Certified Registered Nurse Anesthetist Perception of the Usefulness of a Standardized Reference Guide for the Management of Amniotic Fluid Embolism: A DNP Quality Improvement Project

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Submitted in partial fulfillment of the

requirements for the degree of Doctor of Nursing Practice

Finalized November 30th, 2025

Abstract

AFE is a life-threatening complication of pregnancy with a high mortality rate that currently has no standardized or nationally agreed-upon protocols for treatment based on current best practices. Reference guides or cognitive aids are used in a wide array of emergencies. They can play an important role in helping the provider with a step-by-step approach to managing emergencies, such as amniotic fluid embolism. Evidence shows that a team-based approach to emergencies improved with the use of a(CA) or reference guide, and the rate of errors during emergencies was reduced by 50%. The purpose of this Doctor of Nursing Practice quality improvement project was to evaluate the perception of usefulness of a new reference guide among CRNA participants for improving the management of amniotic fluid embolism via an in-person presentation. This quality improvement project occurred at a small outlying facility in eastern North Carolina with all participants in attendance at the presentation. Data was collected via pre- and post-implementation surveys using Qualtrics and analyzed using Microsoft Excel. The results showed an overall acceptance of the reference guide, a plan to implement the reference guide into their management of amniotic fluid embolism, and an increase in confidence when managing an amniotic fluid embolism event. Limitations to this project included the small number of participants available for implementation in a single facility. Future projects expanding on the work of this DNP project could include a simulation scenario allowing participants to practice using the reference tool in an amniotic fluid embolism event.

Keywords: Amniotic fluid embolism, cognitive aid, CRNA, obstetrics

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Section I. Introduction

Background

Amniotic Fluid Embolism (AFE) is a rare but often life-threatening condition that occurs in approximately 1.9 to 6.1 per 100,000 pregnancies, with a nearly 60% death rate (Pacheco et al., 2020). The potential and severe complication of pregnancy occurs when amniotic fluid and/or other particulates from the fetal sack enter the mother's central blood circulation and subsequently generate an immune response (AFE Foundation, 2024). The immune response leads to a series of events, which may include humoral response, inflammation, homeostatic reaction, and eventual cardiovascular collapse (American Association of Nurse Anesthesiology [AANA], 2022). Arnolds (2022) explains that this obstetric complication can have detrimental effects on the patient, including permanent neurological damage, even if the patient survives. Overall, AFE is one of the most unpreventable causes of death for pregnant mothers (Arnolds, 2022).

Patients with AFE may experience alterations in mental status, hypotension, and anxiety before more detrimental symptoms, including complete cardiovascular collapse, are witnessed (AANA, 2022). According to the AANA, patients with AFE may also experience chest pain, tachycardia, decreased end-tidal CO2, sudden desaturation, pulmonary edema, and coagulopathy (AANA, 2022). The Society of Maternal-Fetal Medicine and the Amniotic Fluid Embolism Foundation have developed a diagnostic criteria checklist for AFE, which includes abrupt cardiopulmonary collapse with systolic blood pressure less than 90mmHg, pulse oximetry (SpO2) less than 90%, disseminated intravascular coagulation (DIC), shock, symptom occurrence during labor or within 30 minutes of delivery, and a lack of fever (Arnolds, 2022). After performing a literature review on AFE identification and management, most professionals

agree on the signs and symptoms of AFE, there is a lack of consensus in the management of this complication. Additionally, the order of symptoms may vary, with some patients showing no signs of AFE until sudden cardiopulmonary collapse occurs (Arnolds, 2022). Varying onset of related symptoms increases the difficulty in quickly identifying an AFE and gaining consensus on treatment guidelines.

Treatment for AFE ranges from supportive care, implementing ACLS protocols, utilizing vasopressors and/or fluid resuscitation, and additional drugs and blood products to correct coagulopathies. The AANA (2022) practice guidelines for AFE management include providing immediate airway support via intubation, managing hemodynamic alterations with vasopressors and fluid, invasive blood pressure monitoring, and hemostatic support using the obstetric hemorrhage protocol. In addition to these guidelines, the AANA (2022) also includes the initiation of extracorporeal membrane oxygenation (ECMO) for cardiopulmonary support if other measures do not improve patient outcomes. Arnolds (2022) reports that there are multiple recommended treatments for AFE, but that none have been universally accepted is an issue. In addition to cardiac support with ACLS protocols when facing cardiopulmonary collapse, it has also been proposed that steroids, lipid emulsion, and C1 esterase inhibitors (C1INH) may be beneficial (Arnolds, 2022). C1INH is a protein that has been clinically identified as being decreased in patients presenting with AFE may reduce the effects of the complement system and inhibit the faulty coagulation pathways. Increasing C1INH may be beneficial for AFE by halting the dysfunctional coagulation system (Akasaka et al., 2018). It is suspected that C1INH could reduce the amount of blood products required to correct coagulopathy and decrease uterine atony (Akasaka et al., 2018).

Arnolds (2022) and the AANA (2022) both suggest that using atropine, ondansetron, and ketorolac may be beneficial in reversing some symptoms. However, Arnolds (2022) claims that there is no true evidence for the use of these additional medications. Pacheco et al. (2020) also noted that blood pressure and cardiopulmonary symptoms should be treated with vasopressors and inotropes while limiting fluid administration due to the possibility of right-sided heart failure and/or total heart failure. Additional recommendations include performing left-lateral displacement of the uterus to decrease vena cava compression, as well as rapid transesophageal electrocardiogram (TEE) to identify cardiac issues such as right-sided heart failure (Pacheco et al., 2020).

Given the rare nature of AFE, there are many unknown factors involved, leading to multiple recommendations for treatment and a lack of accepted protocols based on best practices. However, most agree on supportive measures for cardiopulmonary collapse and the correction of coagulopathies. The lack of consensus, which has been created by a gap in current best practices, could potentially lead to a confidence or knowledge gap among anesthesia providers in the management of AFE. It is also evident that symptoms are inconsistently demonstrated and follow no clear path, which only increases the difficulty in the recognition of AFE. Anesthesia providers must understand the signs and symptoms and current best practices for the management of AFE, as cardiopulmonary collapse can occur rapidly and with little to no warning. This project aims to assess CRNAs' perceptions of managing an AFE event and of the utility of using a newly designed AFE reference guide on their confidence when managing this event.

Organizational Needs Statement

This project will take place in conjunction with a large tertiary healthcare system in eastern North Carolina. AFE is a life-threatening complication of pregnancy with a high mortality rate that currently has no standardized or nationally agreed-upon protocols for treatment based on current best practices. This healthcare system currently uses the "A-OK" acronym, which stands for atropine, ondansetron, and ketorolac, as the treatment standards for this complication, but does not include any other recommendations. The purpose of the QI project is to create an updated best-practice-based reference guide for the management of AFE. Anesthesia providers need to have confidence and a full understanding of the management of various complications, including AFE. By creating a standardized reference tool for the recognition and management of AFE, it is anticipated that the level of confidence and knowledge will increase and, therefore, improve patient outcomes.

Problem Statement

AFE is a life-threatening complication of pregnancy that has been recognized for nearly 100 years. While this complication is rare, the rate of mortality and/or neurological damage is approximately 30% to 40%, with an incidence rate of 1 to 2 of every 100,000 pregnancies (Arnolds, 2022). Arnolds also points out that women are far less likely to survive AFE if there is no anesthesia or obstetric team available at the time of onset. This highlights the anesthesia team's crucial role in rapidly recognizing and managing a suspected AFE event (Arnolds, 2022). However, there is still no national consensus regarding best-practice guidelines for managing an AFE event. This leaves anesthesia providers to use their best judgment based on clinical experience when managing a potential AFE. This lack of consensus regarding the management of AFE may increase anesthesia providers' sense of uncertainty and decrease confidence when

this rare but life-threatening complication occurs. This lack of confidence and possible sense of uncertainty could further impact patient morbidity and mortality.

Purpose Statement

The purpose of this Doctor of Nursing Practice (DNP) Quality Improvement Project is to assess the usefulness of a newly developed reference guide for anesthesia providers on the identification and treatment of AFE. Additionally, this project will assess the utility of the reference tool, including the perceived improvement in the confidence CRNAs have in identifying and managing an AFE event. It is anticipated that knowledge gained from this project could help inform future quality improvement initiatives aimed at diagnosing and treating an AFE.

Section II. Evidence

Description of Search Strategies

In September of 2024, a literature review on the management and treatment of patients with AFE was performed. Limits applied to the search included articles published in the English language, meta-analyses, randomized control trials, systematic reviews, and publications between 2009 and 2024. The literature search was guided by a patient/problem, intervention, comparison, and outcome (PICO) question: *Among CRNAs, does the implementation of a newly designed reference tool increase confidence when managing AFE?* The search was conducted utilizing the databases PubMed, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the search engine Google Scholar. Additional research was performed on East Carolina University's One Search, a library discovery service that retrieves data from large portions of the subscribed content within the library's database (Dr. C. Forbes, personal communication, February 10, 2025). Due to the nature of this product, the search results will vary from institution to institution. The key concepts of obstetrics (OB), AFE, and certified registered nurse anesthetists (CRNAs) were used to sort each article or reference for information useful to this project (Appendix A). Additional searches were made to include articles on CAs and their efficacy in managing emergencies. Multiple articles focused on OB complications but not specifically on AFE were excluded as these were too broad and only explained them as complications in this special population without offering recommendations for management.

Initially, this quality improvement project aimed to increase the CRNA's confidence when managing AFE by initiating a high-fidelity simulation training video. However, upon further review of the literature, it was found that there is a general lack of consensus on a standardized protocol for the management of AFE. This finding changed our project's aim and

direction to review the most up-to-date and best-practice literature to create a reference tool that would increase the CRNA's confidence during the management of AFE.

Using the literature search database PubMed, 69 citations were found using approved MeSH terms. The limitations applied to the search for PubMed included articles published within 10 years (2014-2024), written in the English language, meta-analyses, and systematic reviews. Initially, the author reviewed the titles and abstracts of the 69 resulting articles for inclusion and exclusion criteria. The inclusion criteria from PubMed focused on OB and the treatment of AFE and were focused on the recognition of AFE as well as techniques used for the treatment, such as extracorporeal membrane oxygenation (ECMO). After using these inclusion criteria, one article was kept for full-text review and utilized in the literature synthesis.

Twelve citations were found using the database CINAHL using the key terms (MH embolisms, amniotic fluid) and (MH diagnosis). The limitations applied to the search used for these searches were like those utilized for PubMed. Each article's title and abstract were reviewed to narrow results further. After the abstract was read and included in my research, I then read each article in its entirety. Of the 12 articles found, eight were retained for consideration for this project. Of the eight articles reviewed, one was kept, informing the project tool, and was included in the literature synthesis. These articles also focused on the recognition and treatment of AFE in the OB population.

The search engine Google Scholar was searched with the search terms "amniotic fluid embolism", "diagnosis", and "educational activities." This search resulted in 1,910 citations. The first 15 pages of articles were reviewed, and 15 articles were retained for full-text review based on the previously mentioned inclusion criteria. After full-text review, one article was retained to inform the project and project tool development.

