INCREASING ANESTHESIA PROVIDERS' UNDERSTANDING OF EMERGENCE AGITATION IN THE VETERAN POPULATION

by

Jacob William Thompson

A DNP Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2 0 2 4

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Jacob William Thompson, titled Increasing Anesthesia Providers' Understanding of Emergence Agitation in the Veteran Population, and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

Sarah Torabi _____ Date: Mar 28, 2024
Sarah Torabi, DNP, CRNA

Kristie J Hoch _____ Date: Mar 28, 2024
Kristie Hoch, DNP, CRNA

James Reed (Mar 28, 2024 15:11 PDT) _____ Date: Mar 28, 2024
James R. Reed, DNP, MSNA, CRNA

Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

Sarah Torabi _____ Date: Mar 28, 2024
Sarah Torabi, DNP, CRNA
DNP Project Committee Chair
College of Nursing

ACKNOWLEDGMENTS

I would like to acknowledge Dr. Sarah Torabi for chairing this project and being a magnificent guide. I also acknowledge the committee members Dr. Kristie Hoch and Dr. James Reed for guiding this project.

I would like to acknowledge Dr. Tom Bateman for being the site representative who helped this project come together. I also acknowledge the rest of the VA staff who made this project happen, and I appreciate the care you provide for our beloved veterans.

I also acknowledge my family, especially Rachel, Everett, Rocco, and Ziggy for supporting me in this journey and being my inspiration.

LAND ACKNOWLEDGEMENT

We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

DEDICATION

Dedicated to the ones who have served and continue serving to protect this beautiful country's freedoms and safety.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

TABLE OF CONTENTS – Continued

TABLE OF CONTENTS – Continued

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Purpose. This quality improvement (QI) project aimed to increase knowledge of emergence agitation (EA) and provide guidelines for recommended anesthetic medications amongst anesthesia providers at a veteran's hospital in southern Arizona.

Background. EA is a state of psychomotor excitement that can occur as a person awakens from anesthesia and may involve confusion, thrashing, crying, shouting, and violence. Although this state is typically brief and self-limiting, it can lead to patient or staff harm, as well as other negative consequences. Current literature demonstrates that risk factors and screening techniques for EA have been identified, and modifications to anesthesia care for those at risk can reduce EA occurrence and severity. Combat veterans are at an increased risk of EA, and it is important for anesthesia providers who care for this population to understand the risks of EA and related anesthesia considerations.

Methods. An educational presentation was developed using current literature about EA. Participants from a veterans facility in Southern Arizona were recruited to attend the presentation in person, and participants received a card-sized summary of recommendations for EA. A retrospective pre- and post-survey with six paired questions on paper was administered for participants to complete following the presentation. The survey was designed using a Likert scale to measure knowledge about EA. Each question was examined using a paired t-test to compare results before and after the educational presentation.

Results. There were 19 anesthesia providers present for the presentation, and 18 (n = 18) participants completed the surveys for analysis. The mean pre-score of all survey questions was 3.80 (SD = 0.394), and the mean post-score was 4.46 (SD = 0.120). A significant improvement

occurred as manifested by a p-value of 0.002 and a confidence interval of 95%. When assessing each of the 6 paired questions individually, five out of six pre- and post-scores significantly increased, and one paired question resulted in an insignificant increase which examined if providers adjust their anesthetic plan to reduce the risk of EA.

Conclusions. An educational presentation on EA including a card-sized summary of recommendations is an effective way to increase knowledge of EA and provide guidelines for recommended anesthetic medications amongst anesthesia providers.

INTRODUCTION

Many patients often face the need to undergo surgery due to anxiety or fear. As many as 80% of patients undergoing surgery have reported preoperative anxiety, which has been related to negative peri-operative consequences (Zemła et al., 2019). The ability to mitigate these feelings and perform complication-free anesthesia is a major goal of anesthesia providers. One complication that can interrupt a smooth anesthetic is emergence agitation (EA) (Wei et al., 2020). EA refers to the emergence phase of anesthesia causing an agitated and confused state in a patient, where they become a risk to themselves or others in their confusion (Demir & Yuzkat, 2018). In addition to patient or staff harm, EA can result in increased resource utilization and extended recovery room stays (Fields et al., 2018) United States (US) combat veterans have been identified as a population at an increased risk of experiencing EA (Bartoszek et al., 2023). This increased vulnerability is related to the increased prevalence of post-traumatic stress disorder (PTSD) and other mental health diagnoses in the veteran population, which are predictors for EA (Bartoszek et al., 2023). PTSD occurs in about 6% of the general population at some point in their life (US Department of Veterans Affairs, 2023). The prevalence of PTSD is higher in veterans at 7% but can be as high as 29% for those who served in Operations Iraqi Freedom and Enduring Freedom (US Department of Veterans Affairs, 2023). The incidence of EA occurrence in the general adult population has been reported to be 3.0% to 21.3% after general anesthesia (Huang et al., 2023). The incidence of EA in military personnel is estimated to be 20%, and this increases to an incidence of 46% in the veteran population with mental health diagnoses such as anxiety, depression, and PTSD (Bartoszek et al., 2023). Modifications to care surrounding patients identified as high risk for experiencing EA have been shown to significantly reduce the

occurrence of EA (Tolly et al., 2021). To improve care, anesthesia providers should be able to identify those at risk for EA and have an appropriate anesthetic plan in place. Educating providers to improve practice can lead to better patient outcomes. This project aimed to educate anesthesia providers at a facility in Tucson, Arizona, on the current recommendations on EA.

Background Knowledge and Significance

Emergence agitation (EA) is a state of psychomotor excitement that can take place as a patient experiences the reawakening and return to consciousness after general anesthetic agents are discontinued (Tolly et al., 2021). This state is self-limiting in nature and characterized by disorientation, restlessness, non-purposeful movement, inconsolability, thrashing, and incoherence (Demir & Yuzkat, 2018). Earlier studies on this phenomenon in 1961 referred to it as postanesthetic excitement or emergence excitement (Menser & Smith, 2020). Historical definition and inclusion criteria included patients who would emerge from anesthesia crying, sobbing, disoriented, screaming, or thrashing (Menser & Smith, 2020). Another term that is often used when referring to this phenomenon is emergence delirium. However, emergence delirium is defined separately for this project. Emergence delirium refers to psychomotor excitement that occurs after a patient has fully gained consciousness from anesthesia, and the significant difference in EA is that it occurs as a patient is transitioning from an unconscious state to consciousness (Huang et al., 2023). Emergence agitation poses more of an immediate threat to patient and staff safety as it is often associated with verbal and physical violence as patients act out in confused aggression (Demir & Yuzkat, 2018). Although emergence delirium may lead to a patient acting out in aggression, it is often confined to milder symptoms such as confusion, inattention, and cognitive deficits following the return of mentation (Tolly et al., 2021).

The etiology and underlying neurobiological process of EA is not fully understood. It is hypothesized that the phenomenon is attributed to a non-blunted sympathetic activation during early awakening (Tolly et al., 2020). This sympathetic hyperarousal may be a result of external and internal stimuli. Examples of stimulating factors include uncontrolled pain, endotracheal tubes, indwelling urinary catheters, and nasal packing (Kwon et al., 2016). Other sensory triggers may include loud noises, unfamiliar voices, bright lighting, unpleasant smells, movement, and repositioning (Tolly et al., 2020). In addition, pre-existing mental health disorders have been reported as a contributing factor to EA risk, especially PTSD (Wheat et al., 2018). Anxiety, depression, and PTSD have all been associated with an increased risk for EA, and one study showed a 46% increase in EA rates when these histories were reported (Bartoszek et al., 2023). Studies on metabolic abnormalities have been examined to explain EA pathophysiology, but they have not yet been translated into clinical use (Wang et al., 2021). For example, varying peri-operative serum levels of lipids, purines, and amino acids have provided predictability for EA (Wang et al., 2021). This demonstrates that the understanding of EA pathogenesis has yet to be fully understood.

Post-Traumatic Stress Disorder (PTSD)

Post-traumatic stress disorder (PTSD) diagnostic criteria are defined in the *Diagnostic and Statistical Manual of Mental Health Disorders* (American Psychiatric Association [APA], 2022). PTSD is a psychiatric disorder that occurs in an individual after experiencing a traumatic event through direct exposure, witnessed exposure, indirect exposure, or through the experience of a close friend or relative (APA, 2022). Traumatic exposure may include death, near-death experiences, serious injury, or sexual violence. The traumatic event is re-experienced by the

individual through upsetting memories, flashbacks, nightmares, and emotional distress or physical reactivity to reminders of the event. This leads to negative emotions and thoughts affecting the individual's mental well-being that may manifest as aggression, risky behavior, hypervigilance, heightened reactions, and difficulty sleeping and concentrating (APA, 2022).

PTSD has been identified as an independent risk factor for EA, even in conjunction with treatment for depression and anxiety disorders (Bartoszek et al., 2023). The influence that certain anesthetic agents have on amygdalocentric neurocircuitry is thought to play a role in the connection between anesthesia and EA in those with PTSD (Tolly et al., 2021). The agents most frequently associated with EA in the literature include benzodiazepines, inhalational agents, and anticholinergics (Lee & Sung, 2020). PTSD is associated with a hyperreactive amygdala, which is the fear and excitement center of the brain. This is coupled with a decreased function of the amygdala-inhibiting centers of the brain, which include the medial prefrontal cortex and the hippocampus. Dendritic remodeling in these centers of the brain occurs, and alterations in the receptor binding sites for anesthetic agents take place. This results in the inability of anesthetic agents to prevent hyperarousal at certain anesthetic levels. Dysregulated amygdala function leads to hyperactivity in response to auditory, tactile, and nociceptive stimulation while emerging from anesthesia (Tolly et al., 2021). This results in patients potentially experiencing flashbacks upon awakening, where they may believe themselves to be in a dangerous situation and perceive any additional stimuli as a threat (Wheat et al., 2018). Flashbacks involve a triggering stimulus that a person has related to their trauma such as a loud noise, alarm, yelling, sight, smell, pain, or physical sensation (Manly et al., 2022). This trigger leads to the person remembering or reexperiencing the feelings of the traumatic event, and the symptoms that follow may include

sweating, increased heart rate, fear, anxiety, nightmares, and emotional outbursts (Manly et al., 2022).

Many of the studies on emergence agitation have involved military personnel, as this is a population known for experiencing PTSD at higher rates than the general public (Bartoszek et al., 2023). In a report from the National Epidemiologic Survey on Alcohol and Related Conditions-III, 4.7% of the general population in the US experienced PTSD in the 12 months before the survey (Schein et al., 2021). Studies have suggested that preoperative PTSD identification and protocols to prevent EA can reduce the incidence (Tolly et al., 2021). One study implemented a screening tool found in Appendix H that includes PTSD criteria along with other EA risk factors. This tool improved the identification of patients at risk for EA in a military-serving facility from 5% to 22.5% (Wheat et al., 2018). The focused screening tool included 13 questions on one page that patients were able to self-administer in five minutes or less. The questions evaluated patients for combat history, mental health diagnosis, mental health treatment, undiagnosed mental health symptoms, previous history of EA, complications from anesthesia, history of traumatic brain injury, surgical procedure, and current anxiety level. If patients reported three or more of the risk factors, they were considered at risk for EA (Wheat et al., 2018). Understanding the risk factors for EA and how to screen for them is prudent for anesthesia providers to plan an anesthetic that mitigates the risk.

Primary Care PTSD-5

An accurate PTSD screening tool used in Veterans Affairs (VA) primary care settings is the Primary Care PTSD-5 screen as seen in Appendix H (Bovin et al. 2021). PTSD has been historically difficult for practitioners to identify in shorter encounters, but this tool helps

overcome this barrier since it is a brief and accurate assessment (Williamson et al., 2022). There are five questions on this screening tool that relate to traumatic event exposure. The final score identifies those with probable PTSD. A score from 0-5 is assigned based on yes or no responses, with a score for every yes response. A score of '4' is associated with the most balanced and accurate specificity and sensitivity for PTSD (Williamson et al., 2022).

Significance of Emergence Agitation

EA is understood to have immediate and extended effects that are significant to the care of the patient undergoing anesthesia (Tolly et al., 2021). Episodes of agitation may be short-lived from 1 to 15 minutes and may resolve without any injury, but severe episodes can have a serious impact such as injuries to the patient, injuries to the staff, and extended hospital stay (Lee & Sung, 2020). An initial reaction when emerging in this state is to address any instigating stimuli, which may involve the patient self-removing their intravascular access, endotracheal tube, nasogastric tube, or indwelling foley catheter. When these devices are not removed properly, damage may occur such as vascular injury, vocal cord injury, injury to the urinary tract, or bleeding (Fields et al., 2018). Additionally, the ability to safely treat the patient may be lost without vascular access or a secure airway. If a patient thrashes and resists staff, surgical wounds may be compromised, and suffer wound dehiscence or excessive bleeding (Tolly et al., 2021). There have also been reports of patients falling off stretchers and suffering from fall injuries that result in additional testing and extended hospital stays (Wang et al., 2021). The extended consequences of EA were demonstrated in a study that showed 92% of patients who experienced EA went on to suffer from symptoms of delirium that extended through the recovery phase and

often into the hospital course (Tolley et al., 2021). The full extent of the long-term consequences of EA has not been described in the literature.

Aside from its significance to the patient, EA has implications for those surrounding the patient. EA has been recognized as a safety risk to staff, who are placed at risk for injury when trying to restrain combative patients (Wang et al., 2021). EA can be distressing to witness by staff and other patients. Recovery rooms are often made private only by curtains between patients, and witnessing a severely agitated emergence can impact the satisfaction of nearby patients' experiences (Tolly et al., 2021).

There are significant effects of EA on the costs of care. Injuries from EA may require treatment and add to the care required, especially in cases that lead to long-lasting damage such as airway or vocal cord injury (Fields, 2018). Additionally, staff demands increased in about one-third of the cases of EA, which was noted to be a major consequence in one study (Tolly et al., 2021). EA often leads to extended operating room or recovery room times, which add additional costs (Lee & Sung, 2020). Although the value of the additional cost secondary to EA has not been described in the literature, studies have estimated the cost of operating rooms to be $36 to $37 per minute and the cost of recovery rooms to be an average of $9 per minute (Childers & Maggard Gibbons, 2018; Alshiek et al, 2021). Additional cost factors may include treatment of injuries, increased staff demands, and the potential need to sedate patients with additional medications following their emergence (Huang et al., 2023). The risk that EA poses to staff also places them at risk for workplace injuries that may need treatment funded by the facility where they occur in (Tolly et al., 2021).

Local Problem

A systematic review that examined the prevalence of PTSD in the US found that the civilian lifetime prevalence of PTSD ranges from 2.6 to 6.0% (Schein et al., 2021). In comparison, the veteran population's lifetime prevalence ranges from 7.7 to 13.4% (Schein et al., 2021). Approximately 13 million Americans suffered from PTSD in the year 2020, or 5% of the total population (US Department of Veterans Affairs, 2023). The percentage of the population that are veterans in the State of Arizona is 9%, which is higher than the national average of 7% (Rice, 2021). The largest percentage of these veterans served in the Vietnam era, 37.5%, which happens to be associated with the highest lifetime prevalence of PTSD (Rice, 2021). A hospital in Tucson, Arizona serves about 170,000 veterans in Arizona (US Department of Veterans Affairs, 2022). The hospital also reports over 5,000 surgeries a year performed for veterans across Southern Arizona (US Department of Veterans Affairs, 2022).

The Chief Certified Registered Nurse Anesthetist (CRNA) at a hospital serving veterans in Tucson, Arizona expressed their support for this scholarly project being conducted at this facility. There was no protocol at this facility for the perioperative management of patients at risk for EA. Although the incidence rate of emergence agitation had not been directly measured in this setting, it had been identified as an adverse outcome that occurs at the facility with the potential for improvement. It was identified that anesthesia staff at this facility could potentially improve their delivery of care by better understanding the considerations surrounding emergence agitation and PTSD.

Intended Improvement

Project Purpose

The purpose of this quality improvement (QI) project was to increase knowledge among anesthesia providers about EA and develop evidence-based recommendations for those at risk for EA. This was achieved with an educational session at a hospital in Tucson, Arizona that serves the veteran population. This project aimed to equip anesthesia providers with methods to reduce the occurrence of EA and the adverse events related to this complication.

The results of this project will be disseminated to allow for future reference in QI projects. Similar facilities may benefit from projects such as this considering the results suggest that there is an increase in provider knowledge after an educational presentation surrounding EA. Additionally, facilities that serve populations other than veterans could benefit from awareness of EA risks and considerations since patients in the general population can be at risk for EA (Lee & Sung, 2020).

Project Question

The recognition of this clinical problem prompted the following question: Will an educational presentation on anesthetic considerations for EA increase anesthesia providers' knowledge and intent to change practice?

Project Objectives

The objectives for this project included the following:

1) Implement a live educational session for anesthesia providers at a hospital in Tucson Arizona that serves the veteran population to increase understanding of the risks and interventions for emergence agitation.

2) Conduct a retrospective pre- and post-survey assessment for the participants to evaluate knowledge increase and the intent to modify practice.
3) Develop evidence-based recommendations for EA on laminated cards as a resource for anesthesia providers.

Theoretical Framework

Transformational changes are faced with intricate complexities that hinder action plans if they are not approached with a proper theory for guidance (Mitchell, 2013). Theory-guided practice continues to be recommended over traditional nursing practice (Younas & Quennell, 2019) The Innovation Diffusion Theory provided a theoretical guide to this project as it aimed to increase provider understanding of current practice recommendations. Innovation Diffusion Theory was first theorized in a publication by Everett Rogers in 1962, but it has evolved with the times into Roger's most recent publication in 2003 (Rogers, 2003). The theory proposes that diffusion involves innovation being communicated over time by the participants of a system (Udod & Wagner, 2018). As this project endeavored to diffuse the innovative ideas surrounding EA, this theory provided elucidation on the steps for diffusion to take place (Udod & Wagner, 2018).

Innovation Diffusion Theory Stages

Innovation Diffusion Theory includes five stages (Udod & Wagner, 2018) as depicted in Figure 1 which include: 1) knowledge - which involves an individual being made aware of innovation; 2) persuasion - where the individual furthers their interest in innovation and seeks out the information and details of it; 3) decision - the individual considers the advantages and disadvantages of the innovation and chooses whether to employ the innovation or abandon it; 4)

implementation - the innovation is applied to a degree appropriate for the situation. It is also the implementation stage where the usefulness of the innovation is determined; and the final stage 5) confirmation - the innovation is applied to a degree appropriate for the situation. If a change is not initially successful, the innovation may be employed at a more suitable time or in a different fashion (Udod & Wagner, 2018). This project is in alignment with this theory by completing the following stages:

Stage 1. Knowledge

Review of the literature about EA risk factors and anesthetic considerations.

Stage 2. Persuation

Presentation of an educational session about EA.

Stage 3. Decision

Survey to support the implementation of adapting recommendations.

Stage 4. Implementation

Using EA card badges as reminders to recommendations.

Stage 5. Confirmation

Follow-up survey to determine if a change in practice occurred (this fifth step was omitted due to time constraints).

Key Elements

Diffusion is dependent on five key elements according to the Innovation Diffusion Theory (Udod & Wagner, 2018) as depicted in Figure 1 and include the following: 1) innovation - any new idea, tool, practice, or object that can be considered for change; 2) communication channels - the ways that information is distributed in the system to allow diffusion; 3) time - how

long the innovative processes takes; 4) social system - external and internal influences; 5) adopters - those who adopt change (Roger, 2003). The fifth element is further broken down to describe types of adopters as innovators, early adopters, early majority, late majority, and laggards. This includes the spectrum from the innovators that embrace and thrive on change, to the laggards who are the last ones to adopt change (Udod & Wagner, 2018). These elements are applied to the framework of this project in the following:

Element 1. Innovation

The current practice recommendations to be presented to providers through education.

Element 2. Communication Channels

Communication with the chief certified registered nurse anesthetist as a key stakeholder while planning education to best support the facility. It also includes two-way communication with the participants.

Element 3. Time

Time for providers to gain and apply new knowledge.

