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Final Scholarly Project: Development of Evidence-Based Clinical Practice Guidelines for Pediatric Patients at Risk of Emergence Delirium

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Abstract

Postoperative emergence agitation or emergence delirium (ED) is a phenomenon that can occur in patients who have undergone surgery requiring the administration of inhaled anesthetics. ED is a postoperative side effect of general anesthesia commonly experienced by pediatric patients that negatively impacts a patient's overall postoperative experience. There is a lack of consistent standardized clinical practice guidelines for general anesthesia in pediatric or adult populations. The primary goal of this scholarly project is to develop and implement clinical practice guidelines focusing on the occurrence of postoperative ED and select adverse clinical outcomes in pediatric patients undergoing general anesthesia. The project utilizes the Plan, Do, Study, Act (PDSA) framework to evaluate the outcomes of ED. The guidelines include pharmacological and non-pharmacological interventions addressing treatment options encompassing the preoperative, intraoperative, and postoperative care areas. The projects' objective is to provide EBP guidelines of pharmacological and non-pharmacological perioperative treatment options for pediatric ED to reduce the overall incidence and select adverse clinical outcomes. The outcomes from this scholarly project can be fundamental to recommending EBP guidelines to other pediatric facilities that are struggling with the negative consequences associated with ED.

Key Words: Emergence delirium, emergence agitation, pediatric emergence delirium, total intravenous anesthesia.

Development of Evidence-Based Clinical Practice Guidelines for Pediatric Patients at Risk of Emergence Delirium

Introduction of the Problem

Postoperative emergence delirium (ED) is a phenomenon that can occur in patients who have undergone surgery requiring the administration of inhaled anesthetics. General anesthesia utilizing volatile agents, such as sevoflurane and desflurane, have been associated with an increased incidence of ED in children (Lee & Sung, 2020). It is believed that sevoflurane and desflurane cause differential recovery rates in brain function due to differences in the clearance of inhalational anesthetics from the central nervous system (Lee & Sung, 2020). ED results from cognitive function returning after the sense of hearing and movement (Lee & Sung, 2020). ED's effects can lead to decreased patient and family satisfaction, increased postoperative complications, patient, or caregiver injury, extended post-anesthesia care unit (PACU) stay, increased resource utilization, and higher healthcare costs (Lee & Sung, 2020). ED increases the incidence of patient falls, bleeding at the surgical site, accidental removal of drains or intravenous catheters, unintended extubation, emergent re-intubation, respiratory depression, and prolonged hospitalization (Lee & Sung, 2020). This process can be very frightening for children and their caregivers. In addition, there have been long-term side effects associated with ED. Parents of children who have experienced ED and associated complications have developed Post Traumatic Stress Disorder (PTSD), requiring long-term psychological services (Sobol & Sobol, 2022).

In order to combat the incidence and select adverse clinical outcomes of pediatric ED, anesthesia providers should adopt EBP practice guidelines. Currently, in the adult and pediatric populations there is a lack of standard practices focusing on ED prevention. To alleviate some of

the negative consequences of ED complications, providers can alter their anesthetic practices within the pediatric population to aid in decreasing postoperative ED to ensure the best possible postoperative outcomes. Developing and implementing EBP guidelines focused on alternative anesthetic options, such as alternative perioperative pharmacological strategies and alterations in anesthetic delivery techniques, may decrease the incidence of ED in children undergoing general anesthesia (Ng et al., 2019). In addition, restricting the use of sevoflurane and desflurane in pediatric patients undergoing general anesthesia can reduce the incidence of ED, eliminating the additional associated costs and improving the patient's overall quality of care.

Background of Problem

Emergence Delirium

ED is a phenomenon first identified by Eckenhoff et al. (1961) as neurologic excitement during general anesthesia emergence, with patients in a dissociated state of consciousness. ED is a dissociated state of consciousness in a child which exhibits itself as hyperkinetic and incoherent, with inconsolable crying, screaming, thrashing, or kicking when emerging from general anesthesia (Fleisher &Rosenbaum, 2018). In clinical practice, managing ED often requires the administration of intravenous sedatives in the recovery area to maintain patient and caregiver safety. If a healthcare provider or the patient is injured during an episode of ED, additional testing such as X-rays, computerized tomography (CT) Scans, or Magnetic resonance imaging (MRI) may be required. Injured staff may require medical treatment and time off to recover. Daily costs of care are significantly higher for a day with delirium as compared with a day without delirium 23% increase in costs per day (Traube et al., 2016). A diagnosis of delirium is associated with an 85% increase in treatment costs (Traube et al., 2016). The administration of sedative medications can result in respiratory depression, causing increased

oxygen requirements, monitoring, and even reintubation. In addition, ED may have long-term postoperative maladaptive changes such as sleep disturbances, bed wetting, temper tantrums, attention seeking, and loneliness (Urits et al., 2020). These events take an emotional, physical, and financial toll on patients and their families.

Risk Factors

Risk factors of ED vary significantly between pediatric patients and adults. General risk factors of ED include age, male sex, type of surgery, emergency operation, use of inhalational anesthetics with low blood:gas partition coefficients, long duration of surgery, anticholinergics, premedication with benzodiazepines, voiding urgency, and postoperative pain (Lee & Sung, 2020). Known risk factors more common in pediatric patients can be found in Appendix A. Pre-admission recognition of at-risk populations is vital in providing appropriate treatment modalities.

Significance to Nurse Anesthesia

Certified Registered Nurse Anesthetists (CRNAs) provide multidimensional care during all phases of the patient's perioperative experience. It is the CRNA's responsibility to provide EBP standard care to patients to prevent negative effects, such as ED. However, when a patient experiences ED, it negatively impacts patient care. Although it is a temporary phenomenon, it increases the risk of traumatic injuries, increases healthcare costs, and may decrease overall patient satisfaction (St. Rose et al., 2022). Therefore, providing the safest practices for patient care is a priority in quality patient care.