Nine additional citations were found using the One Search tool as well as professional organizations, including the American Association of Nurse Anesthesiology (AANA), the American College of Obstetricians and Gynecologists (ACOG), the Amniotic Fluid Embolism Foundation, and the Anesthesia Patient Safety Foundation. After reviewing all citations, evidence from four articles of expert organizational/opinion sources, including the management or diagnosis of AFE, and five articles discussing the efficacy or creation of a reference tool that would increase the confidence of the medical provider during an emergency, was retained for full-text review. After full-text review, three citations from professional organizations were retained, and three citations were retained utilizing the One Search library database from East Carolina University to inform the project and project tool development. See Appendix B: Literature Search Log for the search strategies utilized for this project. See Appendix C: Literature Matrix for specific information regarding the articles retained to inform this project.

The Melnyk and Fineout-Overholt Levels of Evidence were utilized to sort each article into its associated Level of Evidence, with Level I being the highest level and Level VII being the lowest level (Melnyk and Fineout-Overholt, 2019). Upon full-text review, two randomized control trials (Level II), one retrospective case-control study (Level III), one systematic review of a descriptive or qualitative study (Level V), two case studies, and EBP, or quality improvement implementation (Level VI), and three expert opinions from individuals or groups (Level VII) were identified pertinent to this project.

Selected Literature Synthesis

History, Morbidity, and Mortality of AFE

AFE was initially discussed in 1926. However, not much was known at the time, and it remains a diagnosis of exclusion (Baxter, 2023). Since that time, AFE has been more widely studied and is understood to be a rare complication of pregnancy with a high mortality rate, and even with survival, there is a high risk of neurological damage (Arnolds, 2022; Baxter, 2023). "AFE is the second leading cause of maternal death on the day of delivery in the United States," (Arnolds, 2022, para. 1), and there is a tremendous risk of mortality and/or permanent neurological damage of nearly 30% to 40% for those patients who survive. While this knowledge is agreed upon, there is still no consensus on the true criteria for the diagnosis of AFE, and without consistent or standardized criteria for diagnosis, AFE remains a diagnosis of exclusion. This lack of consensus on criteria for diagnosis has led to stalled efforts to create a standardized treatment protocol (Arnolds, 2022). To enhance survival and decrease permanent neurological effects on the patient, it is of utmost importance that the signs and symptoms of AFE be recognized early and treatment started rapidly (AANA, 2022; Arnolds, 2022). With this knowledge, initial management for suspected AFE must be a team-based approach with mostly supportive and resuscitative measures based on the patient's hemodynamic status at the time (AANA, 2022; Arnolds, 2022; Baxter, 2023).

Signs, Symptoms, and Diagnostic Criteria of AFE

There has been an effort to standardize the criteria for diagnosis of AFE (Arnolds, 2022). The criteria for the Anesthesia Patient Safety Foundation for diagnosis include sudden onset of cardiopulmonary arrest or hypotension (systolic blood pressure < 90) and respiratory compromise (SpO2 saturations < 90), disseminated intravascular coagulopathy (DIC), clinical

onset of symptoms during or within 30 minutes post-labor, and no fever during labor. Arnolds (2022) explains similar criteria for diagnosis, but that clinical onset usually occurs during labor or within 30 minutes post-labor, Baxter (2023) states that he found AFE to be present during labor or even during earlier stages of pregnancy, specifically during spontaneous abortion or abdominal injury during pregnancy. Some early signs and symptoms of AFE, while not specific, may include anxiety, shortness of breath (SOB), hypoxia, chest pain, alterations to mental status, and seizures (Baxter, 2023). The AANA does not give specific criteria for diagnosing AFE but includes signs and symptoms for suspecting AFE. These signs and symptoms include fetal distress, maternal dyspnea, headache, chest pain, hypotension, tachycardia, O2 desaturation and cyanosis, bronchospasm, uterine atony, seizures, loss of end-tidal CO2, cardiopulmonary arrest, coagulopathy, and pulmonary edema (AANA, 2022). One can see the difficulty in immediately identifying AFE to begin treatment when there is no clear path to recognition.

Arnolds (2022) explains that AFE results in immediate cardiovascular collapse along with extensive coagulation disorders and massive hemorrhage. However, the mechanisms that cause cardiovascular collapse and coagulopathies are not well understood. The AANA states that the cause of AFE is due to an inflammatory or hemostatic response from fetal cells entering the bloodstream of the mother. Interestingly, Arnolds (2022) explains that the presence of fetal cells in the maternal bloodstream has not been proven and lacks evidence to be specific to the cause of AFE. However, the systematic review performed by Baxter (2023) found that one study reported outcomes related to AFE events. Additional studies reviewed showed that multiple post-partum patients transferred to critical care units presented without any symptoms of AFE while having fetal cells in their blood. According to Baxter (2023), hemodynamic instability is thought to be due to extreme pulmonary vasospasm, leading to right heart and eventual cardiovascular

collapse. Baxter, however, does not elaborate on the known cause of coagulopathy and states that fetal cells within the maternal bloodstream need additional research, as it is currently not specific to AFE.

In 2021, a retrospective case-control study was released by Matsunaga et al. This study included 87 participants; nine were diagnosed with AFE, while the other 78 were diagnosed with post-partum hemorrhage (PPH). Matsunaga et al. (2021), found that the patients with AFE had a decreased amount of bleeding in the first two hours compared to the PPH group, but the AFE group had continued heavy bleeding after the two-hour mark and had much more significant blood loss overall. Also of note, the AFE group had more extensive coagulopathies, with laboratory results measuring significantly lower levels of intrinsic coagulation factors (e.g., fibrinogen) with increased bleeding times (Matsunaga et al., 2021). While this may not be specific or universally accepted criteria for the diagnosis of AFE, perhaps it may help guide the identification and management of AFE. Baxter (2023) also cited a study where authors found decreased levels of intrinsic coagulation factors, specifically fibrinogen. In a study of 15 women diagnosed with AFE, 14 had unmeasurable levels of fibrinogen, and one had fibrinogen levels of 65 mg/dl in comparison to women with PPH who had low fibrinogen levels (< 200 mg/dl) but not as depleted as the patients with AFE. While this may not be the only specific marker for diagnosing AFE, perhaps it can help improve early recognition when considered with other signs and symptoms. Regardless, a severely decreased fibrinogen level will contribute to inducing massive blood loss and needs immediate management. However, despite the lack of criteria for AFE, it is easy to see that multiple sources agree that AFE occurs during pregnancy and includes hypotension, cardiovascular collapse, respiratory compromise, coagulopathy, and hemorrhage.

AFE Management

While there is no specific consensus on diagnostic criteria, there is a broad consensus on AFE management to aid in the preservation of patient life and decrease neurological injury. Maternal supportive measures should be based on maintaining oxygenation, hemodynamic support, and decreasing bleeding by correction of coagulopathies (AANA, 2022; Arnolds, 2022; Baxter, 2023). Arnolds (2022) states that initial support in the face of cardiac compromise should follow advanced cardiac life support (ACLS) as presented by the American Heart Association (AHA). AHA authors agreed that hemodynamic support should include the use of vasopressors and minimizing fluid resuscitation, except for replacing blood loss and correcting coagulation factors as the primary resuscitation goals. Careful administration of fluids may decrease the risk of dilutional coagulopathy. Airway support should include intubation, 100% FiO2, and maintaining SpO2 saturations at 96% or greater (AANA, 2022). Hemorrhage should be managed with the correction of the coagulopathy and the initiation of an obstetric hemorrhage protocol (AANA, 2022; Arnolds, 2022). Arnolds (2022), the AANA (2022), and Baxter (2023) all state that the administration of tranexamic acid (TXA) may be beneficial. Lab work should be sent immediately to identify correctable coagulopathies. AANA (2022) recommends the use of TXA, factor VIIa, prothrombin complex, and fibrinogen administration to treat coagulopathies. In addition to vasopressor use, coagulation factor replacement, and intubation, extracorporeal membrane oxygenation (ECMO) may be needed for full cardiopulmonary support (AANA, 2022; Arnolds, 2022; Baxter, 2023).

Additional treatment using the “A-OK” acronym guide for medication management may also be beneficial (AANA, 2022; Arnolds, 2022). “A-OK” stands for atropine, ondansetron, and ketorolac and may aid in treating vagal overstimulation, blocking the further release of mediators

(e.g. histamine, endothelin, and leukotrienes), and blocking thromboxane production, which will help reduce coagulation. Arnolds (2022) also states that additional management includes administering hydrocortisone, C1 esterase inhibitors, and lipid emulsion. All have been suggested but are not universally accepted and have not been proven to be effective. An additional checklist created by the Society for Maternal-Fetal Medicine states that the steps for the initial management of AFE include the management of circulatory collapse, the anticipation of uterine atony, disseminated intravascular coagulation (DIC), hemorrhage, management of pulmonary hypertension, and heart failure (Combs et al., 2021). Combs et al. (2021) provided specific examples of how each step in the checklist is to be initiated. This included the administration of oxytocin for uterine atony; immediate initiation of the massive transfusion protocol; and administering cryoprecipitate instead of fresh frozen plasma (FFP) to minimize the amount of fluid given. Further examples include the use of norepinephrine as the primary vasopressor, using dobutamine or milrinone as positive inotropes; inhaled nitric oxide for pulmonary vasodilation; and the consideration of ECMO when resuscitation attempts have been ongoing.

Evidence to Support the Project Tool

Checklists or CAs are used in a wide array of emergencies, including ACLS. Checklists may play an important role in aiding the provider with a step-by-step method for the management of AFE. The checklist provided by the Society for Maternal-Fetal Medicine is an example of steps that can be taken to initiate treatment. Combs et al. (2021) explain that this checklist was created to address the immediate signs and symptoms of an AFE event and to stabilize the patient. Once the patient is stabilized and reaches the intensive care unit (ICU), a more thorough management plan can be utilized to address the patient's needs. It is also

important to understand that the management of AFE is a team-based approach, so rapidly gathering all resources is key to the patient's survival and outcome. In a study performed by Bauer et al. (2016), the authors found that information transferred between providers during an emergency improved when a CA was used. Another study utilized the Stanford emergency manual CA. Authors found that the willingness of military surgical unit staff to use the manual during an emergency (e.g., malignant hyperthermia) was improved after education on the use of the manual (Gallegos & Hennen, 2022). Further studies performed by Hall et al. (2020) found that a team-based approach to emergencies improved with the use of a CA or checklist, and the rate of errors during the event was reduced by 50%.

According to the American College of Obstetricians and Gynecologists (ACOG; 2016), CAs for any situation must undergo continuous monitoring for effectiveness. This includes receiving continual feedback from the users and reviewing the aid for efficacy to make improvements and necessary updates for use in clinical practice. The ACOG also explains that the successful management of obstetrical emergencies utilizing CAs can increase their acceptance for use, especially when this information is shared among providers. These findings are noteworthy and indicate that a checklist or CA could assist providers in properly identifying and managing an AFE event when utilized by the anesthesia team. A checklist may help improve the accuracy of the treatment as well as aid in the recall of specific details and steps or actions to take regarding management. This allows the provider to implement the needed treatment without attempting to locate multiple sources on their own.

