ASSESSING READINESS FOR POINT-OF-CARE ULTRASOUND IMPLEMENTATION IN A NEONATAL INTENSIVE CARE UNIT

By

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Abstract

Point-of-care ultrasound (POCUS) is an emerging diagnostic tool in neonatal care, yet widespread use in NICUs remains limited by provider training, confidence and organizational readiness. The purpose of this evidence-based practice project was to evaluate whether a brief POCUS educational intervention improved NICU provider readiness for adoption. Using a pre/post design, NICU providers at a regional tertiary NICU in Alaska completed the POCUS Readiness and Adoption Survey (PRAS) immediately before and after a structured 45-minute POCUS orientation presentation. The PRAS measured six domains: knowledge, attitudes, change efficacy, organizational support, intent to adopt, and perceived barriers. Twelve providers completed both surveys. Paired t-test analysis demonstrated significant improvements in knowledge ($p < .001$), attitudes ($p = .022$), change efficacy ($p = .011$), organizational support ($p = .001$), and intent to adopt POCUS ($p = .006$). Qualitative responses emphasized enthusiasm for POCUS integration and identified needs for structured training, clear credentialing pathways, and increased equipment access. Guided by the Iowa Model and Rogers' Diffusion of Innovations, this project established foundational readiness and identified system-level barriers to adoption. Findings indicate that when provided with an appraisal of evidence, there is support for moving forward with comprehensive POCUS training, competency development, and interdisciplinary implementation planning to enhance diagnostic safety and neonatal care outcomes.

Keywords: Point-of-Care Ultrasound (POCUS), NICU, readiness, implementation, evidence-based practice

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Chapter 1: Introduction and Background

Point-of-care ultrasound (POCUS) is the use of portable ultrasound performed and interpreted by the clinician at the bedside to support timely clinical assessment and decision-making. Although POCUS has been used for decades in Emergency Departments, Operating Rooms and Pediatric Intensive Care units, it is not widely used in Neonatal Intensive Care Units (NICUs). My personal experience has been attained while working as a neonatal nurse practitioner in the NICU. I have witnessed many technological advances in the 30 years I have cared for premature and sick babies. I am inspired regularly by the resilience of tiny humans and their incredible will to live. Evidence-based advances make it possible for more neonates to survive and thrive.

My introduction to POCUS occurred in 2019 while attending a neonatal conference. I read the description of the breakout session and was immediately intrigued by yet another piece of new technology. I attended the afternoon session which included a brief introduction to POCUS with hands-on practice. I was initially intimidated, as I often have been with new or unfamiliar equipment. I was motivated to review the literature and learned more about the emerging evidence supporting POCUS use in the NICU. Although the evidence was new and limited at the time, my interest in POCUS continued to grow. I attended a two-day comprehensive POCUS training in 2023 and began my DNP journey shortly thereafter. Over my years of clinical practice, I have led multiple evidence-based quality improvement projects and initiatives in the NICU. Despite the challenges they present, I have experienced the satisfaction that comes with evidence-based advances.

Given the complexity of implementing new clinical practices in the NICU, I chose to begin this project by assessing my team's readiness for organizational change. Readiness is

widely recognized as a critical precursor to successful implementation. Change requires collective action, new skills and workflow adaptation as is the case with neonatal POCUS. Holt et al. (2009) describes readiness as a multidimensional construct that encompasses beliefs about the need for change, perceptions of organizational support and confidence in one's ability to adopt new practices. Similarly, Barwick's (2011) CARI framework emphasizes evaluating system capacity, leadership alignment, organizational culture and staff preparedness to identify barriers that could affect implementation success. Weiner (2009) further conceptualizes organizational readiness as a shared psychological state in which team members feel collectively committed to the change and confident in their group's ability to carry it out.These are conditions that strongly predict implementation effort and persistence. Because POCUS adoption requires shared learning, interdisciplinary collaboration, and consistent practice standards; assessing baseline readiness in my NICU team was a necessary first step. This assessment guided the development of my POCUS Readiness and Adoption Survey (PRAS) ensuring alignment with validated constructs from both the CARI and ORIC frameworks and guiding next steps in the implementation process.

POCUS has rapidly emerged as an essential bedside diagnostic and procedural tool across multiple healthcare settings enabling clinicians to perform real-time imaging that directly informs patient management (Shepherd et al., 2022). In adult and pediatric intensive care environments, POCUS is now considered standard practice contributing to improved diagnostic accuracy, reduced procedural complications and enhanced patient safety. Despite these benefits, the adoption of POCUS in neonatal intensive care units (NICUs) within the United States remains limited. Commonly cited barriers include the absence of standardized education and

competency pathways, inconsistent credentialing processes and limited institutional awareness or support (Fraga et al., 2025; Pai et al., 2024).

Globally, however, neonatal POCUS has expanded substantially with a growing body of evidence demonstrating its positive impact on clinical decision-making, procedural success rates and overall patient outcomes. The contrast between global progress and the slower U.S. implementation suggests that challenges within American NICUs may be more closely related to provider preparedness and organizational readiness than to the technology itself. This gap highlights an urgent need for structured educational initiatives and supportive implementation strategies aimed at enhancing provider readiness for POCUS adoption in neonatal practice.

Background

The neonatal population is among the most vulnerable in healthcare requiring precise and minimally invasive interventions to support survival, growth and neurodevelopment. POCUS offers a valuable means of enhancing accuracy in vascular access; in verifying catheter placement; in evaluating cardiac and pulmonary function and reducing radiation exposure associated with traditional diagnostic imaging (Amer et al., 2023; Stewart et al., 2022). Despite these advantages, many NICU providers lack access to formalized education or structured pathways for POCUS competency and credentialing.

Recently published national guidelines by Fraga et al. (2025) emphasize the urgent need for competency-based education, ongoing quality assurance (QA) and standardized credentialing frameworks for neonatal POCUS. Their recommendations include structured didactic instruction, simulation-based learning, competency tracking, and inter-professional collaboration to ensure safe and sustainable implementation. Similarly, Pai et al. (2024) demonstrated that introducing a formal POCUS program within a large academic NICU increased provider confidence and

reduced reliance on radiology-performed imaging. Wren et al. (2025) further validated the feasibility of affordable implementation, reporting successful training of six providers for under $11,000 with accuracy surpassing radiographic verification. Collectively, these findings reinforce the notion that the primary barrier to neonatal POCUS adoption is not feasibility, but provider readiness, education and the presence of supportive organizational structures.

Problem Statement

The NICU at Providence Alaska Children's Hospital, the only level III NICU in Alaska, currently does not have a POCUS program. The team relies solely on traditional radiology, formal echocardiography and ultrasound for diagnosis and for confirmation of central line tip placement. While there is no dedicated ultrasound machine located within the NICU, several other units within Providence Alaska Medical Center possess ultrasound equipment and established POCUS programs. These internal resources provide a strong foundation for developing a formal neonatal POCUS program. However, successful implementation will require assessment of provider readiness, targeted education and organizational support.

PICO

PICO stands for population, intervention, comparison and outcome (Melnyk & Fineout-Overholt, 2019). The PICO framework is used in evidence-based practice to clearly articulate a focused clinical question and guide the selection of appropriate evidence, interventions and outcome measures. Using PICO in this DNP project ensures that the inquiry into neonatal POCUS implementation is systematic, aligned with evidence-based decision-making and directly linked to measurable outcomes. In NICU providers, how does the introduction of POCUS education and awareness, compared with current practice without

POCUS, influence readiness for adoption as measured by knowledge, attitudes, and willingness to use POCUS in the NICU?

Purpose Statement

The purpose of this Doctor of Nursing Practice (DNP) project is to evaluate the readiness of NICU providers to adopt POCUS as a clinical tool within the NICU. Specifically, the project will measure the impact of a POCUS education and awareness initiative on NICU providers' readiness for adoption. This will be assessed by changes in knowledge, attitudes, and willingness to use POCUS in clinical practice. To achieve this goal, the project will assess baseline readiness using the POCUS Readiness and Adoption Pre-Survey (PRAS); followed by a NICU FOCUS POCUS educational presentation to enhance provider awareness; concluding with completion of the PRAS post-survey. The pre and post surveys will be analyzed following the session to evaluate changes that may inform future, sustainable integration of POCUS into our NICU.

Implications for Advanced Nursing Practice and Health Care System Change

Introducing POCUS education and awareness within the NICU aligns with the evolving role of advanced practice registered nurses (APRNs) as leaders in clinical innovation and implementation of evidence-based practice. DNP prepared nurses are uniquely positioned to implement and evaluate technology-driven quality improvement initiatives that enhance outcomes at the patient, provider and system levels. This project supports several components of the World Health Organization's Health System Building Blocks, especially leadership, health workforce development, service delivery and information systems (World Health Organization, 2007). By equipping NICU providers with foundational POCUS knowledge and skills, this project promotes safer, more efficient and patient-centered care. Evidence highlights the unique role of a Neonatal Nurse Practitioner (NNP) in advancing POCUS adoption. For example, Tong

et al. (2024) demonstrated that NNP-led implementation efforts improved workflow, strengthened interdisciplinary engagement, and accelerated program adoption in a large academic NICU. These findings reinforce the importance of empowering APRNs to serve as clinical champions–bridging educational gaps, promoting standardized practices and supporting sustainable technology integration.