Element 4. Social system

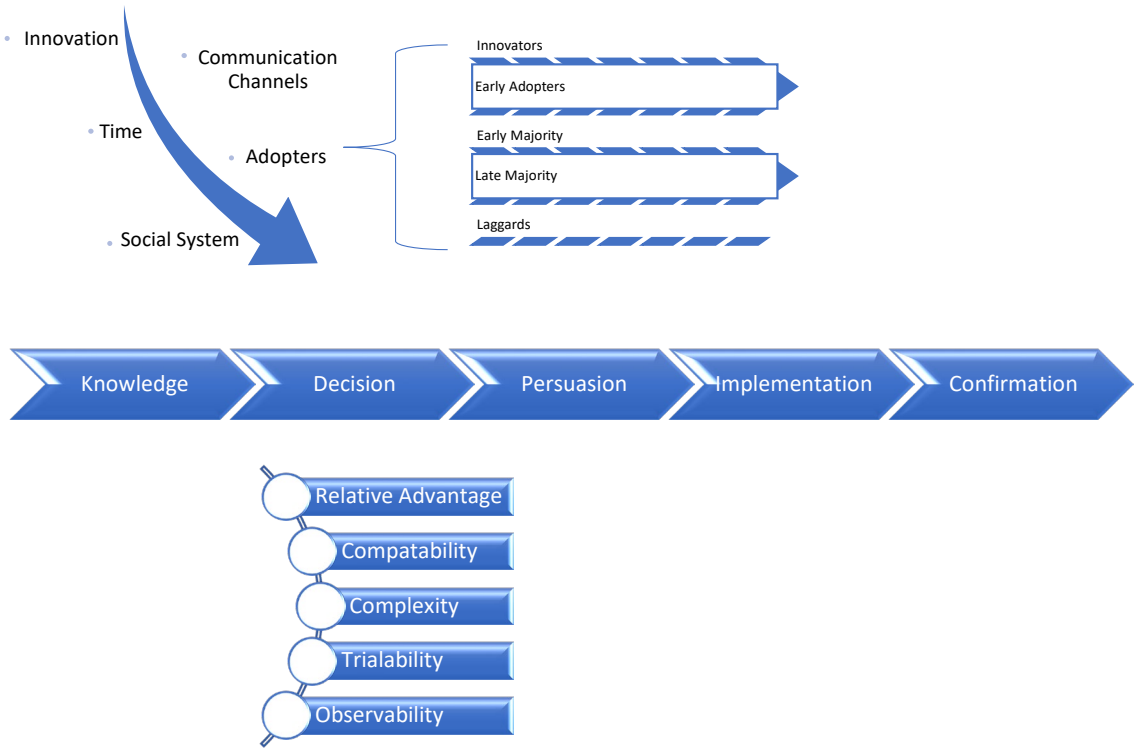
The facility setting and network influencing how the innovation is accepted and applied.

Element 5. Adopters

The staff that will adopt the practice recommendations.

Figure 1

Roger's Diffusion of Innovation Adoption Process



Note. Original image adopted from Roger's Diffusion of Innovation Adoption Process model (Mohammadi et al., 2018).

Perceived Attributes

Roger's model emphasizes that the perception of five attributes determines whether an innovation is adopted (Figure 1). These attributes include the following: 1) relative advantage - the innovation's superiority to what it supersedes in relation to patient benefit, provider benefit, and cost-effectiveness; 2) compatibility - the extent to which the innovation meshes with the adopter's needs, values, experiences, and situation; 3) complexity - the difficulty or ease of application of the innovation; 4) trialability - preferably perceived as testable and explorable in

relation to potential outcomes; 5) observability - the degree that the results of the innovation are visible to those involved in its implementation (Mohammadi et al., 2018).

The investigation into EA considerations for anesthesia providers has been performed with these five attributes in mind. While educating providers on these considerations, these attributes must be represented throughout education. This allows each provider to commit to adopting changes to better their practice surrounding patients at risk for emergence agitation.

Literature Synthesis

Evidence Search

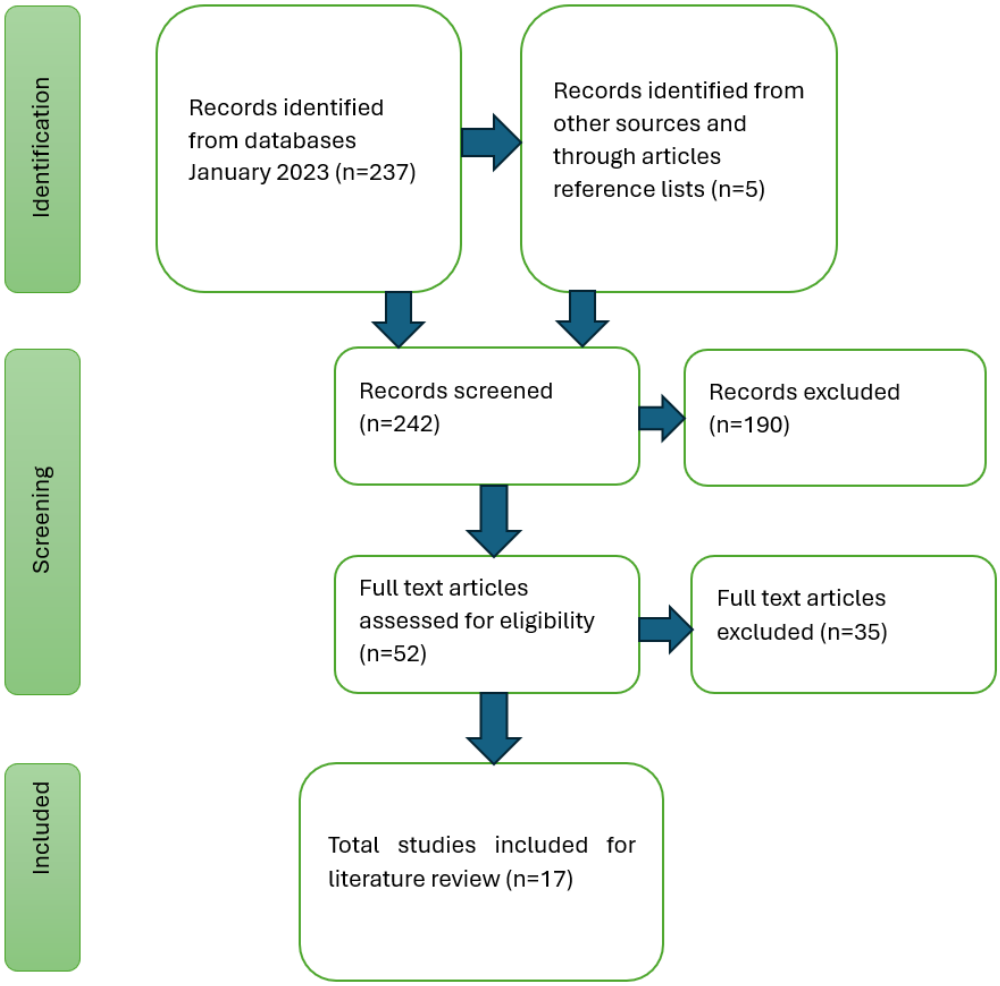
A comprehensive literature search was performed to identify peer-reviewed articles using the online University of Arizona Health Sciences Library. The purpose of this Doctor of Nursing Practice (DNP) project was to improve the understanding among anesthesia providers of the prevalence of EA, the risk factors for EA, and the strategies to reduce its occurrence. Therefore, the conducted literature review aimed at identifying current practice recommendations, risk stratification, and strategies to prevent and treat EA.

PubMed, CINAHL, PsycINFO, and Embase were utilized to identify the most relevant literature from 2016-2023 about EA. This time frame was chosen to identify the most current evidence to develop the educational presentation and reference card. The key terms used in the search included: *emergence agitation, emergence delirium, post-traumatic stress disorder,* and *anesthesia*. The terms “and” and “or” were used to yield more results. The initial search produced 237 articles across the databases, of which 12 were selected for literature review. Articles referenced or cited by these articles were examined for potential use in this literature synthesis, and five additional articles were identified, totaling 17 articles (Appendix G) for

synthesis. Inclusion criteria were articles that focused on adult populations at risk for emergence agitation and the associated risk factors, screening strategies, and anesthetic considerations. The definition of emergence agitation or delirium used had to be in alignment with the definition of emergence agitation previously discussed. Excluded were articles that focused on irrelevant populations, those that had divergent definitions of emergence agitation or delirium, and those that lacked recommendations for emergence agitation considerations.

Figure 2

Article Inclusion Flowchart



Note. Flowchart depicting article inclusion process.

Comprehensive Appraisal of Evidence

Universal themes were identified across the literature that were relevant to the development of this project. Appendix G includes a description and overview of the articles appraised. One theme is the importance of identifying patients at risk for EA. This includes screening for PTSD and recognizing additional risk factors (Wheat et al., 2018, Lee & Sung, 2020). A strategy that is discussed as being useful throughout every portion of the perioperative experience is to take measures to reduce anxiety (Tolly et al., 2021). Additionally, several non-pharmacologic strategies have successfully demonstrated success in reducing EA occurrence. The choice of anesthetics and medications administered has been studied substantially in this population, and several strategies have been successful across studies (Lee & Sung, 2020). Quality improvement projects have been successful in educating providers and peri-anesthesia staff about the considerations for patients with PTSD and other risk factors for EA (Taylor et al., 2020).

Risk of Emergence Agitation

Provider familiarity with the risks of EA is the first step to preventing and managing its occurrence. Screening patients for EA prior to anesthesia has been studied as a useful method to prepare anesthetics appropriately to mitigate risks (Lee & Sung, 2020). A study by Wheat et al. (2018) found that implementing a screening tool improved the identification rates of those at risk for EA from 5% to 21% - 22.5%. This study was implemented at a facility serving a large volume of military personnel. The screening tool included 13 questions that investigated the patient's combat history and any traumatic brain injuries. It also included questions about any diagnosed mental health history and any related treatments. Additional questions inquired about

problems with anesthesia in the past specifically related to EA symptoms, and the current state of anxiety about the present procedure (Wheat et al., 2018). The tool was tailored to not only identify a diagnosed PTSD history but also unveil any undiagnosed mental health disorders or histories that may contribute to EA in the veteran population. A screening tool such as this can be useful in similar settings that experience frequent EA in patients.

The literature discusses several additional risk factors specifically for veterans, and additional studies have focused on risk factors for the general public. For example, PTSD has been discussed as a known risk factor in literature focusing on veterans, but it is also a risk factor in PTSD from other non-combat trauma (Tolly et al., 2021). Psychiatric disorders in general add a risk for EA even with treatment, and this includes alcohol and opioid use disorder (Tolly et al., 2021). Traumatic events surrounding the perioperative period have been demonstrated to contribute to postoperative PTSD and subsequent EA (El-Gabalawy, 2019). Male sex, endotracheal intubation, and volatile anesthetics have been predictive of a higher risk for EA (Wei et al., 2021). Patients in the age range of 40-64 years old tend to be at a lower risk than younger and older patients (Lee & Sung, 2020). Additional patient-related risk factors include African ethnicity, chronic lung disease, a body mass index greater than 30 kg/m^2, and recent smoking (Lee & Sung, 2020).

Several approaches to anesthetic technique should be considered in addition to patient-related factors. Anesthesia-related risk factors are mostly related to enhanced stimulation. These include a higher number of intubation attempts, voiding urgency, postoperative pain, postoperative nausea and vomiting, the presence of invasive devices, and certain medications (Lee & Sung, 2020). Medications thought to contribute to EA include anticholinergics,

doxapram, inhaled anesthetics, and most notably benzodiazepines (Lee & Sung, 2020). Benzodiazepines are often used in anesthesia for their anxiolytic properties, and their contribution to EA may seem counterintuitive to anesthesia providers considering its typical usage. Possible risk factors with less uniform evidence include longer duration of anesthesia, type of surgery, and emergency procedures (Lee & Sung, 2020). Spine surgery, breast surgery, musculoskeletal surgery, otolaryngological surgery, oral cavity surgery, and abdominal surgery have all been identified as higher-risk surgeries regarding EA (Lee & Sung, 2020).

Non-Pharmacological Interventions

Strategies to reduce the risk of EA require staff preparation and communication. The anesthesia team should open transparent communication with the patient to identify the patient's potential triggers (Tolley et al., 2021) This builds a personalized relationship with the patient to develop methods for redirecting and orienting patients if EA does occur (Taylor et al., 2022). Pertinent information should be communicated to the staff at every handoff of care. A study by Gao et al. (2022) examined patients under magnetic resonance imaging receiving either routine nursing and anesthesia, routine nursing and dexmedetomidine-assisted anesthesia, and comfortable nursing and dexmedetomidine-assisted anesthesia. Comfortable nursing and dexmedetomidine-assisted anesthesia reduced the risk of EA most significantly as well as reduced recovery room time, time to extubation, and hospital stay (Gao et al., 2022). Comfortable nursing aims to be patient-centered to fully meet the psychological and physiological needs of patients (Gao et al., 2022). This patient population can markedly benefit from this holistic approach to care (Gao et al., 2022).

The environment throughout the perioperative arena may be modified to reduce EA occurrence. Removing unnecessary stimulation in the operating room can include keeping the patient warm, avoiding music, dimming lights, reducing loud noise, and maintaining provider consistency (Lovestrand et al., 2021). Patients should be transferred to the transport stretcher before emergence, and the side rails should be up during emergence (Tolley et al., 2021). Patients at high risk benefit from a quiet private recovery bay if feasible. Staff should validate patient feelings during and around an EA episode (Manley et al., 2022).

Despite valiant efforts to prevent EA, the risk may not be eliminated, and it is also of benefit to create a safe environment if it occurs in a high-risk patient. This may include extra tape and gauze on intravenous lines, ensuring the securement of tubes or drains, and padding side rails (Tolley et al., 2021). Staff should understand safe techniques to restrain patients to avoid patient and staff harm (Taylor et al., 2022). A plan should be in place for rescue medications to be readily available, such as dexmedetomidine and propofol (Taylor & Pileggi, 2021).

Pharmacological Interventions

Dexmedetomidine, an alpha-2 adrenergic receptor agonist, is one of the most discussed medications that has shown efficacy in reducing EA occurrence and severity (Tolly et al., 2021). A meta-analysis examining the effectiveness of dexmedetomidine on EA mitigation found it was more pronounced if intravenous administration occurred pre-operatively or intraoperatively rather than post-operatively (Zhang et al., 2019). Dexmedetomidine commonly causes side effects such as bradycardia and hypotension, and its use should be cautioned in patients with preoperative hypotension, a history of coronary artery disease, or higher acuity (Gerlach et al., 2016). One randomized controlled trial found that a dexmedetomidine infusion added to the

anesthetic for combat veterans with anxiety significantly reduced EA without any adverse events including bradycardia or hypotension (Bartoszek et al., 2023). This study used a dose of 1 microgram per kilogram bolus over 10 minutes with induction, followed by an infusion of 0.6 micrograms per kilogram per hour continued until 15 minutes before surgery completion (Bartoszek et al., 2023). Research shows that avoiding midazolam and other benzodiazepines is important in this population but suggests replacing these medications with dexmedetomidine (Taylor et al., 2022).

Pharmacologic anesthetic techniques in the preoperative, induction, maintenance, and emergence phases all carry unique considerations. A multimodal approach is often beneficial (Tolley et al., 2021). Premedication may be avoided or include acetaminophen, dexmedetomidine, gabapentin, or opioids, but midazolam should be avoided (Tolley et al., 2021; Taylor et al., 2022). Propofol, lidocaine, ketamine, and hydromorphone are considerations for induction and maintenance (Taylor et al., 2022). Ketamine successfully reduced EA measured using the Richmond Agitation-Sedation Scale from 54.3% to 8.6% in patients receiving rhinoplasty (Demir & Yuzkat, 2018). It is suggested to administer ketamine early in the anesthetic and in doses of no more than 50 milligrams. Total intravenous anesthesia, especially utilizing propofol, has shown some benefits over inhaled anesthetics (Lee & Sung, 2020) Additional drugs related to decreased occurrence of EA include magnesium sulfate, clonidine, tramadol, and nefopam. Regional anesthesia techniques and proper pain management have been shown to reduce EA (Lee & Sung). Slower emergence is preferred over rapid emergence if feasible (Taylor et al., 2022). Rescue medications may include dexmedetomidine for lower-risk behavior, or propofol for high-risk behavior (Taylor et al., 2022).

Provider Awareness and Education

Numerous studies involving emergence agitation have recently been conducted and the data continues to emerge. Therefore, it is likely an area where many providers experience a knowledge gap. Sambuca and Bustos (2022) found while developing a protocol for patients with PTSD that many providers indeed exhibit a knowledge deficit in recent literature surrounding EA. A multidisciplinary team at Veterans Affairs Pittsburgh Healthcare System developed a multi-component intervention to reduce EA occurrence and severity (Taylor et al., 2022). The intervention resulted in a reduced occurrence and severity of EA events (Taylor et al., 2022). The focus points of the interventions included training staff on screening methods, communication strategies, environmental preparation, medication strategies, and manual restraint techniques (Taylor et al., 2022). The staff of facilities serving populations at high risk for EA can also benefit from de-escalation strategies and sensitivity training (Taylor & Pileggi). Improving provider knowledge in these subjects can lead to safer patient care.

Strengths of Evidence

Specific risk factors for EA have been identified that are consistent throughout the literature, and methods to identify at-risk patients have been successful when examining patients for these risks (Tolly et al, 2021). It is also clear across the literature that anesthesia modifications can influence the occurrence or severity of EA. Many studies have had comparable results with the medication strategies discussed that appear to mitigate EA, including meta-analysis studies (Zhang, 2019). There is also strong evidence supporting that environmental modifications to operative and perioperative settings play a role in EA. Another strength of the

evidence is that provider and staff awareness of EA management and mitigation strategies appears to correlate with rates and severity of EA.

Weaknesses of Evidence

Multiple reviews of the literature have examined a large amount of literature to develop protocols to reduce EA. However, many have not been thoroughly studied for efficacy. For example, Tolley et al. (2021) developed an algorithm recommended for use in facilities serving military personnel. However, there is no literature describing the use of such a tool. The interventions employed in the Veteran's Affairs Pittsburg Healthcare System were thoroughly devised and successful. However, more rigorous research would provide better insight into which components of the intervention are reliable in improving the quality of care (Taylor et al., 2022).

Gaps and Limitations

Limitations of the research in this field may be attributed to the varying assessment methods, variable definitions of EA, small study sizes, and varying populations (Tolley et al. 2021). A specific diagnostic tool for EA has not been developed, leading to inconsistent diagnoses. Studies have used various methods to identify EA including the Richmond Agitation-Sedation Scale, Riker Sedation Agitation Scale, Aono's 4-point scale, and Pediatric Anesthesia Emergence Delirium Scale (Tolley et al., 2021). Many studies examining EA are based on pediatric populations as this population is at high risk for emergence agitation due to immature neurocircuitry (Lee & Sung, 2020). Many of the reviews of the literature include findings in pediatric studies, but often the results in similar studies on adults have conflicting outcomes. Although some studies focus on the veteran population at risk for EA, many studies exploring

EA in adults focus on broader populations (Lee & Sung, 2020). Additional areas where further research is indicated to clarify conflicting results include the use of ketamine, clonidine, and gabapentin (Manley et al., 2022). Although the use of medications often used in multimodal approaches has been studied individually, research is lacking on the use of these medications in a multimodal approach specifically for the veteran population suffering from PTSD (Manley et al., 2022).

METHODS

Project Design

This project was designed as a quality improvement (QI) project that was carried out as a group project by two senior students of the DNP-Nurse Anesthesia program at the University of Arizona. These two students acted as the project managers (PMs) and worked in unison to complete specific but unique parts of this project. This QI project was guided by the Iowa Model of Evidence-Based Practice (Iowa Model Collaborative, 2017). The focus of this project was to improve providers' understanding of the anesthetic implications and considerations for patients with EA. A descriptive, qualitative approach was used to determine the effectiveness of the interventions used in this QI project. This was accomplished using self-reported data through a retrospective pre-and-post-survey assessment questionnaire.

Several outcomes were developed to meet the purpose of this project. The education was designed for providers to:

1.) Understand what EA is and its clinical presentation.

2.) Understand the impact of EA on patients and those around them.

3.) Understand methods to screen patients preoperatively for the risk of EA.

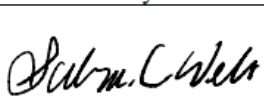
4.) Understand pharmacologic recommendations and interventions to prevent or minimize EA in those at risk.
5.) Understand non-pharmacologic interventions to prevent or minimize EA in those at risk.
6.) Understand how to use an algorithm to identify and manage those at risk for EA.

Group Project

A group project agreement form was developed and approved by the project chair (Figure 2). One PM focused on preparing an educational presentation on up-to-date literature relevant to reducing EA occurrence that was delivered to the participants. The other PM focused on the preparation and presentation of an algorithm for providers to follow when there is a concern for EA. In all aspects of the project, the PMs worked together to carry out this QI project.