The partnering facility does not currently have a comprehensive checklist of best practices for identifying and managing an AFE event, leaving anesthesia providers to use personal preferences based on clinical experience. Providing and using a standardized checklist

for AFE management that is concise, easy to read, and located for immediate use within the labor and delivery department can reduce errors and improve efficiency. The checklist may improve the anesthesia providers' confidence by improving the time to identification and management of an AFE event and potentially improving patient outcomes.

Project Framework

The framework used for this quality improvement project was the Institute for Healthcare Improvement (IHI, 2022) model of improvement by implementing a four-step plan-do-study-act cycle. The PDSA outlines four steps needed for a quality improvement project. Step one includes planning for the test or observations as well as a plan formulated to gather the data. Step two is to carry out the plan and begin the analysis of the data. Step three includes analysis of the data and comparison of the results to predictions. Step four is to understand and implement any modifications that need to be made to the plan. According to the IHI, this model has been utilized by multiple organizations throughout the world for quality improvement as well as other process improvements while ensuring equity gaps are minimized.

The PDSA cycle begins with a "plan". The planning for this project was guided by asking if there would be improved confidence in CRNAs regarding the management of a patient with AFE after reviewing a reference tool. The next step in the PDSA model is "do," which was to create a reference tool to inform CRNAs of current best practices for the management of AFE. The third step in this process is "study." In this step, CRNAs were provided with a presentation on AFE identification and management, followed by a review of the newly designed reference tool. A pre-and post-questionnaire was utilized to assess for an increase in confidence when managing AFE. The QI team predicted that the perceived confidence of CRNAs would increase after reviewing the reference tool. The fourth step is "act." At this stage of the process, the author

analyzed the data from the pre- and post-questionnaires to gain a full understanding of CRNAs' change in confidence when managing AFE and the usefulness of the AFE checklist. This process may help improve the confidence of CRNAs when managing AFE based on best practices and could also guide future interventions to further aid in the management of AFE.

Ethical Considerations and Protection of Human Subjects

Collaboration between the College of Nursing and East Carolina University (ECU) Medical Center Institutional Review Board (UMCIRB), this project was found to be exempt from a full review due to being a quality improvement project (Appendix D). Before beginning this project, the project lead and author of this paper completed the Collaborative Institutional Training Initiative (CITI) Human Research modules under the requirements of East Carolina University (CITI Program, n.d.), https://tinyurl.com/46ykkjza. No patient information was utilized for this quality improvement project. All participants were CRNAs who volunteered to be part of the study. No increased or more than minimal risk was associated with the implementation or informational portion of this project, as all information was evidence-based or from professional organizations. The participants were asked to complete pre- and post-implementation surveys. The results were kept confidential, and no personal information was used outside of participant email addresses.

Section III. Project Design

Project Setting

This quality improvement project was conducted at a hospital located in eastern North Carolina. The hospital is a short-term acute care not-for-profit facility with 101 staffed beds and more than 20 medical specialties, including a birthing center. This hospital has five operating rooms, including one C-section operating room with six CRNAs on staff. According to the NCDHHS (NC Department of Health and Human Services), 188 births occurred at the facility from January to June of 2024 (NCDHHS, 2025). Smaller facilities, including the project site, can lack the resources needed during an emergency event, especially after regular operating hours. The small size, in addition to the number of deliveries that occurred in 2024, makes this an ideal setting for the implementation of an AFE cognitive aid.

Project Population

The population included in this project consisted of six full-time CRNAs employed at the facility. CRNAs are graduate-level nurses who have had various years of experience in an intensive care unit (ICU) before receiving their master's or doctoral degree in Nurse Anesthesia. CRNAs are highly trained providers who are at the forefront of patient care in the operating room. CRNAs are often the first providers to understand a patient's hemodynamic status and anticipate the actions and interventions needed to correct and manage emergencies while in the operating room. CRNAs must be confident in their decisions when managing any emergency, including an AFE event.

Amniotic fluid embolism is a medical emergency that can happen at any time during pregnancy, and staff need to be prepared to identify and respond immediately. CRNAs are primarily responsible for resuscitative efforts during the initial management of an AFE event.

Given that childbirth can occur at any time of day, CRNAs need to feel confident in the early identification and approach to the management of this emergency. However, CRNAs are very highly trained and may not believe that a CA, including an AFE checklist, may improve their confidence.

One barrier to implementation was CRNAs' lack of interest in the utilization of a new CA for AFE management. This was a perceived barrier to implementation, as new emergency checklists or CAs can become excessive when added to current practices. However, each CRNA in attendance showed great interest in the project and was receptive to the in-person PowerPoint presentation and CA. Another barrier was the small number of CRNAs working at the facility who were willing to come to the presentation during their own time. This QI project was implemented at a small rural hospital that employs six full-time CRNAs. However, only three are on staff at one time. The author was only able to implement this QI project one time, so the presentation was only given to three full-time CRNAs.

Additional barriers included the ease of using the CA during an AFE emergency, as well as actual utilization of the CA given current hospital guidelines, which include the "A-OK" protocol as a priority. Multiple printed and laminated copies of the CA were provided to the participants, which would aid in eliminating this barrier. The Chief CRNA at this small rural hospital was the major facilitator for this project. The CRNA was receptive to emails and helped organize the author's presentation with staff CRNAs. One major barrier to this project, however, was that the author was not able to gather all the participants' email addresses. The project was organized via the Chief CRNA and the project chair, and the information was passed on to the CRNAs who volunteered to participate.

Project Team

The project team consisted of the SRNA project lead, the project chair, and three additional SRNAs within this class. The project's implementation was performed independently; however, the project was developed utilizing input from all three SRNAs and the project chair. The project chair is currently a CRNA faculty member. Knowledge from the project chair concerning current operating room protocol and prior knowledge of quality improvement projects aided in the successful creation of the CA and implementation of this project. Additional team members included the DNP anesthesia project course director, who helped guide our project and helped with gaining permission to implement our quality improvement project. Our project team overcame barriers during the implementation of this project, including redirecting the project tool goal from a recorded simulation training event on AFE to creating an updated AFE CA. The project team meetings and collaboration facilitated overcoming these barriers.

Methods and Measurement

This quality improvement project included the sharing of a new CA, developed by student registered nurse anesthetists (SRNAs) and the project chair, that can be utilized in an AFE emergency. The CA was developed using current literature findings, as well as professional organization recommendations. Implementation of the CA included an in-person PowerPoint presentation at the facility with CRNAs in attendance. The pre- and post-implementation surveys were given to the CRNA volunteers via a QR code before and after the presentation. A separate post-implementation survey was given to the volunteers via a different QR code. The purpose of this project was to assess CRNAs' perception of the usefulness of a newly designed CA when dealing directly with an AFE emergency. The author's goal in implementing this project was to assess the perceptions and any change in the level of confidence of the CRNA when utilizing this

CA reference tool during an AFE emergency. This project was formed based on the Plan-Do-Study-Act cycle (PDSA cycle), which included planning the project and key components needed for implementation. This included research that spanned multiple professional organizations' recommendations based on current best practices, a review of the current literature on AFE, gaining permission to implement the quality improvement project, and the creation of a CA. Additionally, an email was created to distribute to volunteers for implementation, along with an in-person PowerPoint presentation on AFE, which was preceded by a pre-implementation questionnaire and followed by a post-implementation questionnaire.

The "planning" phase of this project involved researching articles gathered from professional organizations and current literature on the topic. This research included guidelines and recommendations for the quick recognition and management of AFE, current best practice meta-analysis studies of AFE events, and how to produce a purposeful and professional CA. Appendix B shows how the author's search was performed. The research that was gathered also backed up the author's findings that CAs may assist in the rapid management of emergent situations and potentially improve patient outcomes. A literature matrix (Appendix C) was devised to help guide the literature review. Additionally, team meetings took place that included our project chair, additional SRNA team members, and the DNP course director throughout the entirety of this project, which helped guide the direction of the project. During the Planning phase, the CA, PowerPoint presentation, and pre- and post-implementation questions were also created and critiqued for effectiveness.

The "do" phase of this project included the selection of a project implementation site and gathering the emails of volunteer participants. A pre-implementation and post-implementation questionnaire (Appendix E) was designed using the program Qualtrics and distributed to each

participant in the form of a QR code via email (Appendix F). The email sent to each volunteer also explained how the project would be conducted and requested their participation throughout the entire project to achieve a sufficient sample size. Likert-type scale questions, as well as yes or no questions and free response answers, were utilized for the pre-and post-implementation questionnaires to assess CRNAs' perception of the usefulness of the CA created for use during an AFE event. The pre-implementation questionnaire was used as guidance to identify the CRNAs' current knowledge of AFE, whether they have used CAs in the past, their perceptions of such CAs, and their perceived usefulness of a newly designed CA for the management of AFE events. The author also sought to assess the use of any current AFE CAs at the facility. Another integral part of the "do" phase was conducted by an in-person PowerPoint presentation that was performed at the facility to provide each CRNA who volunteered to participate with the ability to be present at the presentation.

Additionally, the CA (Appendix G) was dispersed to each participant during the presentation. After the presentation, a digital post-implementation questionnaire (Appendix E) was distributed to each participant via a QR code. Each participant was asked to complete the questionnaire before leaving the presentation. This assessed the current views and perceived usefulness of the CA post-presentation and any changes in thoughts or suggestions from the pre-implementation questionnaire. All data and information were kept confidential during this entire process. No participants' names or identifying information were used in any part of this project.

Data collected during the "study" phase, including the pre- and post-implementation questionnaires, were reviewed and entered into an Excel spreadsheet for analysis. Future recommendations for the use of the CA were discussed during the "act" phase. This included future project goals and future PDSA cycles regarding AFE and the use of a CA to improve

CRNAs' confidence during an AFE event and improve patient outcomes during this emergency. The author was aware, at the beginning of the project, that there would be statistical significance limitations with this QI project due to the small study sample of only six CRNAs working at this facility, as well as attempting to plan presentation times so that all employees could attend.

Section IV. Results and Findings

Results

The purpose of this DNP QI project was to evaluate the perception of a newly designed CA for the identification and management of AFE, as well as current and post-implementation confidence for identifying and managing an AFE event. The CA was presented in person to three CRNAs via a PowerPoint presentation. The CA was available for each participant to review during the presentation. The survey questions were designed to identify the participants' level of confidence in managing AFE before and after the presentation. Each participant was asked to use the provided QR code to answer the pre-implementation survey questions. After the presentation and CA review, each participant was then asked to complete the post-implementation survey via a separate QR code. There was a total of three CRNAs in attendance for the presentation. However, only two out of three participants answered the pre- and post-implementation survey. Two participants' responses were collected through Qualtrics. This data was later analyzed using Excel.

Data Presentation

The pre-implementation survey was accessed via a QR code and assessed the participants' years practicing as a CRNA, the amount of education or in-services received regarding AFE while practicing as a CRNA, the number of times each participant had been involved with the management of an AFE, and the level of confidence in identifying and managing a patient with AFE. Of the two participants, one reported being a CRNA for five to nine years, and one reported being a CRNA for 15 to 20 years. Two of the participants stated they had received no further education or in-service regarding AFE since being in practice. Two of the participants reported that they had not been involved with the management of a patient

with AFE. The two participants who answered the pre-implementation survey stated their confidence in identifying and managing an AFE event as “neutral.”