The pharmacological decisions made by CRNAs can significantly impact a patient's recovery experience. These clinical consequences can affect the patient in a positive or negative manner. Negative clinical consequences resulting from ED can result in injury to the affected

patient or medical personnel, falling out of bed, bleeding at the surgical site, accidental removal of drains or intravenous catheters, unintended extubation, emergent re-intubation, respiratory depression, prolonged hospitalization and increasing medical care costs (Lee & Sung, 2020). CRNAs must provide patient-centered care that respects the patient as an individual while implementing a treatment plan that will yield the best overall outcomes for the patient.

In clinical practice, a patient experiencing ED requires multiple nurses, anesthesia providers, or physicians to keep the patients from harming themselves or others. ED significantly impacts the overall cost for patients and healthcare systems. As a result, the length of stay in the recovery phase is significantly prolonged to ensure patient safety. The financial impact an episode of ED can have on a healthcare facility and patient can be very costly.

Problem, Intervention, Comparison, Outcomes, and Time (PICOT) Question

Providing the safest practices for patient care is a priority in health care. Therefore, this raises the question: In outpatient pediatric surgical patients at risk for emergence delirium (P), how does the development and implementation of evidence-based practice guidelines (I) compared to traditional approach (C) affect the incidence and select adverse clinical outcomes of ED (O) in the immediate recovery period in PACU (T)? This PICOT question aims to determine if using EBP guidelines would decrease the incidence of emergence delirium in children receiving general anesthesia for surgical procedures.

Project Objectives

This project aims to develop EBP guidelines related to the incidence of ED in pediatric patients undergoing general anesthesia in the outpatient setting. The following are the objectives for the scholarly project:

- Perform a systematic literature review and create EBP guidelines to reduce the risks of complications and improve overall patient outcomes for pediatric patients at risk of developing ED after receiving general anesthesia.
- Develop a comprehensive plan to implement the EBP guidelines to reduce the incidence of ED.
- Develop a comprehensive plan describing how to monitor and measure the EBP guidelines based on patient outcomes during the immediate recovery period.
- Develop a comprehensive plan to adjust the guidelines if the outcomes could be more desirable.

By successfully completing the above outlined objectives, the facility hopes to successfully implement guidelines to decrease the incidence of emergence delirium in pediatric patients undergoing general anesthesia.

Literature Review

A literature search focused on reducing ED in pediatric patients undergoing general anesthesia through the EBSCO database. If full texts are unavailable on EBSCO, the database offers options where the complete texts can be accessed. The terms within the search are emergence delirium, emergence delirium and children, and emergence delirium and Total Intravenous Anesthesia (TIVA). In addition to the terms, the Boolean Operator "and" forms the two phrases searched. The phrases are "emergence delirium and children" and "emergence delirium and TIVA." In addition, the filters "available online," "scholarly journals," and "published less than five years" narrowed the populated results.

EBSCO yielded 79,637 results from the phrase "emergence delirium and children."

Adding the filter "available online" narrowed the results to 40,143 articles. Adding the filter “scholarly journals” narrowed the results to 11,674 articles. Finally, adding the filter “published less than five years” narrowed the results to 3,944 articles. Due to the high volume of articles on the topic proposed, it was necessary to use all three filters to narrow down the results.

A total of 49,209 articles resulted from the phrase "emergence delirium" within the EBSCO database. Adding the filter "available online" narrowed the results to 49,203 articles. Adding the filter “scholarly journals” narrowed the results to 18,804 articles. Finally, adding the filter “published less than five years” narrowed the results to 6,879 articles. Once again, it was necessary to use all three filter options available.

A total of 1,921 articles resulted from the phrase "emergence delirium and TIVA" within the EBSCO database. Adding the filter "available online" narrowed the results to 1,106 articles. Adding the filter “scholarly journals” narrowed the results to 758 articles. Finally, adding the filter “published less than five years” narrowed the results to 247 articles. Due to the immense number of results, the filters “available online,” “scholarly journals,” and “published less than five years” were necessary.

The use of specific terms, phrases, and filters resulted in five relevant articles describing the effect of inhaled volatile anesthetics versus the use of total intravenous anesthetics within the desired patient population. The abundance of articles to pick from made this literature search straightforward. In addition, the immense number of articles surrounding the proposed PICOT question show that the topic is relevant to current practice and significantly impacts the quality of care postoperatively. Articles were picked based on relevance, sample and setting, major variables studied, outcome measurements, data analysis, findings, level of evidence, and quality

of evidence. Once the articles were narrowed down, a literature review table was completed that can be found in Appendix B.

Synthesis of the Literature

Evidence-Based Guidelines for Reducing Emergence Delirium

Jiao et al. (2020) conducted a systematic review and meta-analysis of randomized control trials (RCTs) that reviewed 25 studies that included a total of 2,151 participants who were under the age of eighteen, undergoing only adenotonsillectomy procedures. The meta-analysis found that sevoflurane was the most utilized inhalation agent for pediatric anesthesia, leading to a high incidence of ED (Jiao et al., 2020). Dexmedetomidine significantly reduced the risk of sevoflurane-related ED in pediatric patients undergoing adenotonsillectomy surgery (Jiao et al., 2020). Furthermore, fentanyl closely followed dexmedetomidine in its ability to decrease the incidence of pediatric ED (Jiao et al., 2020). Remifentanil, ketamine, midazolam, clonidine, propofol, and sufentanil were also shown to be less superior than dexmedetomidine and fentanyl but more superior than sevoflurane in reducing the incidence of ED (Jiao et al., 2020).

Ketamine

Ng et al. (2019) conducted a quantitative meta-analysis of 13 studies involving 1,125 pediatric patients undergoing surgery or magnetic resonance imaging (MRI) scans. Evidence shows that children receiving ketamine had a lower incidence of ED (Ng et al., 2019). Patients receiving ketamine were also found to have superior pain management postoperatively than those who did not receive ketamine (Ng et al., 2019). Based on the combined data from eight randomized controlled trials, including 748 children, there was no evidence that ketamine reduced the discharge time from PACU (Ng et al., 2019). Ketamine is well-tolerated within the

pediatric population, with no notable adverse effects, such as postoperative nausea and vomiting (PONV), the incidence of desaturation, or laryngospasm.