Furthermore, this project establishes a model for scalable implementation of educational programs in regional and rural NICUs where specialized training opportunities may be limited. Sustainable POCUS integration has the potential to reduce dependence on radiography; to shorten time to diagnosis; to improve procedural safety; and empower nurses and providers to practice at the top of their scope (Fraga et al., 2025; Wren et al., 2025).

Chapter 1 introduced the clinical significance of neonatal POCUS, described the local practice gap at Providence Alaska Children's Hospital and presented the rationale for conducting a readiness assessment prior to implementation. The literature suggests that while POCUS is well-supported internationally, US NICUs face unique barriers that require targeted education, organizational and leadership strategies. This project aims to address those foundational needs. Chapter 2 will provide a comprehensive review of current neonatal POCUS evidence, training models and implementation frameworks that informed the design of this DNP project.

Chapter 2: Literature Review and Critical Appraisal of the Evidence

The purpose of this chapter is to critically appraise and synthesize current evidence related to POCUS in neonatal intensive care practice and to examine factors influencing readiness for implementation.The review examines diagnostic and procedural applications of POCUS, identifies barriers and facilitators to adoption, and evaluates organizational and provider-level factors influencing readiness for change. The findings informed the design of this Doctor of Nursing Practice (DNP) project, which aims to evaluate how targeted POCUS education and awareness influence NICU providers' knowledge, attitudes, and willingness to adopt this technology in clinical practice.

Search Strategy

A comprehensive literature search was conducted using CINAHL, PubMed, Scopus, and Google Scholar. Search terms included "point-of-care ultrasound," "POCUS," "neonatal ultrasound," "NICU ultrasound training," "ultrasound-guided vascular access," "neonatal catheter placement," "provider readiness," "implementation," and "organizational readiness for change." Boolean combinations such as "POCUS AND NICU," "ultrasound-guided AND neonatal," and "neonatal AND readiness for change" were used. Inclusion criteria consisted of peer-reviewed articles, guidelines, and systematic reviews published between 2017–2025. Exclusion criteria eliminated adult-only studies, commentaries and papers lacking methodological rigor. A PRISMA-style flow diagram summarizing the literature identification and screening process is provided in Appendix G.

Critical Appraisal Approach

Evidence was evaluated using critical appraisal criteria emphasizing validity, quality, applicability and methodological rigor. Priority was given to studies examining POCUS

diagnostic and procedural utility, competency-based training approaches, implementation readiness and organizational change models applicable to NICU practice.

Summary of Evidence

The final evidence table includes 21 peer-reviewed studies evaluating neonatal POCUS across central line verification, vascular access, cardiopulmonary assessment, program implementation, and radiation/cost outcomes. Collectively, these studies demonstrate that neonatal POCUS is feasible, safe, and clinically valuable when supported by structured training and local infrastructure.

Study Characteristics

Across the 21 studies, designs included randomized or quasi-experimental trials, prospective and retrospective observational cohorts, diagnostic accuracy studies, narrative and systematic reviews, and program implementation reports. Sample sizes ranged from small feasibility cohorts of 20–40 infants to large databases exceeding 1,000 POCUS examinations. Most studies were conducted in tertiary NICUs or mixed neonatal–pediatric intensive care units, often with neonatologists or POCUS-trained advanced practice providers performing scans. Overall, the body of evidence is moderate in strength, with consistent findings despite heterogeneity in design and setting.

Central Line Tip Localization and Vascular Access

Seven studies in the table focus on central line tip localization and vascular access (including UVC, PICC, and peripheral arterial lines). Across these studies, POCUS consistently demonstrated high accuracy for identifying catheter tip position compared with radiography and, in several cases, greater sensitivity for detecting malposition. Ultrasound guidance reduced the

number of insertion attempts, improved first-pass success, and identified a meaningful proportion of malpositioned lines that required repositioning or removal. Together, this evidence supports the use of neonatal POCUS as a reliable alternative to routine radiographic confirmation and as a tool to reduce procedure-related complications.

Lung and Respiratory Applications

Five articles address lung ultrasound for neonatal respiratory disorders, including respiratory distress syndrome, transient tachypnea of the newborn, pneumothorax, and other parenchymal or pleural pathology. These studies demonstrate strong diagnostic performance of lung POCUS, often with sensitivity and specificity comparable to, or better than, chest radiography. Lung ultrasound allowed rapid bedside differentiation between common etiologies of respiratory distress and reliably detected pneumothorax and pleural effusions. The evidence suggests that integrating lung POCUS into NICU practice can accelerate diagnosis, reduce radiation exposure, and improve real-time clinical decision-making.

Cardiac and Hemodynamic POCUS

Three studies focus on focused cardiac ultrasound in neonates and critically ill infants. These investigations show that targeted cardiac POCUS can identify pericardial effusion, depressed ventricular function, and abnormal volume status, and can differentiate structural from functional causes of hemodynamic instability. While formal echocardiography remains essential for comprehensive structural assessment, the evidence supports focused cardiac POCUS as a valuable adjunct for triage, early recognition of life-threatening conditions, and guiding initial management.

Program Implementation, Training, and Provider Roles

Three key implementation and program-development papers describe the processes and outcomes of establishing neonatal POCUS programs, including structured curricula, competency expectations, quality assurance processes, and interprofessional collaboration. These reports highlight the importance of leadership support, defined scopes of practice, image archiving, and ongoing QA meetings. One study specifically examines the role of neonatal nurse practitioners in POCUS program development and demonstrates that NNPs can successfully lead education, image acquisition, supervision, and quality initiatives when provided with dedicated training and protected time. Across studies, programs that incorporated standardized training pathways and multidisciplinary engagement reported steady growth in POCUS volume, expanded applications, and improved provider confidence.

Safety, Radiation Exposure, and Cost Implications

Three articles in the evidence table focus on radiation exposure and broader safety or cost implications of imaging in the NICU. These studies quantify cumulative radiation doses associated with conventional radiography and argue that replacing or reducing X-rays with POCUS has meaningful long-term safety benefits for premature and critically ill infants. When combined with data from catheter-verification and lung studies, the literature suggests that POCUS-based protocols may decrease the number of radiographs per patient, shorten time to diagnosis, and potentially reduce costs related to delayed diagnosis, transport to radiology, and management of line-related complications.

Overall Synthesis and Relevance to the Current Project

Taken together, the 21 studies provide a coherent evidence base demonstrating that neonatal POCUS: Improves accuracy and timeliness of central line tip verification and vascular access, enhances diagnostic capability for respiratory and hemodynamic instability at the bedside, can be implemented safely with structured training, QA processes, and clear role delineation, has the potential to reduce radiation exposure, streamline workflows, and decrease downstream costs. However, the literature also notes persistent gaps: variability in training standards, limited formal credentialing pathways, and uneven access to equipment and institutional support. Very few studies specifically address provider readiness, attitudes, and organizational factors prior to POCUS implementation. This gap directly supports the design of the current DNP project, which focuses on assessing and improving NICU provider readiness through a structured educational intervention. By targeting domains such as knowledge, attitudes, change efficacy, organizational support, intent, and perceived barriers, the project extends the existing evidence base beyond clinical accuracy to the practical conditions required for sustainable neonatal POCUS adoption.

Diagnostic Applications of Point-of-Care Ultrasound

POCUS has transformed neonatal diagnostic capabilities by enabling clinicians to obtain real-time, bedside imaging without the delays and radiation exposure associated with traditional imaging modalities (Stewart et al., 2022). Cardiac POCUS facilitates early identification of abnormalities such as patent ductus arteriosus and pericardial effusion, supporting timely intervention (Singh et al., 2020). Lung ultrasound demonstrates higher sensitivity and specificity for diagnosing pneumothorax, pleural effusion and respiratory distress syndrome than chest radiography (Barone et al., 2022). Cranial ultrasound remains a safe and repeatable option for

detecting intraventricular hemorrhage and hydrocephalus. These diagnostic applications reinforce the importance of structured POCUS training to ensure accurate interpretation and safe clinical use.

Procedural Applications of Point-of-Care Ultrasound

POCUS plays a critical role in guiding neonatal procedures and improving accuracy and safety. Ultrasound-guided vascular access increases first-attempt success rates and reduces complications compared to traditional landmark-based methods (Amer et al., 2023). Studies also demonstrate that ultrasound verification of umbilical venous catheter placement is faster and more accurate than radiographic confirmation, reducing radiation exposure and procedural delays (Wren et al., 2025). In a large tertiary NICU, implementation of a POCUS program cost approximately $10,500 and resulted in higher accuracy than X-ray confirmation. Similarly, Pai et al. (2024) reported that 75% of POCUS studies were diagnostic and 23% procedural, demonstrating significant utility when supported by training and quality oversight.