Additional questions from the pre-implementation survey were aimed at addressing the use of the current treatment guidelines or any current CA for AFE provided by their facility, time it would take to access this material, the effectiveness of the facility's current AFE management guidelines, if applicable, whether they would use a newly designed CA if provided, and whether they have used a CA in the past for an emergency. Two of the participants reported that they were unaware of a current CA within their facility, but answered that if they needed to access reference material regarding AFE, it would take approximately “4-6 minutes.” No participants answered the question regarding the effectiveness of current treatment guidelines at their facility. When asked about the likelihood of using a new CA for the management of AFE, one participant reported, “I will probably use it,” and the second responded, “I am very likely to use it.” Both participants reported that they had used CAs in the past during an emergency.

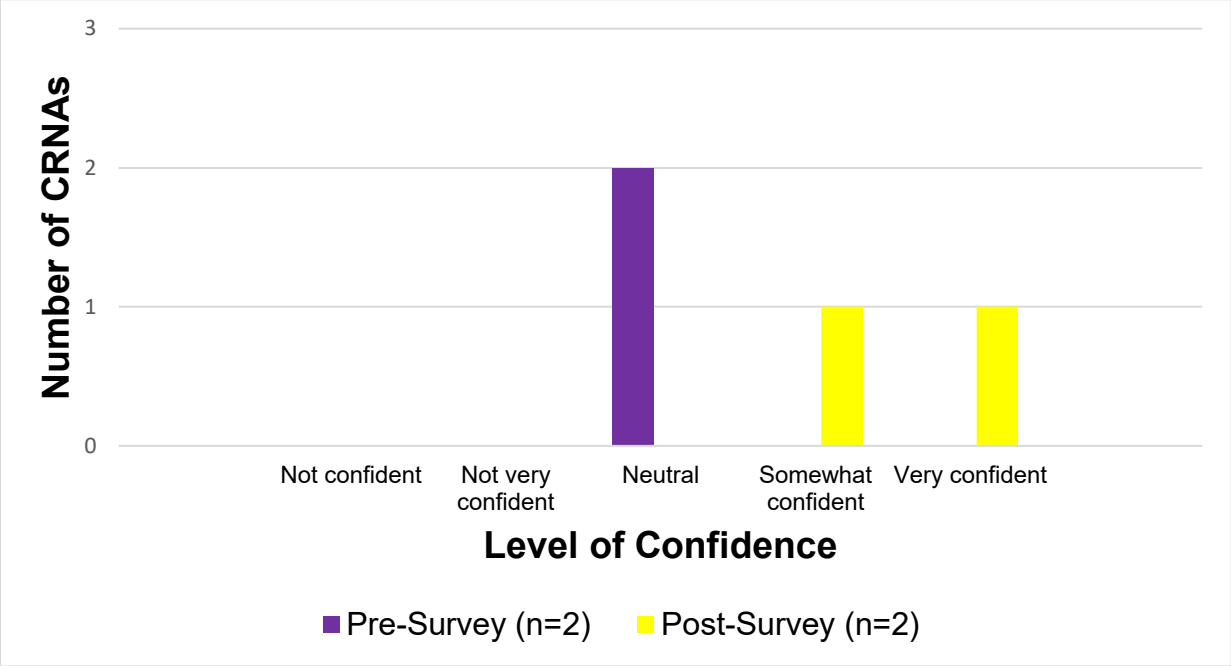
The post-implementation survey was administered via a QR code after an in-person PowerPoint presentation. The post-implementation survey asked the participants to indicate their perceptions of the different aspects of the CA. Two of the participants “strongly agreed that the handout was easy to read and understand, the CA was organized well, the information included was applicable and accurate, and overall, I was satisfied with this CA.” The post-implementation survey also asked how likely the participants were to use the new evidence-based CA after the presentation, and which location would be the easiest and fastest to access the CA. Two of the participants answered that they were “very likely” to use the new evidence-based CA and that the CA should be located at all the listed locations to provide the fastest and easiest access during an AFE event. The locations listed in the question included placing a QR code on the anesthesia

machine in Labor, Delivery, Recovery, and Postpartum (LDRP) room, a laminated handout in the anesthesia machine in LDRP rooms, and a Practice Advisory Popup with a link within the Electronic Health Record (EHR). There was also a write-in section for suggested locations to gain access to the CA; none of the participants provided additional locations.

Two of the post-implementation survey questions were repeated from the pre-implementation survey. The first repeated question was to gain an understanding of whether the presentation and CA had increased the participant's level of confidence when identifying and managing an AFE event. The second repeated question was to assess the perceived amount of time the participant would need to spend accessing the CA if it were placed in one of the above locations. The level of confidence post-implementation was answered by two participants. One answered, "Somewhat confident," while the other answered, "Very confident." The perceived amount of time to access the CA as a tool for managing AFE decreased with both participants. One participant answered, "Less than 1 minute," and the other participant answered, "1-3 minutes." Two additional questions were asked in the post-implementation survey. These questions included other personnel who could benefit from this presentation and CA, and whether there were any suggestions for improving the CA and presentation. Both responding participants selected "Obstetrical (OB) Residents/Fellows," "OB Nurses," and "OB Attendings." No additional responses were provided in the free-text box asking for additional personnel who would benefit from this presentation. No additional suggestions for improving the CA and presentation were provided. The level of confidence regarding the management of AFE was assessed in the pre- and post-implementation surveys (see Figure 1).

Figure 1

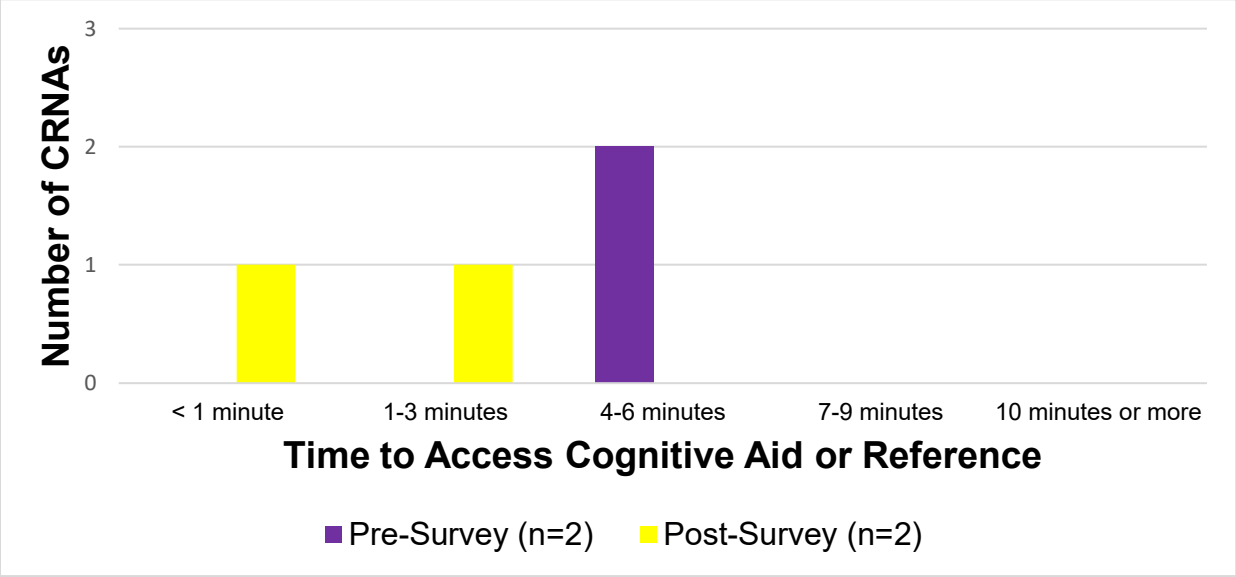
CRNA Level of Confidence Regarding the Management of AFE


3
2
1
0
Number of CRNAs
Not confident
Not very confident
Neutral
Somewhat confident
Very confident
Level of Confidence
Pre-Survey (n=2)
Post-Survey (n=2)

The estimated time to access evidence-based reference material or a CA for the management of AFE was also assessed in pre- and post-implementation surveys (see Figure 2).

Figure 2

Estimated Time to Access an Evidence-Based Reference Guide or Cognitive Aid for the Management of AFE



Analysis

This data was obtained via pre-implementation and post-implementation Qualtrics surveys during an in-person PowerPoint presentation with all participants in attendance. The data from this project helped gain a better understanding of CRNAs' perceptions of a newly designed CA developed for AFE, as well as the perceived confidence when managing an AFE event. By administering a pre-implementation survey before the presentation, followed by a post-implementation survey, a direct comparison of the findings was able to be analyzed. Two out of three participants answered both the pre- and post-implementation surveys. Years of clinical experience could influence the impact of the project on participant confidence. Both participants have used CAs in the past and stated they had not received further education on AFE during their

time as a CRNA. Both participants also stated feeling “neutral” in their confidence level in the identification and management of an AFE event.

Based on the answers received from the pre- and post-implementation surveys, the CRNAs' level of confidence in the identification and management of AFE improved after the PowerPoint presentation and review of the new evidence-based CA. Before implementation, two CRNAs rated their level of confidence as “neutral.” The post-implementation survey showed an increase in the level of confidence in the management of AFE by both CRNAs from “neutral” in the pre-implementation survey to “somewhat confident” for one CRNA and “very confident” for the second CRNA. The estimated time it would take to access evidence-based resources like the newly designed CA was reduced by one to five minutes post-implementation. This is evidenced by the pre- and post-implementation survey question answers. Two CRNAs who answered the pre-implementation survey stated that they estimated it would take four to six minutes to access these resources. A separate post-implementation survey question asked which location they felt would provide the easiest or best location for this CA. The follow-up question aimed to assess the time it would then take CRNAs to find this CA if placed at these suggested locations. One CRNA estimated that it would take “less than 1 minute” to access this CA, and the second CRNA estimated that it would take “1-3 minutes” to access the CA. Being able to access a CA quickly can lead to more rapid decision-making during an emergency such as AFE. This data shows that the level of confidence in the management of AFE was improved post-implementation, as well as a reduction in time to access the evidence-based CA during an AFE emergency.

Additionally, no participants answered the pre-implementation survey question regarding the effectiveness of current treatment guidelines at their facility, as both participants reported that

they were unaware of a current AFE CA within their facility. When asked about the likelihood of using a new CA for the management of AFE, one participant reported, “I will probably use it,” and the second responded, “I am very likely to use it.” Working at a smaller outside outlying facility allows for more autonomy. However, a CA such as the one provided in this QI project may be better received than at a larger facility. Smaller facilities may not have the resources and additional colleagues available to share thoughts and ideas during an emergency. Via data analysis from the pre- and post-implementation surveys, the CRNAs’ confidence level in the identification and management of AFE had increased, the time it would take to access the CA had decreased, and both participants’ likelihood of utilizing the new CA had increased. This is an initial positive outcome for this project implementation at this facility. However, it is important to note that only two out of three participants who were present during the presentation completed the pre-and post-implementation surveys. This data sample was small and may show better results by repeating the project using a larger sample. Using this pilot project with additional interventions on a larger-scale project will help understand the effectiveness and the utility of the CA in managing AFE events.