Propofol

Oriby & Elrashidy (2020) conducted a RCT that included 84 patients aged three to 11 years undergoing general anesthesia. The patients were separated into two groups. Group I consisted of 42 patients receiving sevoflurane and dexmedetomidine. Group II comprised 42 patients receiving TIVA with propofol and remifentanil infusion. The incidence of ED decreased in both groups. However, Group I faced bradycardia, hypotension, and a higher incidence of PONV (Oriby & Elrashidy, 2020). Although Group II had fewer adverse effects, the recovery time was significantly shorter by (40.1 ± 6.1 min) in Group I (Oriby & Elrashidy, 2020). The incidence of ED was decreased when dexmedetomidine was used in adjunct with sevoflurane for pediatric patients receiving general anesthesia (Oriby & Elrashidy, 2020). The incidence of ED decreased in pediatric patients receiving general anesthesia when inhalational gases were not used, and the drug of choice for TIVA was propofol (Oriby & Elrashidy, 2020). There was a decrease in heart rate and mean arterial pressure (MAP) at 10 and 20 minutes after dexmedetomidine administration, requiring rescue atropine in 33% of children in this group. Compared with sevoflurane, TIVA and remifentanil reduced the risk of PONV by 26% (Oriby & Elrashidy, 2020). TIVA with propofol significantly decreases the incidence of PONV compared to volatile anesthetics (Oriby & Elrashidy, 2020).

Talih et al. (2020) conducted a single RCT focusing on 90 rhinoplasty patients undergoing general anesthesia, the patients were divided into two groups. One group was placed on a propofol infusion immediately after induction. The second group was administered sevoflurane with a fresh gas flow of 1 l/min and a minimum alveolar concentration (MAC) of 1

to 1.1. The TIVA group receiving only propofol had earlier emergence times, less bleeding, higher surgeon satisfaction, and lower incidence of ED compared to the low-flow sevoflurane group (Talih et al., 2020). It is accepted that volatile anesthetics are well-established risk factors for ED. TIVA using propofol is superior to volatile anesthetics, as evidenced by decreased incidence of ED (Talih et al., 2020). TIVA results in shorter, earlier emergence times than volatile agents (Talih et al., 2020). TIVA may be superior for rhinoplasty surgeries due to less PONV and shorter, early emergence times (Talih et al., 2020). The frequency of ED is higher after ear-nose-throat surgeries in children and adults (Talih et al., 2020). The results of this study are helpful but limited to a specific population of patients undergoing a particular type of procedure. Healthcare providers also need to consider the sample limitation when establishing EBP guidelines.

Dexmedetomidine in Adjunct with Sevoflurane

Urits et al. (2020) published an expert opinion article to comprehensively review anesthetic considerations for pediatric ED. The goal was to provide an update on practices that effectively reduce the overall risk of developing postoperative ED in pediatric patients receiving general anesthesia. The article focuses on pharmacological and non-pharmacological interventions that have been shown to result in optimal postoperative recovery, free from ED. The article explains that a high incidence of ED in the pediatric patient population undergoing general anesthesia contributes to increased morbidity and higher perioperative costs (Urits et al., 2020). Non-pharmacological interventions such as using a recording of mothers' voice for emergence, having a parent present at the time of induction, video distraction during induction, or tablet-based interactive distraction (TBID) during induction have all been shown to help decrease the incidence of ED in pediatric patients (Urits et al., 2020). Regional anesthesia, if

applicable, has a lower incidence of ED than traditional volatile anesthetics (Urits et al., 2020). Midazolam administered preoperatively or within 20 to 30 minutes of the administration of inhaled anesthetics reduces the incidence of ED (Urits et al., 2020). Remifentanil administered to children undergoing ophthalmic surgery under sevoflurane anesthesia reduced the incidence of ED without clinically significant hemodynamic changes (Urits et al., 2020). Propofol administration during sevoflurane anesthesia has been shown to decrease the incidence of ED. However, a continuous intraoperative infusion is more effective than a single propofol administration (Urits et al., 2020). However, dexmedetomidine administered in adjunct with sevoflurane has shown the most significant decrease in the incidence of ED and decreases the amount of sevoflurane needed for sedation (Urits et al., 2020).

Parents' Time Perspective

Sobol & Sobol (2022) conducted a prospective study focusing on 98 children aged 2 to 15, along with their parents or caregivers. The study aimed to test hypotheses regarding the associations of parents' time perspective with a child's postoperative pain, ED, and parents' PTSD symptoms following the child's surgery (Sobol & Sobol, 2022). The study measures parents' time perspective and PTSD symptoms obtained from postoperative questionnaires. Nurses and anesthesiologists rated the level of children's postoperative pain and delirium. The results prove associations between parents' time perspective with a child's ED and parents' posttraumatic stress disorder symptoms after their child's surgery. A parent's tendency to focus on the negatively perceived future and threats may significantly intensify the child's ED after surgery, which is dangerous for the child and a challenging environment (Sobol & Sobol, 2022). A parent's past-positive perspective can prevent children from experiencing PTSD symptoms after a child's surgery (Sobol & Sobol, 2022). A parent's negative or exaggerated attitude

expressed to a child preoperatively increases the stress level in children experiencing painful medical procedures (Sobol & Sobol, 2022). A parent's overall behavior towards their child before surgery was related to the level of child ED in children aged two to eight (Sobol & Sobol, 2022). The associations of parent behavior with child ED can help create pre-admission education guidelines for pediatric patients at risk of developing postoperative ED.

Summary

ED is a common complication in pediatric patients receiving general anesthesia. ED during the perioperative period is distressing to the patient and affects parents and nursing staff as it predisposes to unnecessary violence and self-harm (Urits et al., 2020). The administration of prophylactic medications and non-pharmacologic preventative measures preoperatively should be implemented to decrease the risk of ED. Establishing and implementing EBP for perioperative management of pediatric patients can significantly improve overall patient outcomes and quality of care.