Barriers to POCUS Adoption in the NICU

Despite strong evidence supporting neonatal POCUS, several barriers limit widespread adoption in U.S. NICUs. Common challenges include lack of standardized education and credentialing pathways, limited faculty expertise, insufficient administrative support, and inadequate equipment access (Cowan et al., 2021; Elsayed et al., 2023). Fraga et al. (2025) emphasize that successful integration requires competency-based instruction, simulation training, ongoing quality assurance and institutional credentialing frameworks. Although international programs supported by organizations such as The European Society of Paediatric and Neonatal Intensive Care (ESPNIC) demonstrate effective skill development, many U.S. NICUs remain in

early adoption stages. These gaps highlight the need for DNP-led initiatives focused on readiness assessment, education, and interprofessional collaboration.

Discussion and Synthesis of the Evidence

Three overarching themes emerge across the literature: (1) POCUS strengthens diagnostic and procedural safety by improving accuracy and reducing complications; (2) education and competency frameworks are essential to ensuring consistent and safe clinical practice; and (3) readiness—rather than feasibility—is the primary barrier to adoption. Evidence indicates that POCUS is feasible, cost-effective, and clinically beneficial, but adoption depends on provider preparedness and organizational support. These findings directly support the rationale for assessing readiness in this DNP project using the POCUS Readiness and Adoption Surveys (PRAS).

Purpose of the Project

The literature review identifies a critical gap: while POCUS benefits are well established, adoption remains limited by provider readiness, education, and organizational capacity. The purpose of this DNP project is to assess readiness for POCUS adoption among NICU providers at Providence Alaska Children's Hospital and evaluate the impact of a targeted POCUS education and awareness initiative on provider knowledge, attitudes, and willingness to adopt POCUS into clinical practice.

Conclusion

Evidence strongly supports POCUS as a valuable diagnostic and procedural tool in neonatal medicine. When paired with competency-based training and quality assurance, NICU providers can integrate POCUS safely and effectively, improving clinical decision-making and patient outcomes (Fraga et al., 2025; Pai et al., 2024; Wren et al., 2025). Despite its benefits,

adoption is hindered by educational and organizational barriers. This review reinforces the importance of readiness assessment and structured POCUS education to support sustainable implementation. Chapter 3 will describe the methodological approach used to assess readiness and evaluate the impact of a POCUS orientation/educational intervention.

Chapter 3: Methods and Implementation

This chapter describes the methods and implementation plan for evaluating NICU providers' readiness to adopt POCUS following a structured educational intervention. Guided by the Iowa Model of Evidence-Based Practice and Rogers' Diffusion of Innovations theory, the project utilized a pre/post design to measure changes in provider knowledge, attitudes, confidence, perceived organizational support, intent to adopt and perceived barriers.

Project Design

This evidence-based practice project used a one-group pre/post intervention design. The POCUS Readiness and Adoption Survey (PRAS) pre-survey was completed prior to the intervention which consisted of a 45-minute NICU FOCUS POCUS educational presentation followed by administration of the PRAS post-survey. The purpose was to determine whether brief, targeted education could improve NICU provider readiness for POCUS adoption.

Setting

The project was conducted in a regional level III NICU in the state of Alaska. The unit cares for premature and critically ill neonates from across the state and relies heavily on transport services and regionalized referral patterns. The presentation occurred during a regularly scheduled clinical conference time and was attended by members of the interdisciplinary team. Only providers completed the survey but the discussion after was open to all.

Participants

A convenience sample of neonatal providers, including neonatal nurse practitioners, physician assistants and neonatologists were invited to participate. The providers were licensed in the state of Alaska and credentialed in the NICU. A 45 minute presentation by the author was titled NICU FOCUS POCUS and included: literature review with summary of the evidence, an

overview of neonatal POCUS applications, review of image acquisition fundamentals, clinical examples and workflow considerations, discussion of safety considerations, competency and guideline recommendations. The session was designed to increase awareness, strengthen foundational knowledge and stimulate interest in further development of a formal POCUS program in our NICU.

PRAS Survey

The PRAS survey was created by the author and modeled after the checklist to assess readiness for implementation (CARI) by Barwick (2011) and after reviewing the theory of organizational readiness for change by Weiner (2009). This validated tool and theory were the foundation of the survey questionnaire. The domains included knowledge, attitudes, change efficacy, organizational support, intent to adopt and perceived barriers. There were three questions in each of the domains and the items were rated on a 5-point Likert scale from 1= strongly disagree to 5= strongly agree.The pre and post survey were identical in the domain questions but the post survey added three open-ended questions. The scoring was the sum of the three items, with one domain (Perceived Barriers) requiring reverse coding. The survey included several negatively worded items to reduce response bias and to ensure participants were reading each statement carefully. For the perceived barriers domain which contained negatively phrased statements, reverse coding was applied prior to statistical analysis. Reverse coding adjusts the direction of responses so that higher scores consistently reflect higher levels of the construct being measured. For these items, responses were transformed by converting a score of 1 to 5, 2 to 4, 3 remaining unchanged, 4 to 2 and 5 to 1. This procedure ensured consistent scoring direction prior to calculating domain totals and conducting paired t-tests. This step improves

internal consistency and prevents misinterpretation of scores. The full surveys are included in Appendix A.

Conceptual Framework

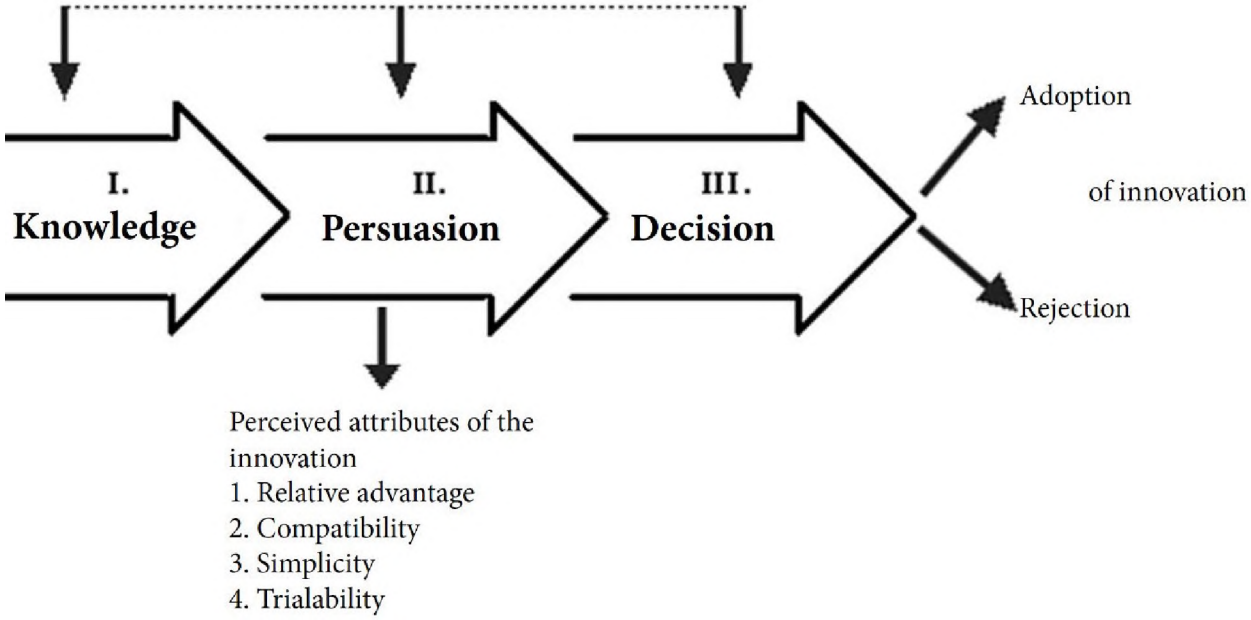
Iowa Model of Evidence-Based Practice

The Iowa Model of Evidence-Based Practice provides the overarching framework for this project. The model outlines a systematic process for implementing evidence-based practice changes beginning with identifying a triggering issue, forming a team, appraising the evidence, piloting a change, evaluating outcomes and integrating successful interventions into practice (Buckwalter et al., 2017). For this project, the triggering issue was the absence of structured POCUS training or credentialing in the NICU.

Rogers' Diffusion of Innovations Theory

Rogers' Diffusion of Innovations theory complements the Iowa Model by explaining how new technologies and practices spread within organizations (Rogers, 2003). This theory explains how adoption depends on perceived relative advantage, compatibility with existing practice, and endorsement by credible clinical leaders. These principles support the project's focus on provider readiness as a precursor to implementation (Mohammadi, 2018).

Figure 1. *The process of adoption in Rogers's diffusion of innovation model*



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Rogers' Diffusion of Innovations theory provides a valuable framework for understanding how new clinical practices–such as POCUS–spread within a healthcare organization. The theory outlines a five-stage adoption process that begins with knowledge, progresses through persuasion and decision-making, and culminates in implementation and confirmation. Recent evidence supports the relevance of this model in nursing practice. Mohammadi et al. (2018) demonstrated that adoption of evidence-based innovations is most strongly influenced by providers' attitudes, knowledge levels, individual innovativeness and their perceptions of the innovation's attributes, including relative advantage, simplicity, observability and trialability. These findings underscore that clinicians are more likely to adopt a new technology when they understand its benefits, can observe its effectiveness and have opportunities to trial it in a supervised environment. In the context of this DNP project, the POCUS educational intervention is intentionally designed to address these elements by building

foundational knowledge, proposing hands-on skill development, demonstrating clear clinical advantages and creating early experiences with ultrasound use. By aligning the project with the core determinants of adoption identified in Rogers' model, the intervention aims to improve NICU provider readiness and accelerate the diffusion of POCUS within the NICU at Providence Alaska Children's Hospital.