Section V. Implications

Financial and Nonfinancial Analysis

Amniotic Fluid Embolism is a rare and often fatal obstetric emergency. Due to this, it is challenging to estimate the total hospital stay and costs for this patient population accurately. In a case study performed by Jaya-Bodestyne et al. (2025), four cases of AFE were examined. The parameters examined included age, delivery method, onset of symptoms, duration of mechanical ventilation, and intensive care unit (ICU) stay, as well as other factors. One significant finding from this study was the onset of symptoms, which ranged from 4 minutes post-delivery of the baby to one hour and 45 minutes post-rupture of membranes (Jaya-Bodestyne et al., 2025). The same study stated that the ICU time of stay ranged from three to 25 days, with an average stay of 10.5 days. The daily costs of an ICU stay ranged widely depending on multiple factors. In 2005, the first day of an ICU stay in the U.S. cost approximately $10,794 with mechanical ventilation and $6,667 without mechanical ventilation, and decreased to $4,796 with mechanical ventilation and $3,496 without mechanical ventilation on the second day (Dasta et al., 2005). These prices have surely increased in the past 20 years. The adoption of this project and CA for AFE could decrease the CRNA's time to recognition and reduce time in initiating management for AFE, based on the most recent evidence-based guidelines. This, in turn, could decrease the patient's length of stay and improve outcomes.

Patients may also require ECMO for the extended management of AFE, which would increase the cost of the ICU stay. The average cost of ECMO varies widely and is dependent on multiple factors. However, a systematic review performed in 2021, which included the U.S., Europe, Japan, Australia, and Taiwan, found that the cost of ECMO management could range from $22,305 to $334,608, depending on additional factors from the surgery or severity of the

patient's status (Lansink-Hartgring et al., 2021). Use of the CA could help reduce these costs by potentially identifying and managing a suspected AFE sooner.

This project, performed by four DNP Nurse Anesthesia students, was to create a current and evidence-based CA that could aid in the rapid identification and management of an AFE event. It is well known that rapid identification leads to decreased time to the initiation of the management in an emergency, which could decrease the patient's length of stay (LOS) in the hospital as well as improve the outcome. If the hospital were to choose to implement this project, costs would be minimal. After the necessary committee approves the CA, costs would include a short training session. This cost would include paying for the training CRNA as well as the CRNAs in attendance. In the U.S., the average hourly pay of a CRNA is $103 (United States Bureau of Labor Statistics, 2023). The implementation of this project could provide significant benefits to patient outcomes with minimal costs to the facility, given that the CA has already been created and reviewed positively by CRNA participants.

Implications of Project

The AANA (2022), Amniotic Fluid Embolism Foundation (2024), and Baxter (2023) all have practice guidelines for AFE identification and management. After reviewing these listed sources, as well as many additional citations for this project, it was found that there was no single source that included all this information in an easy-to-read checklist. The goal of this project was to incorporate all findings into one easy-to-read, current best-practice CA to help direct the management of AFE.

As mentioned previously, AFE is rare and often fatal to the patient. Having immediate access to a CA, especially in such a rare event, could save multiple lives. In addition to saving lives and decreasing morbidity following the event, there is a strong possibility that the length of

hospital stay could be reduced. This project directly aligns with the Triple Aim theory, which aims to improve the patient experience, enhance patient health, and reduce associated costs (Whittington et al., 2015). CAs have been shown to improve effectiveness in emergencies, particularly during high-risk, low-frequency events. However, a CA should not detract from the clinical knowledge and critical thinking of an experienced anesthesia team. In a study by Greig et al. (2022), it was found that the use of a CA increased the time required to manage a simulated airway emergency but decreased the time spent administering the lifesaving drug dantrolene in a malignant hyperthermia crisis simulation. This finding suggests the effectiveness of a CA in low-frequency emergencies but could increase the time required for managing an emergent situation where the CRNA has expertise and experience. Given that an AFE emergency is rare, the use of a CA has enormous potential for improving patient outcomes.

The costs of implementation for the facility would be minimal. The implementation of this project would not require any additional equipment or devices other than laminated copies of the CA. Additional costs would include hourly pay for the training sessions that include the training CRNA and the CRNA participants. Given the low frequency and the high mortality and morbidity of AFE, it is expected that hospitals could see large cost savings, especially in a hospital with a large birthing center. Not only would the hospital save money for the ICU stay, but also for the faculty that provides care during the extended hospital stay, including nurses, nurse aids, respiratory therapists, and multiple other support staff.

Additionally, AFE may require the assistance of ECMO depending on the severity of the symptoms. The CA developed for this project could save time in the identification and initiation of life-saving management of this patient population and, therefore, could potentially decrease the chance of requiring ECMO for hemodynamic instability. During a discussion period

following the project implementation, CRNAs noted that if an AFE event occurs at their facility, the patient would be sent to a larger facility for management. This is common in smaller rural hospitals that lack resources for the care of such catastrophic events. However, it is the goal of this project to inform and educate the CRNAs of the identification and rapid initial management of such events through education and a CA. To reiterate, the advantages of this project are paramount as it could aid in the rapid detection of an AFE event and rapid management, which could alter the course of treatment for the patient for the better.

Sustainability

The facility could see future cost reductions in this patient population with the adoption of this project into its anesthesia patient care guidelines. However, the facility may need to implement this project in a manner that aligns with their individual needs and assesses CRNA perceptions of the CA before initiation of the guidelines. If the project proves successful, additional training could include nursing and surgical staff within labor and delivery, which would only increase patient satisfaction, outcomes, and costs associated with AFE.

Ownership of the project would be that of the anesthesia group, CRNAs, and the nurse educators. The anesthesia group and CRNAs would ensure that periodic education is performed utilizing the CA for continuing education for AFE. Nurse educators would also play a role in continuing education for labor and delivery nurses and staff if the project were to be implemented outside of the CRNAs.

CRNAs are very highly trained and efficient providers, but rare events such as AFE could potentially decrease the CRNAs' confidence in the initiation of rapid management guidelines. With additional training, this quality improvement project could increase CRNAs' confidence if an AFE event occurs. The adoption of this project may also increase interest in creating a time

for education on rare and emergent events such as this. The success of this project may also lead to future projects. Overall, this facility could benefit from both cost savings and patient satisfaction scores through the implementation of this project and CA.

Dissemination Plan

This quality improvement project was concluded with an in-person poster presentation given to the DNP faculty at East Carolina University. The final version of this DNP quality improvement paper is published in The Scholarship, the East Carolina University digital repository.

Section VI. Conclusion

Limitations

The limitations to this quality improvement project were the small number of participants and the implementation length of one day at a single facility. Three participants were available during the time of implementation, with one participant on vacation during the week of implementation. Multiple implementation dates may have allowed more participants to be present. The collected data was limited due to these factors, and the inability to implement the project at a larger facility. Implementing at a larger facility may have allowed a larger number of participants to be present for the implementation of this project.

Two CRNA participants answered both the pre- and post-implementation surveys. Pre-implementation survey questions were provided as a Qualtrics link before the presentation, with time allowed for each participant to respond. A post-implementation survey link was provided to the participants after the presentation concluded. One participant started but did not complete either survey. This may have been a Qualtrics or user error. However, the author was unable to view which participants responded due to the confidentiality in completing the survey. In addition, one single Qualtrics link was used for all pre- and post-implementation survey questions. Because of this, these incomplete responses were not used for the final analysis of the collected data.

An additional limitation was the setup used by the author for the Qualtrics survey. It could have been more beneficial if the pre-implementation survey had been emailed to each participant in advance, in addition to providing time before the live presentation to fill out the survey. This would provide a longer length of time for each participant to respond appropriately

before implementation. The post-implementation survey link could have been provided to the participants in attendance or via email, with a longer length of time to respond.

Recommendations for Future Implementation and/or Additional Study

Recommendations for future implementation include a larger sample size as well as more implementation sites. This would improve analysis of the responses and allow more insight into the usefulness of the reference guide at outlying facilities versus the main facility. This QI project took place at a small outlying facility in eastern North Carolina. The project should be expanded to larger facilities that may have current guidelines in place for emergency events such as AFE. This could have changed the perceived usefulness of this QI project reference guide. Continuing to utilize the Qualtrics survey format and Microsoft Excel for data interpretation in any future projects due to the cost-effectiveness is recommended.

Additional recommendations include expanding the project or a follow-up to this project to include an AFE simulation experience. A simulation may help expand the perceived usefulness of the reference tool when managing emergencies such as AFE. Given that AFE is rare and there are no conclusive diagnoses and treatments, perhaps potential results from future research will provide clearer guidelines for managing AFE. Overall, the benefit of providing an updated AFE CA was provided to a small sample of practicing CRNAs, with initial findings noting the benefit of repeating the PDSA cycle on a larger scale.

References

Akasaka, M., Osato, K., Sakamoto, M., Kihira, T., Ikeda, T., & Yamawaki, T. (2018). Practical use of C1 esterase inhibitor concentrate for clinical amniotic fluid embolism. *Journal of Obstetrics and Gynaecology Research, 44*(10), 1995-1998. https://doi.org/10.1111/jog.13717

American Association of Nurse Anesthesiology. (2022). *Analgesia and anesthesia for the obstetric patient.* ISSUU. https://tinyurl.com/5n6mbye9

Amniotic Fluid Embolism Foundation. (2024). *What is amniotic fluid embolism (AFE)?* https://afesupport.org/

The American College of Obstetricians and Gynecologists. (2016). The use and development of checklists in obstetrics and gynecology. *Obstetrics and Gynecology, 128*(5), 237-240. https://oce.ovid.com/article/00006250-201611000-00055/HTML

Arnolds, D. E. (2022). Recognition and management of amniotic fluid embolism: A critical role for anesthesia professionals on labor and delivery. *Anesthesia Patient Safety Foundation Newsletter, 37*(3). https://tinyurl.com/4t6tfzeb

Bauer, B., Rebel, A., Dilorenzo, A., Schell, R., Dority, J., Lukens, F., & Sloan, P. (2016). Cognitive aid use improves transition of care by graduating medical students during a simulated crisis. *Medical Education Online 21*, 32118. https://doi.org/10.3402/meo.v21.32118

Baxter, F. (2023). Amniotic fluid embolism: A narrative review. *Journal of Obstetric Anesthesia and Critical Care, 13*(2), 130-141. https://tinyurl.com/yu9kef76

Combs, C. A., Montgomery, D. M., Toner, L. E., & Dildy, G. A. (2021). Society for maternal-fetal medicine special statement: Checklist for initial management of amniotic fluid

embolism. *American Journal of Obstetrics and Gynecology, 224*(4). https://www.ajog.org/article/S0002-9378(21)00001-6/pdf

Dasta, J. F., McLaughlin, T. P., Mody, S. H., & Piech, C. T. (2005). Daily cost of an intensive care unit day: The contribution of mechanical ventilation. *Critical Care Medicine, 33*(6), 1266-1271. https://doi.org/10.1097/01.ccm.0000164543.146