Project Model

Plan-Do-Study-Act (PDSA) Framework

EBP frameworks help introduce newfound interventions and care models and implement them into current practice. Utilizing EBP frameworks can provide safer environments for patients and healthcare providers. Decision-makers must utilize a detailed framework or model to ensure the best possible outcomes. PDSA is a commonly used rapid cycle change method that helps organizations plan and respond to change (Appendix C) (Finkelman, 2022). PDSA was created by Dr. W. Edwards Deming in 1950. PDSA is used to respond to needs and make improvements when indicated. Within the model, the PDSA focuses on three main questions. The first question focuses on what the organization is trying to accomplish. The second question

focuses on how the organization will know that the changes resulted in improvements. Finally, the third question focuses on the changes that can result in improvement (Moran et al., 2020). This model would be effective when implementing evidence-based practice guidelines to prevent the phenomenon known as emergence delirium in pediatric patients undergoing general anesthesia.

Stages of the PDSA Cycle

The PDSA cycle begins with the Plan step. During this stage, a multidisciplinary project team identifies a goal or purpose, gathers data and literature to support EBP guidelines, defines success metrics, and puts a plan into action (PDSA Cycle | Deming.Org, 2023). The cycle then moves into the Do step, implementing the plan components, such as formulating EBP guidelines (PDSA Cycle | Deming.Org, 2023). Next comes the Study step, where outcomes are monitored and measured to test the validity of the implemented plan. During this stage, the project team uses data analysis to determine progress, failures, successes, and opportunities for improvement (Finkelman, 2022). The final stage of the cycle is the Act step. This step closes the cycle by integrating the learning generated by the entire process, which can alter the goal, change methods, reformulate a theory, or expand the learning (PDSA Cycle | Deming.Org, 2023). After completing all four steps, the team will adjust as needed and repeat the cycle from the beginning.

PDSA Cycle: Plan

The first stage of the PDSA cycle involves problem identification, the development of a change plan, and defining outcomes (Finkelman, 2022). Initial investigation indicated the absence of standardized or EBP guidelines regarding anesthesia care for pediatric patients undergoing general anesthesia at risk of developing ED in the outpatient surgery setting. After this problem was identified, a comprehensive literature search was performed to investigate the

problem. The literature synthesis established an opportunity to reduce ED in at-risk pediatric patients by implementing specific anesthesia care interventions.

PDSA Cycle: Do

The second stage of the PDSA cycle involves testing the hypothesis formulated during the planning stage. The multidisciplinary project team consists of perioperative nurses and anesthesia providers. The team introduces potential changes on a smaller scale that will lead to measurable outcomes. Data collection results are observed quantitatively once the changes are introduced on a trial basis (Millard, 2022). Data is collected by recovery room personnel by utilizing the Pediatric Anesthesia Emergence Delirium (PAED) scale (Appendix D). The PAED was developed in 2004 to assess the five common symptoms of ED in children ages two and older (Lee, 2017). The scale has been proven to have a high rate of reliability and validity in pediatric patients. PAED scale use can significantly help diagnose ED in the PACU among children with a sensitivity ranging from 64%-100% and specificity of 80-90% in individual studies (Russell et al., 2022).

The proposed implementation of the EBP guidelines for anesthesia care of pediatric patients at risk of experiencing ED will occur in the perioperative setting at the outpatient surgery center (OSC). Project implementation will involve preoperative nurses, anesthesia providers, surgeons, operating room nurses, PACU nurses, and the appropriate quality assurance performance improvement (QAPI) department at the OSC.

PDSA Cycle: Study

The third stage of the cycle is the data analysis stage. During this stage the perioperative care team collects data using the PAED scale and compares it with the team's expected results. Based on PAED scale scoring the team will determine if measurable improvement was achieved

from the data collected during the trial. Collaborating with perioperative staff regarding outcome data allows for determining the impact of the proposed clinical practice guidelines. Finally, team members determine if the outcome aligns with the expectations identified in the planning stage (Millard, 2022). The team will share the results and feedback quarterly with key stakeholders at the OSC. At the end of the data collection period, the data will be presented to the Board of Managers. If the Board of Managers approves of the proposed guidelines, the team will continue to the final stage of the PDSA cycle.

PDSA Cycle: Act

The fourth and final stage of the cycle involves adopting, adjusting, or abandoning the proposed EBP guidelines based on the data obtained during the trial period. Then, the next pilot test is planned, or the decision is made to apply the change throughout the organization, focusing on the specific purpose of the change initiative (Finkelman, 2022). If an improvement meets expectations, the proposed and approved guidelines will become the standard of care for pediatric patients at risk of ED. A designated team will be responsible for staff education, training, and adherence to the newly implemented guidelines. The QAPI Committee will monitor provider compliance and patient outcomes to ensure the established guidelines are utilized, resulting in improved results. The PDSA model allows for continuous flexibility, improvement, and reevaluation (Moran et al., 2020).

Design and Method Plan

Purpose and Desired Outcomes

This EBP scholarly project aimed to introduce, establish, and promote clinical practice guidelines focusing on reducing the occurrence of postoperative ED in at-risk pediatric patients undergoing general anesthesia. After completing a thorough literature review with data

collection, EBP anesthesia guidelines were developed. The guidelines include pharmacological and non-pharmacological interventions addressing treatment options provided in the preoperative, intraoperative, and postoperative care areas. The established guidelines are recommendations that are not meant to eliminate an anesthesia provider's use of clinical judgment. The use of the guidelines is at the discretion of the anesthesia provider after an autonomous review of each case.

Clinical Immersion Site, Population, Inclusion and Exclusion Criteria

The Final Scholarly Project (FSP) clinical immersion site is an OSC in an urban area which has not currently adopted clinical practice guidelines for preventing ED in pediatric patients undergoing general anesthesia. The facility provides outpatient surgical services for patients ranging from 1 year of age to 85 years of age. For this final scholarly project, male and female patients to be included will range from 2-12 years. Exclusion factors include patients with allergies to the intravenous options that would require use of traditional volatile inhalant for induction. Each qualifying patient will be placed on a TIVA protocol by the pre-admission testing (PAT) department before the day of surgery.