Figure 3

Group Project Agreement Form

Requirements	Jacob Thompson	Sabrena C. Wells
Describe contributions to DNP Project Planning	• Bi-monthly progress meetings • Literature search • EA education presentation planning • Attend QI meetings with Chief CRNA • IRB request and approval	• Bi-monthly progress meetings • Literature search • Algorithm presentation planning/staff badges • Attend QI meetings with Chief CRNA • Special committee member request
Describe Individual Contributions for : Project Implementation	• Recruit participants for education and training • Advertisement of EA education and training • Presentation of education	• Recruit participants for education and training • Presentation of algorithm application to staff • Provide refreshments
Describe Individual Contributions for : Project Evaluation	• Develop a pre and post day of education survey. • Place data into Qualtrics program	• Develop 30-day survey related to algorithm and education and training.
Describe Individual Contributions for : Data Analysis and Synthesis	• Pre and post survey analysis.	• Analyze 30-day follow up survey results. • Use Qualtrics to graph all survey results.
Student Signature		

Note. Contract for group project including member contributions.

Model for Implementation

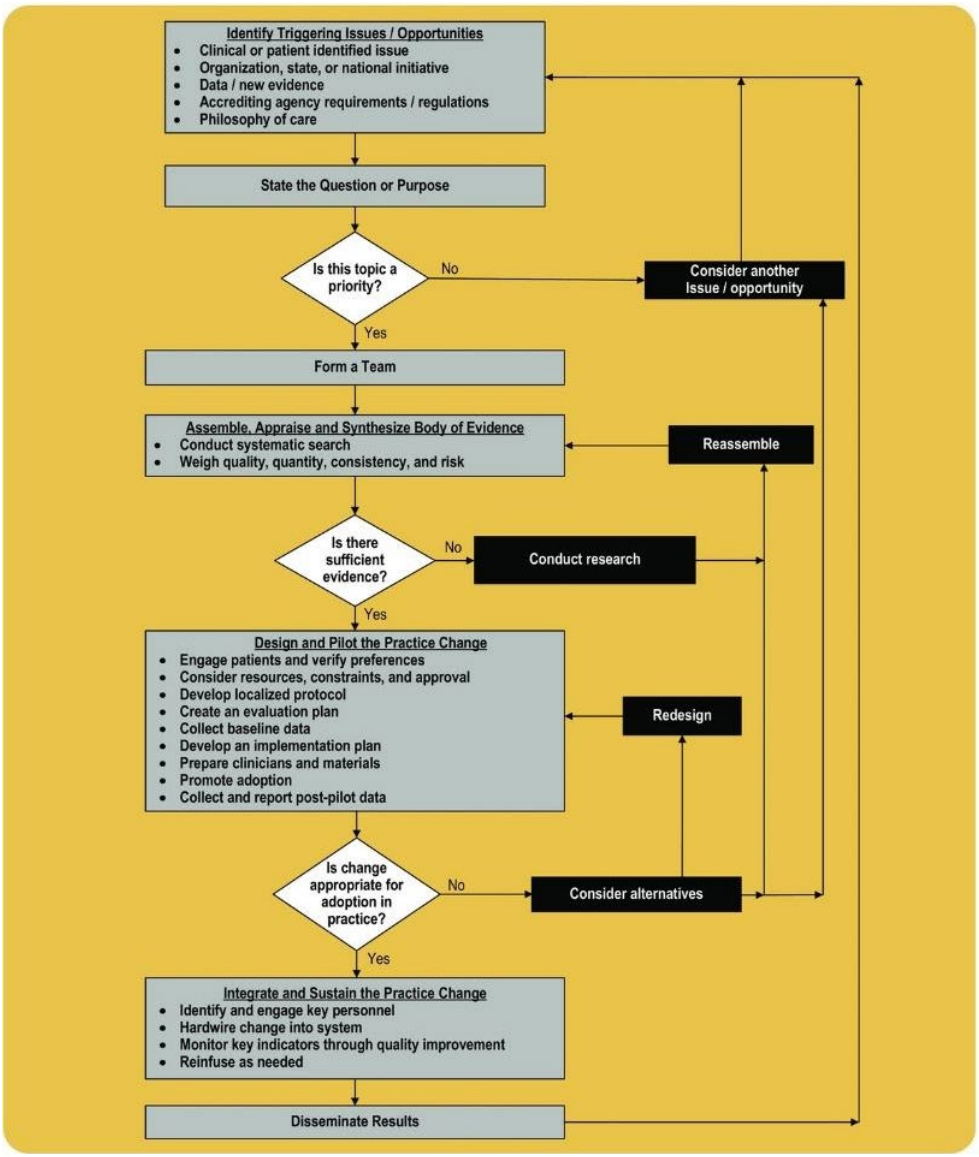
Iowa Model of Evidence-Based Practice

The Iowa Model of Evidence-Based Practice serves as a model for evidence-based practice change with a history in all 50 states in the US and 130 different countries (Iowa Model Collaborative, 2017). It has a long history of use, with more than 3,900 projects claiming its use at the time of its most recent update in 2015 (Figure 3), according to a report by the Iowa Model Collaborative (Iowa Model Collaborative, 2017). Its use supports research in clinical areas and

provides a framework for identifying and implementing research through evidence-based solutions for identified problems. (Rycroft-Malone & Bucknall, 2011).

Figure 4

Iowa Model Algorithm



Note. Image of algorithm depicting The Iowa Model of Evidence-Based Practice to Promote Quality of Care (Iowa Model Collaborative, 2017) Used with permission granted March 28, 2022, from the University of Iowa Hospitals and Clinics (Appendix H).

In 1994, the first version of the model was created by research leaders at the University of Iowa Hospital and Clinic (Iowa Model Collaborative, 2017). This model was originally based on Rogers' Diffusion of Innovations Theory and evolved in part from the research-based quality assurance model. As the world of healthcare evolves and advances, the model has been brought up to date with revisions such as those developed in 1998 and 2015 to provide continued utility in research and practice (Iowa Model Collaborative, 2017).

Developed for acute practice, the model greatly benefits acute care practitioners (Rycroft-Malone & Bucknall, 2011). It provides a guide for practitioners to navigate systems into evidence-based practice, and it possesses theoretical underpinnings in organization and systems literature. It also provides a theoretical foundation for improving quality and performance (Rycroft-Malone & Bucknall, 2011). Model authors continue to support its usefulness through workshops and consultations to illustrate its integration, as well as updates to the model. (Rycroft-Malone & Bucknall, 2011).

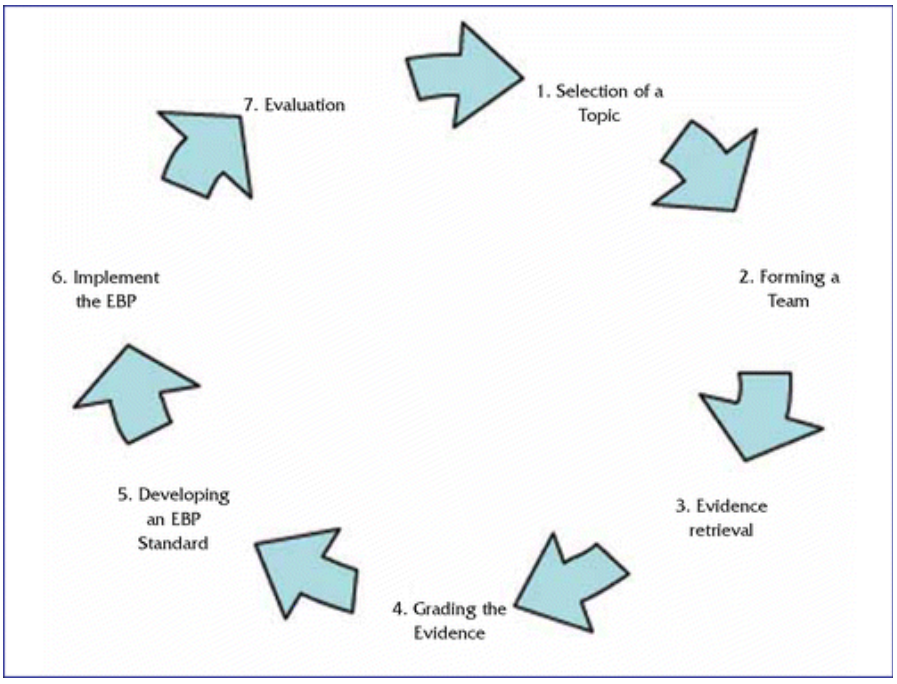
The Iowa Model of Evidence-Based Practice includes seven primary steps to direct the flow of implementing evidence-based practice. As seen in Figure 3, These steps can be followed using a more detailed algorithm that prompts questions to assess readiness for advancing to the next step. In Figure 4, a simpler depiction of the steps is portrayed. The model begins with identifying a topic that needs to be investigated and is a priority (Doody & Doody, 2013). The next step is to form a team to undertake the project that consists of stakeholders who can provide input and practical considerations of the practice being developed (Iowa Model Collaborative, 2017). The team then collects evidence to be graded for its applicability to the clinical issue (Iowa Model Collaborative, 2017). Once the evidence is collected and graded, the team then

develops a standard based on the evidence (Doody & Doody, 2013). This can then be implemented into practice and evaluated appropriately (Doody & Doody, 2013).

These steps are very simplified explanations of how to carry out a practice change based on evidence. The model provides more detailed guidance on how to ensure evidence grading is performed effectively to properly interpret applicable evidence into practice (Doody & Doody, 2013). The model also allows for the formation of an implementation that can be properly carried out with an appropriate evaluation at the end to determine success and identify future considerations for change (Doody & Doody, 2013).

Figure 5

Iowa Model Seven Steps of Evidence-Based Practice



Note. Original image adopted from the seven steps in The Iowa Model of Evidence Based Practice (Doody & Doody, 2013).

Identify Issue/Opportunity

The first step in the Iowa Model is to identify an issue or opportunity (Iowa Model Collaborative, 2017). This was achieved by recognizing emerging evidence that supports changing anesthetic care for patients with PTSD to avoid EA. The opportunity to incorporate this evidence into a facility was recognized by speaking with the chief (CRNA) at a facility that serves a large volume of military veterans who are at a higher risk of having PTSD and subsequent EA.

State the Purpose

The Iowa Model includes stating the purpose of a project as the next step (Iowa Model Collaborative, 2017). The primary purpose of this project is to improve the understanding amongst anesthesia providers of EA considerations and interventions in patients with post-traumatic stress disorder (PTSD). This purpose was chosen with the anticipation that care surrounding patients at risk for EA would be improved and better tailored to their specific needs. This ultimately aims to improve patient care and satisfaction.

Form a Team

A team must be formed to devise a plan to carry out the quality improvement project (Iowa Model Collaborative, 2017). The team consists of the two PMs who have their shared and specific responsibilities with additional team members which include the professors who make up the chair and committee members for the project. The chief CRNA at the project facility is also an important team member for the success of this project implementation.

Synthesize Evidence

Once a team was formed, the next step was to conduct a systematic search for evidence, which was assembled, appraised, and synthesized (Iowa Model Collaborative, 2017). The existing research relevant to the project is to be weighed for quality, consistency, and risk. Both PMs performed individual literature syntheses to develop a plan to guide the project. The findings were used in the development of the educational presentation and a card badge reference was used for provider education.

Pilot the Change

A practice change is piloted once development is complete (Iowa Model Collaborative, 2017). This allows for an initial period to assess the logistics of the change to be assessed in the specific setting. The initial pilot can then be assessed for baseline data to be collected, reported, and examined for further development of a sustainable and site-specific quality improvement. For this project, the pilot makes the bulk of the implementation. Once the education was completed, an assessment of the resultant data was performed. This data and the interpretation thereof will be available to the facility for any further modification and implementation of the quality improvement principles.

Integrate Sustained Change

Once a practice improvement is implemented, the next step is to integrate a sustained change (Iowa Model Collaborative, 2017). This sustained change incorporates any modifications indicated by the pilot to the practice change. This step allows for a change to be optimized based on the facility-specific dynamics. For this project, the sustained change will be manifested by the practitioners implementing the education into their practice. It will also be an option for the

facility to take the pilot data to apply further changes to enhance and sustain the practice changes.

Dissemination

The Iowa Model recognizes the value of sharing any lessons learned through projects such as this. Therefore, the results of this project will be disseminated to the facility where the implementation took place. The results will also be disseminated at a conference in Arizona for CRNAs in April 2024. The final paper discussing this project will be available through the University of Arizona repository as a scholarly graduate dissertation. The results will also be reported at the following local CRNA conference for further dissemination.

Setting and Stakeholders

A facility in Tucson, Arizona is where this project took place. Serving about 170,000 veterans in Arizona, this medical center is part of the Veterans Health Administration which is America's largest integrated healthcare system (US Department of Veterans Affairs, 2022). The facility is a teaching hospital with state-of-the-art technology and reports over 5,000 surgeries a year for veterans across Southern Arizona (US Department of Veterans Affairs, 2022).

The key stakeholders for this project included the certified registered nurse anesthetists (CRNAs), anesthesiologists (MDs), nurse anesthesiology residents (NARs), and the hospital administration at the facility. Indirect stakeholders for this project include the patients who may be ultimately affected by the influence of this project on the anesthesia provider's practice. Additional indirect stakeholders include surgeons, surgical staff, perioperative staff, and pharmacy staff. These positions all play a role in the success of preventing and treating patients for EA.

Planning the Intervention

Site authorization for this project was obtained before receiving Institutional Review Board (IRB) approval from the University of Arizona IRB and Veterans Affairs (VA) IRB. (Appendix A). The educational session was scheduled at a time when the recurring staff meetings take place to allow some convenience for providers to attend. To improve awareness and promote provider attendance, an informational flyer (Appendix C) was posted in high-traffic locations for anesthesia providers, such as the lounge, break rooms, and memo boards in the perioperative area. The PMs prepared a PowerPoint presentation (Appendix E) using current evidence synthesized from the literature that was delivered live over 45 minutes. The educational session was followed by a paper retrospective pre-and-post-survey assessment with a total of 12 questions (6 pre- & 6 post-). The PMs handed out laminated reference cards with the key points of assessment and management about EA after the survey was completed.

Participants and Recruitment

Participants for this project included CRNAs and physician anesthesiologists at the facility of interest. The exact number of attendees on the day of the educational presentation was 19, and 18 participated in completing the pre- and post-survey. To improve participation, the project was carried out on a day when a monthly staff meeting typically occurs. Additionally, an advertising flyer (Appendix C) was placed three weeks before the intervention with the date, time, and subject displayed to gain staff interest and participation. The chief CRNA sent out recruitment emails (Appendix C) to all anesthesia providers (26) one week before implementation which included a letter explaining the project, disclosure, and consent (Appendix B).

Consent and Ethical Considerations

Participation in the survey was emphasized as being completely voluntary. The UA and VA IRB approved the project and deemed it "not human research" (Appendix A) The survey was anonymous with no identifiable data, and all responses were maintained as confidential.

The three basic ethical principles that were considered in the planning of this project include respect for persons, beneficence, and justice (OHRP, 2018). Respect for persons involves acknowledging a person's autonomy and protecting those individuals who experience diminished autonomy (OHRP, 2018). All participants will remain anonymous and maintain autonomy. The principle of "respect for persons" will ensure all participants understand the details of the project which will be attached to the survey. Participation in this project was voluntary. Beneficence is understood to mean going beyond doing no harm to people, but also making efforts to ensure people's well-being (OHRP, 2018). This project was carried out in a manner to ensure that no harm to the participants took place, and their well-being was ensured. Justice involves ensuring that people are treated equally in relation to burdens and benefits (OHRP, 2018). This project was designed to ensure that all participants were treated equally with respect and dignity.

Data Collection

The data collection included compiling the results of retrospective pre- and post-survey assessments consisting of 6 pairs of questions in a Likert scale format (Appendix D). These paired questions covered 6 aspects of the education and were worded to evaluate the pre-and post- comparison. Retrospective pre-post surveys provide valid means to determine the effectiveness of an educational intervention (Chang & Little, 2018). The survey questions were designed to be answered with responses on a Likert scale including "strongly disagree, disagree,

neutral, agree, and strongly agree." These questions were designed by the PMs to assess participants' perceptions of how the education expanded their understanding. The six questions also assessed the participants' intent to use the gained knowledge in practice. The surveys were administered in person on paper on the day of the intervention to enhance participation. To ensure the results remained anonymous, the PMs were not responsible for the collection of the surveys or able to see the surveys being completed. Paper surveys were distributed at the completion of the presentation by the chief CRNA while the PM's left the room during completion of the survey. Participants left their surveys face down on their table when completed. The surveys were scanned and saved electronically to Google Drive which is accessible through student access from the University of Arizona, and the paper copies were shredded and destroyed.

Data Analysis

The data was analyzed using paired t-tests to calculate whether significant improvement in provider knowledge was evident. Paired t-tests are useful when the data is in the form of matched pairs, such as a subject being tested before and after an intervention (Xu et al., 2017). The paired groupings included the participants' ratings prior to the intervention and the ratings after the intervention.

To calculate the paired t-tests, a number was assigned to each response. This was necessary to represent the ordinal data as continuous data to be examined as a paired t-test. "Strongly disagree" was assigned the number '1,' "disagree" was '2,' "neutral" was '3,' "agree" was '4,' and "strongly agree" was '5.' This data was put into the software program Statistical Package for the Social Sciences® (SPSS) created by The International Business Machines

Corporation® (IBM) (Aldrich, 2019). These tests yielded a mean pre-score with standard deviation, a mean post-score with standard deviation, and a p-value for the differences between means to assess for significant change. An alpha of 0.05 was used with a confidence interval (CI) of 95%. The total means of all pre- and post-questions were assessed to identify an overall increase in knowledge among providers. Bar graphs and tables were created through Excel to present findings.

RESULTS

Outcomes

A total of 19 anesthesia providers attended the educational presentation. The pre- and post-survey was administered to all 19 participants. One participant did not complete the post portion of the survey and was therefore not included in the analysis. This resulted in a 94.7% (n=18) response rate for participants who completed the surveys for analysis. The null hypothesis (H_0) for the paired t-tests was that there was no change in provider knowledge before and after the educational presentation regarding EA and anesthesia considerations with a mean difference of 0. The alternative hypothesis (H_a) used was that a change in knowledge occurred as evidenced by a change in the mean between the pre- and post-survey results which is greater than zero and statistically significant as manifested by a p-value less than the alpha of 0.05. There were six individual pre- and post-survey questions which were analyzed by the paired t-test (Table 1) and overall combined pre-survey and post-survey paired t-test results (Table 2).

Table 1

Paired t-tests for Individual Question Comparisons

Paired t-Test Individual

	Mean	***Std. Deviation***	***Std. Error Mean***	***Individual Means***		***t***	***df***	***p-value***
Question 1	0.44444	0.70479	0.16612	4.166667	4.611111	2.675	17	0.008*
Question 2	0.88889	0.96338	0.22707	3.555556	4.444444	3.915	17	<.001*
Question 3	0.88889	0.90025	0.21219	3.444444	4.333333	4.189	17	<.001*
Question 4	0.5	0.5145	0.12127	4.111111	4.611111	4.123	17	<.001*
Question 5	0.22222	0.73208	0.17255	4.166667	4.388889	1.288	17	0.108
Question 6	1.05556	0.80237	0.18912	3.333333	4.388889	5.581	17	<.001

**p < 0.05*

Table 2

Paired t-tests for Overall Pre- and Post-Comparison

Paired t-Test Total

	Mean	***Std. Deviation***	***Std. Error Mean***	***Individual means***		***t***	***df***	***p-value***
				Pre	*Post*			
Pre: Post mean	0.665	0.32519	0.13276	3.7967	4.4617	5.009	5	0.002*

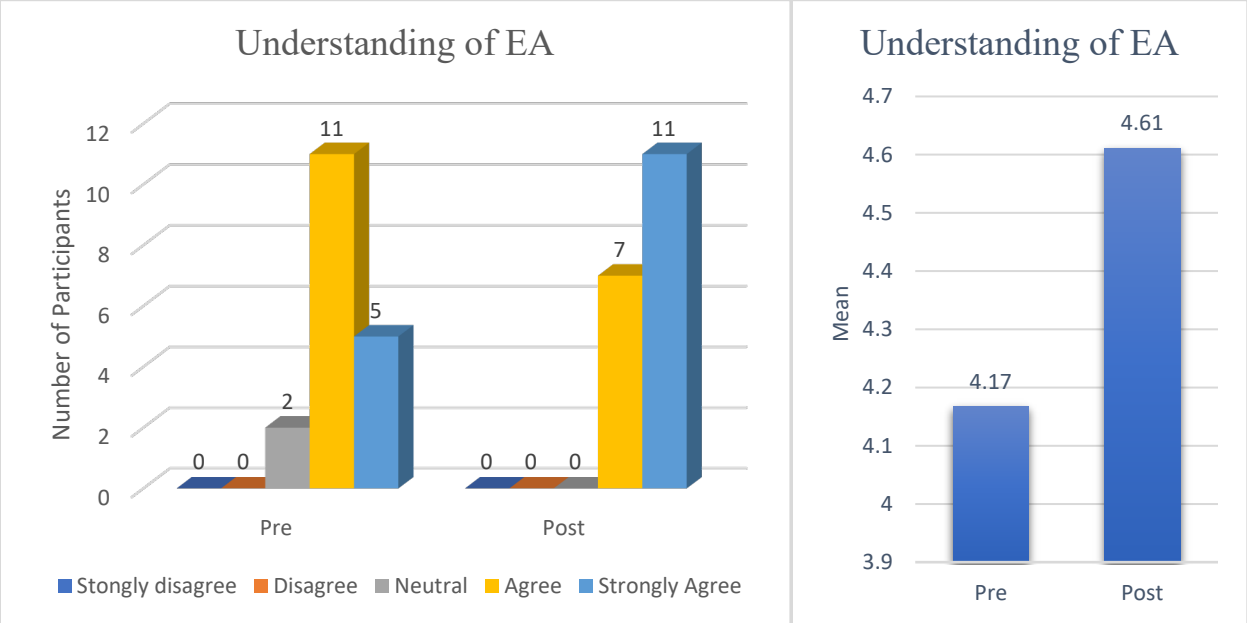
**p < 0.05*

Question 1

I understand what EA is, its clinical presentation, and its impact on patients and those around them (Figure 6). The mean pre-score was 4.17 with a standard deviation of 0.618, and the mean post-score was 4.61 with a standard deviation of 0.502. A statistically significant improvement occurred as manifested by a p-value of 0.008.