Gallegos, E. & Hennen. B. (2022). Malignant hyperthermia preparedness training: Using cognitive aids and emergency checklists in the perioperative setting. *Journal of PeriAnesthesia Nursing, 37*(1), 24-28. https://www.jopan.org/article/S1089-9472(20)30363-4/abstract

Greig, P., Zolger, D., Onwochei, D., Thurley, N., Higham, H., & Desai, N. (2022). Cognitive aids in the management of clinical emergencies: A systematic review. *Anaethesia, 78*(3), 343-335. https://doi.org/10.1111/anae.15939

Hall, C., Robertson, D., Rolfe, M., Pascoe, S., Passey, M., & Winona Pit, S. (2020). Do cognitive aids reduce error rates in resuscitation team performance? Trial of emergency medicine protocols in simulation training (TEMPIST) in Australia. *Human Resources, 18*(1), 1. https://doi.org/10.1186/s12960-019-0441-x

Institute for Healthcare Improvement. (2022). *How to improve: Model for improvement.* https://tinyurl.com/26f7274e

Jaya-Bodestyne, S. L., Tan, W. C., Kanagalingam, D., Yong, T. T., Nadarajah, R., Tan, L. K., & Yang. (2025). Amniotic fluid embolism: A case series. *Obstetric Medicine.* https://doi.org/10.1177/1753495X251326125

Lansink-Hartgring A. O., van Minnen, O., Vermeulen, K., & van der Bergh, W. M., (2021). Hospital costs of extracorporeal membrane oxygenation in adults: A systematic review. *PharmacoEconomics – Open, 5*(4), 613-623. https://doi.org/10.1007/s41669-021-00272-9

Matsunaga, S., Masuko, H., Takai, Y., Kanayama, N., & Seki, H. (2021). Fibrinogen may aid in the early differentiation between amniotic fluid embolism and postpartum hemorrhage: A retrospective chart review. *Scientific Reports, 11*(1), 8379. https://doi.org/10.1038/s41598-021-87685-y

Melnyk, B. M., & Fineout-Overholt, E. (2019). *Evidence-based practice in nursing & healthcare: a guide to best practice.* Fourth edition. Philadelphia: Wolters Kluwer.

NC Division of Public Health. (2025). *Births occurring in hospital by month.* https://tinyurl.com/2p4jv59x

Pacheco, L. D., Clark, S. L., & Klassen, M. (2020). Amniotic fluid embolism: Principles of early clinical management. *American Journal of Obstetrics and Gynecology, 222*(1), 48-52. https://doi.org/10.1016/j.ajog.2019.07.036

United States Bureau of Labor Statistics. (2023). *Occupational employment and wage statistics.* https://www.bls.gov/oes/2023/may/oes291151.htm

Whittington, J. W., Nolan, K., Lewis, N., & Torres, T. (2015). Pursuing the triple aim: The first 7 years. *The Millbank Quarterly, 93*(2), 263-300. https://doi.org/10.1111/1468-0009.12122

Appendix A

Literature Search Concept Table

(PubMed, CINAHL, Google Scholar)

	Concept 1 CRNA Nurse Anesthetist	Concept 2 Amniotic Fluid Embolism	Concept 3 Simulation	Concept 4 Diagnosis
Keywords	CRNA Nurse Anesthetist	AFE Embolism Amniotic Fluid Embolism	Simulation Lab Simulation Training Nurse Education	Diagnosis
PubMed MeSH	"Nurse Anesthetist" [MeSh term] "Anesthetist, Nurse" [MeSH term] "Anesthetists, Nurse" [MeSH term]	"Amniotic Fluid Embolisms" [MeSH term] "Amniotic Fluid Embolism" [MeSH term] "Embolisms, Amniotic Fluid" [MeSH term]	"Training, Simulation" [MeSH term] "Interactive Learning" [MeSH term] "Learning, Interactive" [MeSh term] "Educational Activities" [MeSH term] "Activities, Educational" [MeSH term]	"Diagnoses" [MeSh term] "Diagnose" [MeSH term]
CINAHL Subject Headings	(MH "Certified Registered Nurse Anesthetists")	(MH "Embolism, Amniotic Fluid") OR (MH "Amniotic Fluid) OR (MH "Embolism")	(MH "Simulations") OR (MH "Patient Simulation") OR (MH "Education, Nurse Anesthesia")	(MH "Diagnose") OR (MH "Diagnosis, OB-GYN")

Google Scholar	"Nurse Anesthetist" "Anesthetist, Nurse"	"Amniotic Fluid Embolisms" "Embolisms, Amniotic Fluid"	"Training, Simulation" "Interactive Learning" "Learning, Interactive" "Educational Activities" "Activities, Educational"	"Diagnoses" "Diagnose"

Appendix B

Literature Search Log

Search date	Database or search engine	Search strategy	Limits applied	Number of citations found/kept	Rationale for inclusion/exclusion of items
09/12/2024	PubMed	(Amniotic Fluid Embolism) AND (Diagnose) OR (Educational Activities) (((“embolism, amniotic fluid”[MeSH Terms] OR (“embolism”[All Fields] AND “amniotic”[All Fields] AND “fluid”[All Fields]) OR “amniotic fluid embolism”[All Fields] OR (“amniotic”[All Fields] AND “fluid”[All Fields] AND “embolism”[All Fields])) AND (“diagnosable”[All Fields] OR “diagnosis”[All Fields] OR “diagnosis”[MeSH Terms] OR “diagnosis”[All Fields] OR “diagnose”[All Fields] OR “diagnosed”[All Fields] OR “diagnoses”[All Fields] OR “diagnosing”[All Fields] OR “diagnosis”[MeSH Subheading])) OR ((“educability”[All Fields] OR “educable”[All Fields] OR “educates”[All Fields] OR “education”[MeSH Subheading] OR “education”[All Fields] OR “educational status”[MeSH Terms] OR (“educational”[All Fields] AND “status”[All Fields]) OR “educational status”[All Fields] OR “education”[MeSH	10 years (actual years 2014-2024) English Language Meta-Analysis Randomized Control Trial Review Systematic Review	69/16	These articles focused on recognition and techniques but also treatment options such as ECMO for cardio-pulmonary support. A couple of articles focuses nurse education techniques as well. I omitted quite a few articles because they weren’t specific to Amniotic Fluid Embolism (AFE), but rather on OB complications.

		Terms] OR "education s"[All Fields] OR "educational"[All Fields] OR "educative"[All Fields] OR "educator"[All Fields] OR "educator s"[All Fields] OR "educators"[All Fields] OR "teaching"[MeSH Terms] OR "teaching"[All Fields] OR "educate"[All Fields] OR "educated"[All Fields] OR "educating"[All Fields] OR "educations"[All Fields]) AND "Activites"[All Fields])) AND (y_5[Filter])			
09/12/2024	CINAHL	(MH "Amniotic Fluid Embolisms" OR "Embolisms, Amniotic Fluid") AND (MH "Diagnoses" OR "Diagnose")	15 years (actual years 2009-2024) English Language	12/8	These articles focused on recognition and diagnosing techniques but also treatment options such as ECMO for cardio-pulmonary support.
09/12/2024	Google Scholar	(Amniotic Fluid Embolism) AND (Diagnose) OR (Educational Activities)	5 years (actual years 2019-2024)	1,910 found /15 kept (Reviewed first 15 pages)	A few of these articles were helpful in attempting to identify biomarkers that could help in identify high risk patients and giving a full diagnosis of AFE. There was another good article on how high-fidelity simulations for treating AFE could be helpful.

Appendix C

Literature Matrix

Year	Author, Title, Journal	Purpose & Conceptual Framework or Model	Design and Level of Evidence	Setting	Sample	Tool/s and/or Intervention/s	Results
2023	Baxter, F. (2023). Amniotic fluid embolism: A narrative review. *Journal of Obstetric Anesthesia and critical care, 13*(2), 130-141.	Description of AFE, clinical presentation and treatment No framework or model noted	V: Systematic review of descriptive or qualitative study	Not provided	127 articles	Narrative review of 127 articles from Ovid and Cochrane Library	AFE is a rare but deadly complication of pregnancy. No clear etiology or specific test identified to confirm diagnosis. Hemodynamic instability appears to be caused by pulmonary vasospasm and subsequent right heart failure. Treatment recommendations included
2022	American Association of Nurse Anesthesiology. (2022). Analgesia and anesthesia for the obstetric patient	Provide guidelines or suggestions in the recognition and treatment of AFE	VII: Expert opinion from individuals or groups	Not provided	None noted	None noted	AANA protocol for the recognition and treatment of AFE

		No framework or model noted					
2022	Arnolds, D.E. (2022). Recognition and management of amniotic fluid embolism: A critical role for anesthesia providers on labor and delivery. *Anesthesia Patient Safety Foundation Newsletter, 37*(3).	Provide guidelines in creating a facility specific cognitive aid for intervention and treatment of AFE No framework or model noted	VI: Case study and EBP implementation	Not provided	None noted	Author used data collected from studies such as the WOMAN Trial as well as case analysis from information submitted to the United States AFE registry to aid in guidance for the recognition and treatment of AFE Article does not state number of participants in each trial or specific information	Diagnostic criteria developed with expert panel from the Society of Maternal-Fetal Medicine and the Amniotic Fluid Embolism Foundation
2022	Gallegos, E., & Hennen, B. (2022). Malignant hyperthermia preparedness training: Using cognitive aids and emergency checklists in the perioperative setting. *Journal of PeriAnesthesia Nursing, 37*(1). 24-28.	To improve staff perception of cognitive aid use during medical emergencies via simulated exercise with addition of cognitive aid No famework or model noted	VI: Quality Improvement	Military ambulatory surgical center	Convenience sample of 13 perioperative staff and all full-time staff. All completing pre- and post-implementation surveys	Educational session Pre- and post-implementation survey	The use of simulated experiences with the addition of cognitive aids was the best way to ensure that the participants would include these vital steps during the treatment of malignant hyperthermia. The use of cognitive aids in

							supporting other medical crisis management could benefit as well from cognitive aids
2021	Combs, C. A., Montgomery, D. M., Toner, L. E., & Dildy, G. A. (2021) Society for maternal-fetal medicine special statement: Checklist for initial management of amniotic fluid embolism. *American Journal of Obstetrics and Gynecology, 224*(4).	This expert opinion article in AJOG was to help guide the creation of a hospital-specific checklist for the management of AFE It also provides suggestions and goals for creating a checklist specific to the needs of the unit No framework or model noted.	VII: Expert opinion	Not provided	None noted	None noted	A basic checklist for the management of AFE was given in the article. This article was not to provide hospitals with a checklist but with suggestions on what to include in a checklist that would be specific for the providers (nurses, CRNAs, and MDs) that would be present in the case AFE is diagnosed.
2021	Matsunaga, S., Masuko, H., Takai, Y., Kanayama, N., & Seki, H. (2021). Fibrinogen may aid in the early differentiation between amniotic fluid embolism and postpartum haemorrhage: A retrospective chart review. *Scientific Reports 11*(1), 8379.	This study's aim was to determine if blood loss and fibrinogen levels can differentiate AFE and PPH. No framework of model noted.	III: Retrospective case-control study	Tertiary care perinatal center in Japan	87 total participants 9 with diagnosis of AFE 78 with diagnosis of postpartum hemorrhage	Statistical analysis performed using JMP v13.0 Chi-square test Univariate analysis	Patients with AFE had decreased amount of initial bleeding in the first two hours. However, the bleeding continued and therefore lost significantly more blood overall than the patients with PPH. The coagulopathy of the AFE group was far