EBP Guideline Development Framework

PDSA: Plan

This project aimed to decrease the incidence of ED by providing guidance to anesthesia providers on how the use of prophylactic measures and alternative anesthesia techniques can potentially decrease the incidence of ED in pediatric patients compared to the traditional anesthetic approach. The planning stage began by introducing the need for a multidisciplinary team to establish guidelines to reduce ED to the Quality Improvement Committee. Patient outcome data was collected through patient satisfaction surveys, variance reports, and current

and retrospective patient medical records to determine the incidence of ED over the last year. The data was then shared with the committee to increase awareness of the issue within the OSC. The QAPI committee is comprised of a Medical Director, Administrator, Physician Chair, and Director of Nursing (DON) within the OSC. For a change to be implemented within the center, the QAPI team must recommend approval for the project to the Board of Managers. Once reviewed and approved by the Board of Managers, a multidisciplinary team can be created to discuss the issue and have a brainstorming session.

The team had an initial brainstorming session to discuss the identified problem and establish EBP clinical practice guidelines. The initial planning stage was critical to laying the foundation of the project. A multidisciplinary team was formulated to include one Informational Technology (IT) specialist, one PAT nurse, two preoperative nurses, two operating room (OR) nurses, two PACU nurses, one CRNA, one anesthesiologist, and one DON. Within the session the team determined the aim for the project, projected outcomes, and data collection tools to be utilized and completed further literature analysis. The team examined the current processes within the facility and compared the processes to the recommendations found within the literature analysis. The team was able to compare processes to determine what was done well and what was needed to improve upon. Discussion ensued regarding potential barriers to any change within the organization. Formulating a plan for educating providers, communicating changes, and monitoring changes must all be determined before moving on to the next stage. Once the team determined the projects who, what, when, where, and why, movement towards creating the organization specific EBP clinical practice guidelines.

PDSA: Do

Once the planning stage was completed, the team must implement the change plan. Several medications were found during a literature review to be superior at reducing the incidence of ED than the traditional inhaled anesthetic induction medication, sevoflurane. Data collection showed that sevoflurane resulted in a high incidence of postoperative ED in pediatric patients undergoing general anesthesia. Research showed that TIVA using Midazolam, Ketamine, Remifentanil, Dexmedetomidine, Propofol, or Fentanyl decreased ED. However, implementing non-pharmacologic interventions was also shown to decrease a patient's overall anxiety preoperatively, resulting in improved patient outcomes.

The team recommended that the following pharmacological guidelines for implementation:

1) Sevoflurane would only be utilized for pediatric patients 12 and younger requiring general anesthesia when there is a contraindication to TIVA, such as allergies to recommended IV medications.
2) TIVA would include using Midazolam, Remifentanil, Propofol, Ketamine, or Dexmedetomidine.
3) Midazolam would be administered preoperatively within 20-30 minutes of the start of the procedure.

The team also recommended the following non-pharmacological interventions for implementation:

1) Allowing group educational visits to the surgical center before the day of surgery allows the patients and parents to meet with a perioperative team member to give an overview of what is expected for the day of surgery. Creating a fun, welcoming environment where

the children can familiarize themselves with the facility, process, and monitoring equipment to decrease day of surgery anxiety.

2) During registration, each pediatric patient is provided a recording of the mother's or father's voice in a stuffed animal for emergence.
3) Video distraction during induction or tablet-based interactive distraction (TBID) during induction.

During the "Do" stage, the team planned to implement the established guidelines.

Prior to implementing any change, it is vital that all providers are educated on the new process and can ask questions. Successful implementation requires exceptional communication. The team used several methods of communication to educate providers on the proposed guidelines for the EBP study. The multidisciplinary team held a mandatory one-hour introductory meeting for all providers and staff to introduce the identified problem. The team allowed for a question-and-answer session following the meeting. The project team also provided education via an electronic communication board located in the staff lounge. The team e-mailed educational instructions to the perioperative team members. During the first two weeks of implementation, one team member from each department was removed from patient care to be a resource person to help answer questions, ensure proper data collection, and promote the use of the EBP guidelines.

PDSA: Study

During the study stage, the team utilized the QAPI committee to monitor and measure outcomes to determine the validity of the implemented plan. All patients under 12 undergoing general anesthesia had their charts reviewed bi-weekly. The team pulled historical data from PAED scores for patients who received traditional inhalational induction anesthesia in the year

prior to implementing the EBP guidelines. Data was compared to previous patient records over the past six months who received general anesthesia utilizing the EBP guidelines being used. Findings were discussed amongst the multidisciplinary team in a 1-hour collaborative team meeting.

PDSA: Act

During the final stage of the PDSA cycle, the project team analyzed data pulled from patient medical records to determine progress, failures, successes, and opportunities for improvement. The team integrated the data generated by the entire process to determine if the guidelines resulted in the expected outcomes. The team presented the data analysis to the QAPI committee. The team proposed the recommended adjustments to the QAPI committee. The QAPI committee discussed areas of needed improvement and recommended adjustments to the BOM for approval. During this stage in the PDSA cycle, the organization determines if the implemented EBP guidelines should remain, be altered, or be removed altogether. If adjustments are needed, then the cycle repeats itself.

Implementation Plan

PDSA Cycle: PLAN

Following the QAPI project framework of PDSA, the “Plan” stage of the QAPI project led by the project team is initiated after reports from perioperative staff that pediatric patients undergoing general anesthesia are experiencing ED, resulting in undesirable outcomes at an urban OSC. The incidence of ED led to an in-depth patient medical record review and variance report revealing a lack of EBP guidelines for pediatric patients at risk of ED. Due to the high incidence of pediatric ED, the project team performs a literature review (Appendix B). The

literature review reveals data reflecting the significance and correlation of TIVA use and decreased incidence of ED.