Figure 6

Question 1: Understanding What EA Is

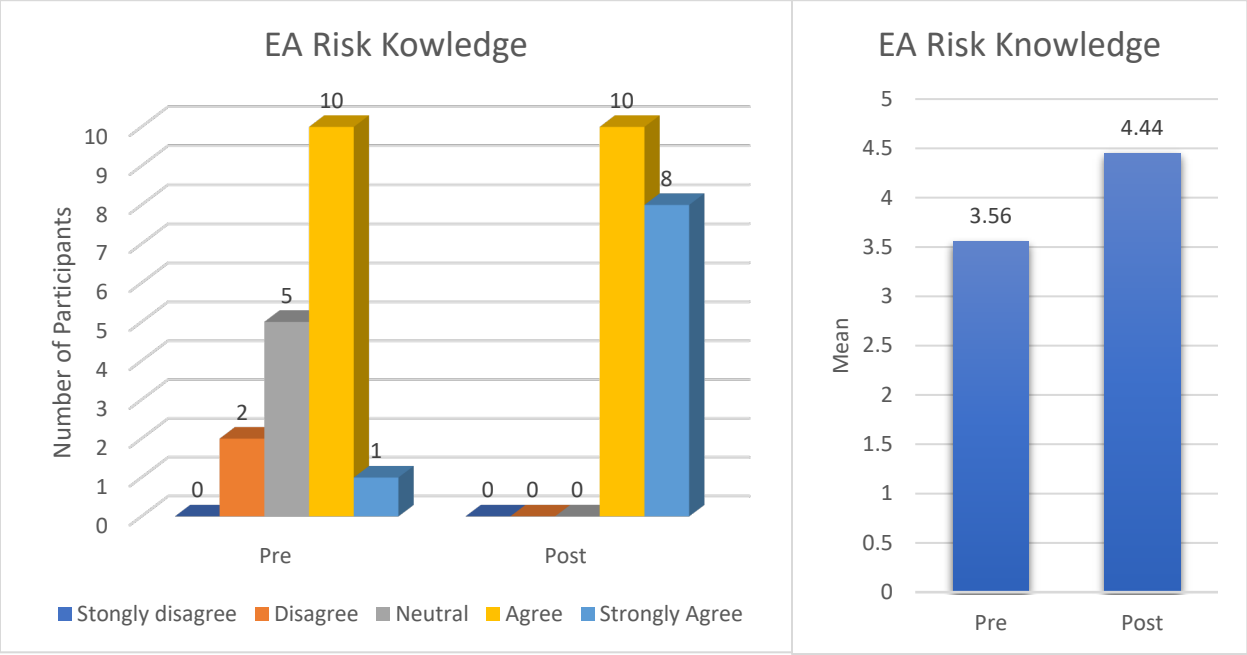


Question 2

I understand methods to screen patients preoperatively for the risk of EA (Figure 7). The mean pre-score was 3.56 with a standard deviation of 0.784, and the mean post-score was 4.44 with a standard deviation of 0.511. A statistically significant improvement occurred as manifested by a p-value of <0.001.

Figure 7

Question 2: Understanding Methods to Screen for a Risk of EA

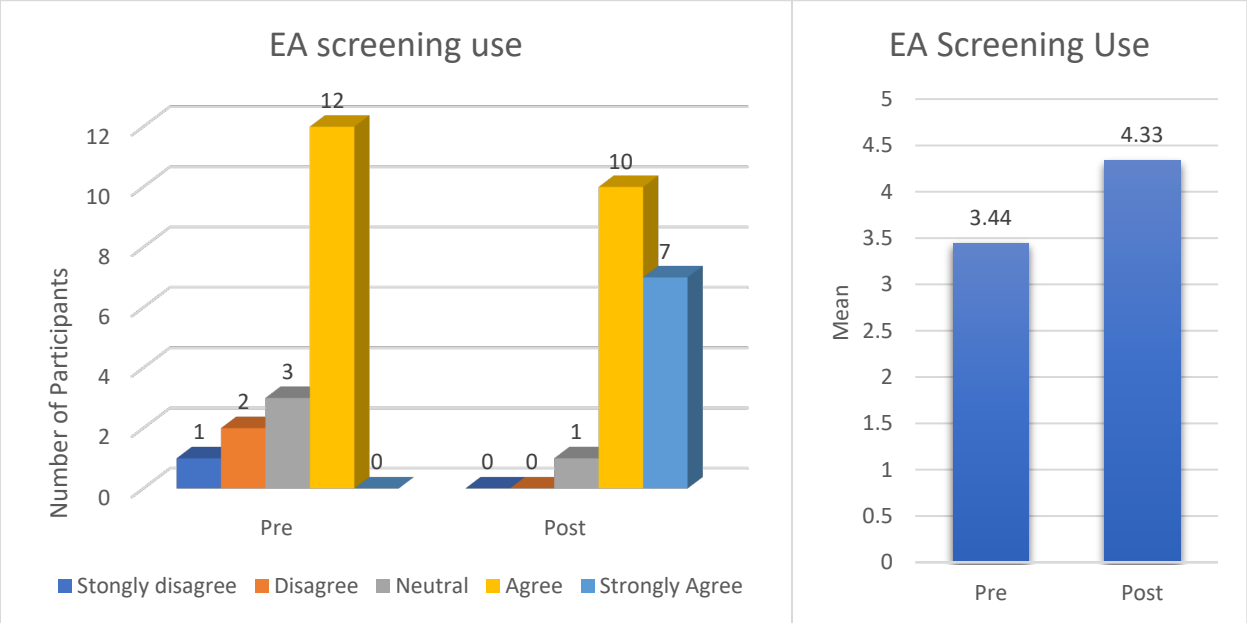


Question 3

I will ask patients questions to gauge their risk for EA (Figure 8). The mean pre-score was 3.44 with a standard deviation of 0.922, and the mean post-score was 4.33 with a standard deviation of 0.594. A statistically significant improvement occurred as manifested by a p-value of <0.001.

Figure 8

Question 3: Asking Questions to Gauge Risk of EA

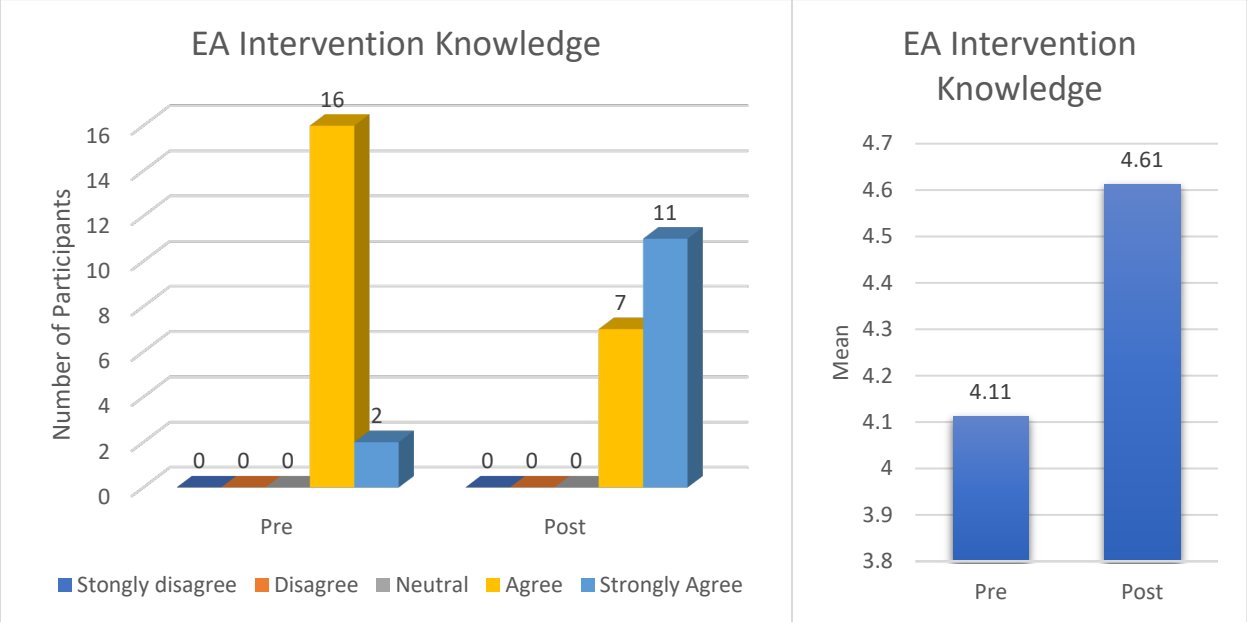


Question 4

I understand pharmacologic and non-pharmacologic interventions to prevent or mitigate EA (Figure 9). The mean pre-score was 4.11 with a standard deviation of 0.323, and the mean post-score was 4.61 with a standard deviation of 0.502 A statistically significant improvement occurred as manifested by a p-value of <0.001.

Figure 9

Question 4: Understanding Pharmacologic and Non-Pharmacologic Interventions to Prevent or Mitigate EA

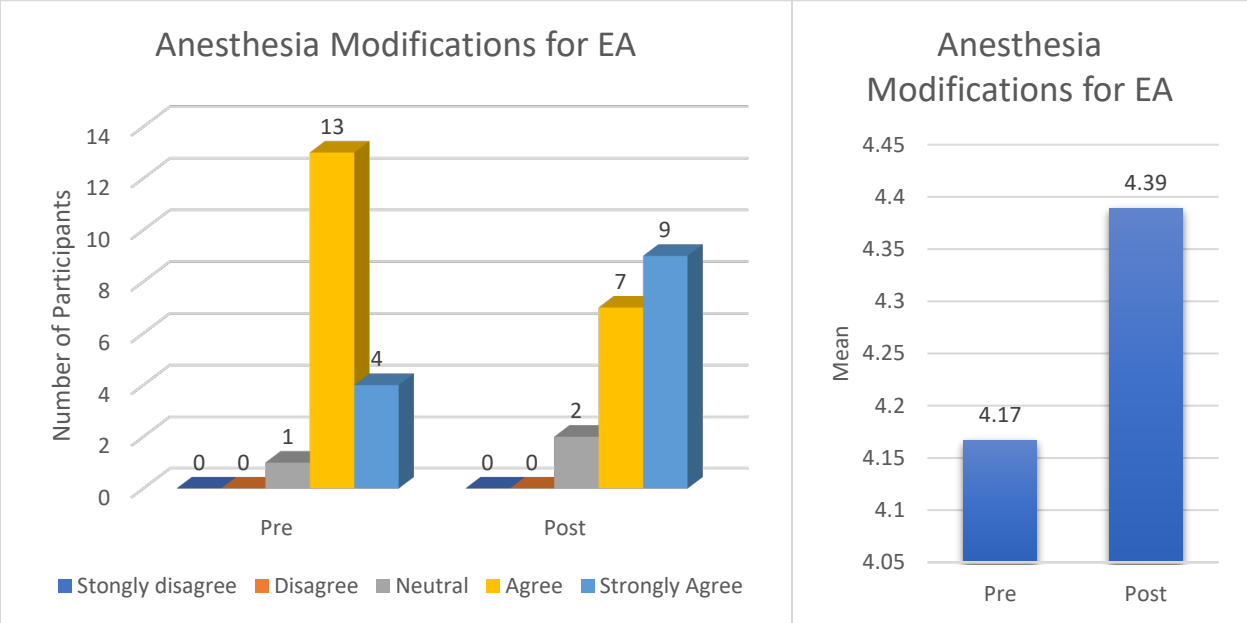


Question 5

I will adjust my anesthetic plan to reduce the risk of EA if indicated (Figure 10). The mean pre-score was 4.17 with a standard deviation of 0.515, and the mean post-score was 4.39 with a standard deviation of 0.698. There was an improvement, however it was not considered statistically significant as the p-value was 0.108.

Figure 10

Question 5: Adjusting Anesthetic Plan to Mitigate EA

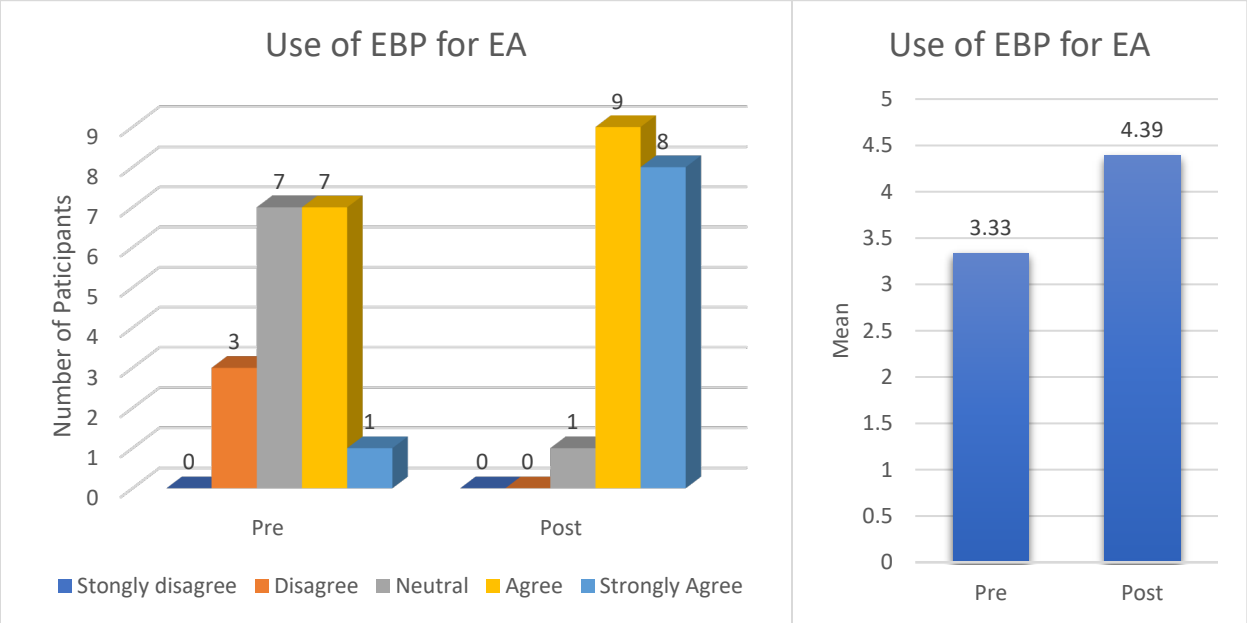


Question 6

I will use evidence-based recommendations for decision-making in preventing and treating EA (Figure 11). The mean pre-score was 3.33 with a standard deviation of 0.840, and the mean post-score was 4.39 with a standard deviation of 0.608. A statistically significant improvement occurred as manifested by a p-value of <0.001.

Figure 11

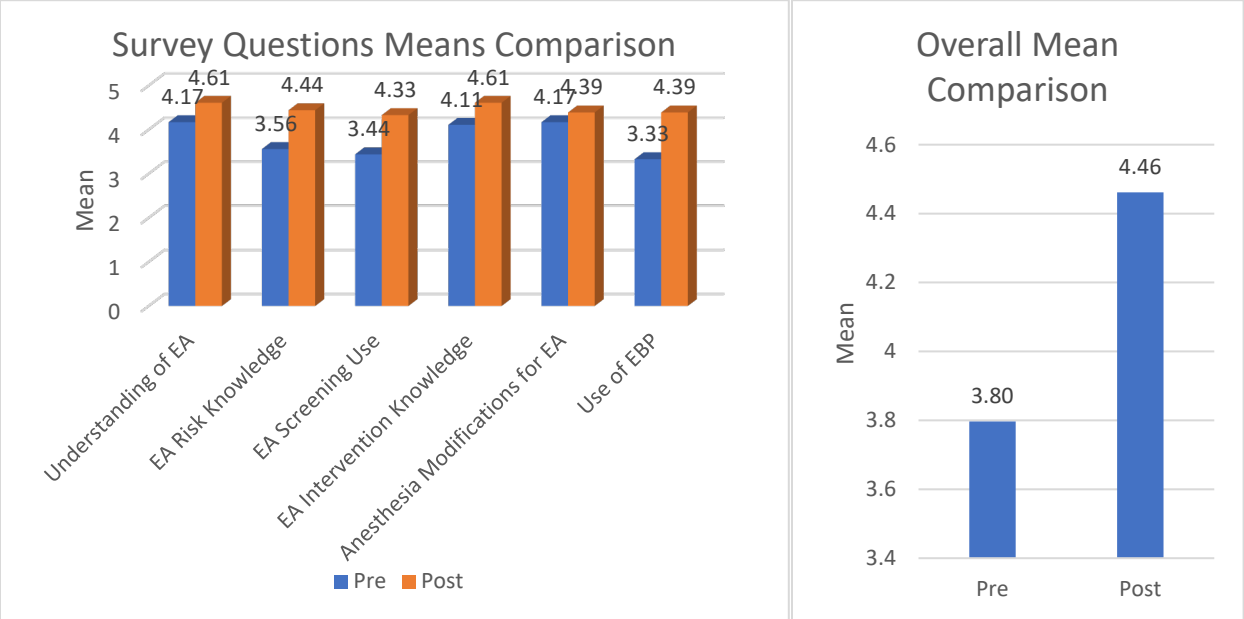
Question 6: Using Evidence-Based Recommendations for EA



The means of all the questions were compared with a paired t-test (Figure 12). The mean pre-score was 3.80 with a standard deviation of 0.394, and the mean post-score was 4.46 with a standard deviation of 0.120. A statistically significant improvement occurred as manifested by a p-value of 0.002.

Figure 12

Overall Pre- and Post-Comparison



DISCUSSION

Summary

The primary purpose of this doctoral project was to increase anesthesia providers' knowledge of emergence agitation and the surrounding anesthesia considerations in the veteran population. The outcome of interest was that anesthesia providers would have an increase in knowledge of the most recent evidence on emergence agitation and its definition, etiology, risk assessment techniques, and mitigation strategies. A live PowerPoint presentation was delivered to anesthesia providers at a Veterans Affairs hospital in Arizona, and providers were left with a badge-sized summary of recommendations. Pre- and post-survey data was examined to determine the effectiveness of an educational presentation on emergence agitation. The results

suggest that an educational presentation is an effective way to increase provider knowledge of emergence agitation and the surrounding anesthesia considerations.

Interpretation

When comparing the pre- and post-survey results, participants reported significantly higher scores after the educational presentation on EA. These survey results suggest that the educational presentation on EA was an effective method to increase provider knowledge of EA and the surrounding anesthesia considerations. When looking at the individual questions, all but one of the survey results indicated a significant change in knowledge. The one question that showed an increase that was not significant was the question that asked participants to evaluate if they modified their anesthesia planning to reduce the risk of EA. This suggests that most of the objectives focused on areas in which anesthesia providers were able to increase their knowledge. Following the presentation, providers reported a higher rating on their understanding of EA, its etiology, and its impact. They also reported a higher rating for understanding EA risk screening methods and their utilization of screening questions to gauge risk. Providers also reported higher ratings for their understanding of methods to reduce the risk of EA, as well as their intentions to use evidence-based practice surrounding EA. On the question asking providers to evaluate if they modify anesthesia planning to reduce the risk of EA, the percentage of providers that reported "highly agree" did increase from 22% to 50 % despite an insignificant increase in the mean response. This insignificant result may indicate that a good portion of providers are already using anesthesia techniques that lower the risk of EA regularly.