							more extensive than and these patients had significantly lower levels of extrinsic coagulation factors. The Blood loss/Fibrinogen (F/B) ratio was much higher at the onset of bleeding in the AFE group than the PPH group. This information could help in forming an early diagnosis of AFE and aid in forming the correct treatment plan.
2020	Hall, C., Robertson, D., Rolfe, M., Pascoe, S., Passey, M., & Winona Pit, S. (2020). Do cognitive aids reduce error rates in resuscitation team performance? Trial of emergency medicine protocols in simulation training (TEMPIST) in Australia. *Human Resources for Health 18*(1), 1.	Assess effectiveness of a newly designed cognitive aid in a simulated environment by observing error rates with and without the availability of the cognitive aid The groups were able to use the newly designed cognitive aid for two randomly chosen emergencies.	II: Randomized control trial	Simulated emergency room crisis in a resuscitation room with all appropriate monitoring resuscitation equipment available	21 groups of participants (nurses and doctors) that worked in emergency room within the past 12 months Article did not specify how many part	Statistical analysis performed using SPSS Version 22 Participant experience performed with 5-point Likert scale	When cognitive aids were used for complex emergencies, the clinicians nearly halved their rate of error across the four simulated events. This is helpful in proving that cognitive aids can help to guide a treatment plan for patients that can save lives as well as increase

		However, the cognitive aid was not available for the other two scenarios No framework of model noted					confidence when faced with emergencies.
2016	Bauer, B., Rebel, A., Dilorenzo, A., Schell, R., Dority, J., Lukens, F., & Sloan, P. (2016). Cognitive aid use improves transition of care by graduating medical students during a simulated crisis. *Medical Education Online 21*, 32118.	Aim of project was to assess ability to perform transition of care in a crisis and whether a cognitive aid improves the quality of the transition of care No framework or model noted	II: Randomized control trial	Simulated hospital setting during emergent event	112 senior medical students. Randomly separated into groups of three students. CA n=19 nCA n=17	Statistical analysis using t-test and Mann-Whitney U test Pre- and post-intervention questionnaire using Likert scale scoring tool	Completeness of information transferred during transition of care process improved when using a cognitive aid in simulated medical crisis. The authors of the study pointed out that in a recent study, the quality of the transition of care process by anesthesia residents in a crisis had a loss of important and vital information. The results from this study could be helpful as it found that cognitive aids help

							ensure that the steps needed to successfully function during a crisis are met.
2016	The American College of Obstetricians and Gynecologists. (2016). The use and development of checklists in Obstetrics and Gynecology. *The American College of Obstetricians and Gynecologists.*	Aim is to recognize the efficiency of checklists used during OB emergencies and to provide goals and suggestions to creating a clear and effective checklist. Another aim of the article is to ensure that the checklist is provided in a manner that promotes the safety of the patient as well as the competency and confidence of staff.	VII: Expert opinion	Not provided	None noted	None noted	Provides suggestions on how to create and implement a checklist for maximum efficiency. The article notes that ongoing monitoring, feedback, review, and revisions are needed to enhance the effectiveness of the checklist. "Sharing successes with practitioners will increase the acceptability of a checklist and foster its adoption" (ACOG, 2016).

Note: Key to abbreviations used in chart: ACOG: The American Journal of Obstetricians and Gynecologists; AFE: Amniotic fluid embolism; CA: Cognitive aid; nCA: No cognitive aid; PPH: Postpartum hemorrhage

Note: Key to Levels of Evidence: I: Systematic review/meta-analysis of randomized controlled trials (RCTs); II: RCTs; III: Nonrandomized controlled trials; IV: Controlled cohort studies; V: Uncontrolled cohort studies; VI: Descriptive or qualitative study, case studies, EBP

implementation, and QI; VII: Expert opinion from individuals or groups. Adapted from Evidence-based practice in nursing and healthcare: A guide to best practice (4th ed.), by B. M. Melnyk and E. Fineout-Overholt, 2019, p. 131. Copyright 2019 by Wolters Kluwer.

(Adapted from Brown, S. J. (2018) Evidence-based nursing: The research-practice connection. (3rd ed.). Jones & Bartlett Learning.)

Appendix D

Final QI Project Approval

Human Subject Research Determination Form

This form should be completed and submitted for review by the service lines impacted by the work prior to project initiation (including, but not limited to, collection or analysis of baseline data). Projects that are "Not Human Subjects Research" are not required to submit an IRB application in ePirate. To help make that determination, you may utilize the Decision Chart provided by the Office for Human Research Protections along with this worksheet. For any project where there is a question as to whether it qualifies as Quality Improvement or Research, or if certification of "Not Human Subjects Research" is needed for publication, please route to the UMCIRB office via email: umcirb@ecu.edu.

Please check the Office of Clinical Research Website or UMCIRB website to make sure that you have the most recent version of this form.

Project Title	Certified Registered Nurse Anesthetist Perception of the Usefulness of a Standardized Reference Guide for the Management of Amniotic Fluid Embolism: A DNP Quality Improvement Project
Project Leader	Charles Blake Compliment
Project Leader Contact E-mail	ComplimentC20@students.ecu.edu
Department or Unit Affiliation	Anesthesia
Project Advisor (if applicable)[1]	Travis L. Chabo, PhD, CRNA, Project Chair

Additional Faculty, Staff, and Trainees Involved (add more rows if needed):

Name	Department or Unit	Role	Check this box if this team member will access PHI or PII for the purposes of this project.
Michaela Davenport	Anesthesia	Student project team member	☐
Ashley Perry	Anesthesia	Student project team member	☐
Selina Villamor	Anesthesia	Student project team member	☐
			☐
			☐
			☐
			☐
			☐

[1] All student, resident, and fellow projects must have a faculty or unit leader designated as the advisor for the project.

			☐
			☐
			☐
			☐
			☐
			☐

Please answer the following questions to the best of your ability. If the answers to these questions change during the course of the project, please resubmit this form for review:

End Goal / Desired Outcome:

This Doctor of Nursing Practice (DNP) quality improvement project aims to assess Certified Registered Nurse Anesthetists' (CRNAs') perceptions of the adequacy of a newly developed cognitive aid regarding amniotic fluid embolism (AFE) and any impact it may have on their confidence in managing AFE. This project is relevant as it has been shown that cognitive aids can decrease errors by nearly half during a team-based approach to emergencies. The accuracy of treatment is also improved with the utilization of a checklist or cognitive aid as the individual provider or team will not have to recall each step or detail. A cognitive aid can allow a provider to implement treatment rapidly without having to locate multiple sources for the information. This project will be deemed successful if the newly developed cognitive aid is well-received and increases CRNA confidence in managing AFE. Knowledge gained from this project could be used in future quality improvement and policy efforts aimed at standardizing anesthesia care and increasing CRNA confidence in managing AFE.

Methodology / Intervention:

The project framework is a single Plan, Do, Study, Act (PDSA) cycle using a pre- and post-implementation survey design. During the *plan* phase, a cognitive aid addressing AFE will be designed based on current national guidelines and accepted practice standards within the practice site and will address a project site need. CRNA participants will be contacted via email to be invited to attend an in-person presentation on current AFE management, the use of cognitive aids, and the newly developed cognitive aid. During the *do* phase, project participants will be asked to complete a pre-implementation survey just before attending the PowerPoint presentation and complete a post-implementation survey evaluating the cognitive aid presented in the PowerPoint based on their perceptions of its applicability to their clinical practice and any impact it may have on their confidence in managing AFE. During the *study* phase, the project lead will analyze the data obtained from the pre- and post-implementation surveys to determine CRNA perceptions of the cognitive aid and any impact on their confidence in managing AFE. Knowledge gained from this project could be used in future quality improvement and policy efforts to standardize anesthesia care and increase CRNA confidence in managing AFE.

Data to be collected:

Data will be gathered confidentially directly from participants through the completion of Qualtrics pre- and post-implementation surveys delivered and completed electronically. Qualtrics survey software is accessed through ECU and involves multifactorial password protection. The surveys will contain nominal, ordinal, and free response data. No PHI will be collected for this project.

Aside from participant emails, no identifiable data will be gathered. Data of interest are participant perceptions of the adequacy of the cognitive aid in clinical practice and any impact it may have on their confidence in managing AFE.

Once collected, the data will be transferred to Excel for deidentification and analysis. Data in Excel will be stored on a password-protected spreadsheet and laptop. The deidentified data will be analyzed with results shared via a poster presentation to the ECU Nurse Anesthesia Program students and faculty, with project participants invited to view the presentation remotely. If requested, a presentation of results to the participating department will be provided. Data will be stored in Qualtrics and Excel files (de-identified) until student graduation, anticipated to be in the spring of 2026. Additionally, the analysis of results will be discussed in a DNP Project Paper, the completion of which is required for program graduation. This paper will be posted in the ECU digital repository, The Scholarship.

Complete the following questions to guide leadership's determination of this project's status:

	True	False
The PRIMARY purpose of the proposed activity or project is limited to: - implementing a standard practice to improve the quality of patient care and to collect data regarding that implementation for clinical, practical, or administrative purposes, and/or - delivering healthcare and measuring and reporting provider performance data for clinical, practical, or administrative uses.	☒	☐
The activity or project would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting.	☒	☐
The activity or project falls under well-accepted care practices/guidelines and are designed to bring about immediate improvements in health delivery or quality of care. If "true" and the project is related to clinical activity, please provide a citation below as evidence that project activities fall within standards of care. Projects not directly related to clinical activity, such as medical education, do not need to provide a citation. Hall, C., Robertson, D., Rolfe, M., Pascoe, S., Passey, M., & Winona Pit, S. (2020). Do cognitive aids reduce error rates in resuscitation team performance? Trial of emergency medicine protocols in simulation training (TEMPIST) in Australia. *Human Resources 18*(1), 1. https://doi.org/10.1186/s12960-019-0441-x	☒	☐
The activity or project involves "no more than minimal risk" procedures. (i.e., the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests).	☒	☐

Please submit this form to your supervisor (or designee) for review and approval. Signature on this form certifies that that the below individual is in support of this project taking place and agrees with the project leader's answers to the above questions:

Supervisor's Name	Dewayne Byrd	Nick Schuermann
Signature	Signed by: [redacted] 0704FC6E5DCA423...	Signed by: [redacted] 206E6CF9A147473...

Date	2/18/2025 | 11:26 PM EST	2/7/2025 | 8:26 AM EST

For Project Leaders: From the list below, please check the boxes for each service line where interventions may take place or where data may be collected. For each selected area, please route for signature for both the physician leader and administrator (preferably via DocuSign). Send a completed copy of the form to qualityimprovement@ecu.edu.