PDSA Cycle: DO

During the "Do" stage of the PDSA cycle, the project team identifies TIVA as a vital option in reducing ED. Due to the wide variety of available anesthesia options, the project team narrows the pharmacological options to those that reveal a decreased incidence of ED in at-risk pediatric patients undergoing general anesthesia. The pharmacological options for TIVA are using any combination of Midazolam, Ketamine, Remifentanil, Dexmedetomidine, Propofol, or Fentanyl. The project team also chooses to offer non-pharmacological interventions that also shows a decrease in the risk of ED. These interventions include the option of on-site pre-admission facility visits providing education for patients and their families, the creation of a stuffed animal that contains a recording of the mother's, father's or guardians voice that can be brought on the day of surgery to accompany the patient through the entire process, and video distraction during induction. The QAPI department will collect retrospective chart reviews for comparison. The PAT department will also schedule pre-admission on-site visits. Sessions will be held every Tuesday and Thursday at 3 p.m. and 4 p.m.

PDSA Cycle: STUDY

In the "Study" stage, the project team will study the implemented change plan. The team will assess the data collected by the QAPI committee. The QAPI committee will collect and analyze data on a bi-weekly basis focusing on compliance with guidelines and documentation, PAED scores, recovery times, hospital admission rates, and variance reports of patients who received only TIVA and non-pharmacological interventions. The frequency of data analysis allows for frequent feedback to allow for adjustments, if needed. Data analysis will be

communicated to all project team members and key stakeholders monthly via secure electronic communication. Education will be provided by project team members to any individuals who may need reinforcement to ensure that proper technique and documentation are followed. Provider reinforcement would be as evidence by lack of utilizing guidelines for eligible participants. The anesthesia providers are crucial stakeholders because their compliance with guidelines, interventions and documentation will significantly impact the amount of time necessary to complete the implementation stage of the project. Failure to comply may result in a prolonged implementation stage to reach an adequate sample size.

PDSA Cycle: ACT

During the final stage of the PDSA cycle, the QAPI model reveals the project results and recommendations. The project team will provide a formal presentation to communicate the results to key stakeholders. The results will be made available to all perioperative providers. The communication will include the results and an update on future project modifications directed at decreasing the incidence of ED.

Timeline

The timeline for the project team to implement the EBP guidelines at a future facility will occur over an estimated 12-month period (Appendix E). The estimated timeline includes project team meetings, chart reviews, informational sessions for staff, and the cost of materials needed for informational fliers. The first month of implementation focuses on the development of the guidelines and education of perioperative staff. Once the education phase is complete, months two through six focus on implementation and monitoring. During the implementation period, the QAPI committee will monitor and analyze provider compliance and outcomes data related to the implemented guidelines. Cumulative data analysis will take place in months seven and eight.

Based on outcome analysis and provider compliance rates, adoption or adjustments of the guideline would occur during the ninth month. If favorable outcomes are yielded, the facility will implement the guidelines. If undesirable outcomes are yielded, modification may occur, followed by a reimplementation phase. The modification and reimplementation stages would take place during the tenth month. Throughout the reimplementation phase, data analysis will continue to be monitored by the QAPI committee. If desirable outcomes are met, the guidelines can be adopted into standard practice during months 11 and 12.

Budget

The budget for the project includes expected costs for planning, implementation, and monitoring. The primary expenditure for the project is the intravenous medications required for induction and maintenance of the case. The current pricing for Midazolam 1mg/ml 2ml vials is $7.88 per box of 25 or $.32 per vial (Order Express, 2023). Propofol is typically the primary medication utilized for maintenance of sedation during a TIVA case. The current pricing for Propofol 10mg/ml 20ml vials is $23.97 per box of 10 or $2.40 per vial (Order Express, 2023). Dexmedetomidine is another option for sedation during pediatric surgery that is less cost-effective. Dexmedetomidine 4mcg/ml 20ml vial is $112.35 per box of 10 or $11.24 per vial (Order Express, 2023). Ketamine is another commonly used medication for TIVA in pediatric patients. The current pricing of Ketamine 50mg/ml 10ml vial is $38.50 per box of 10 or $3.85 per vial (Order Express, 2023). Two common medications used for pain management during surgery are Fentanyl and Remifentanil. Based on the length of the procedure, a provider may choose to use a longer-acting option such as fentanyl versus a short-acting analgesic like Remifentanil. There is a significant difference in price between the two medications. The current price of Fentanyl 50mcg/ml 2ml vial is $16.05 per box of 25 or $.64 per vial (Order Express,

2023). The price of Remifentanil 1mg vial is $688.0 per box of 10 or $68.80 per vial (Order Express, 2023). Every patient will have their own individualized anesthetic plan determined by their anesthesia provider. Therefore, the cost per case can vary significantly based on the individualized care plan. To prepare for the initiation of the project, the facility will need to order an additional ten boxes of Midazolam, Propofol, Ketamine, Dexmedetomidine, Fentanyl, and Remifentanil to ensure there are adequate supplies and no current back orders or supply chain issues. The project team must also ensure adequate storage space within the facility to maintain compliance with medication storage regulations.

Non-pharmacological interventions will also add additional costs. The project team decided that the patients would benefit from having a stuffed animal containing a recorded voice of their parent(s) or guardian(s) that will be with the child as they travel to the OR and upon emergence. The price per stuffed animal would be $14.43 (G. Beauregard, personal communication, September 12, 2023). There will also be required office supply costs associated with the project. The allotted approved budget for stationery supplies for the project is estimated to be $800 per the proposed 12-month timeline.

Project planning, implementation, and data analysis require a shift in staffing to allow adequate time to perform required tasks. However, no overtime is associated with the project's planning or implementation. The initial planning phase would require all team members to be present for brainstorming sessions. The average salaries in Ohio for project team members are described in Appendix F. While the QAPI committee may be collecting additional data from medical records, this will not add any additional costs because a budget was already previously in place for chart audits. Based on average salary data and the estimated hours necessary to complete the project, the facility can expect to pay $6,000-$7,000 during the 12 months. The

budget is an estimate that allows for adjustments. However, there is the potential for more or less meetings depending on issues with implementing the EBP guidelines.