Evidence Implementation Plan

Following the Iowa Model, the project implementation plan includes:

1. Identify Trigger – Recognition of a practice gap: no structured POCUS program, credentialing pathway, or formal training available to NICU providers.

2. Form a Team – The author and NICU medical director are the stakeholders until after the readiness assessment.

3. Appraise and Synthesize Evidence – Chapter 2 demonstrates that POCUS is feasible, cost-effective, and clinically beneficial.

4. Determine Priority and Feasibility – Implementation aligns with institutional safety, quality, and efficiency goals.

5. Pilot the Change – Administer the baseline PRAS survey, deliver the NICU FOCUS POCUS educational presentation, and administer the post-education PRAS.

6. Evaluate Outcomes – Analyze quantitative and qualitative findings to assess changes in readiness.

7. Plan for Sustainability – Present the data from this project to support long-term strategies including simulation-based practice, quality assurance review, and proposing a credentialing pathway.

Data Collection

Quantitative Data

Pre- and post-intervention PRAS surveys were administered anonymously. Likert-scale items measured six domains: knowledge, attitudes, change efficacy, perceived organizational support and willingness to adopt POCUS and perceived barriers. The surveys were paired by a code that was decided by the participants.

Qualitative Data

Open-ended questions solicited provider feedback on perceived barriers, facilitators and recommendations for POCUS. Questions asked, what is the greatest benefit of introducing POCUS, what do you see as the greatest challenge or barrier and what would help you feel more ready to adopt POCUS in your practice?

Data Analysis

Quantitative analysis included descriptive statistics and paired t-tests to compare pre- and post-intervention domain scores. Qualitative comments were analyzed thematically to identify recurrent ideas.

Ethical Considerations

IRB approval was obtained through both Providence Alaska Children's Hospital and the University of Alaska Anchorage. Participation was voluntary, and informed consent implied through the completion and submission of the surveys. No personal identifiers were collected to ensure anonymity, and all data is reported in aggregate form. There were minimal risks associated with participation. Participants may experience minor discomfort reflecting on their confidence or readiness to adopt POCUS; however, participation will not affect their employment, evaluation or standing with the organization. The potential benefit includes

contributing to quality improvement and professional development within the NICU by informing future educational and implementation strategies for POCUS.

Chapter 3 described the methodological foundation for assessing NICU provider readiness for POCUS adoption. The next chapter will present the results of the intervention including quantitative outcomes, qualitative themes and cost considerations.

Chapter 4: Results and Impact Analysis

Chapter 4 presents the results of the neonatal POCUS readiness and education initiative. This chapter includes an overview of project implementation; quantitative outcomes from paired t-test analysis, qualitative themes derived from open-ended survey responses, preliminary cost considerations and the alignment of findings with the project's evidence-based frameworks. Finally, this chapter examines the overall impact of the project, identifying factors that influence adoption and discussing implications for scalability, sustainability, and future clinical practice.

Overview of the Implementation

The project evaluated whether a structured POCUS educational intervention improved NICU provider readiness to adopt POCUS in a regional tertiary NICU in Alaska. Readiness for adoption was measured using this author's original Pre–Post POCUS Readiness and Adoption Survey (PRAS) consisting of six domains: knowledge, attitudes, change efficacy, organizational support, intent to adopt, and perceived barriers. The meeting was attended by twenty interdisciplinary team members and twelve neonatal providers (NNPs, PAs, and neonatologists) completed both the pre-intervention and post-intervention surveys, allowing for paired t-test statistical analysis.The intervention, NICU FOCUS POCUS, provided foundational instruction on neonatal POCUS applications, evidence-based benefits, image acquisition and workflow examples.

Participant Characteristics

Twelve NICU providers participated in the intervention and completed both surveys. Participants represented a range of neonatal experience and backgrounds. The majority reported no prior formal POCUS training and limited access to bedside ultrasound equipment. This descriptive data provides essential context for interpreting changes in readiness.

Table 1: *Participant Characteristics*

Characteristic	Value	Notes
Number of Participants	**12**	
Years of Experience (M ± SD)	**14.5 ± 10.3**	
Prior POCUS Training	**17%**	

Quantitative Results

Paired t-tests were conducted for the six PRAS domains using the pre- and post-intervention subscale total scores. Significant improvements were observed in five of the six domains: knowledge, attitudes, change efficacy, perceived organizational support, and intent to adopt POCUS. Perceived barriers showed a small but nonsignificant reduction.

Domain-Level Outcomes

Table 2 summarizes domain-level means, standard deviations, and paired t-test results.

Table 2: *Pre–Post Domain Scores and Paired t Tests*

Domain	Pre M (SD)	Post M (SD)	Mean Change	SD Change	*t*	p	Cohen's d
Knowledge	**7.75 (2.26)**	**12.75 (1.48)**	**5.00**	**2.30**	**7.54**	**< .001**	**2.18**
Attitudes	**12.17 (2.44)**	**14.00 (1.13)**	**1.83**	**1.34**	**4.73**	**.001**	**1.37**
Change Efficacy	**11.50 (1.38)**	**13.92 (1.38)**	**2.42**	**1.98**	**4.23**	**.002**	**1.23**

Organizational Support	**8.00 (1.86)**	**10.00 (1.65)**	**2.00**	**1.48**	**4.69**	**.001**	**1.35**
Intent to Adopt	**10.83 (1.60)**	**12.08 (1.14)**	**1.25**	**1.14**	**3.80**	**.003**	**1.10**
Perceived Barriers (Reversed)	**6.83 (1.53)**	**6.33 (2.19)**	**-0.50**	**2.20**	**-0.79**	**.447**	**-0.23**

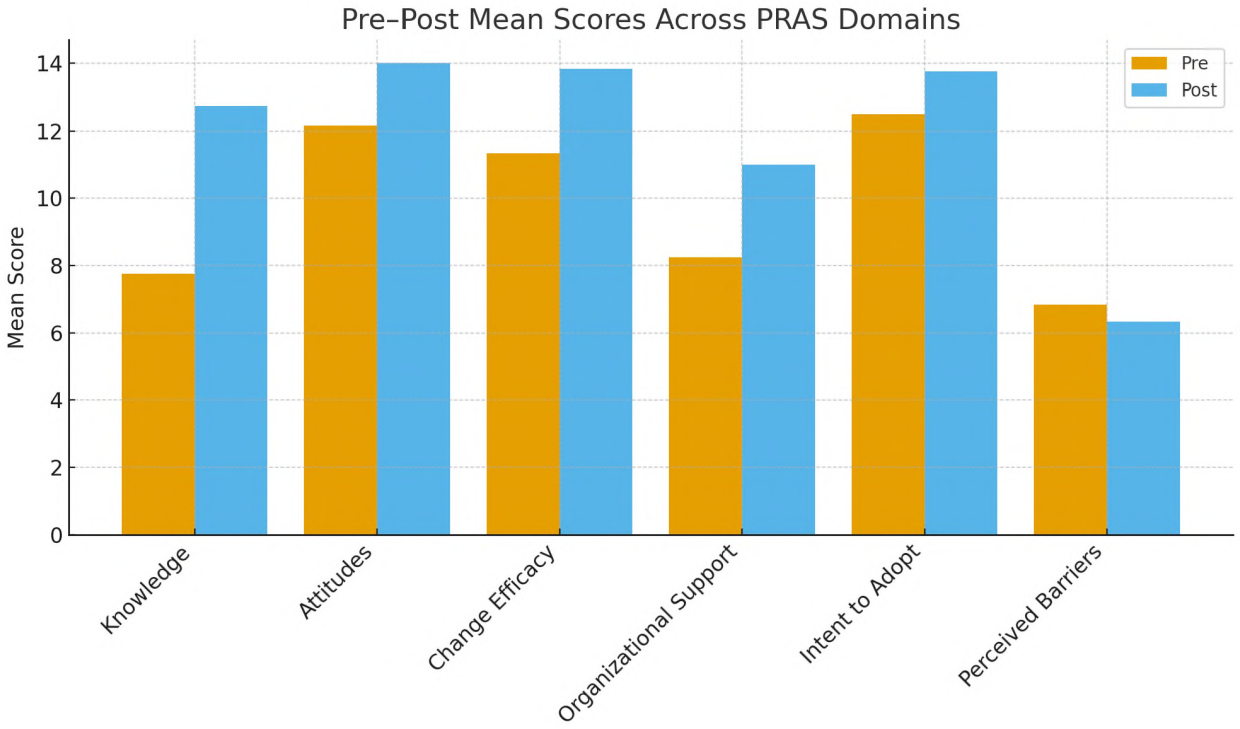
Key Findings

The POCUS readiness initiative resulted in clear and meaningful improvements across nearly every measured domain. The distribution of pre-post difference scores showed no outliers or skew, supporting the use of paired t-testing.Providers demonstrated greater understanding of POCUS application, benefits and safety, alongside stronger attitudes toward adoption. Confidence in their ability to learn and apply POCUS also improved, as did perceptions of organizational support. This is a signal that the NICU environment feels increasingly ready for POCUS integration. Intent to adopt POCUS rose as well, indicating genuine movement toward practice change. Effect sizes ranged from moderate to large indicating that these improvements were not only statistically significant but also clinically meaningful for a small pilot sample. The only domain that was not statistically significant in change was perceived barriers, which remained relatively stable. This pattern suggests that while education effectively strengthens knowledge, confidence and readiness, system-level challenges, such as equipment access, workflow constraints and credentialing pathways, require more than a single educational session to shift.