For Service Line Leaders: Signature on this form certifies that you are in support of this project taking place and agree with the answers to the above questions. If you are not in support of the proposed project, please discuss with the project leader, supervisor, and UMCIRB as needed.

	SERVICE LINE	SIGNATORY
☐	Adult Medicine (Medical Critical Care, Infectious Disease, Hospital Medicine, Pulmonology, Endocrinology, Allergy, Dermatology, & Nephrology)	Paul Bolin, MD
☒	Adult Surgical Service (Anesthesiology, Trauma, ENT, Benign Urology, Plastics, Ophthalmology, Transplant Surgery, & Acute Care Surgery)	Signed by: [redacted] Eric DeMaria, MD Signed by: [redacted] Wendy Leutgens, MSN
☐	Behavioral Health (Child / Adolescent Psychiatry, Behavioral medicine, & Adult Psychiatry)	Michael Lang, MD Todd Hickey, MHA
☐	Cancer (Breast cancer, Lung cancer, Gynecologic cancer, hematology, GI cancer, Urologic cancer, and Head & Neck cancer)	Emmanuel Zervos, MD Todd Hickey, MHA
☐	Children's Health (Pediatric Surgery, General Pediatrics, Well Newborn, Newborn & Pediatric Critical Care, Pediatric Hem-Onc, Neonatology, Pediatric medicine, Medicine subspecialities, surgical subspecialties)	Matthew Ledoux, MD Tara Stroud, DNP
☐	Emergency Services (Emergency Preparedness, Emergency Management, & Emergency Services)	Leigh Patterson, MD Debra Hernandez, MHA
☐	Heart & Vascular (Interventional Cardiology, Electrophysiology, Cardiac Surgery, Advanced Heart Failure, Cardiac Critical Care, Vascular Surgery, Cardio pulmonary rehab, Structural heart, & Thoracic Surgery)	Mark D. Iannettoni, MD

		Jay Briley, MHA
☐	Neuro Sciences (Neurology, Neurosurgery, Neuro Degenerative Disease, Neuro Critical Care, Stroke, Neuro Radiology, & Spine)	Stuart Lee, MD Jay Briley, MHA
☐	Nursing	Trish Baise, DNP
☐	Orthopedics (Joints, Orthopedic Surgery, Rheumatology, Sports medicine, Orthopedic medicine, & Orthopedic Trauma)	Deanna Boyette, MD Van Smith, MBA/MHA
☐	Pathology & Lab Services	Craig Steffee, MD Dave Harlow, PharmD
☐	Physical Medicine & Rehab (Rehab, Therapy (OT, PT, SLP), Pain, Wound Care, & Audiology)	Clint Faulk, MD Dave Harlow, PharmD
☐	Primary Care (Family medicine, Med-Peds, General Internal Medicine, Palliative Care, Geriatrics, & Sleep Medicine)	Jonathon Firnhaber, MD Dan Drake, PhD
☐	Radiology	Eric Martin, MD, PhD Dave Harlow, PharmD
☐	Women's Health (Gynecology, Obstetrics, & Maternal Fetal Medicine)	James Whiteside, MD Tara Stroud, DNP
☐	Projects that do not fit in the above service line areas	Niti Armistead, MD

[redacted]arch Determination Worksheet

Brian Floyd, MBA

Optional Determination:

For any project where there is a question as to whether it qualifies as Quality Improvement or Research, or if certification of "Not Human Subjects Research" is needed for publication, please route to the UMCIRB office via email: umcirb@ecu.edu.

☒ **Not Human Subjects Research:** The UMCIRB office has determined that based on the description of the project, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the UMCIRB office at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ **Human Subjects Research:** This project requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

UMCIRB Office Staff Signature: Signed by: [redacted] **Date:** 4/3/2025 | 8:03 PM EDT

The UMCIRB office will contact you if any further information is needed to make this determination. Please note that if the UMCIRB office determines the activity is not human subjects research, then any presentation, publication, etc. should not refer to the activity as such.

Appendix E

Pre- and Post-Implementation Questionnaires

AFE Pre-Implementation Survey

How many years have you practiced as a Certified Registered Nurse Anesthetist (CRNA)?

- ○ Less than 5 years
- ○ 5-9 years
- ○ 10-14 years
- ○ 15-20 years
- ○ Greater than 20 years

Since graduation and/or recertification, have you received any in-service or other education regarding the identification or management of AFE?

- ○ Yes
- ○ No
- ○ Not Sure

How many times have you been involved in managing and caring for a patient with a suspected Amniotic Fluid Embolism (AFE)?

Rate your confidence regarding AFE identification and management.

Not confident Not very confident Neutral Somewhat Confident Very confident

Are you aware of a cognitive aid outlining current treatment guidelines regarding AFE identification and management at your facility?

- Yes
- No
- Not sure

Rate the effectiveness of your current treatment guidelines regarding AFE management.

Very ineffective	Ineffective	Neutral	Effective	Very effective

If you had a question about the management of AFE, how long would it take you to find reference material regarding AFE identification and management?

- < 1 minute
- 1-3 minutes
- 4-6 minutes
- 7-9 minutes
- 10 minutes or more

Have you used a cognitive aid (e.g., an ACLS card) to support your management of an emergency in the past?

- Yes
- No
- Unsure

If a cognitive aid is provided, how likely are you to use it to manage AFE?

- I am never going to use it
- I will probably not use it
- I have no preference
- I will probably use it
- I am very likely going to use it

AFE Post-Implementation Survey

Please select the answer that best describes the extent to which you agree or disagree with the following four statements regarding the provided cognitive aid:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Cognitive aid was organized well					
The information included was applicable and accurate					
This handout was easy to read and understand					
Overall, I was satiswith this cognitive aidfied					

After reviewing this cognitive visual aid, how likely are you to use this tool to manage

AFE?

Very unlikely	Somewhat unlikely	Neutral	Somewhat likely	Very likely
○	○	○	○	○

Since reviewing the cognitive aid and listening to our presentation, how confident do you feel regarding the management of AFE?

Not confident	Not very confident	Neutral	Somewhat confident	Very confident
○	○	○	○	○

Which location would provide the easiest/quickest/best accessibility to the cognitive aid?

- ○ QR on anesthesia machine in Labor, Delivery, Recovery, and Postpartum (LDRP)
- ○ Laminated handout in the anesthesia machine in LDRP rooms
- ○ Practice Advisory Popup with a link within the Electronic Health Record (EHR)
- ○ All of the above

Other. Please write in your response below. _____

If provided in one of the locations mentioned above, how long would it take to access this cognitive aid to manage AFE?

- ○ Less than 1 minute
- ○ 1-3 minutes
- ○ 4-6 minutes
- ○ 7-9 minutes
- ○ 10 minutes

What other healthcare personnel would benefit from this cognitive aid and presentation? Select all that apply.

- ☐ Obstetrical (OB) Residents/Fellows
- ☐ OB Nurses
- ☐ OB Attendings
- ☐ Critical Care Nurses
- ☐ Critical Care Fellows/Residents
- ☐ All of the Above
- ☐ Other. Please write in your response below. _____

Do you have any suggestions for improving the effectiveness of this cognitive aid and presentation? Please write in your suggestions.

Appendix F

Emails sent to participants

Dear ECU Health Edgecombe CRNAs,

Thank you for considering participating in a quality improvement project titled "Certified Registered Nurse Anesthetist Perception of the Usefulness of a Standardized Reference Guide for the Management of Amniotic Fluid Embolism: A DNP Quality Improvement Project." The purpose of this project is to assess your perception of a newly designed cognitive aid used for the management of amniotic fluid embolism (AFE) at ECU Health Edgecombe.

Participation is voluntary and will involve completing a short pre-intervention survey, attending a brief PowerPoint presentation on AFE, and completing a short post-intervention survey when the two-week implementation period is over.

Each survey and the video should take less than 5-10 minutes to complete. The surveys were created and are completed using Qualtrics® survey software. The use of this cognitive aid falls within currently accepted practice in your work area. Your participation is voluntary and confidential. We will share the results of this QI study with you upon completion.

Following completion of the survey, I will present a PowerPoint presentation on AFE, including current best practices and a little information about the newly designed cognitive aid and its use for this project. The cognitive aid will be available in a digital format, as well as paper copies placed in each L&D room.

Again, thank you for your participation in our quality improvement project. I will be at ECU Health Edgecombe from April 1 until April 30 if you have any questions. You may also reach out to me or Dr. Travis Chabo, PhD, CRNA by email at any time.

Sincerely,

Blake Compliment, SRNA Complimentc20@students.ecu.edu

Dr. Travis Chabo, PhD, CRNA, Project Chair

Chabot14@ecu.edu

Dear ECU Health Edgecombe CRNAs,

I just wanted to say thank you so much to everyone for helping me out with my DNP Project! I have collected all the data I need to proceed with data analysis and will then be finishing my paper. Once it's complete you all will be able to read it if you'd like. And if you liked the cognitive aid and found it useful, you can continue to use it as you please. If you have any recommendations or thoughts on additional clinical areas that the cognitive aid could be of use, please reach out.

Thank you again! I hope to work with you more in the future.

Take care,

Blake Compliment, SRNA

ECU Nurse Anesthesia Program

Class of 2026

Dear ECU Health Medical Center CRNAs,

Thank you for considering participating in a quality improvement project titled "Certified Registered Nurse Anesthetist Perception of the Usefulness of a Standardized Reference Guide for the Management of Amniotic Fluid Embolism: A DNP Quality Improvement Project." The purpose of this project is to assess your perception of a newly designed cognitive aid used for the management of amniotic fluid embolism (AFE) at ECU Health Edgecombe.

Participation is voluntary and will involve completing a short pre-intervention survey, attending a brief PowerPoint presentation on AFE, and completing a short post-intervention survey when the two-week implementation period is over.

Each survey and the video should take less than 5-10 minutes to complete. The surveys were created and are completed using Qualtrics® survey software. The use of this cognitive aid falls within currently accepted practice in your work area. Your participation is voluntary and confidential. We will share the results of this QI study with you upon completion.

Following completion of the survey, I will present a PowerPoint presentation on AFE, including current best practices and a little information about the newly designed cognitive aid and its use for this project. The cognitive aid will be available in a digital format, as well as paper copies placed in each L&D room.

Again, thank you for your participation in our quality improvement project. I will be at ECU Health Edgecombe from April 1 until April 30 if you have any questions. You may also reach out to me or Dr. Travis Chabo, PhD, CRNA by email at any time.

Sincerely,

Blake Compliment, SRNA Complimentc20@students.ecu.edu

Dr. Travis Chabo, PhD, CRNA, Project Chair

Chabot14@ecu.edu

Dear ECU Health Medical Center CRNAs,

I just wanted to say thank you so much to everyone for helping me out with my DNP Project! I have collected all the data I need to proceed with data analysis and will then be finishing my paper. Once it's complete you all will be able to read it if you'd like. And if you liked the cognitive aid and found it useful, you can continue to use it as you please. If you have any recommendations or thoughts on additional clinical areas that the cognitive aid could be of use, please reach out.

Thank you again! I hope to work with you more in the future.

Take care,

Blake Compliment, SRNA

ECU Nurse Anesthesia Program

Class of 2026

Appendix G

Cognitive Aid