Outcomes Analysis Plan

Data Collection & Analysis

Upon implementation of the proposed EBP guidelines, an outcome analysis plan must be utilized. Candidates for the study will have charts flagged by a member of the PAT department. A pre-admission chart review will be performed by an anesthesiologist who will determine the most appropriate interventions to be performed for each candidate. Patient-specific recovery room data will be collected by the PACU nurse using the PAED scale. The QAPI department will analyze the data collected by chart reviews of all patients included in the study. Data will also be collected from redacted patient satisfaction surveys, variance reports, and retrospective patient medical records to determine the incidence of ED over the last year. The QAPI team will focus on collecting the following data:

1. PAED Scores.
2. Variance reports completed by perioperative staff indicating patient or caregiver injury, PACU Time, and incidence of postoperative respiratory events such as laryngospasm or desaturation.
3. Whether or not study interventions were implemented. If so, what interventions were used?
4. If study interventions were not implemented, what is the rationale for not utilizing the proposed guidelines?

This data will be collected and analyzed on study candidates as proposed in the timeline described above. The data will be assessed by comparative analysis with the retrospective chart reviews performed over the previous 12 months.

Limitations & Barriers

To determine the overall effectiveness of EBP guidelines, the best approach would be to compare the data collected from patients included in the study to data collected from retrospective chart reviews. Timing may pose a limitation. The proposed timeline for data collection was estimated to take approximately six months to obtain an estimated 1000 participants. This sample size was determined based on the average sample size in multiple studies. However, the timeline can be adjusted depending on the volume of patients within the facility eligible to be included in the study. Another unexpected barrier could be supply chain shortages for medications or any supplies necessary to carry out any of the recommended guidelines. Therefore, the DON will work closely with the Materials Manager to stay current on any shortages. Additionally, a barrier could be the anesthesia providers' attitude toward implementing the proposed guidelines. It is essential to collect data points that can be tracked to show if certain providers are not utilizing the guidelines. Follow-up and re-education may be needed if specific providers are not participating appropriately. The success of any project involves a team approach. The project team will utilize a collaborative approach to determine what changes need to be made to the overall project or if alternative methods should be considered.

Conclusion

A comprehensive review of the literature demonstrated that pediatric patients have an increased incidence of ED and experience select adverse clinical outcomes after receiving

general anesthesia utilizing volatile agents. Currently, there is a lack of consistent standard EBP guidelines for pediatric patients at risk of ED who are receiving general anesthesia. Literature synthesis concluded that there are non-pharmacological and pharmacological interventions that can decrease the incidence of ED in at-risk pediatric patients. A proposed plan for implementation, evaluation, and guideline revision was created using the PDSA quality improvement framework. EBP clinical guidelines were developed to drive the implementation of non-pharmacological and pharmacological interventions related to the incidence of ED and select adverse clinical outcomes.

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Talih, G., Yüksek, A., & Şahin, E. (2020). Evaluation of emergence agitation after general anaesthesia in rhinoplasty patients: inhalation anaesthesia versus total intravenous anaesthesia. *American Journal of Otolaryngology*, 41(3), 102387. https://doi.org/10.1016/j.amjoto.2020.102387

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Appendix A

Factors of Emergence Delirium

Risk Factors of Emergence Delirium
• Pre-school age (2–5 years) • No surgical history of hospitalization • High number of previous medical interventions • Poor adaptability • Attention-deficit hyperactivity disorder (ADHD) • Patient pre-existing behavior • Psychological immaturity • Preoperative anxiety • Parental anxiety • Lack of premedication (with midazolam) • Prior paradoxical reaction to midazolam • Type of surgery • Use of inhalational anesthetic: Sevoflurane • Excessively rapid awakening (in a hostile environment) • Pain

Note: (Lee, 2017).

Appendix B: Evidence Review Worksheet

APA Citation:

Jiao, H., Wang, H., Jiang, Z., & Hu, J. (2020). Comparative efficacy of ancillary drugs in sevoflurane-related emergence agitation after paediatric adenotonsillectomy: a Bayesian network meta-analysis. *Journal of Clinical Pharmacy and Therapeutics,* 45(5), 1039–1049. https://doi.org/10.1111/jcpt.13133

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
A Bayesian grade model	Systematic review/meta-analysis	Meta-analysis of randomized control trials reviewed 25 studies that included a total of 2,151 participants who were under the age of 18, undergoing only adenotonsillectomy procedures. Obtained from MEDLINE, Embase, the Cochrane Library and Web of Science databases.	No variables noted.	Number of patients experiencing emergence delirium after receiving sevoflurane	R Software, RevMan 5.3 software, and Chi-square test	Dexmedetomidine (90.04%) showed the highest possibility of reducing the risk of ED, followed by fentanyl (87.45%), remifentanil (63.85%), ketamine (52.07%), midazolam (51.27), clonidine (49.94%), propofol (29.89%), sufentanil (21.38%), and placebo (4.09%)	I	Large, high-quality RCTs are required to further confirm the findings.

Annotated Bibliography Statement:

A quantitative meta-analysis was performed including twenty-five randomized control trials, involving two thousand one hundred and fifty-one pediatric participants. The incidence of sevoflurane-related emergence delirium was significantly lower in patients receiving dexmedetomidine,

ketamine, propofol, fentanyl, midazolam, sufentanil, remifentanil, clonidine, or a placebo. Evidence suggests that the effects of dexmedetomidine in reducing the risk of sevoflurane-related emergence delirium was superior to other commonly used anesthetic drugs. However, larger, higher-quality randomized controlled trials would be necessary to further validate these findings.

Thematic Analysis Key Themes or FSP related significance:

1. Sevoflurane is the most used inhalation agent utilized for pediatric anesthesia and leads to a high incidence of emergence delirium.
2. Dexmedetomidine significantly reduces the risk of sevoflurane-related emergence delirium in pediatric patients undergoing the adenotonsillectomy surgery.
3. Fentanyl closely followed behind Dexmedetomidine in its ability to decrease the incidence of pediatric emergence delirium.
4. Remifentanil, ketamine, midazolam, clonidine, propofol and sufentanil were also shown to be less superior than Dexmedetomidine and fentanyl, but more superior than sevoflurane in reducing the incidence of emergence delirium.