Overall, the findings reflect a highly encouraging early response: a brief, targeted orientation session was sufficient to advance providers through early stages of the adoption process and position the NICU for next phase implementation efforts.

A visual comparison of pre- and post-intervention domain scores further illustrates the impact of the POCUS educational session on provider readiness. As shown in Figure 1, mean scores increased across five of the six PRAS domains following the intervention, including knowledge, attitudes, change efficacy, organizational support, and intent to adopt POCUS. These increases reflect enhanced confidence, improved perceptions of organizational support, and greater readiness for change among NICU providers. Perceived barriers demonstrated only a modest decrease, which aligns with the statistical findings indicating nonsignificant change in this domain. Collectively, the visual pattern reinforces the overall positive movement toward POCUS adoption within the NICU.

Figure 2 *Pre–post mean scores across POCUS Readiness and Adoption Survey (PRAS) domains*



Key Quantitative Results

Analysis of domain-level responses indicated that the greatest improvements occurred in items assessing clinical confidence, perceived usefulness, and readiness to learn POCUS. In contrast, items related to workflow obstacles and equipment availability showed minimal change, consistent with the nonsignificant domain result for perceived barriers.

Qualitative Feedback

Qualitative responses from the PRAS post- survey provided additional insights into provider perceptions and were categorized into three preliminary themes. All twelve of the participants answered the open-ended questions at the end. First, participants expressed enthusiasm for POCUS adoption, noting strong interest in future hands-on training and emphasizing the potential for POCUS to enhance clinical safety, reduce radiation exposure, and

expedite diagnostic decisions. Second, providers emphasized the desire for structured training pathways, including standardized education, mentorship, and competency validation processes. Third, respondents identified several system-level needs including consistent access to ultrasound machines, clear policies and credentialing pathways and protected time for training. Collectively, these themes supported the quantitative findings, specifically the intent to adopt and attitudes subscale findings and underscored the need for dedicated organizational planning during subsequent phases of POCUS integration.

Cost Considerations

Although the focus of this project was readiness and not full implementation, a preliminary cost overview was conducted to illustrate the potential organizational impact of POCUS adoption. Notable potential cost savings include reduced reliance on radiology services and fewer X-rays which may decrease both direct imaging costs and indirect costs associated with transporting fragile neonates. Faster line placement may reduce procedural complications and related expenses, while earlier or more accurate bedside diagnosis may reduce length of stay and prevent clinical deterioration.

Education and training expenses include provider instructional time, development of training materials and the release of clinical staff to attend training. Equipment-related costs include the purchase or allocation of bedside ultrasound machines and ongoing service or maintenance contracts. Even with conservative estimates, reductions in radiology utilization alone may offset initial training costs within the first year of adoption. This conclusion is supported by current neonatal POCUS literature. A detailed cost analysis is provided in the Appendix.

Conceptual Framework Alignment

This project was guided by the Iowa Model of Evidence-Based Practice and Rogers' Diffusion of Innovations theory. Alignment with the Iowa Model was demonstrated through identification of a practice gap, assessment of organizational priority, synthesis of supportive literature, presentation of evidence through the POCUS education session and evaluation of outcomes using pre- and post-intervention PRAS scores. Rogers' theory further informed interpretation of outcomes with each survey domain mapping directly to a key construct of innovation adoption. Knowledge aligned with awareness; attitudes aligned with persuasion; change efficacy reflected perceived ability to adopt; organizational support represented social and structural context; intent corresponded to the decision to adopt; and perceived barriers aligned with constraints that limit innovation uptake. Improvement across these constructs with the exception of persistent structural barriers, suggest that the intervention successfully advanced providers through early stages of the adoption process.

Impact and Scalability

This project demonstrated early success in improving NICU provider readiness for POCUS adoption. Short-term impacts included immediate improvements in provider confidence and readiness, increased awareness of POCUS applications and strengthened perception of institutional support. Long-term potential impacts include improved patient safety, more efficient clinical workflows, reduced procedural and diagnostic delays and enhanced provider autonomy.

Scalability considerations emerged through both quantitative and qualitative findings. Key next steps may include development of a structured POCUS training curriculum, establishment of competency validation processes, formal policy and credentialing pathway development and integration of POCUS documentation into the electronic health record.

Participants also suggested expanding POCUS training to multidisciplinary teams, such as developmental therapists and neonatal transport providers, which would further support sustained implementation.

Summary

Chapter 4 presented the quantitative and qualitative results of the POCUS readiness and education initiative. Statistically significant improvements in knowledge, attitudes, change efficacy, organizational support, and intent suggest strong early readiness for POCUS implementation. Although perceived barriers remained unchanged, qualitative findings indicate that these challenges are primarily structural and can be addressed through future quality improvement work. Overall, the results indicate that a structured introductory educational intervention is effective in preparing NICU teams for future phases of POCUS integration. Chapter 5 will discuss the broader implications, sustainability considerations and recommendations for future practice and policy development.

Chapter 5: Discussion, Implications and Recommendations

This chapter interprets the findings of the neonatal POCUS readiness and education initiative and discusses their implications for neonatal practice, organizational policy and future implementation planning. It also outlines recommendations for sustainability, scalability and alignment with Doctor of Nursing Practice (DNP) Essentials.

Discussion of Findings

The project demonstrated that a brief, structured POCUS educational intervention significantly improved NICU provider readiness across five of the six measured domains: knowledge, attitudes, change efficacy, perceived organizational support and intent to adopt. These findings indicate that NICU providers are receptive to POCUS education and view it as a valuable tool for enhancing neonatal care. Improvements in knowledge and attitudes are particularly important as they influence early stages of innovation adoption described by Rogers' Diffusion of Innovations theory. Increased change efficacy suggests that providers feel more confident in their ability to learn and apply foundational POCUS skills.

Perceived organizational support also increased following the intervention reflecting providers recognition that POCUS adoption is feasible within the NICU environment. Although perceived barriers did not significantly change, this outcome is expected because system-level barriers–such as equipment availability, workflow integration and credentialing–cannot be resolved through education alone. These findings highlight the importance of aligning future efforts with organizational infrastructure, leadership support and interdisciplinary planning.

Impact on Standards of Care and Health Policy

The implementation of a neonatal POCUS program represents an emerging standard that aligns with national trends toward ultrasound-guided bedside diagnostics and reduced reliance on x-rays. The project assessed provider readiness for POCUS adoption in a tertiary NICU in Alaska and identified key factors affecting its successful integration into existing standards of care. Findings demonstrated strong provider interest in using POCUS for procedures such as central line tip confirmation, lung assessment and targeted evaluations, yet also revealed gaps in formal training, credentialing pathways and organizational support structures.

These findings have implications for local policy development, particularly regarding standardized protocols for competency assessment, documentation, image storage, and quality assurance. As healthcare organizations move toward greater ultrasound utilization, local policies must align with national guidelines from the American Academy of Pediatrics (AAP), the Association of American Medical Colleges (AAMC), and other bodies endorsing ultrasound education for trainees and advanced practice providers. This readiness assessment lays the groundwork for developing clear policy recommendations that ensure safe, consistent and evidence-based POCUS use in the NICU.

Leadership, Innovation and System Complexity

Successful POCUS implementation requires coordinated leadership and interdisciplinary collaboration. Leadership engagement is essential to address system-level challenges such as equipment procurement, IT and PACS integration, structured training programs and establishment of credentialing pathways. The readiness assessment findings reflect the complexity of integrating a new diagnostic modality into a high-acuity clinical environment. .

The project also highlighted the role of advanced practice providers, especially NNPs in leading clinical innovation. Providers expressed interest in participating in future POCUS initiatives reinforcing the potential for frontline clinicians to serve as clinical champions.

Anticipated Impact on Patient, Provider and System Outcomes

Although this project did not implement POCUS clinically, the findings informed the anticipated impact once implementation occurs and was a necessary first step. Providers identified several outcomes likely to improve with POCUS adoption, including more accurate and timely central line confirmation, decreased reliance on diagnostic radiographs and faster clinical decision-making. After the presentation, several team members expressed interest in POCUS for evaluating swallowing in preemies struggling to progress on oral feeds. Also, in Alaska's geographic context, POCUS has the potential to reduce transport related imaging dependence and enhance diagnostic safety during neonatal transport. This was an added discussion that I did not review in the literature.