Implications (Practice, Education, Research and Policy)

The results of this project suggest that other anesthesia providers may benefit from an educational presentation on EA, especially in practices that see a high volume of veteran populations. The result of this project and data analysis did not examine a clinical impact and therefore does not have strong implications for policy influence, but it does identify a gap in provider knowledge that may exist in other settings. The greatest gap of knowledge was seen in the question examining providers' use of evidence-based practice surrounding EA, as the mean responses increased by 1.06. An educational tool such as the one developed for this project could be deployed elsewhere to close this gap. Although some research has indicated that a multi-component intervention to reduce EA can decrease EA rates and related injuries, more research is still needed to support widespread practice and policy change (Taylor et al., 2022).

Future research could examine the effectiveness of a protocol designed to assess and mitigate EA, such as the one prepared for this project. A universal diagnostic criteria or tool for EA could benefit future literature on the subject, as there is none in existence currently and the use of common definitions would aid future discussion on the topic (Tolly et al, 2021). Further understanding of the true etiology and biochemical processes that occur with EA should continue to be examined, as they may provide additional insight into pharmacological considerations for EA (Mi et al., 2022).

Limitations

One limitation of this project was the inability to perform a follow-up assessment to determine if the providers truly adopted the practice recommendations taught in the education. This was initially planned into the project but was forgone due to time constraints. Although this

project focused on the veteran population, EA does occur in other populations. There may be a greater gap in knowledge of EA in the providers that do not practice at Veterans Affairs facilities. Other populations serving providers may benefit from similar educations and even experience a greater increase in knowledge. Another limitation is that the education only included anesthesia providers, but including peri-operative and intra-operative nurses may have added value to the project since they contribute to the care of patients at risk for EA. Another limitation is that although the data suggests an increase in provider knowledge, this does not translate to clinical significance. Additional evaluation would be required to assess for a change in clinical outcomes.

DNP Essentials Addressed

The core competencies for the advanced practice nurse are defined by the Doctor of Nursing Practice (DNP) Essentials (AACN, 2006). It is salient to consider the essentials addressed when carrying out doctoral projects and how. The most applicable essentials that this project aimed to address are *DNP Essential I: Scientific Underpinnings for Practice*, *DNP Essential III: Clinical Scholarship and Analytical Methods*, *DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes*, and *DNP Essential VIII: Advanced Nursing Practice* (AACN, 2006).

DNP Essential I: Scientific Underpinnings for Practice

This discusses the ability of the practitioner to assemble knowledge obtained from the sciences and apply it to practice (AACN, 2006). The preparation for the project included collecting the most current evidence and recommendations on EA to generate the ideas being

shared with anesthesia providers. This aligns with *DNP Essential I*, as it utilizes the most up-to-date recommendations supported by scientific research.

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

This involves the practitioner analyzing research and incorporating the best evidence to create better patient-centered care (AACN, 2006). This project achieved this by involving a literature review and synthesis to bring the best evidence to practitioners with the idea of improving patient-centered care.

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

This essential instructs the doctorate nurse to collaborate with the interdisciplinary team and work to improve population outcomes, which was incorporated into this project (AACN, 2006). The project was directed at addressing care for a specific population, namely those at risk for EA, especially in the veteran population. *DNP Essential VI* was addressed since care for this population includes a multidisciplinary approach, which was outlined in the educational presentation for providers. *DNP Essential VIII: Advanced Nursing Practice* was addressed by this project because it focused on refining practices in an advanced practice specialty of nursing, which is nurse anesthesiology (AACN, 2006).

Conclusions

Evidence suggests that identifiable risk factors for EA exist, and that proper anesthetic planning can prevent or mitigate the occurrence and severity of EA. This doctoral project aimed to increase anesthesia providers' knowledge of EA in the veteran population and the anesthetic

considerations involved. An educational presentation was delivered to anesthesia providers at a hospital in Arizona that serves the veteran population. A pre- and post-survey examined the efficacy of the presentation delivered. The results suggested that the educational presentation delivered was effective at increasing the participant's knowledge of EA in the veteran population and the applicable anesthetic considerations.

Plan for Sustainability

As discussed, the plan for sustainability includes the materials left with the participants, namely the laminated algorithm with a QR code to the reference list. This provides an easy way for providers to refer to the current recommendations surrounding EA when assessing patients or planning for high-risk EA patients. Additional copies of the reference list were left with the staff to share with those staff members not present for the presentation. Additionally, the interpreted results of the survey were submitted to the leadership at the facility, as there was some potential interest in further process improvements based on staff receptiveness to the recommendations being presented.

Plan for Dissemination

A summary of the project will be disseminated at a local state conference for CRNAs in the form of an informative poster board (Appendix H). This conference is organized by the Arizona Association of Nurse Anesthesiologists (AzANA) and is typically attended by many nurse anesthesia providers and nurse anesthesiology residents from across the State of Arizona. The results of this project will also be made available in the repository of doctoral projects at the University of Arizona. The results of the survey and interpretation will be shared with the

anesthesia leadership at the facility so they can use it to guide future process improvements related to the subject matter.

APPENDIX A

SITE APPROVAL/AUTHORIZATION LETTER/INSTITUTIONAL REVIEW BOARD DETERMINATION LETTERS

Tucson Veteran Affairs Medical Center
3601 S 6th Ave
Tucson, AZ 85723

07/16/2023

Human Subjects Protection Program
The University of Arizona
845 N Park Ave., Suite 537A
Tucson, AZ 85719

Please note that Sabrena C. Wells and Jacob Thompson, from The University of Arizona, Doctor of Nursing Practice-Nurse Anesthesia Program, have permission to carry out their quality improvement project at the Tucson VA Medical Center in requirement of degree fulfillment. The project is titled: "Improving Anesthesia Providers' Understanding of Emergence Agitation in Post-Traumatic Stress Disorder."

Sabrena C. Wells and Jacob Thompson will perform an educational presentation on the above topic to the anesthesia staff and discuss the use of an algorithm with considerations for high-risk patients. They will distribute pre- and post-surveys to participants to assess knowledge change due to participation in the learning activity.

Sabrena C. Wells and Jacob Thompson have agreed to provide a copy of the University of Arizona IRB determination before they recruit participants. They will also present the results of the surveys to our department at the Tucson VA Medical Center.

If there are any questions, please contact the signed below.

Respectfully,

Thomas Bateman, DNP, CRNA
Tucson Veterans Affairs Medical Center
[redacted]


USER PROFILE
LOGOUT
IRBNet
Welcome to IRBNet
Jacob Thompson
Help
My Projects
Create New Project
My Reminders (10)
Project Administration
Project Overview
Designer
Share this Project
Sign this Package
Submit this Package
Delete this Package
Send Project Mail
Reviews
Project History
Create a New Package
Messages & Alerts (8)
Other Tools
Forms and Templates
Reviews
[1781164-1] INCREASING ANESTHESIA PROVIDERS' UNDERSTANDING OF EMERGENCE AGITATION IN THE VET...
Southern Arizona VA Health Care System Research Administration (RA), Tucson, AZ
Reviews:
Pkg # | Submission Date | Submission Type | Agenda | Review Type | Board Action | Effective Date | Project Status | Expiration Date
1 | 10/28/2023 | New Project | Unassigned | Administrative Review | Not Research | 12/24/2023 | Not Research |
Board Documents:
There are currently no documents from Southern Arizona VA Health Care System Research Administration (RA).

THE UNIVERSITY OF ARIZONA
Research
Innovation & Impact

University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

NOT HUMAN RESEARCH

January 12, 2024

Sabrena Wells

Dear Sabrena Wells:

On 1/12/2024, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title:	EVIDENCE BASED RECOMMENDATIONS FOR THE PREVENTION AND TREATMENT OF EMERGENCE AGITATION IN VETERANS
Investigator:	Sabrena Wells
IRB Submission ID:	STUDY00004000
Sponsor:	None
Prime Sponsor:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• Advisor Attestation, Category: Other; • Disclosure and Agreement Form, Category: Consent Form; • Education Presentation for Participants, Category: Participant Material; • Group Project Component Agreement, Category: Other; • Implementation Site Authorization Letter (Signed), Category: External Site Authorization; • IRB Protocol for Determination of Human Research, Category: IRB Protocol; • Pre and Post Implementation Survey, Category: Data Collection Tool; • Recruitment Email, Category: Recruitment Materials; • Recruitment Flyer, Category: Recruitment Materials; • Recruitment Letter for Participants, Category:

THE UNIVERSITY OF ARIZONA
Research
Innovation & Impact

University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

	Recruitment Materials; • VA IRB Non Research Approval Letter, Category: Institutional Approval;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving humans in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

All Covered Individuals must disclose all sponsored and non-sponsored Research Projects to the Office for Responsible Outside Interests (OROI) prior to Conducting Research if the individual is an Investigator. Please visit the OROI website for more information.

We value your feedback and would appreciate you taking the time to complete our survey about your experience with the IRB staff:
https://uarizona.co1.qualtrics.com/jfe/form/SV_ehQ04WxNA06b42i.

If questions arise at any time during your study, please email the general IRB inbox at VPR-IRB@arizona.edu.

APPENDIX B

CONSENT DOCUMENT (DISCLOSURE AND PARTICIPANT AGREEMENT FORM)

Disclosure and Participation Agreement Form

EVIDENCE BASED RECOMMENDATIONS FOR THE PREVENTION AND TREATMENT OF EMERGENCE AGITATION IN VETERANS

Sabrena C. Wells, BSN, RN & Jacob Thompson, BSN, RN

University of Arizona, DNP – Nurse Anesthesiology Candidates - 2024

The purpose of this quality improvement project is to improve or increase the knowledge of anesthesia providers regarding emergence agitation prevention and treatment in the veteran population at the Tucson Veterans Affairs. Participant activities include listening to the dissemination of an education session and receipt of a reference card on the topic. All information provided via this quality improvement project is evidence based and current (2017-2023) and not the opinion of the implementors/investigators. This project is a requirement towards the fulfillment of the DNP – Nurse Anesthesiology degree at the University of Arizona. This project has been approved by the Veterans Affairs' and University of Arizona's IRB departments.

Participation in project activities is completely voluntary. If you choose to take part in this project, you will be asked to provide feedback via a pre-intervention and a post-intervention survey consisting of 12 questions. Data provided will assess the effectiveness of the activity - education session. Participants may choose to skip any or all of the survey question(s). Data collected will be statistically analyzed and included in a paper on the project. Dissemination of information and completion of surveys has a burden of participation totaling approximately 60 minutes.

There are no foreseeable risks associated with participating in this quality improvement project. There are no immediate or financial benefits from your participation. Survey responses are completely anonymous. Personally identifiable information and or demographics will not be collected or linked to your answers.

Choosing not to participate in this project is not associated with penalty or loss of benefits to which you are otherwise entitled. Legal rights of any kind are not forfeited due to participation in this project. Withdrawal from the project at any time and for any reason is voluntary and acceptable.

For questions, concerns, recommendations, or complaints the following points of contact can be reached:

Jacob Thompson: [redacted] or [redacted]
Sabrena C. Wells: [redacted] or [redacted]

APPENDIX C

RECRUITMENT MATERIAL (RECRUITMENT FLYER AND EMAIL)

Recruitment Flyer:

PRESENTATION ON EMERGENCE AGITATION AND ANESTHESIA CONSIDERATIONS

Topics to be discussed include:

- Defining emergence agitation.
- Mechanisms of etiology and risk factors for emergence agitation.
- Current evidence-based recommendations on anesthetic management in patients at risk for emergence agitation.

February 7, 2024
7:30 AM

Location: VA Tucson Medical Center, Bldg. 2 Rooftop Med. Conf. Room

College of Nursing

Presented by Sabrena Wells RN, BSN, and Jacob Thompson RN, BSN
DNP Nurse Anesthesia Candidates at the University of Arizona

Recruitment email:

Dear Provider,

You are invited to take part in an educational session on the anesthesia considerations for emergence agitation. This educational session will include a PowerPoint presentation focusing on emergence agitation risk assessment strategies and management.

This education is part of a doctorate in nursing practice (DNP) project being carried out by students Jacob Thompson and Sabrena Wells at the University of Arizona. The practice recommendations provided in the presentation are supported by recent literature on the subject published within the last 5 years.

Participation in this educational session is voluntary, and there are no known risks involved. Participants will be asked to complete a paper survey to assess the effectiveness of education for increasing provider knowledge of emergence agitation considerations. No personal identifiers will be collected, and all feedback will remain confidential and anonymous. Participants may choose to not participate or stop participation at any time without penalty or repercussions.

We appreciate your consideration for participation in this session and contribution to our DNP project.

For any questions or concerns, please contact Jacob Thompson at [redacted]

Project Managers:

Jacob Thompson RN, BSN, CCRN

Sabrena Wells RN, BSN, MA, CCRN

The University of Arizona
DNP-CRNA program

APPENDIX D

EVALUATION INSTRUMENTS (PRE- AND POST-EDUCATION SURVEY)

Improving Anesthesia Providers' Understanding of Recommendation for the Treatment and Prevention of Emergence Agitation in Veterans

Pre(a) – Post(b) Education Survey

Please respond to the following questions with a checkmark in the column for strongly disagree, disagree, neutral, agree or strongly agree.

	Question	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1.(a)	Before this education I understood what EA is, its clinical presentation, and its impact on patients and those around them.					
(b)	After this education, I understand what EA is, its clinical presentation, and its impact on patients and those around them.					
2.(a)	Before this education, I understood methods to screen patients preoperatively for the risk of EA.					
(b)	After this education, I understand methods to screen patients preoperatively for the risk of EA.					
3.(a)	Before this education, I would ask patients questions to gauge risk for EA.					
(b)	After this education, I will ask patients questions to gauge risk for EA.					
4.(a)	Before this education, I understood pharmacologic and non-pharmacologic interventions to prevent or mitigate EA.					
(b)	After this education, I understand pharmacologic and non-pharmacologic interventions to prevent or mitigate EA.					
5.(a)	Before this education, I would adjust my anesthetic plan to reduce the risk of EA if indicated.					
(b)	After this education, I will adjust my anesthetic plan to reduce the risk of EA if indicated.					
6.(a)	Before this education, I would use evidence-based recommendations for decision-making in preventing and treating EA.					
(b)	After this education, I will use evidence-based recommendations to facilitate decision-making in preventing and treating EA.					

APPENDIX E

PARTICIPANT MATERIAL (EDUCATIONAL PRESENTATION, CLINICAL PRACTICE RECOMMENDATIONS CARD)

Practice Recommendations: Anesthesia Considerations for Emergence Agitation

Jacob Thompson, BSN, RN and Sabrena C. Wells, BSN, RN
DNP - Nurse Anesthesia, 2024

THE UNIVERSITY OF ARIZONA
College of Nursing

Objectives

At the conclusion of this presentation, participants will be able to:

- Define emergence agitation and recognize its clinical presentation.
- Understand the impact and local significance of emergence agitation.
- Identify risk factors for emergence agitation.
- Understand pharmacologic recommendations and interventions to prevent, mitigate, or treat emergence agitation.
- Identify non-pharmacologic interventions to prevent or mitigate emergence agitation.
- Understand the appropriate use of recommendations to identify, treat and prevent emergence agitation in the veteran population.

2

Defining Emergence Agitation

- A self-limiting state of psychomotor excitement or "extreme arousal" during awakening from general anesthesia.
- Confined to the emergence period of anesthesia as consciousness is restored (temporary, less than 30 min)
- Distinct from emergence delirium (occurs following emergence from anesthesia where hyperactive state of delirium with alteration in consciousness exists)
- Characteristics:

Restlessness	Thrashing
Violent behavior	Agitation
Excitation	Non-purposeful movement
Inconsolability	Crying

3

Significance of Emergence Agitation

- Emergence agitation (EA) episodes can become violent, potentially harming both patient and staff.
- Injuries can occur: wound dehiscence, vascular access compromise, indwelling urinary catheter dislodgement, nasogastric tube dislodgement, surgical bleeding, premature endotracheal extubations, airway injury, vocal cord damage.
- 92% of EA patients will develop postoperative delirium

VA Pittsburg Study:

- **62%** => dangerous/nonviolent behavior
- **26%** => dangerous/violent behavior
- **40%** => patient injuries
- **36%** => additional healthcare services or monitoring
- **54%** =>immediate and high risk of staff harm

4

Significance

- EA-induced patient injuries – increases morbidity and mortality
- Increases staff demands and resource utilization
- Staff at risk for injury
- Extends recovery room times – may alter disposition plan
- Increases costs
- Long-term effects of EA unknown – increases risk for global cognitive dysfunction
- Changes to care surrounding at-risk patients could lead to positive outcomes: increased patient and staff safety, increased patient satisfaction, decreased costs, and decreased morbidity and mortality.

5

EA Etiology

- Exact etiology unknown – several theories proposed in the literature
- Thought to be attributed to sympathetic activation during premature arousal due to uncontrolled pain, mental health disorders, PTSD in veterans
- Hyperactivity in response to auditory, tactile, and nociceptive stimulation
- The influence that anesthetic agents have on the amygdalocentric neurocircuitry is thought to play a role.
- Inhalational agents differentially clear the central nervous system: audition and locomotion recover first, followed by cognitive function recovery. Blood gas solubility is proposed as a factor. Lower solubility (Desflurane) passes through clearance quicker and less variably.
- Metabolic abnormalities involving lipids, purines, and amino acids have shown that preoperative serum metabolite analysis might predict risk for EA. The utility of such tests are not yet known.
- In GI surgery, plasma levels of brain-derived neurotrophic factor (BDNF) collected 10 minutes after intubation and at skin closure were significantly increased in patients with EA. No significant alteration of BDNF existed preoperatively.
- EEG has shown to be predictive of EA, but clinical relevance is not established.

6

Post Traumatic Stress Disorder

- *Diagnostic and Statistical Manual of Mental Health Disorders* - Psychiatric disorder following a traumatic event by direct exposure, witnessed exposure, indirect exposure, or through the experience of a close friend or relative
- Traumatic exposure: death, near-death experiences, serious injury, or sexual violence.
- Traumatic event is re-experienced: upsetting memories, flashbacks, nightmares, and emotional distress or physical reactivity to reminders of the event.
- Leads to aggression, risky behavior, hypervigilance, heightened reactions, and difficulty sleeping and concentrating
- PTSD = Independent risk factor for EA, even in conjunction with treatment for depression and anxiety disorders
  - Hyperreactive amygdala - fear and excitement center of the brain
  - Decreased amygdala inhibition by medial prefrontal cortex and the hippocampus
  - Dendritic remodeling

7

PTSD and EA

- Anesthetic agents are ineffective in preventing hyperarousal
  - Alterations in receptor binding sites in the central nervous system
  - Commonly used anesthetics (benzodiazepines/volatile gases) blunt neurotransmission in the amygdala and hippocampus
  - An unopposed hyperactive amygdala compounds a dysfunctional hippocampus during emergence = EA
  - Stimuli during this period is sensed as a valid threat
- PTSD trigger identification and protocols can prevent EA and reduce the incidence

8

Prevalence

- Incidence of EA risk in military personnel is 20%.
  - Increases to 46-50% for veterans with mental health diagnoses.
- ~90% of US adults experience trauma in life
- PTSD prevalence in veterans = 14-16% of population
- 138,000 new PTSD diagnoses/year
- In 2019, 9% of Arizona population = veterans (national average of 7%)
  - The largest percentage served in the Vietnam era, 37.5%- highest lifetime prevalence of PTSD
- United States combat veterans carry increased risk of EA.
- The Tucson Veterans Affairs (VA) Medical Center serves:
  - more veterans than any other facility in the state
  - over 5,000 veteran surgical and anesthesia services annually.

