential involves health care policy and advocacy. Engagement in the process of policy development is central to creating a health care system that meets the needs of its constituents (AACN, 2006). This DNP essential highlights the importance of educating others regarding nursing, health policy, and patient care outcomes. This specific project did not directly involve healthcare policy development, but it did require the group members to effectively educate others about a health care intervention designed to improve patient outcomes.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

The sixth essential recognizes the importance of interprofessional collaboration. The goal is that DNP graduates are prepared to be effective team leaders and play a central role in establishing interprofessional teams, participating in the work of the team, and assuming

leadership of the team when appropriate (AACN, 2006). From the start of the DNP project process, the project group members worked together closely with the DNP chair, mentor, and stakeholders at the clinical site. Through this teamwork, the project was created and successfully implemented, leading to improved patient outcomes.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

The seventh DNP essential focuses on implementation of clinical prevention and population health activities. There has been a longstanding focus on health promotion and disease prevention in nursing curricula and roles and the DNP graduate is prepared with a foundation in clinical prevention and population health (AACN, 2006). This essential was met by the analysis of biostatistical and other appropriate scientific data related to the goals and outcomes of this project, which includes improving provider confidence levels. An improvement in provider confidence levels will ultimately lead to improving the health and outcomes of patients.

Essential VIII: Advanced Nursing Practice

The final essential involves the expectations of advanced nursing practice. All DNP graduates are expected to demonstrate refined assessment skills and base practice on the application of nursing science as appropriate in their area of specialization (AACN, 2006). This project fulfilled this essential since POCUS is an important assessment skill for CRNAs to have, and an increased knowledge of it assisted in raising their overall confidence levels with it. Increased confidence in performing POCUS demonstrates advanced levels of clinical judgment and accountability in delivering evidence-based care to improve patient outcomes.

Chapter Eight: Summary of Project

Summary and Conclusions

Ultrasound is the most commonly used non-invasive diagnostic tool in healthcare (Hani et al., 2019). Anesthesia providers utilize POCUS daily for multiple tasks such as the insertion of invasive lines, identification of anatomy for the safe performance of nerve blocks, and to perform diagnostic bedside imaging. Current evidence has been consistent that POCUS reduces potential complications such as vascular injury, local anesthetic systemic toxicity, pneumothorax, and nerve injury (Barrington & Uda, 2018). It has also been demonstrated to improve success rates of regional anesthesia and invasive line insertion, as well as decrease complications and pain in patients (Gottlieb et al., 2017).

Due to the increasing popularity of POCUS, anesthesia providers are expected to be proficient in its use. Despite the frequent need to use POCUS in daily practice, many CRNAs do not feel comfortable or confident with its use. Therefore, an educational intervention is required to ensure an increase in competency within this population. This training is essential for practicing CRNAs to master. Lack of confidence and/or competency with POCUS use can have negative patient outcomes, such as a delay in needed care or unsafe performance. Simulation-based training will allow CRNAs to practice POCUS techniques in a safe environment, that allows room for error. Recent evidence shows that simulation-based training can improve patient outcomes compared with didactic teaching alone (Chen et al., 2017).

After a discussion with key stakeholders, it was decided to create an evidenced-based education simulation regarding the use of POCUS. This educational simulation day allowed current practicing CRNAs to improve their POCUS skills in a controlled, safe environment, which ultimately increased their skills and confidence with POCUS use. The goal of this project

was to improve the confidence level of current practicing CRNAs when performing POCUS. The outcomes were achieved by the end of the simulation day. Despite the smaller participant sample size, there was an overall high satisfaction and confidence level increase self-reported by the CRNAs who attended the simulation education day. This is proof that even small interventions such as these can make a significant impact in the patient population.

Dissemination Plans

Further awareness of this project will be created in various ways. This will ensure that the proper populations receive information regarding safe and effective POCUS use. This project will be disseminated on April 20th, 2023 at the Cedar Crest College School of Nursing to faculty members and students. Additionally, the group members plan to submit to an anesthesia conference for presentation.

Future Ideas

Due to the successful implementation of this DNP project, there are many implications for future nursing anesthesia practice. Besides making these project findings known to other anesthesia providers by way of national conferences, there are many other avenues for raising awareness regarding POCUS use for CRNAs. Attendees of the educational day expressed interest in attending other ultrasound-related workshops, as well as discussed the idea of hosting hospital-based educational days related to this topic. Through the various uses of education-based simulation, confidence can be improved among anesthesia providers.