Provider-level outcomes included enhanced knowledge of POCUS applications and reinforcement of evidence-based practice and standards of care. System-level improvements may include reduced radiation exposure, improved efficiency of care delivery and alignment with evidence-based neonatal best practices. The readiness assessment underscores the value of preparing the workforce ahead of implementation to optimize these future outcomes.

Contribution to Nursing Practice Improvement

This project contributes to neonatal nursing practice by identifying gaps and strengths in provider readiness related to emerging neonatal POCUS roles. Advanced practice providers are increasingly integral to procedural support, diagnostic assessment and interprofessional leadership in NICUs, and POCUS aligns directly with these evolving responsibilities. Readiness

findings guide the development of training pathways, simulation programs, competency checklists and documentation protocols that support NNP and PA scope of practice.

The education and readiness initiative required coordinated leadership, interdisciplinary engagement, and alignment with organizational priorities. Several factors supported implementation success. First, the executive nursing team and NICU leadership demonstrated openness to innovation, creating an environment in which frontline clinicians could explore new diagnostic tools. Second, the project design—featuring concise education, structured assessments, and rapid pre-/post-evaluation—allowed for minimal disruption to workflow while still generating measurable outcomes. Third, the survey structure captured changes across multiple domains (knowledge, attitudes, confidence, organizational support, intent, and perceived barriers), enabling a deeper understanding of NICU provider readiness.

However, the implementation occurred within a busy tertiary NICU environment where competing clinical demands, staffing constraints, and variable familiarity with ultrasound technology affected participation and engagement. Providers expressed enthusiasm for learning POCUS but also noted that protected time, clear credentialing pathways, and reliable access to an ultrasound machine were essential for sustained participation. These factors influenced the readiness domains and highlighted areas where future implementation strategies should focus (e.g., increasing access to equipment, formalizing education pathways, and clarifying scope-of-practice guidelines).

Overall, the project demonstrated that NICU clinicians—particularly NNPs, PAs, and physicians—are willing to integrate POCUS into practice when organizational structures support its adoption. The gains reflected in post-survey scores suggest that POCUS education holds potential as a sustainable, scalable innovation in NICU care.

Role of Leadership, Innovation, System Complexity, and Teamwork

Leadership was central to the implementation of this project. The DNP student served as project lead, coordinating communication with NICU leaders, aligning the plan with institutional policies, and ensuring compliance with ethical requirements. This leadership role modeled the DNP expectation of guiding practice change through evidence, collaboration, and structured evaluation.

Innovation in clinical environments requires navigating system complexity, including staffing patterns, equipment availability, and variable provider experience. The NICU—characterized by high acuity, rapid decision making, and inter-professional teamwork—presented an ideal setting for demonstrating how innovative practice tools such as POCUS can enhance bedside care. The interdisciplinary nature of the NICU (NNPs, PAs, neonatologists, RNs, PTs) facilitated strong discussion during the educational presentation, supporting shared mental models related to when and how POCUS would be useful.

Teamwork was evident throughout the implementation. Providers collectively reviewed clinical scenarios during the educational session, discussed opportunities for POCUS-guided assessment, and provided constructive feedback for future training. This collaborative exchange reflected a maturing readiness for POCUS adoption, consistent with Rogers' Diffusion of Innovations theory indicating that early adopters influence the pace of implementation within a social system.

The results support the future development of a neonatal POCUS guideline or bedside protocol. This aligns with the American Academy of Pediatrics (AAP) recommendations that NICUs establish structured educational, QA, and interdisciplinary oversight mechanisms prior to widespread POCUS use.

The project outcomes also suggest that building a POCUS implementation team—composed of NNPs, physicians, and educators—would increase clarity and sustainability. This is consistent with the Iowa Model, which emphasizes team formation early in the innovation process.

Dissemination

Dissemination of this project occurred through presentations to NICU leadership, providers and interdisciplinary teams involved in quality and safety initiatives. Preliminary findings were shared with key stakeholders responsible for POCUS adoption to increase awareness, build support and facilitate discussion of next steps.

The final manuscript will be shared with academic faculty with opportunities for broader dissemination at neonatal conferences, regional perinatal outreach meetings and potential collaboration with statewide neonatal education programs. Dissemination ensures that readiness findings inform ongoing planning and help shape future POCUS initiatives across the region.

Replication and Sustainability

The findings of this project have high potential for replication in other NICUs across Alaska along with neonatal transport teams due to their limited access to immediate radiology services. Readiness assessment provides a practical framework for evaluating local capacity, identifying educational needs and determining resource requirements prior to implementation. Brief educational design with survey-based measurements also contribute to replication. The PRAS pre/post assessment structure can be easily adapted across NICUs nationally.

Sustainability will depend on ongoing training, annual competency review, integration into new provider orientation and routine quality assurance. The readiness framework developed

in this project can serve as a template for other units or institutions seeking to implement POCUS programs.

Alignment with DNP Essentials

This project directly supports the DNP Essentials and advanced practice competencies by demonstrating leadership in practice inquiry, evidence translation, systems analysis and quality improvement. Specifically, the project aligns with: Essential I: Scientific Underpinnings for practice, demonstrated through evidence-based evaluation of POCUS literature and readiness frameworks. The Rogers'Diffusion of Innovations theory was applied and the Iowa Model was used to guide the project design and evaluation. Essential II: Organizational & Systems Leadership through leading interdisciplinary collaboration in the NICU and assessment of system-level barriers and facilitators. Essential III: Clinical Scholarship with synthesis of evidence and interpretation of project outcomes. .Essential IV: Information Systems/Technology**:** Utilized PRAS surveys and excel to evaluate readiness and outcomes. Will need to utilize information systems for future image storage and documentation planning. Essential V: Healthcare Policy**:** Identified the need for NICU POCUS guidelines and contributed to foundational policy discussions. Essential VI: Inter-professional Collaboration: Engaged NNPs, PAs, neonatologists, and nursing leadership in all phases of the project. More interprofessional collaboration in planning for team-based POCUS adoption. Essential VII: Clinical Prevention & Population Health**:** Advanced diagnostic safety and early identification of neonatal deterioration. Promote safe, efficient neonatal care while on transport in Alaska. Reducing radiation exposure. Essential VIII: Advanced Nursing Practice**:** Demonstrated leadership, clinical expertise, education, and evaluation consistent with APRN practice expectations. This alignment demonstrates the scholarly, clinical, and leadership contributions of the project.

Conclusion

This DNP project successfully assessed NICU provider readiness for the adoption of POCUS and demonstrated meaningful improvements in knowledge, attitudes, change efficacy, intent to use POCUS, and perceptions of organizational support following a brief educational intervention. These findings indicate strong potential for future implementation of a structured NICU POCUS program.

The project contributes to nursing practice by supporting advanced assessment skills, reducing reliance on radiography, enhancing patient safety, and aligning with evolving national standards for neonatal care. Sustained implementation will require leadership engagement, development of policy and competency pathways, inter-professional collaboration, and continued education.

Overall, this initiative reflects the core competencies of doctoral-prepared advanced practice nurses—integrating evidence, leading change, improving systems, and enhancing outcomes for vulnerable neonatal populations. The project positions the NICU for the next phase of innovation: full integration of POCUS into clinical practice, quality improvement, and provider training. Future steps include developing structured training pathways, acquiring dedicated equipment, formalizing credentialing processes and integrating POCUS into clinical workflows and documentation systems.

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Appendix A

POCUS Readiness and Adoption Survey (PRAS): Pre-Survey and Post-Survey

Description

The POCUS Readiness and Adoption Survey (PRAS) is a 20-item instrument developed for this project to assess NICU provider readiness across six domains: knowledge, attitudes, change efficacy, organizational support, intent to adopt, and perceived barriers. Items are rated on a 5-point Likert scale from 1 = Strongly Disagree to 5 = Strongly Agree.

The Post-Survey includes three open-ended qualitative questions.

Scoring

Each domain is scored as the **sum of three items**, with one domain (Perceived Barriers) requiring **reverse coding**. Higher scores reflect greater readiness for adoption.

Instrument

The full Pre-Survey and Post-Survey are reproduced on the following pages.

POCUS Readiness and Adoption Survey (PRAS) – Pre-Survey

Purpose: To assess readiness to adopt point-of-care ultrasound (POCUS) before an introduction/education session. Participation is voluntary and anonymous. Completing the survey implies consent. Please use the same Study ID for both surveys so responses can be paired.

Header:

- Study ID code: _____ (Use a memorable, private code you can reproduce)
- Years of NICU experience (rounded to nearest whole year): _____ years
- Have you attended prior formal POCUS training: ☐ No ☐ Yes _____
- Do you have access to bedside ultrasound on a typical shift: ☐ No ☐ Yes

Instructions: Please rate each statement based on your current views and experience.

Knowledge	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I can describe Neonatal POCUS applications.					
I know the steps to safely acquire POCUS images at the bedside.					
I can identify when POCUS is appropriate vs radiography or formal echocardiography.					

Attitudes	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Implementing POCUS would improve quality of care in our NICU.					
POCUS could reduce delays in procedure confirmation or diagnosis.					
I am comfortable with expanding POCUS use in our NICU.					