9

Prevalence

3 Veteran Affairs (VA) hospitals in Arizona (AZ)

- Prescott: serves 29,000 veterans in Northern AZ
- Phoenix: serves 120,000 veterans in Central AZ
- Tucson: serves 170,000 veterans in Southern AZ

AZ Veterans

- 2019 Veteran Population: 488, 061 (9% > nationwide of 7.3%)
- Male: 91%
- White race: 78.6%
- Age: 52.8% > 65 years old
- Vietnam-era vets: 35.7%
- Gulf War (1990-2001): 20.1%
- Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF): (2001-later): 18.4%

PTSD Prevalence

- OIF and OEF: 11-20% per year diagnosed since 2000
- Gulf War (Desert Storm): 12% per year (every 12/100 veterans).
- Vietnam War: 30%
- Military Female Sexual Assault: 23%
- Military Female Sexual Harassment: 55%
- Military Male Sexual Trauma: 1 in 3 men report Yes

10

Non-Modifiable Risk Factors

- History of EA
- Male
- Smoker
- Post-traumatic stress disorder
- Traumatic event (e.g., sexual assault, previous perioperative trauma)
- Traumatic brain injury
- Anxiety
- Substance use
- Depression
- Younger/Older ages (<40 or >64)
- Intellectual disability
- Cognitive impairment
- Type of surgical procedure
- Chronic pain
- Sleep difficulties
- African ethnicity
- Chronic lung disease
- Body mass index(BMI) >30 kg/m2

11

Anesthesia Related Risk Factors

- Enhanced stimulation
- Postoperative pain
- Inhaled anesthetics
  - Low blood gas solubility agents pose higher risk
  - Sevoflurane >Desflurane
  - Nitrous oxide unclear, attenuated EA in pediatric cases
- Endotracheal intubation
- Multiple intubation attempts
- Benzodiazepines
- Anti-cholinesterase reversals
- Succinylcholine
- Doxapram
- Ketamine in higher doses or near emergence
- Voiding urgency
- Postoperative nausea and vomiting (PONV)
- Presence of invasive devices
- Longer duration of anesthesia

12

Higher Risk Procedures

- Otolaryngological surgery
- Emergency procedures
- Spine surgery
- Breast surgery
- Musculoskeletal surgery
- Oral cavity surgery
- Abdominal surgery

13

Considerations

- Dexmedetomidine- sedative, anxiolytic, and analgesic. Inhibits the release of norepinephrine via alpha-2 adrenergic receptors in the locus ceruleus and spinal cord
- Meta-analysis demonstrated a significant reduction of EA with peri-operative administration and decreased rescue analgesia requirements.
- Most studies indicate preoperative and early anesthetic.
- Caution with bradycardia and hypotension, or transient hypertension following initial bolus.
- MAC lowering effect

14

Considerations to mitigate risks

- Total intravenous anesthesia
- Premedication
  - Acetaminophen
  - Dexmedetomidine
  - Gabapentin
  - Opioids
- Multimodal
  - Regional
  - Propofol
  - Lidocaine
  - Hydromorphone
- Subanesthetic doses of ketamine early in anesthetic.
- Dexmedetomidine boluses or infusion.
- Non-depolarizing neuromuscular blockers versus succinylcholine.
- Sugammadex versus other reversals.
- Additional
  - Magnesium sulfate
  - Clonidine
  - Tramadol
  - Nefopam
  - Butorphanol

15

Additional interventions

- "Comfortable nursing" shown to reduce EA
- Staff preparation and clear communication
  - Relay risks, triggers, redirecting methods
- Familiarization strategies and provider consistency
- Environmental modifications
  - Patient warming, music selection, noise reduction, private recovery area, dim lighting
- Validate feelings around EA, reorient
- Safe transport
  - Siderails, padding, multiple staff, rescue medication
- Careful securement of lines, tubes, and drains
- Safe physical restraining techniques

16

Screening Considerations

- Wheat et al., (2018) implemented an EA screening tool
- Results = increased identification rate for at-risk patients from 5% to 21%-22.5%.

For Patients 18 years of age or older

Initials _____ Age_____ Gender (M/F) _____

Military Status (active/former military/retired/civilian)_____

1) Have you ever been deployed to a combat zone? (Y/N) ____(If no, skip to question 5)

2) How many times have you been deployed to a combat zone? _____

3) How many months total did you spend in a combat zone? _____

4) Were you injured while deployed in a combat zone? _____

5) Are you currently being treated for any psychiatric or mental health diagnosis? _____
(such as PTSD, depression, anxiety, nightmares, sleep disorder)

If so, what are you currently receiving treatment for? _____

6) Have you been treated for any mental health diagnosis in the past? (Y/N) _____

If so, what have you received treatment for in the past? _____

7) Are you currently taking any medication for mental health diagnosis? (Y/N) _____

If so, what medications are you taking? _____

What diagnosis are you taking medication to treat? _____

8) Are you currently having symptoms that you are not receiving treatment for
(such as nightmares, anxiety, flashbacks, depression, etc.)? _____

9) Have you ever been diagnosed with a Traumatic Brain Injury (TBI)? (Y/N)_____

10) Have you ever received General Anesthesia (being completely asleep with medication for any surgery or procedure)? (Y/N) _____

11) Have you ever had (or been told that you had) problems or difficulties waking up from General Anesthesia? (Y/N) _____
(examples of problems may include having a hard time waking up, waking up confused or angry, or waking up combative or fighting, severe pain and/or nausea)

If so, what problems did you experience? _____

12) What type of surgery are you having? _____

13) How nervous or anxious are you about this surgery? 1 2 3 4 5
(1 = not nervous at all, 5 = extremely nervous)

17

Summarized Literature Assessment Considerations

Literature review recommendations specifically for veterans:

Pre-Anesthetic Evaluation:
- Review past anesthetics for EA episodes
  - EMR
  - Preoperative interview
- Assess psychiatric history and medications
- Note comorbid TBI or physical combat injury
- Alcohol or illicit substance screen
- Note chronic pain and opiate use

Triggers for EA Prophylaxis
- Prior difficult wake-up or EA history
- Formal PTSD diagnosis
- Suspected PTSD based on history of nightmares, hyperarousal, or re-experiencing symptoms
- Individualized decision based on known patient and anesthetic factors

19

Preoperative Anesthesia Assessment, Medication Strategy, and Outcome

Part 1: Preoperative Anesthesia Assessment	**Staff who complete part 1**: Anesthesia provider **Purpose**: Identify patients who are at elevated risk for emergence delirium, further refine the medication strategy, gather information to orient the patient upon emergence, and facilitate hand-offs

1.1. Based on chart review and patient interview, is there a history of the following symptoms, conditions, or experiences (potential risk factors for emergence delirium)?

- ☐ **NONE**
- ☐ Previous occurrence of emergence delirium (confusion, anger, thrashing, flashbacks, hallucinations, screaming or hurt yourself or hurt someone else)
- ☐ Post-traumatic stress disorder (PTSD)
- ☐ Hypervigilance
- ☐ Flashbacks
- ☐ Irritability
- ☐ Exaggerated startle response
- ☐ Depression
- ☐ Anxiety
- ☐ Nightmares
- ☐ Sleep or mood disorder
- ☐ Traumatic brain injury (TBI)
- ☐ Traumatic event (e.g., sexually assaulted, domestic violence, combat)
- ☐ Substance use
- ☐ Other:

1.2. Based on chart review and patient interview, what is *your estimate* of the patient's risk for emergence delirium?
☐ ***Low*** ☐ ***Moderate*** ☐ ***High***

1.3. Based on chart review and patient interview, are there any current medications and/or substances used (drugs and alcohol) that may impact the effectiveness of analgesic or sedative agents? ☐***No*** ☐***Yes***, list:

Questions to Facilitate Wake-Up

1.4A. At home, do you often wake up confused, angry or violent?
☐***No*** ☐***Yes***, list:

1.4B. Is there anything specific I should do or not do (*triggers*) to wake you up at the end of your procedure? E.g., Don't touch me, only touch your left shoulder, gender preference for nursing care team, etc.
☐***No*** ☐***Yes***, list:

1.4C. Are there any names that I can use to help orient you when you wake up? E.g., your nickname, family member, pet

20

Summarized Risk Assessment

- Past EA episodes
  - prior difficult wake-up, confusion, thrashing, flashbacks, hallucinations, screaming, violence from review of anesthetic records/preoperative interview
- Assess psychiatric history and formal diagnoses
  - PTSD, depression, anxiety, mood disorder, sleep disorder, traumatic brain injury, and medication therapy
- Suspected PTSD symptoms
  - Nightmares, hyperarousal/hypervigilance, re-experiencing symptoms, irritability, exaggerated startle response, avoidance
- Traumatic event
  - Physical combat injury, combat exposure, domestic violence, sexual assault, childhood trauma, military training accident
- Substance abuse
  - Alcohol, tobacco, vaping, recreational drugs
- Chronic pain/opioid abuse

Individualize decisions based on known patient risks and consider modifiable factors

21

Project Golden Eagle

- VA Pittsburgh Healthcare System
- PTSD history => "Golden Eagle" sticker on chart, golden-yellow chart folder, yellow surgical OR hat
- Cues to alert the staff of the patient's history of PTSD.
- Subsequent interventions for the project were multidisciplinary
  - Anesthesia providers
  - Perioperative surgical staff
  - Music therapy department.
- Music therapy (Bonny Method of Guided Imagery and Music) containing selected sequences of classical music, no words, a tempo of 60-80 beats/minute, and has a relaxing quality.
- Statistical analysis showed that veterans with PTSD and those exhibiting PTSD-like behavior had a much quieter emergence from anesthesia.
- Helped to enhance communication across services proactively for early identification of the PTSD patient

22

Project Golden Eagle

- 1,800 PTSD patients in 2019
- Pre-training: documented one to two incidences of EA per week.
- Post training: 0.028% of cases.
- Since training program in August 2018: no injuries for staff or patients, no lost airways, no lost IVs
- Avoided benzodiazepines in those at risk
- Planned patients' emergence from anesthesia differently, provided longer emergence phase.

23

PAASO Form

Part 2: Medication Strategy	**Staff who complete part 2**: Anesthesia provider **Purpose**: Facilitate hand-offs and monitor the perioperative intervention across department providers	
2.1. Medications administered during *pre-operation, induction, and/or maintenance of anesthesia phases*	□ Dexmedetomidine □ Fentanyl □ Hydromorphone □ Ketamine □ Acetaminophen	□ Propofol □ Remifentanil □ Midazolam □ Volatile agent □ Oral opiates
2.2. *Preemergence*	□ **NONE** □ Dexmedetomidine	□ Hydromorphone □ Propofol
2.3. If applicable, in *response to emergence delirium*	□ **NONE** □ Dexmedetomidine	□ Propofol □ Midazolam
Part 3: Outcome	**Staff who complete part 3**: Anesthesia provider or PACU nurse **Purpose**: Monitor effectiveness of the intervention across department providers and facilitate collecting information for patient record	
3.1. Was there an episode of emergence delirium? E.g., violence, thrashing, aggression, combativeness, screaming, hallucinating, attempting to exit bed/table, and/or attempting to remove medical apparatuses	□***No***	□***Yes***
If yes emergence delirium (3.1): **3.2A. Was the behavior dangerous?**	□***No***	□***Yes***, describe:
3.2B. Was anyone injured?	□***No***	□***Yes***, describe:
3.2C. What may have triggered the episode? E.g., loud sound, bright light, or tactile stimulus	Describe:	

24

VA Medication Strategy

Preoperation Preparation Immediately prior to transfer to operating room

Sequence of Meds	Intravenous (IV)/Monitored Sedation With or Without Regional Anesthesia	General Anesthesia With or Without Regional Anesthesia
1	**Acetaminophen**: 1000–1300 mg, oral	
2	***Optional* Dexmedetomidine**: 8–20 mcg (0.25–0.5 mcg/kg ideal body weight, titration to effect), IV	
3	***Optional***, one of the following: • **Fentanyl**: 50–100 mcg, IV • **Hydromorphone**: 0.2–1.0 mg, IV (**Note**: not administered as a premedication with regional anesthesia) • **Oral Opioid**	

Note: With dexmedetomidine, the clinically effective onset of sedation occurs 5–10 minutes after bolus administration.

Induction of Anesthesia Administration of an agent to provide sedation or general anesthesia as necessary

Sequence of Meds	Intravenous (IV)/Monitored Sedation With or Without Regional Anesthesia	General Anesthesia With or Without Regional Anesthesia
1	**Lidocaine**: 50–100 mg, IV	
2	**Propofol**, *one or both* of the following: • **Bolus:** Incremental doses, 25–100 mg, IV • **Infusion**: 25–150 mcg/kg/min, IV	**Propofol**, *both* of the following: • **GETA:** 1.0–2.0 mg/kg, IV • **Infusion**: 50–150 mcg/kg/min, IV
3	***Ketamine**: <0.5 mg/kg (low dose ketamine, maximum of 50 mg), IV	
4	***Hydromorphone**: 0.2–1.0 mg, IV	

Note: *During most procedures we (VAPHS) recommend use of Ketamine and/or Hydromorphone as an analgesic.

25

VA Medication Strategy

Phases

Types of Anesthesia and Medications

Maintenance of Anesthesia Maintain desired level of anesthesia required for the procedure

Sequence of Meds	Intravenous (IV)/Monitored Sedation With or Without Regional Anesthesia	General Anesthesia With or Without Regional Anesthesia
1	**Propofol infusion**: 25–150 mcg/kg/min, IV	
2	**Dexmedetomidine:** • ***Optional* loading dose:** 0.5–1.0 mcg/kg, IV, over 10 minutes • **Infusion**: 0.2–1.0 mcg/kg/hour, IV	
3	Not applicable	***Optional* Remifentanil infusion**: 0.04-0.1mcg/kg/min, IV
4	***Ketamine:** <0.5 mg/kg (low dose ketamine, maximum of 50 mg), IV	
5	***Hydromorphone**: 0.2–2.0 mg, IV	

Note: A dexmedetomidine infusion alone can be used with a limited number of specific procedures (e.g., awake fiberoptic intubation) as an IV/monitored sedation. *During most procedures we (VAPHS) recommend use of ketamine and/or hydromorphone as an analgesic.

26

VA Medication Strategy

Phases

Types of Anesthesia and Medications

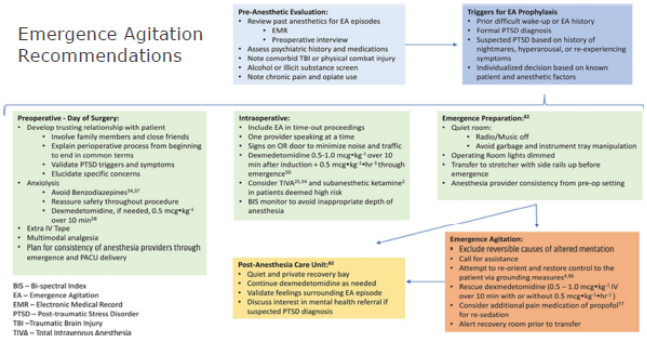
Emergence- Patient awakens from anesthesia leading to the greatest potential for emergence delirium

Sequence of Meds	Intravenous (IV)/Monitored Sedation With or Without Regional Anesthesia	General Anesthesia With or Without Regional Anesthesia
1	**Preemergence, *bolus* or *infusion* of dexmedetomidine**: • **Bolus:** 8–20 mcg (0.25–0.5 mcg/kg ideal body weight, titration to effect), IV, repeat as needed • **Infusion**: 0.2–1.0 mcg/kg/hour, IV (**loading dose**: 0.5–1.0 mcg/kg, IV, over 10 minutes)	
2	**Preemergence, hydromorphone bolus**: 0.2-1.0mg, IV, repeat as needed	
3	**Preemergence, if not previously administered, acetaminophen infusion**: 1000 mg, IV, over 20 minutes	
4	**Post-emergence, if patient demonstrates low-to-moderate-risk behavior, *bolus* or *infusion* of dexmedetomidine:** • **Bolus:** 8–20 mcg (0.25–0.5 mcg/kg ideal body weight, titration to effect), IV, repeat as needed • **Infusion**: 0.2–1.0 mcg/kg/hour, IV (**loading dose**: 0.5–1.0 mcg/kg, IV, over 10 minutes)	
5	**Post-emergence, if patient demonstrates moderate-to-high-risk behavior, *bolus* or *infusion* of propofol**: • **Bolus:** 50–200 mg, IV, repeat as needed • **Infusion**: 50–150 mg/kg/min, IV	

Note: *We* (VAPHS) *do not recommend* administering ketamine pre-emergence (late in the case), as this may increase the likelihood of emergence delirium.

27

Literature Supported Algorhithm



Note. This algorithm devised by Tolly et al. (2020) is based on current literature and recommendations for emergence agitation risk assessment, management, and considerations.

28

References

Abitağaoğlu, S., Köksal, C., Alagöz, S., Karip, C. Ş., & An, D. E. (2021). Effect of ketamine on emergence agitation following septoplasty: A randomized clinical trial. *Brazilian Journal of Anesthesiology (Elsevier), 71*(4), 381–386. https://doi.org/10.1016/j.bjane.2020.12.027

American Association of Colleges of Nursing (AACN). (2021). *The Essentials: Core Competencies for Professional Nursing Education*. Retrieved from https://www.aacnnursing.org/Portals/42/AcademicNursing/pdf/Essentials-2021.pdf

Bartoszek, M., McGuire, J. M., Wilson, J. T., Sorensen, J. S., Vice, T. F. R., & Hudson, A. J. (2023). The effectiveness of dexmedetomidine as a prophylactic treatment for emergence delirium among combat veterans with high anxiety: A randomized placebo-controlled trial. Military Medicine, 188(1-2), e286–e294. https://doi.org/10.1093/milmed/usab212

Choi, G. J., Baek, C. W., Kang, H., Park, Y. H., Yang, S. Y., Shin, H. Y., Jung, Y. H., Woo, Y. C., & Lee, U. L. (2015). Emergence agitation after orthognathic surgery: A randomised controlled comparison between sevoflurane and desflurane. *Acta Anaesthesiologica Scandinavica, 59*(2), 224–231. https://doi.org/10.1111/aas.12435

Daskalakis, N. P., Rijal, C. M., King, C., Huckins, L. M., Ressler, K. J. (2018). Recent genetics and epigenetics approaches to PTSD. *Current Psychiatry Reports, 20*(5), 1-12. https://doi-org.ezproxy4.library.arizona.edu/10.1007/s11920-018-0898-7

Demir, C. Y., & Yuzkat, N. (2018). Prevention of emergence agitation with ketamine in rhinoplasty. *Aesthetic Plastic Surgery, 42*(3), 847–853. https://doi.org/10.1007/s00266-018-1103-4

Elsha, S., & Nagelhout, J. (2018). *Nurse Anesthesia*. Elsevier.

Fields, A., Huang, J., Schroeder, D., Sprung, J., & Weingarten, T. (2018). Agitation in adults in the post-anaesthesia care unit after general anaesthesia. *British Journal of Anaesthesia, 121*(5), 1052–1058. https://doi.org/10.1016/j.bja.2018.07.017

Fischer, H. (August, 2015). *A guide to US military casualty statistics: Operation new dawn, operation Iraqi freedom, and operation enduring freedom*. Congressional Research Service. Retrieved from https://sgp.fas.org/crs/natsec/RS22452.pdf

Gao, J., Zheng, Q., Liu, M., & Bao, J. (2022). Functional magnetic resonance imaging of brain function and emergence agitation of patients with dexmedetomidine-assisted general anesthesia under comfortable nursing intervention. *Computational Intelligence and Neuroscience*. https://doi.org/10.1155/2022/8527568

Hesse, S., Kreuzer, M., Hight, D., Gaskell, A., Devari, P., Singh, D., Taylor, N. B., Whalin, M. K., Lee, S., Sleigh, J. W., & García, P. S. (2019). Association of electroencephalogram trajectories during emergence from anaesthesia with delirium in the postanaesthesia care unit: An early sign of postoperative complications. *British Journal of Anaesthesia, 122*(5), 622–634. https://doi.org/10.1016/j.bja.2018.09.016

Huang, J., Chopra, N., Yepuri, N., & Kinthala, S. (2023). Emergence agitation and anesthetic considerations in the management of patients with post-traumatic stress disorder: A report of two cases and a review of the literature. *Cureus, 15*(1), e33794. https://doi.org/10.7759/cureus.33794

References

Lee, S. J., & Sung, T. Y. (2020). Emergence agitation: Current knowledge and unresolved questions. *Korean Journal of Anesthesiology*. 73(6), 471–485. https://doi.org/10.4097/kja.20097

Manley, E. L., Rametta, L., & Blau, A. (2022). PTSD: Anesthesia considerations for the patient with post-traumatic stress disorder. *AANA Journal, 90*(5), 359–365.