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Appendix A: Evidence Synthesis Table

PICO Question: For Certified Registered Nurse Anesthetists (CRNAs), does the use of education-based simulation training for ultrasound-guided anesthesia compared to no simulation training improve the knowledge, confidence, and incorporation of ultrasound use within the clinical practice setting?								
Author & Date	**Aim & Research Design**	**Sample Size, Population & Setting**	**Methods**	**Measures & Outcomes**	**Study Findings that Answer the PICO**	**Limitations**	**Evidence Rating**	
							Level	**Quality**
Chen, X. X., Trivedi, V., AlSaflan, A. A., Todd, S. C., Tricco, A. C., McCartney, C., & Boet, S. (2017).	This systematic review aimed to examine the effectiveness of simulation-based education for the acquisition and maintenance of competence in ultrasound guided regional anesthesia.	176 citations and 45 full-text articles were reviewed, 12 studies were included.	Simulation-enhanced training was compared to non-simulation training to evaluate knowledge acquisition.	Seven studies measured skill acquisition, one study measured transfer of learning into the clinical setting, two studies examined patient outcomes.	Simulation-enhanced training was significantly more effective than alternative teaching methods or no intervention. Simulation-based training improved patient outcomes compared with didactic teaching.	One study was discontinued early because of technical challenges.	I	A
Davis, J. D., Treggiari,	Prospective study was	228 anesthesia providers and	Training program	Success of the program was	Through this simulation	Participant dropout (36	II	B

PICO Question: For Certified Registered Nurse Anesthetists (CRNAs), does the use of education-based simulation training for ultrasound-guided anesthesia compared to no simulation training improve the knowledge, confidence, and incorporation of ultrasound use within the clinical practice setting?								
Author & Date	**Aim & Research Design**	**Sample Size, Population & Setting**	**Methods**	**Measures & Outcomes**	**Study Findings that Answer the PICO**	**Limitations**	**Evidence Rating**	
							Level	**Quality**
M. M., Dickson, E. A., & Schulman, P. M. (2021).	conducted to develop and implement a comprehensive program to train providers to place subclavian central venous catheters (CVCs) using real-time ultrasound guidance.	intensivists were eligible to participate, 106 participants voluntarily enrolled, 70 successfully completed the program at academic medical center.	consisted of a didactic module, hands-on instruction and practice using a CVC simulator and a standardized patient.	measured by pre and post knowledge tests and direct observation during the hands-on sessions.	participants learned how to successfully perform ultrasound-guided catheterization of the subclavian vein. A simulation-based module with competency evaluation in CVC placement should be a standard component of training and continuing education.	of 106 participants who completed phase 1 did not go on to complete the in-person training Lack of follow-up for long-term knowledge and skill retention		

PICO Question: For Certified Registered Nurse Anesthetists (CRNAs), does the use of education-based simulation training for ultrasound-guided anesthesia compared to no simulation training improve the knowledge, confidence, and incorporation of ultrasound use within the clinical practice setting?								
Author & Date	**Aim & Research Design**	**Sample Size, Population & Setting**	**Methods**	**Measures & Outcomes**	**Study Findings that Answer the PICO**	**Limitations**	**Evidence Rating**	
							Level	**Quality**
Hani, S., Chalouhi, G., Lakissian, Z., & Sharara-Chami, R. (2019).	Exploratory study aimed to assess health care professionals' need for and enthusiasm toward practicing using ultrasound via simulation.	Setting was a medical center and included 41 health care providers, such as physicians, nurses, ultrasound technicians, residents, and medical students.	A day-long intervention was organized to provide a free-of-charge interactive ultrasound simulation workshop—using CAE Vimedix high-fidelity simulator.	Following the intervention, attendees completed an evaluation, which included 4 demographic questions and 16 close-ended questions based on a Likert scale agree-neutral-disagree. The results are based on this evaluation form.	Participants agreed that ultrasound provided a realistic setting and that it allowed for training and identification of pathologies.	Small study Only includes analysis of one workshop	II	B
Le, C. K., Lewis, J., Steinmetz, P., Dyachenko, A., & Oleskevich, S. (2019).	Randomized-controlled trial evaluated the use of ultrasound simulators for retaining	Fourth-year medical students (n = 19) with prior training in point-of-care sonography were recruited	Students were randomly assigned to a study group (n = 10) with simulation use. The control group (n = 9) had	A blinded assessment of the students was performed before and after the 4-week study period to evaluate their	Students in the study group performed better than those in the control group on the visual examination	Small sample size	I	B

PICO Question: For Certified Registered Nurse Anesthetists (CRNAs), does the use of education-based simulation training for ultrasound-guided anesthesia compared to no simulation training improve the knowledge, confidence, and incorporation of ultrasound use within the clinical practice setting?								
Author & Date	**Aim & Research Design**	**Sample Size, Population & Setting**	**Methods**	**Measures & Outcomes**	**Study Findings that Answer the PICO**	**Limitations**	**Evidence Rating**	
							Level	**Quality**
	and improving ultrasound skills acquired in undergraduate ultrasound training.	for this study, done at a Canadian university	no access to a simulator or ultrasound training.	image acquisition skills on standardized patients (practical examination).	and on the practical examination after the 4-week study period.			
Zawadka, M., Graczyńska, A., Janiszewska, A., Ostrowski, A., Michałowski, M., Rykowski, M., & Andruszkiewicz, P. (2019).	This prospective study aimed to assess the effectiveness of a one-day POCUS simulation course.	57 final year medical students in anesthesia training participated in this study at a medical school's simulation center.	The one-day POCUS training consisted of four lectures, seven practical skill training sessions on models, and one computer-based ultrasound interpretation session.	The knowledge of the students on POCUS was assessed before and two weeks after the course with image-based testing, as well as with self-evaluation surveys.	One day of POCUS training integrated into anesthesia curriculum improved performance in the post-training test scores and improved their confidence scores.	The method of enrolment of study participants limited the number of students included in the study. Availability of instructors and patients	II	B