Change Efficacy	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
With training, I am confident I can learn the essential neonatal POCUS skills.					
I could incorporate POCUS into my workflow without compromising other responsibilities.					
I can obtain help or supervision when learning new POCUS skills.					

Organizational Support	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Our leadership supports implementing POCUS in our NICU.					
There will be protected time/ opportunities for POCUS education.					
I am familiar with a POCUS policy at our institution.					

Intent	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I plan to participate in POCUS education if it is offered.					
I would be likely to use POCUS in my clinical practice.					
I would like to be part of a POCUS implementation team.					

Perceived Barriers	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Learning neonatal POCUS would take too much time away from clinical care.					
POCUS would make my workflow more complicated.					
I am concerned about credentialing or scope of practice with POCUS.					

POCUS Readiness and Adoption Survey (PRAS) – Post-Survey

Purpose: To assess readiness to adopt point-of-care ultrasound (POCUS) after an introduction/education session. Participation is voluntary and completing the survey implies consent. Please use the same Study ID for both surveys so responses can be paired.

Header:

• Survey ID code: _____ (Please use the same code as you did on the Pre-Survey)

Instructions: Please rate each statement based on your current views and experience.

Knowledge	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I can describe Neonatal POCUS applications.					
I know the steps to safely acquire POCUS images at the bedside.					
I can identify when POCUS is appropriate vs radiography or formal echocardiography.					

Attitudes	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Implementing POCUS would improve quality of care in our NICU.					
POCUS could reduce delays in procedure confirmation or diagnosis.					
I am comfortable with expanding POCUS use in our NICU.					

Change Efficacy	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
With training, I am confident I can learn the essential neonatal POCUS skills.					
I could incorporate POCUS into my workflow without compromising other responsibilities.					
I can obtain help or supervision when learning new POCUS skills.					

Organizational Support	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Our leadership supports implementing POCUS in our NICU.					
There will be protected time/ opportunities for POCUS education.					
I am familiar with a POCUS policy at our institution.					

Intent	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I plan to participate in POCUS education if it is offered.					
I would be likely to use POCUS in my clinical practice.					
I would like to be part of a POCUS implementation team.					

Perceived Barriers	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Learning neonatal POCUS would take too much time away from clinical care.					
POCUS would make my workflow more complicated.					
I am concerned about credentialing or scope of practice with POCUS.					

Open-ended Questions

In your opinion, what is the greatest benefit of introducing POCUS in our NICU?

_____

What do you see as the greatest challenge or barrier to implementing POCUS in our NICU?

_____

What would help you feel more ready to adopt POCUS in your practice?

_____

THANK YOU for your time and support of my DNP project. Stacy

Appendix B

Participant Characteristics

Description

This appendix provides descriptive characteristics of the NICU provider sample (N = 12) who completed both the pre- and post-intervention POCUS Readiness and Adoption Survey (PRAS). Participants represented a range of neonatal experience and prior exposure to point-of-care ultrasound.

Table B1

Participant Characteristics (N = 12)

Characteristic	n	%
Years of NICU Experience		
0–5 years	2	16.7%
6–10 years	5	41.7%
11–15 years	3	25.0%
≥16 years	2	16.7%
Prior Formal POCUS Training		
Yes	1	8.3%
No	11	91.7%

Access to Bedside Ultrasound on Typical Shift		
Yes	7	58.3%
No	5	41.7%

Note. Percentages may not total 100% due to rounding. Experience categories were rounded to the nearest whole year as reported on the survey.

Appendix C

Paired *t*-Test Results for PRAS Domains

Description

This appendix presents the results of the paired *t*-tests conducted to evaluate changes in NICU provider readiness before and after the POCUS educational intervention. Each domain of the POCUS Readiness and Adoption Survey (PRAS) was analyzed using paired samples testing to compare pre- and post-intervention scores within participants (N = 12).

Table C1

Paired Samples t-Test Results for PRAS Domains (N = 12)

Domain	Pre-Mean (SD)	Post-Mean (SD)	Mean Difference	t	p
Knowledge	10.67 (1.37)	12.33 (1.07)	+1.67	3.82	**.0006**
Attitudes	12.33 (1.87)	13.42 (1.31)	+1.08	2.42	**.022**
Change Efficacy	11.50 (1.45)	12.67 (1.30)	+1.17	2.72	**.011**
Organizational Support	9.92 (1.73)	11.42 (1.73)	+1.50	3.57	**.0013**
Intent to Adopt	11.25 (1.60)	12.50 (1.24)	+1.25	2.92	**.0067**
Perceived Barriers†	8.92 (1.50)	8.50 (1.31)	–0.42	–0.80	.432

Note. Higher scores indicate greater readiness, except for perceived barriers.

†Perceived Barriers are reverse-scored (lower scores reflect fewer perceived barriers).

Appendix D

Figures

Description

This appendix contains the graphical representations of pre–post changes in provider readiness domains measured by the POCUS Readiness and Adoption Survey (PRAS). Figures illustrate improvements in knowledge, attitudes, change efficacy, organizational support, and intent to adopt POCUS following the educational intervention. Perceived barriers are also represented.

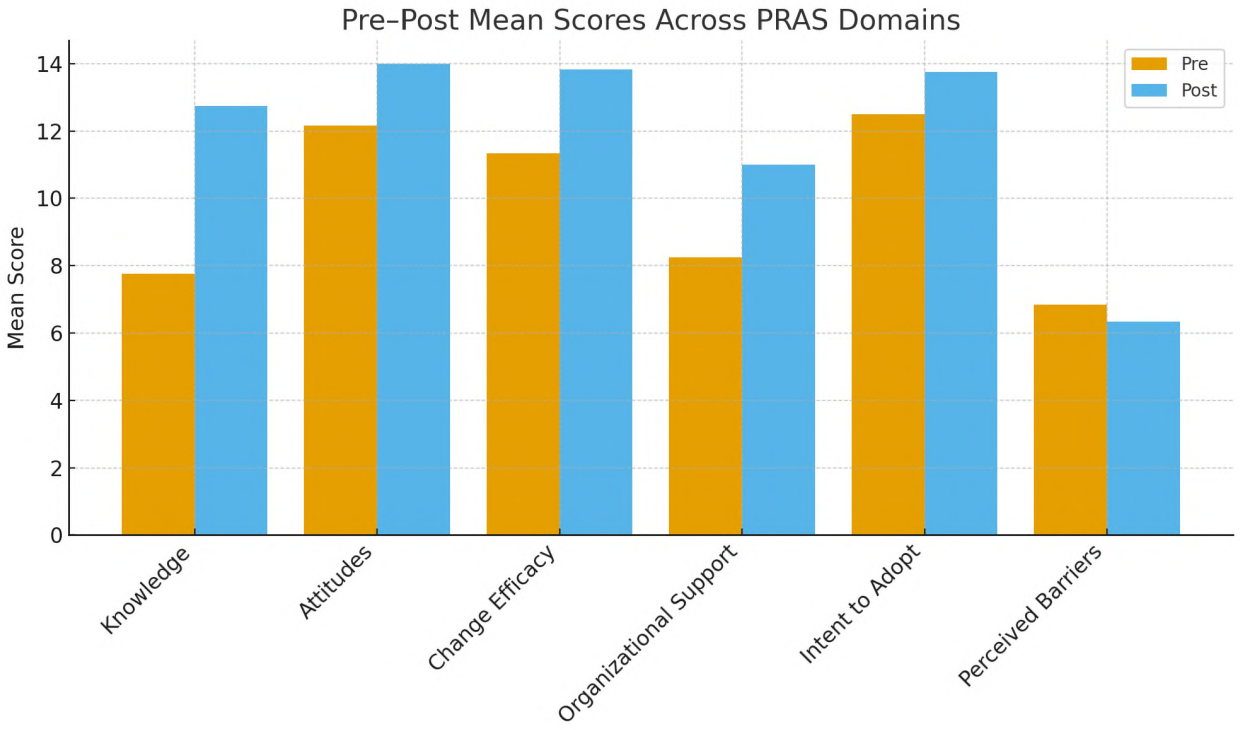

Figure D1

Pre–post mean scores across POCUS Readiness and Adoption Survey (PRAS) domains.

Appendix E

Detailed Cost Analysis for POCUS Implementation

Description

This appendix provides a detailed summary of the anticipated costs associated with implementing a point-of-care ultrasound (POCUS) program within a Level III–IV NICU. Cost domains include one-time startup expenses, annual ongoing operational costs, and optional institution-specific considerations. These estimates reflect typical expenditures for neonatal POCUS programs and are intended to guide program development and sustainability planning.

One-Time Startup Costs

Initial implementation of a POCUS program in the NICU requires investment in equipment, training, and administrative preparation. Ultrasound machines capable of neonatal imaging typically range from **$10,000 to $45,000**, depending on brand, portability, and available presets. Two essential transducers—commonly a linear probe for vascular access and a phased-array probe for cardiac assessments—add approximately **$3,000 to $8,000 per probe**. Image storage solutions such as PACS or secure cloud archives may cost **$2,000 to $5,000**, depending on institutional integration needs.