Mei, X., & Tong, J. (2016). The plasma levels of brain-derived neurotrophic factor are positively associated with emergence agitation in the elderly after gastrointestinal surgery. *Journal of Anesthesia, 30*(5), 811–816. https://doi.org/10.1007/s00540-016-2212-3

Pileggi, W., Boland, M., & Taylor, M. (2023). *Emergence Delirium Treatment and Prevention: A Multidisciplinary Intervention at a VA Medical Center [Lecture notes]*. Patient Safety Authority. http://patientsafety.pa.gov/AuthorityEvents/Documents/04.19.2023.EmergenceDeliriumTreatmentandPrevention.pdf

Rice, V. (2021). An Economic snapshot of Arizona's veterans. *Arizona's Economy*. https://www.azeconomy.org/2021/12/economy/an-economic-snapshot-of-arizonas-veterans/

Tolly, B., Waly, A., Peterson, G., Erbes, C. R., Prielipp, R. C., & Apostolidou, I. (2021). Adult emergence agitation: A veteran-focused narrative review. *Anesthesia and Analgesia, 132*(2). 353–364. https://doi.org/10.1213/ANE.0000000000005211

Wheat, Turner, B. S., Diaz, A., & Maani, C. V. (2018). Military service members and emergence delirium screening: An evidence-based practice project. *Journal of Perianesthesia Nursing : Official Journal of the American Society of PeriAnesthesia Nurses, 33*(5). 608–615. https://doi.org/10.1016/j.jopan.2017.02.004

Umholtz, M., Cilnyk, J., Wang, C. K., Porhomayon, J., Pourafkari, L., & Nader, N. D. (2016). Postanesthesia emergence in patients with post-traumatic stress disorder. *Journal of Clinical Anesthesia, 34*, 3–10. https://doi.org/10.1016/j.jclinane.2016.02.047

U.S. Department of Veterans Affairs (August 29, 2022). How Common is PTSD in Veterans? Retrieved from https://www.ptsd.va.gov/understand/common/common_veterans.asp

Zhang, J., Yu, Y., Miao, S., Liu, L., Gan, S., Kang, X., & Zhu, S. (2019). Effects of peri-operative intravenous administration of dexmedetomidine on emergence agitation after general anesthesia in adults: a meta-analysis of randomized controlled trials. *Drug Design, Development, and Therapy, 13*, 2853–2864. https://doi.org/10.2147/DDDT.S207016

Thank you

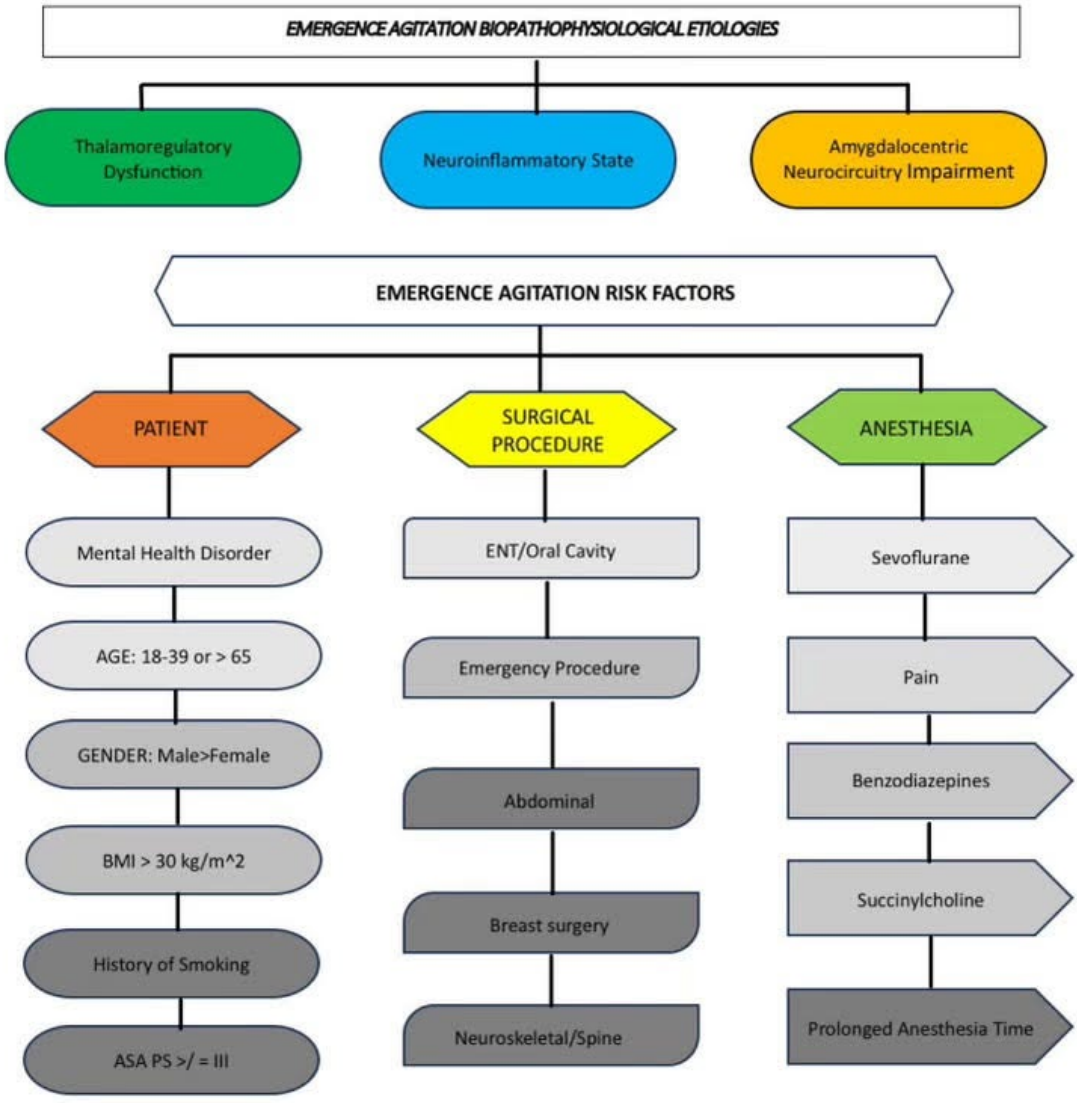
Jacob Thompson
DNP-NA, 2024
jwthompson1@arizona.edu

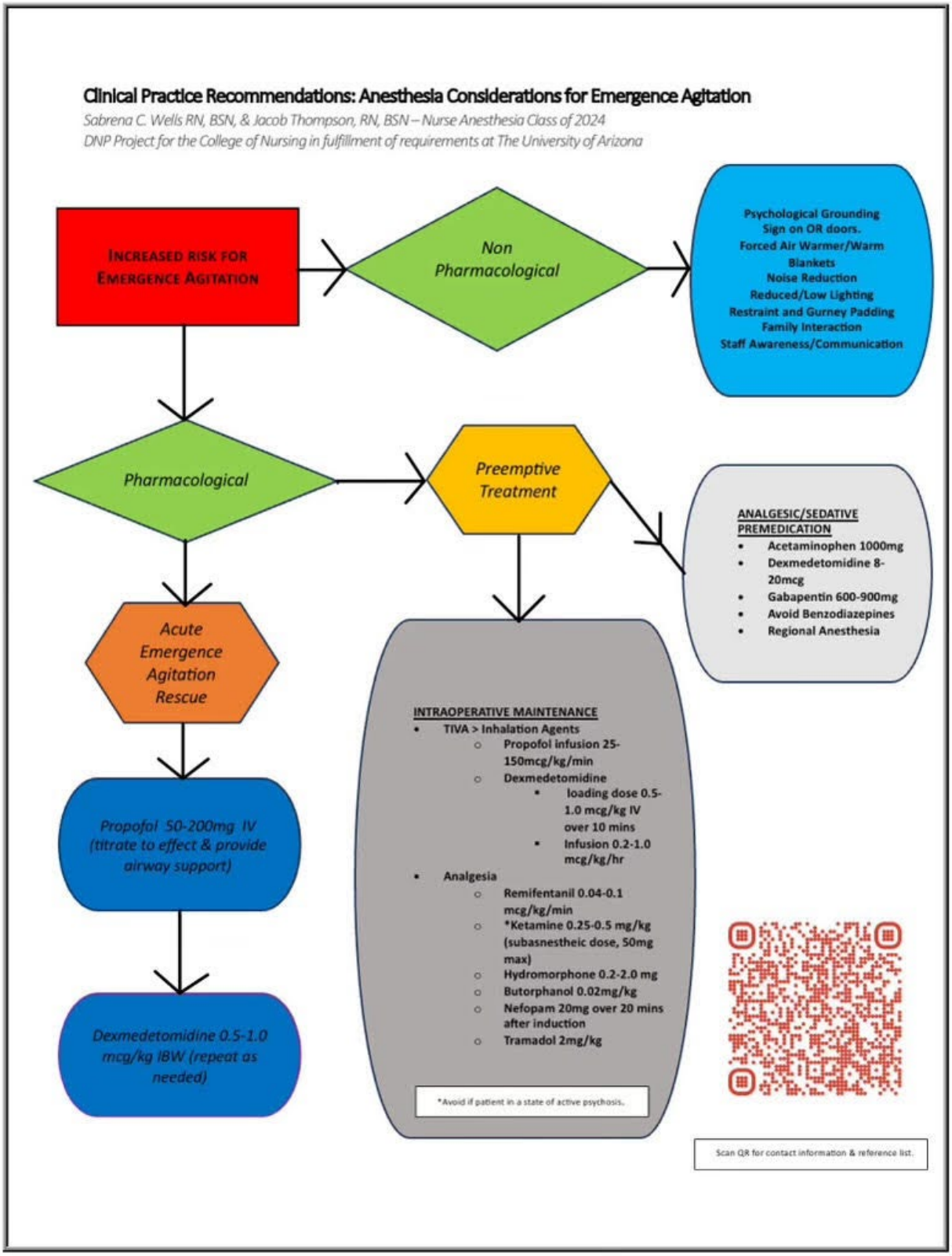
Sabrena C. Wells
DNP-NA, 2024
sabrenawells@arizona.edu

Clinical Practice Recommendations: Anesthesia Considerations for Emergence Agitation

Sabrena C. Wells RN, BSN, & Jacob Thompson, RN, BSN – Nurse Anesthesia Class of 2024
DNP Project for the College of Nursing in fulfillment of requirements at The University of Arizona

Emergence Agitation: A short lived, post-anesthetic/anesthetic emergence phase syndrome, evident by agitation, inconsolability, and violent, uncontrollable, involuntary, behavior. Begins in the operating room and can last 30 seconds to 30 minutes. The patient has not regained full consciousness during this state which may result from delayed central nervous system microcircuitry reconnection or a pathogenesis of time limited cognitive dysfunction. Agitation in this context is not a subtype nor a precursor of delirium.




Clinical Practice Recommendations: Anesthesia Considerations for Emergence Agitation
Sabrena C. Wells RN, BSN, & Jacob Thompson, RN, BSN – Nurse Anesthesia Class of 2024
DNP Project for the College of Nursing in fulfillment of requirements at The University of Arizona
INCREASED RISK FOR EMERGENCE AGITATION
Non Pharmacological
Psychological Grounding
Sign on OR doors.
Forced Air Warmer/Warm Blankets
Noise Reduction
Reduced/Low Lighting
Restraint and Gurney Padding
Family Interaction
Staff Awareness/Communication
Pharmacological
Preemptive Treatment
ANALGESIC/SEDATIVE PREMEDICATION
Acetaminophen 1000mg
Dexmedetomidine 8-20mcg
Gabapentin 600-900mg
Avoid Benzodiazepines
Regional Anesthesia
Acute Emergence Agitation Rescue
INTRAOPERATIVE MAINTENANCE
TIVA > Inhalation Agents
Propofol infusion 25-150mcg/kg/min
Dexmedetomidine
loading dose 0.5-1.0 mcg/kg IV over 10 mins
Infusion 0.2-1.0 mcg/kg/hr
Analgesia
Remifentanil 0.04-0.1 mcg/kg/min
*Ketamine 0.25-0.5 mg/kg (subasnestheic dose, 50mg max)
Hydromorphone 0.2-2.0 mg
Butorphanol 0.02mg/kg
Nefopam 20mg over 20 mins after induction
Tramadol 2mg/kg
*Avoid if patient in a state of active psychosis.
Propofol 50-200mg IV (titrate to effect & provide airway support)
Dexmedetomidine 0.5-1.0 mcg/kg IBW (repeat as needed)
Scan QR for contact information & reference list.

APPENDIX F

PROJECT TIMELINE

Completion Date	Planning	Pre-implementation	Implementation	Evaluation
July 2022	Project topic proposal to faculty			
October 2022	Student commitment agreement form			
December 2022	Zoom meeting with the site facilitator			
August 2023	DNP Paper submitted to chair and committee			
September 2023	Project Proposal			
October-December 2023		IRB submissions (VA and University)		
December-January 2024		IRB Reviewed (VA and University)		
January 2024		Recruitment materials distributed		
February 7, 2024			Live implementation and data collection	
February 2024				Data analysis
March 2024				Final revision process
March 2024				Final defense

APPENDIX G

LITERATURE REVIEW GRID

Project Question: Will an educational presentation on anesthetic considerations for emergence agitation increase anesthesia providers' knowledge and intent to change practice?

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
2021. Tolly, B., Waly, A., Peterson, G., Erbes, C. R., Prielipp, R. C., & Apostolidou, I. https://doi.org/10.1213/ANE.0000000000005211	Adult Emergence Agitation: A Veteran-Focused Narrative Review	Narrative Review	The authors found that current literature on EA suggests military personnel are more vulnerable to EA due to high rates of PTSD. Thematic strategies to successfully manage these patients were identified throughout the current literature.	The current knowledge of EA mechanisms, risk factors, and management strategies is summarized based on current literature. The authors devised an algorithm for use in determining the risk of EA and strategies to mitigate its occurrence.
2021. Taylor, M. A., & Pileggi, W. https://doi.org/10.33940/med/2021.12.2	Perioperative Delirium/Agitation Associated With the Use of Anesthetics and/or Adjunct Agents: A Study of Patient Behaviors, Injuries, and Interventions to Mitigate Risk	Retrospective Analysis	Events across 63 facilities were queried resulting in 97 qualifying events for descriptive data analysis. Anesthesia-related agitation events occurred 8% preoperatively, 8% intraoperatively, and 84% postoperatively. Immediate and high risk of staff harm occurred in 54% of cases. Thematically successful interventions were identified.	The findings of the study imply that interventions to treat, prevent, and de-escalate EA can impact staff and patient safety. The results are combined with previously existing data on the subject to provide suggested interventions including evaluation, preoperative actions, intraoperative actions, postoperative actions, and post-EA actions.
2022. Taylor, M. A., Pileggi, W., Boland, M., Boudreaux-Kelly, M. Y., Julian, D. V., & Beckstead, A. K.	A Perioperative Intervention to Prevent and Treat Emergence Delirium at a Veterans Affairs Medical Center	Evaluation study	An intervention including 21 clinical components was implemented that successfully reduced the occurrence and severity of EA, as well as adverse events related to EA.	The interventions applied to reduce EA are provided for replication in similar settings, such as the setting of interest for this project.
2018. Fields, A., Huang, J., Schroeder, D., Sprung, J., & Weingarten, T.	Agitation in adults in the post-anesthesia care unit after general anesthesia	Retrospective, matched, case-controlled study	Clinical associations with emergence agitation were identified. Significant findings	This study suggests that anticipating high-risk patients can allow staff to

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			included postoperative tracheal intubation, indwelling catheters, and pre-existing mental health problems.	improve patient safety by considering the identified risk factors.
2018. Demir C. Y. & Yuzkat, N. https://doi.org/10.1007/s00266-018-1103-4	Prevention of Emergence Agitation with Ketamine in Rhinoplasty	Randomized controlled trial	The incidence of EA in the control group measured by the Richmond Agitation-Sedation Scale was 54.3% and significantly reduced to 8.6% in the group that received ketamine just after extubation. 28.6% in the control group vs. 0% in the ketamine group for EA rate in PACU.	This study demonstrated that ketamine successfully reduced the occurrence of EA in surgery at high risk for EA occurrence. Additional risk factors for EA in this study included male gender, severe pain, and a history of smoking.
2016. Munk, L., Anderson, G., & Møller A. M. https://doi.org/10.1111/aas.12717	Post-Anaesthetic Emergence Delirium in Adults: Incidence, Predictors and Consequences	Prospective, observational cohort study	Significant risks for patients experiencing EA included male sex, volatile anesthetics, and the use of an endotracheal tube. The most significant clinical consequences of EA were increased staff utilization and the need to restrain patients.	These results help risk stratify patients presenting to surgery. This study also noted that the additional staff required for EA events is a significant consequence, and EA is an everyday phenomenon in many clinical practice settings.
2019. Zhang, J., Yu, Y., Miao, S., Liu, L., Gan, S., Kang, X., & Zhu, S. https://doi.org/10.2147/DDDT.S207016	Effects of Peri-operative Intravenous Administration of Dexmedetomidine on Emergence Agitation after General Anesthesia in Adults: A Meta-Analysis of Randomized Controlled Trials	Meta-Analysis of Randomized Controlled Trials	Perioperative intravenous dexmedetomidine could significantly reduce the incidence of EA and postoperative analgesics. The timing of administration appears to influence this effect, with preoperative and intraoperative administration being more effective than postoperative administration.	This study provides evidence of a successful pharmacologic strategy to consider in patients at risk for EA.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
2019 El-Gabalawy, R., Sommer, J. L., Pietrzak, R., Edmondson, D., Sareen, J., Avidan, M. S., & Jacobsohn, E. https://doi.org/10.1007/s12630-019-01418-4	Post-traumatic stress in the postoperative period: current status and future directions	Narrative literature review	This study identified contributing factors to EA including high-risk surgery, psychiatric history, intraoperative awareness, dissociation, surgical complications, medication administration, delirium, and pain. The findings indicate that the identification of perioperative risk factors and stress symptoms early in the postoperative period allows for proper intervention.	The summary of the literature discusses the evidence of preoperative psychiatric disorders being related to postoperative complications such as EA. The relationship between EA and postoperative PTSD is explored.
2019.Greiner, S., & Kremer, M. J.	Clarifying the Confusion of Adult Emergence Delirium.	Delphi study literature review	This study compiled existing literature on emergence delirium and developed an algorithm for differential diagnosis of emergence delirium.	Although this study focuses on emergence delirium, it discusses the phenomenon of emergence agitation, and the implications apply to patients experiencing both. The risk factors and differential diagnoses are relevant to EA considerations.
2017. Lovestrand, D., Lovestrand, S., Beaumont, D. M., & Yost, J. G. https://doi.org/10.1016/j.jopan.2015.11.011	Management of Emergence Delirium in Adult PTSD Patients: Recommendations for Practice	Literature Review	This study examined existing evidence surrounding perioperative considerations for those with PTSD. Preoperative identification, anesthetic tailoring, and minimizing stimulation during recovery reduce EA occurrence.	The summary of environmental considerations is thorough and has considerable evidence to support the efficacy. Considerations for recovery room staff are also discussed, including the application of cognitive behavior therapy.
2022. Manley, E. L., Rametta, L., & Blau, A.	PTSD: Anesthesia Considerations for the Patient	Journal article	PTSD is common in military personnel and contributes to	This article discusses the importance of assessing for

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	with Post-Traumatic Stress Disorder		EA. Planning for such patients requires adjustments throughout the entire perioperative period and involves perioperative staff.	PTSD in the preoperative period and assessing triggers, symptoms, and therapy. Effective environmental changes to reduce EA are discussed, and medication selection is discussed with recent literature support.
2022. Gao, J., Zheng, Q., Liu, M., & Bao, J. https://doi.org/10.1155/2022/8527568	Functional Magnetic Resonance Imaging of Brain Function and Emergence Agitation of Patients with Dexmedetomidine-Assisted General Anesthesia under Comfortable Nursing Intervention.	Randomized controlled trial	When compared to routine nursing with anesthesia and comfortable nursing with dexmedetomidine-assisted anesthesia, comfortable nursing with dexmedetomidine-assisted anesthesia is most effective at reducing the risk of emergence agitation.	This study supports the use of dexmedetomidine to reduce EA occurrence. It also demonstrates that perioperative care influences the risk of EA, with comfortable nursing care reducing the risk.
2022. Bustos, A. & Sambuca, R. https://digitalcommons.lasalle.edu/dnp_scholarly_projects/7	Perioperative Protocol to Prevent Emergence Delirium in Patients with Post-Traumatic Stress Disorder	Doctoral Dissertation	Literature was compiled to form a protocol applicable to patients with PTSD receiving anesthesia.	This study found a knowledge gap among anesthesia providers exists and that educating providers on current literature through a protocol for patients with PTSD undergoing anesthesia.
2020. Moran, W. F.	Enhanced Recovery Pathway Development for the Patient with Posttraumatic Stress Disorder	Doctoral dissertation/ QualitativeNonexperimental study	Patient optimization is critical in those with PTSD preparing for surgery. The emergence should be a priority in planning care, with collaboration between perioperative staff.	A comprehensive enhanced recovery after surgery pathway is discussed that addresses considerations for patients with PTSD undergoing anesthesia.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
2018. Wheat, Turner, B. S., Diaz, A., & Maani, C. V. https://doi.org/10.1016/j.jopan.2017.02.004	Military Service Members and Emergence Delirium Screening: An Evidence-Based Practice Project	Quality improvement project pre-implementation postimplementation.	After the implementation of a screening tool, the identification of patients at risk for EA rose from 5% to 21%-22.5%	The results demonstrate the value of screening patients for EA risk. The screening tool also provides successful screening methods.
2020. Lee, S. J., & Sung, T. Y. https://doi.org/10.4097/kja.20097	Emergence agitation: current knowledge and unresolved questions.	Narrative literature review	Current literature involving EA studies is discussed and compared for synthesis.	Adult and pediatric studies are compared including risks, prevention, and treatments for EA.
2023. Bartoszek M., McGuire J. M., Wilson J. T., Sorensen J. S., Vice T. F. R., Hudson A. J. https://doi.org/10.1093/milmed/usab212	The Effectiveness of Dexmedetomidine as a Prophylactic Treatment for Emergence Delirium Among Combat Veterans with High Anxiety: A Randomized Placebo-Controlled Trial	Double-blind randomized, controlled study	Dexmedetomidine is an effective treatment to reduce the risk of EA in combat veterans who experience pre-operative anxiety.	The study examined the population of interest and showed promising results for a therapy that can reduce EA in this veteran population. It also discusses the increased risk of EA associated with pre-operative anxiety and the implications thereof.