Training represents another significant component of startup cost. CME-accredited courses for approximately 5–6 NICU providers typically range from **$1,000 to $3,000 per learner**, depending on course format and duration. Time for protocol development, internal credentialing, and administrative planning contributes an additional **$3,000 to $5,000**. Overall, total estimated startup costs range from **$25,000 to $80,000**.

Annual Ongoing Costs

Annual costs include provider continuing education, equipment maintenance, and consumables. Ongoing education for skills maintenance and competency development typically requires **$500 to $1,000 per provider** per year. Routine maintenance and service contracts range from **$1,000 to $3,000 annually**, supporting calibration, repairs, and device reliability. Consumables, including ultrasound gel, probe covers, and disinfecting supplies, average **$300 to $600** annually. Finally, time allocated for quality assurance (QA), image review, and competency evaluations contributes **$1,000 to $3,000** per year. Overall, estimated ongoing costs range from **$5,000 to $10,000** annually.

Optional Indirect Costs

Several institution-specific costs may also arise depending on adoption scope and workflow design. Integration with electronic medical records (EMR) or PACS may require additional IT support, potentially adding moderate expense. Staff time for training, equipment setup, and workflow modifications may vary but is generally low to moderate. Programs that include radiology overreads during the early adoption phase may incur variable additional costs depending on local requirements.

Summary of Estimated Costs

Startup costs: $25,000–$80,000

Annual ongoing costs: $5,000–$10,000

These ranges are scalable based on NICU size, number of trained clinicians, equipment tier, and institutional workflow infrastructure. Many NICUs begin with one ultrasound machine and gradually expand capacity as clinical competency grows. This cost analysis demonstrates that early investment in POCUS infrastructure is offset over time by reductions in radiology utilization, transport-associated risks, and procedural delays.

Appendix F

Evidence Table

This appendix summarizes key evidence supporting the implementation of point-of-care ultrasound (POCUS) in neonatal intensive care practice. The table includes primary research, systematic reviews, program development studies, and expert consensus guidelines that informed the development, implementation, and evaluation of this DNP project. Each study is summarized according to purpose, design, sample, major findings, and level of evidence.

Table F1a. Evidence Summary (Purpose, Design/Sample, Key Findings, Level of Evidence)

Author(s) & Year	Purpose	Design & Sample	Key Findings	Level of Evidence
Doyle et al. (2022)	Assess US accuracy for PICC confirmation.	Systematic review & meta-analysis; 8 studies; 421 infants; 341 US assessments.	US sensitivity 95% and specificity 71%; fewer radiographs.	I
Cao et al. (2021)	Compare US vs X-ray for UVC tip accuracy.	Systematic review & meta-analysis; 14 studies; 979 UVCs.	US superior; X-ray frequently misidentifies tip position.	I
Singh et al. (2020)	Create international POCUS guidelines.	Consensus guideline; ESPNIC panel; 20 experts.	Standardized multi-system POCUS recommendations.	VII
Katheria et al. (2013)	Compare US vs radiograph PICC confirmation.	Randomized controlled trial; 40 neonates.	US faster & more accurate; reduced malposition and radiation.	II

Sobczak et al. (2021)	Monitor UVC/UAC tip migration and complications.	Prospective observational study; 129 infants; 194 catheters.	High rate of dislocation and thrombosis; US improves detection.	III
Narvey et al. (2023)	Canadian national central line tip verification guidance.	Position statement (Canadian Paediatric Society).	Recommends US as preferred confirmation method.	VII
Lin et al. (2024)	Evaluate POCUS for neonatal PICC tip location.	Prospective non-randomized controlled study; 394 catheters.	Higher optimal tip placement, fewer radiographs, lower infection risk with US.	III
Recker (2024)	Synthesize neonatal POCUS applications and gaps.	Systematic review; NICU settings.	Faster bedside diagnosis; reduced radiation; standardization needed.	I
Bhombal et al. (2025)	Outline steps for POCUS program development.	Expert consensus.	Seven pillars: scope, curriculum, workflow, QA.	VII
Shepherd et al. (2022)	Evaluate structured POCUS education impact.	QI; NICU clinicians.	Improved readiness; supports education-first adoption.	IV

Shepherd, Thomas & O'Brien (2022)	Assess POCUS for line placement confirmation.	Observational; preterm/term infants.	Accurate tip confirmation; fewer radiographs.	IV
Fraga et al. (2025)	Define competencies and supervision standards.	Consensus guideline.	Competency framework for training, QA, credentialing.	VII
Singh et al. (2025)	Summarize neonatal POCUS advances and future directions.	Editorial; synthesis of 10 peer-reviewed studies.	Highlights rapid expansion, AI integration, QA, improved outcomes.	VII
Singh et al. (2024)	Simulation-based POCUS training outcomes.	Quasi-experimental.	Improved skill, knowledge, retention via simulation.	III
Tong et al. (2024)	NNP-led implementation of POCUS in NICU.	Mixed methods.	Improved workflow and adoption led by NNPs.	IV
Stewart & Cowan (2022)	Workflow and cost impacts of POCUS.	Observational.	Reduced transfers; improved efficiency.	IV

Wren et al. (2025)	Readiness and adoption across U.S. NICUs.	Survey/QI registry.	Variable training; strong interest in adoption.	VI
AAP Committee on Fetus and Newborn (2022)	National guidance for NICU diagnostic/procedural POCUS.	Technical report.	Scope, credentialing, training, safety defined.	VII
Amer, Rozovsky & Elsayed (2023)	POCUS for CVC tip confirmation.	Observational.	Accurate confirmation; reduced radiation.	IV
Barone et al. (2022)	Lung ultrasound evidence and applications.	Narrative review.	High utility for RDS/TTN/pneumothorax.	V
Pai et al. (2024)	Practical applications and implementation.	Narrative review.	Clinical workflow, QA integration.	V

Table F1b. Summary of Evidence Supporting NICU POCUS Adoption

Theme	Key Findings From Literature	Relevance to Project
Accuracy & Safety of POCUS	POCUS demonstrates high sensitivity/specificity for line tip confirmation (Doyle et al., 2022; Cao et al., 2021). Reduced malposition, fewer radiographs, and improved diagnostic speed (Katheria et al., 2013; Lin et al., 2024). Systematic reviews confirm superiority to X-ray for several neonatal applications (Recker, 2024).	Reinforces the clinical value highlighted in the presentation; justifies provider education on safety and accuracy. Aligns with participant comments about reduced radiation and faster diagnosis.
Clinical Applications in NICU	Evidence supports POCUS for lungs (Barone et al., 2022), heart/hemodynamics (Stewart & Cowan, 2022), line confirmation (Amer et al., 2023), and procedural guidance (AAP, 2022). Strong utility for RDS, TTN, pneumothorax, effusions.	Supports expanding POCUS readiness for core neonatal conditions. Demonstrates alignment between evidence-based applications and provider interest expressed in surveys.
Training Improves Competence & Confidence	Structured education improves knowledge, skill acquisition, and retention (Shepherd et al., 2022; Singh et al., 2024). Simulation enhances procedural accuracy and reduces errors.	Mirrors the significant increases in knowledge, attitudes, intent, and change efficacy observed in your PRAS pre/post data. Validates education-first strategy.
Importance of Credentialing & Policy	Consensus guidelines emphasize standardized training, credentialing pathways, QA oversight, and role clarity (Singh et al., 2020; Fraga et al., 2025; Bhombal et al., 2025). Institutional consistency is necessary for safe use.	Directly addresses the organizational support and barrier domains where your participants expressed concern (e.g., need for policy, access, protected time).

Workflow, Efficiency & Cost Benefits	Reduced transfers to radiology, fewer X-rays, faster procedures, improved workflow (Stewart & Cowan, 2022; Sobczak et al., 2021). Lower complication rates and improved time to diagnosis.	Supports your cost analysis and aligns with reported provider interest in efficiency and reduced stimulation for fragile neonates.
National Readiness & Variability	Wide variation in NICU POCUS adoption; inconsistent availability of training (Wren et al., 2025). National guidance encourages standardization (Narvey et al., 2023).	Validates the need for this project—local readiness gaps mirror national trends, emphasizing need for foundational education and early implementation steps.
Future Directions & Innovation	Growing emphasis on AI integration, neonatal-specific protocols, and advancing technology (Singh et al., 2025).	Supports sustainability planning and long-term recommendations in Chapter 5.

Appendix G

PRISMA-Style Evidence Flow Diagram

Description

This appendix presents the PRISMA-style flow diagram summarizing the identification, screening, eligibility assessment, and inclusion of studies used in the development of the evidence table for this project. The counts reflect a structured literature review process conducted across multiple databases and supplementary sources to identify neonatal POCUS articles relevant to diagnostic accuracy, procedural guidance, training, competency development, program implementation, and workflow outcomes. The diagram illustrates the number of records identified, duplicates removed, studies screened, full-text articles reviewed, reasons for exclusion, and the final number of studies (n = 21) included in the synthesis and evidence table.

Figure G1

PRISMA Flow Diagram of Study Selection for Neonatal POCUS Evidence Review