APPENDIX H

OTHER DOCUMENTS AS APPLICABLE TO THE PROJECT (EA SCREENING TOOL, PTSD-5 SCREENING TOOL, PERMISSION FOR IOWA MODEL, DISSEMINATION POSTER)

Screening Tool for EA risk in military service members:

For Patients 18 years of age or older

Initials _____ Age_____ Gender (M/F) _____

Military Status (active/former military/retired/civilian)_____

1) Have you ever been deployed to a combat zone? (Y/N) ____(If no, skip to question 5)

2) How many times have you been deployed to a combat zone? _____

3) How many months total did you spend in a combat zone? _____

4) Were you injured while deployed in a combat zone? _____

5) Are you currently being treated for any psychiatric or mental health diagnosis? _____
(such as PTSD, depression, anxiety, nightmares, sleep disorder)

If so, what are you currently receiving treatment for? _____

6) Have you been treated for any mental health diagnosis in the past? (Y/N) _____

If so, what have you received treatment for in the past? _____

7) Are you currently taking any medication for mental health diagnosis? (Y/N) _____

If so, what medications are you taking? _____

What diagnosis are you taking medication to treat? _____

8) Are you currently having symptoms that you are not receiving treatment for
(such as nightmares, anxiety, flashbacks, depression, etc.)? _____

9) Have you ever been diagnosed with a Traumatic Brain Injury (TBI)? (Y/N)_____

10) Have you ever received General Anesthesia (being completely asleep with
medication for any surgery or procedure)? (Y/N) _____

11) Have you ever had (or been told that you had) problems or difficulties waking
up from General Anesthesia? (Y/N) _____
(examples of problems may include having a hard time waking up, waking up confused
or angry, or waking up combative or fighting, severe pain and/or nausea)

If so, what problems did you experience? _____

12) What type of surgery are you having? _____

13) How nervous or anxious are you about this surgery? 1 2 3 4 5
(1 = not nervous at all, 5 = extremely nervous)

(Wheat et al., 2018)

PTSD-5 screening tool:

PC-PTSD-5

Sometimes things happen to people that are unusually or especially frightening, horrible, or traumatic. For example:

- a serious accident or fire
- a physical or sexual assault or abuse
- an earthquake or flood
- a war
- seeing someone be killed or seriously injured
- having a loved one die through homicide or suicide.

Have you ever experienced this kind of event?

YES NO

If no, screen total = 0. Please stop here.

If yes, please answer the questions below.

In the past month, have you…

1. had nightmares about the event(s) or thought about the event(s) when you did not want to?

   YES NO

2. tried hard not to think about the event(s) or went out of your way to avoid situations that reminded you of the event(s)?

   YES NO

3. been constantly on guard, watchful, or easily startled?

   YES NO

4. felt numb or detached from people, activities, or your surroundings?

   YES NO

5. felt guilty or unable to stop blaming yourself or others for the event(s) or any problems the event(s) may have caused?

   YES NO

(Prins et al., 2022)

[EXT]Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care External Inbox ×

Kimberly Jordan - University of Iowa Hospitals and Clinics <survey-bounce@survey.uiowa.edu> Fri, Mar 18, 2022, 10:15 PM
to jwthompson1

External Email

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care*. Click the link below to open.

The Iowa Model Revised (2015)

Copyright is retained by University of Iowa Hospitals and Clinics. **Permission is not granted for placing on the internet.**

Reference: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

> In written material, please add the following statement:
> *Used/reprinted with permission from the University of Iowa Hospitals and Clinics, copyright 2015. For permission to use or reproduce, please contact the University of Iowa Hospitals and Clinics at 319-384-9098.*

Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.

THE UNIVERSITY OF ARIZONA College of Nursing

Increasing Anesthesia Providers' Understanding of Emergence Agitation in the Veteran Population

Jacob Thompson Chair: Dr. Sarah Torabi Committee Members: Dr. Kristie Hoch & Dr. James Reed

Purpose

- To increase the knowledge among anesthesia providers of emergence agitation and develop evidence-based recommendations for those at risk for emergence agitation (EA).
- This project aimed to equip anesthesia providers with methods to reduce the occurrence of EA and the adverse events related to this complication.

Background

- EA is a state of psychomotor excitement that can occur as a person awakens from anesthesia and may involve confusion, thrashing, crying, shouting, and violence.
- Although this state is typically brief and self-limiting, it can lead to patient or staff harm, as well as other negative consequences.
- Current literature demonstrates that risk factors and screening techniques for EA have been identified, and modifications to anesthesia care for those at risk can reduce EA occurrence and severity.
- Combat veterans are at an increased risk of EA, and it is important for anesthesia providers who care for this population to understand the risks for EA and the related anesthesia considerations.

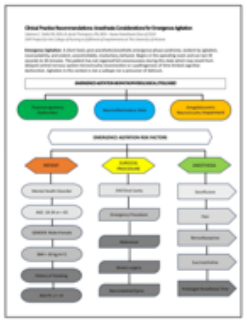
Theoretical Framework

Roger's Diffusion of Innovation Adoption Process

Note. Original image adopted from Roger's Diffusion of Innovation Adoption Process model (Mohammadi et al., 2018).

Methods

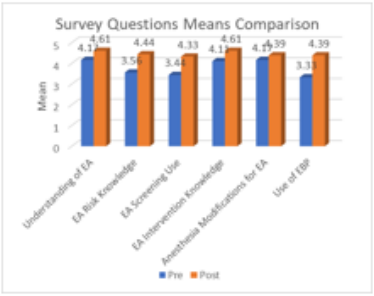
- An educational presentation was developed using current literature about EA.
- Participants from a Veterans facility in Southern Arizona were recruited to attend the presentation in person, and participants received a card-sized summary of recommendations for EA.
- A retrospective pre-and post-survey with 6 questions on paper was administered for participants to complete following the presentation.
- The survey was designed using a Likert scale to measure knowledge about EA. Each question was examined using a paired t-test to compare results before and after the educational presentation.



References

Results

- There were 19 anesthesia providers present for the presentation, and a 94.7% (n = 18) response rate for participants who completed the surveys for analysis.
- The mean pre-score of all survey questions was 3.80 (SD = 0.394), and the mean post-score was 4.46 (SD = 0.120)
- A significant improvement occurred as manifested by a p-value of 0.002 and a confidence interval of 95%.
- When assessing each of the 6 paired questions individually, 5 out of 6 pre- and post-scores significantly increased, and one paired question resulted in an insignificant increase which examined if providers adjust their anesthetic plan to reduce the risk of EA.
- The greatest increase in scores occurred in asking providers if they intend to use evidence-based practice surrounding EA.



Discussion

- An educational presentation on EA including a card-sized summary of practice recommendations is an effective way to increase knowledge of EA amongst anesthesia providers who care for veterans.
- This project aided anesthesia providers in gaining knowledge on a subject that may be useful in other settings where veterans are cared for. It may also be useful in other populations considering EA occurs in the general population.

REFERENCES

Aldrich. (2019). *Using IBM® SPSS® statistics: An interactive hands-on approach* (Third edition.). SAGE Publications, Inc

Alshiek, J., Hamade, S., Vaz, J. and Shobeiri, S. (2021) Preoperative gabapentin dosage relationship to length of stay in post-anesthesia care unit in patients undergoing pelvic and breast surgery. *Open Journal of Obstetrics and Gynecology* 11(12) 1843-1850. https://doi.org/10.4236/ojog.2021.1112171

American Association of Colleges of Nursing. (AACN). (2006). *The essentials of doctoral education for advanced nursing practice*. Advancing Higher Education in Nursing.

American Psychiatric Association. (APA). (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). https://doi.org/10.1176/appi.books.9780890425787

Bartoszek, M., McGuire, J. M., Wilson, J. T., Sorensen, J. S., Vice, T. F. R., & Hudson, A. J. (2023). The effectiveness of dexmedetomidine as a prophylactic treatment for emergence delirium among combat veterans with high anxiety: A randomized placebo-controlled trial. *Military Medicine*, *188*(1-2), e286–e294. https://doi.org/10.1093/milmed/usab212

Bovin, M. J., Kimerling, R., Weathers, F. W., Prins, A., Marx, B. P., Post, E. P., & Schnurr, P. P. (2021). Diagnostic accuracy and acceptability of the primary care posttraumatic stress disorder screen for the Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) Among US Veterans. *JAMA Network Open*, *4*(2), e2036733. https://doi.org/10.1001/jamanetworkopen.2020.36733

Bustos, A. & Sambuca, R. (2022). Perioperative protocol to prevent emergence delirium in patients with post-traumatic stress disorder. *La Salle University DNP Scholarly Projects*. 7. https://digitalcommons.lasalle.edu/dnp_scholarly_projects/7

Chang, R., & Little, T. D. (2018). Innovations for evaluation research: Multiform protocols, visual analog scaling, and the retrospective pretest-posttest design. *Evaluation & the Health Professions, 41*(2), 246–269. https://doi.org/10.1177/0163278718759396

Childers C. P., & Maggard-Gibbons, M. (2018). Understanding costs of care in the operating room. *JAMA Surgery 153*(4), e176233. https://doi.org/10.1001/jamasurg.2017.6233

Demir, C. Y., & Yuzkat, N. (2018). Prevention of emergence agitation with ketamine in rhinoplasty. *Aesthetic Plastic Surgery*, *42*(3), 847–853. https://doi.org/10.1007/s00266-018-1103-4

Doody, C. M., & Doody, O. (2013). Introducing evidence into nursing practice: Using the IOWA model. *British Journal of Nursing (Mark Allen Publishing)*, *20*(11), 661–664. https://doi.org/10.12968/bjon.2011.20.11.661

El-Gabalawy, R., Sommer, J. L., Pietrzak, R., Edmondson, D., Sareen, J., Avidan, M. S., & Jacobsohn, E. (2019). Post-traumatic stress in the postoperative period: Current status and future directions. *Canadian Journal of Anaesthesia, 66*(11), 1385–1395. https://doi.org/10.1007/s12630-019-01418-4

Fields, A., Huang, J., Schroeder, D., Sprung, J., & Weingarten, T. (2018). Agitation in adults in the post-anaesthesia care unit after general anaesthesia. *British Journal of Anaesthesia*, \ *121*(5), 1052–1058. https://doi.org/10.1016/j.bja.2018.07.017

Gao, J., Zheng, Q., Liu, M., & Bao, J. (2022). Functional magnetic resonance imaging of brain function and emergence agitation of patients with dexmedetomidine-assisted general anesthesia under comfortable nursing intervention. *Computational Intelligence and Neuroscience*. https://doi.org/10.1155/2022/8527568

Gerlach, A. T., Blais, D. M., Jones, G. M., Burcham, P. K., Stawicki, S. P., Cook, C. H., & Murphy, C. V. (2016). Predictors of dexmedetomidine-associated hypotension in critically ill patients. *International Journal of Critical Illness and Injury Science*, *6*(3), 109–114. https://doi.org/10.4103/2229-5151.190656

Greiner, S., & Kremer, M. J. (2019). Clarifying the confusion of adult emergence delirium. *AANA Journal*, *87*(3), 243–251.

Hawkes, B., & Hendricks-Jackson, L. (2017). *Nursing professional development review and resource Manual* (4th Ed.) American Nurses Association

Huang, J., Chopra, N., Yepuri, N., & Kinthala, S. (2023). Emergence agitation and anesthetic considerations in the management of patients with post-traumatic stress disorder: A report of two cases and a review of the literature. *Cureus*, *15*(1), e33794. https://doi.org/10.7759/cureus.33794

Iowa Model Collaborative, Buckwalter, K. C., Cullen, L., Hanrahan, K., Kleiber, C., McCarthy, A. M., Rakel, B., Steelman, V., Tripp-Reimer, T., Tucker, S., & Authored on behalf of the Iowa Model Collaborative (2017). *Worldviews on Evidence-Based Nursing*, *14*(3), 175–182. https://doi.org/10.1111/wvn.12223

Kwon, S. Y., Joo, J. D., Cheon, G. Y., Oh, H. S., & In, J. H. (2016). Effects of dexmedetomidine infusion on the recovery profiles of patients undergoing transurethral resection. *Journal of Korean Medical Science*, *31*(1), 125–130. https://doi.org/10.3346/jkms.2016.31.1.125

Lee, S. J., & Sung, T. Y. (2020). Emergence agitation: Current knowledge and unresolved questions. *Korean Journal of Anesthesiology*, *73*(6), 471–485. https://doi.org/10.4097/kja.20097

Lovestrand, D., Lovestrand, S., Beaumont, D. M., & Yost, J. G. (2017). Management of emergence delirium in adult PTSD patients: Recommendations for practice. *Journal of Perianesthesia*, *32*(4), 356–366. https://doi.org/10.1016/j.jopan.2015.11.011

Manley, E. L., Rametta, L., & Blau, A. (2022). PTSD: Anesthesia considerations for the patient with post-traumatic stress disorder. *AANA Journal*, *90*(5), 359–365.

Mei, X., & Tong, J. (2016). The plasma levels of brain-derived neurotrophic factor are positively associated with emergence agitation in the elderly after gastrointestinal surgery. *Journal of Anesthesia, 30*(5), 811–816. https://doi.org/10.1007/s00540-016-2212-3

Menser, C., & Smith, H. (2020). Emergence agitation and delirium: Considerations for epidemiology and routine monitoring in pediatric patients. *Local and Regional Anesthesia*, *13*, 73–83. https://doi.org/10.2147/LRA.S181459

Mi, X., Hong, J., Li, Z., Liu, T., Wang, Q., Zhou, J., Li, Y., Wang, X., Yuan, Y., Yang, N., Han, Y., Zhou, Y., Guo, X., Li, Y., & Han, D. (2022). Identification of serum biomarkers associated with emergence agitation after general anesthesia in adult patients: A metabolomics analysis. *Frontiers In Medicine, 9*, 828867. https://doi.org/10.3389/fmed.2022.828867

Mitchell G. (2013). Selecting the best theory to implement planned change. *Nursing Management (Harrow, London, England: 1994)*, *20*(1), 32–37. https://doi.org/10.7748/nm2013.04.20.1.32.e1013

Mohammadi, M. M., Poursaberi, R., & Salahshoor, M. R. (2018). Evaluating the adoption of evidence-based practice using Rogers's diffusion of innovation theory: A model testing study. *Health Promotion Perspectives*, *8*(1), 25–32. https://doi.org/10.15171/hpp.2018.03

Moran, W. F. (2020). *Enhanced recovery pathway development for the patient with posttraumatic stress disorder* (Order No. 27831552). Available from ProQuest Dissertations & Theses Global. (2466097068). https://ezproxy.library.arizona.edu/login?url=https://www.proquest.com/dissertations-theses/enhanced-recovery-pathway-development-patient/docview/2466097068/se-2

Munk L., Andersen G., & Møller A. M. (2016, September) Post-anaesthetic emergence delirium in adults: Incidence, predictors, and consequences. *Acta Anaesthesiologica Scandanavia. 60*(8), 1059-66. https://doi.org/10.1111/aas.12717

Office for Human Research Protections. (OHRP). (2018). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research.* https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html#:~:text

Prins, A., Bovin, M. J., Kimerling, R., Kaloupek, D. G, Marx, B. P., Pless Kaiser, A., & Schnurr, P. P. (2022). *Primary care PTSD screen for DSM-5 (PC-PTSD-5) [Measurement instrument]*. National Center for PTSD. https://www.ptsd.va.gov/professional/assessment/screens/pc-ptsd.asp

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Sanson-Fisher R. W. (2004). Diffusion of innovation theory for clinical change. *The Medical Journal of Australia*, *180*(S6), S55–S56. https://doi.org/10.5694/j.1326-5377.2004.tb05947.x

Schein, J., Houle, C., Urganus, A., Cloutier, M., Patterson-Lomba, O., Wang, Y., King, S., Levinson, W., Guérin, A., Lefebvre, P., & Davis, L. L. (2021). Prevalence of post-traumatic stress disorder in the United States: A systematic literature review. *Current Medical Research and Opinion*, *37*(12), 2151–2161. https://doi.org/10.1080/03007995.2021.1978417

Taylor, M. A., & Pileggi, W. (2021). Perioperative delirium/agitation associated with the use of anesthetics and/or adjunct agents: A study of patient behaviors, injuries, and interventions to mitigate risk. *Patient Safety*, *3*(4), 16–27. https://doi.org/10.33940/med/2021.12.2

Taylor, M. A., Pileggi, W., Boland, M., Boudreaux-Kelly, M. Y., Julian, D. V., & Beckstead, A. K. (2022). A perioperative intervention to prevent and treat emergence delirium at a veteran's affairs medical center. *Patient Safety*, *4*(4), 26–35. https://doi.org/10.33940/med/2022.12.3

Tolly, B., Waly, A., Peterson, G., Erbes, C. R., Prielipp, R. C., & Apostolidou, I. (2021, February 1). Adult emergence agitation: A veteran-focused narrative review. *Anesthesia and Analgesia*, *132*(2), 353–364. https://doi.org/10.1213/ANE.0000000000005211

Udod, S., & Wagner, J. (2018). Common change theories and application to different nursing situations. In J. Wagner (Ed.), *Leadership and influencing change in nursing*. (pp. 155-173). University of Regina Press.

U.S. Department of Veterans Affairs (2022). *VA Southern Arizona Health Care.* https://www.va.gov/southern-arizona-health-care/about-us/

U.S. Department of Veterans Affairs (2023) *How common is PTSD in adults?* https://www.ptsd.va.gov/understand/common/common_adults

Wang, Q., Zhou, J., Liu, T., Yang, N., Mi, X., Han, D., Han, Y., Chen, L., Liu, K., Zheng, H., Zhang, J., Lin, X., Li, Y., Hong, J., Li, Z., & Guo, X. (2021). Predictive value of preoperative profiling of serum metabolites for emergence agitation after general anesthesia in adult patients. *Frontiers in Molecular Biosciences, 8*(739227). https://doi.org/10.3389/fmolb.2021.739227

Wei, B., Feng, Y., Chen, W., Ren, D., Xiao, D., & Chen, B. (2020). Risk factors for emergence agitation in adults after general anesthesia: A systematic review and meta-analysis. *Acta Anaesthesiologica Scandinavica*, *65*(6), 719–729. https://doi.org/10.1111/aas.13774

Wheat, Turner, B. S., Diaz, A., & Maani, C. V. (2018, October). Military service members and emergence delirium screening: An evidence-based practice project. *Journal of Perianesthesia Nursing: Official Journal of the American Society of PeriAnesthesia Nurses, 33*(5), 608–615. https://doi.org/10.1016/j.jopan.2017.02.004

Williamson, M. L. C., Stickley, M. M., Armstrong, T. W., Jackson, K., & Console, K. (2022). Diagnostic accuracy of the primary care PTSD screen for DSM-5 (PC-PTSD-5) within a civilian primary care sample. *Journal of Clinical Psychology*, *78*(11), 2299–2308. https://doi.org/10.1002/jclp.23405

Younas, A., & Quennell, S. (2019). Usefulness of nursing theory-guided practice: An integrative review. *Scandinavian Journal of Caring Sciences, 33*(3), 540–555. https://doi.org/10.1111/scs.12670

Zhang, J., Yu, Y., Miao, S., Liu, L., Gan, S., Kang, X., & Zhu, S. (2019). Effects of peri-operative intravenous administration of dexmedetomidine on emergence agitation after general anesthesia in adults: a meta-analysis of randomized controlled trials. *Drug Design, Development, and Therapy*, *13*, 2853–2864. https://doi.org/10.2147/DDDT.S207016