APA Citation:

Ng, K. T., Sarode, D., Lai, Y. S., Teoh, W. Y., Wang, C. Y., & Anderson, B. (2019). The effect of ketamine on emergence agitation in children: A systematic review and meta-analysis. *Pediatric Anesthesia*, 29(12), 1163–1172. https://doi.org/10.1111/pan.13752

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Cochrane Handbook for Systematic Reviews and Interventions	Systematic Review/ Meta-analysis	Thirteen studies (1125 patients) were included in the quantitative meta-analysis focusing on children undergoing surgery or imaging	No variables noted.	Pediatric Anesthesia Emergence Delirium Scale (PAED), Modified Children's Hospital of	Review Manager Version 5.3, Fixed-effect model, PRISMA checklist.	The incidence of emergence agitation was 14.7% in the	I	Systematic Review/Meta-analysis

ketamine, propofol, fentanyl, midazolam, sufentanil, remifentanil, clonidine, or a placebo. Evidence suggests that the effects of dexmedetomidine in reducing the risk of sevoflurane-related emergence delirium was superior to other commonly used anesthetic drugs. However, larger, higher-quality randomized controlled trials would be necessary to further validate these findings.

Thematic Analysis Key Themes or FSP related significance:

1. Sevoflurane is the most used inhalation agent utilized for pediatric anesthesia and leads to a high incidence of emergence delirium.
2. Dexmedetomidine significantly reduces the risk of sevoflurane-related emergence delirium in pediatric patients undergoing the adenotonsillectomy surgery.
3. Fentanyl closely followed behind Dexmedetomidine in its ability to decrease the incidence of pediatric emergence delirium.
4. Remifentanil, ketamine, midazolam, clonidine, propofol and sufentanil were also shown to be less superior than Dexmedetomidine and fentanyl, but more superior than sevoflurane in reducing the incidence of emergence delirium.

APA Citation:

Ng, K. T., Sarode, D., Lai, Y. S., Teoh, W. Y., Wang, C. Y., & Anderson, B. (2019). The effect of ketamine on emergence agitation in children: A systematic review and meta-analysis. *Pediatric Anesthesia*, 29(12), 1163–1172. https://doi.org/10.1111/pan.13752

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Cochrane Handbook for Systematic Reviews and Interventions	Systematic Review/ Meta-analysis	Thirteen studies (1125 patients) were included in the quantitative meta-analysis focusing on children undergoing surgery or imaging	No variables noted.	Pediatric Anesthesia Emergence Delirium Scale (PAED), Modified Children's Hospital of	Review Manager Version 5.3, Fixed-effect model, PRISMA checklist.	The incidence of emergence agitation was 14.7% in the	I	Systematic Review/Meta-analysis

		Procedures. RCT's obtained from databases of MEDLINE, EMBASE, and CENTRAL.		Eastern Ontario Pain Scale (mCHEOP), Aono's Four-point Scale and Emergence Agitation Scale.		ketamine group and 33.3% in the placebo group. Children receiving ketamine had a lower incidence of emergence agitation, with an odds ratio being 0.23 (95% confidence interval: 0.11 to 0.46), certainty of evidence: low. In comparison with the placebo, ketamine group achieved a lower postoperative pain score (odds ratio: −2.42, 95%		

						confidence interval: −4.23 to −0.62, certainty of evidence: very low) and lower pediatric anesthesia emergence delirium scale at 5 minutes after operation (odds ratio: −3.99, 95% confidence interval: −5.03 to −2.95; certainty of evidence: moderate).		

Annotated Bibliography Statement:

A quantitative meta-analysis was performed focusing on thirteen studies involving one thousand one hundred and twenty-five pediatric patients undergoing surgery or magnetic resonance imaging (MRI) scan. Evidence shows that children receiving ketamine had a lower incidence of emergence delirium. Patients receiving ketamine were also found to have superior pain management post-operatively than those who did not receive ketamine. There were no adverse effects associated with the use of ketamine.

Thematic Analysis Key Themes or FSP related significance:

1. Ketamine had a lower incidence of emergence delirium for pediatric patients receiving general anesthesia.
2. Based on the combined data of eight randomized controlled trials including a total of 748 children, there was no evidence that ketamine reduced the discharge time from PACU.
3. Ketamine is well-tolerated within the pediatric population. There are no notable adverse effects, such as postoperative nausea and vomiting, incidence of desaturation, or laryngospasm.
4. Postoperative pain scores are lower in patients who received ketamine when compared to those who did not.

APA Citation:

Oriby, M. E., & Elrashidy, A. (2020). Comparative effects of total intravenous anesthesia with propofol and remifentanil versus inhalational sevoflurane with dexmedetomidine on emergence delirium in children undergoing strabismus surgery. *Anesthesiology and Pain Medicine*, 11(1), e109048. https://doi.org/10.5812/aapm.109048

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
N/A	Single Randomized Controlled Trial	84 patients aged 3 to 11 years scheduled for strabismus surgery under general anesthesia were randomly assigned to two groups.	Independent variables: Intraoperative use of Sevoflurane and DEX versus TIVA with propofol and remifentanil. Dependent Variables:	The study focused on Pediatric Anesthesia Emergence Delirium Scale (PAED), pain rating with faces, legs, activity, cry and consolability (FLACC) scale, need for rescue	The IBM SPSS program for Windows (version 25)	HR and MAP significantly decreased ten to twenty minutes after induction compared to baseline group I after infusion of DEX. The incidence of	II	The results of this study are helpful but limited to a specific population of patients undergoing a particular type of procedure. Healthcare

		Group I received sevoflurane and DEX. Group II received TIVA with propofol and remifentanil	Postoperative pediatric emergence delirium, pain rating with faces, legs, activity, cry and consolability (FLACC) scale, need for rescue analgesics, recovery time, parents' satisfaction, and nausea/vomiting	analgesics, recovery time, parents' satisfaction, and nausea/vomiting		PONV was significantly lower in group II than in group I, while the recovery time was significantly shorter in group I. The incidence of emergence delirium decreased in both groups.		providers also need to consider the sample limitation if applying this study.

Annotated Bibliography Statement:

A single randomized controlled trial was performed that included eighty-four patients aged three to eleven years undergoing strabismus surgery under general anesthesia. The patients were separated into two groups. Group I consisted of forty-two patients receiving sevoflurane and dexmedetomidine. Group II consisted of forty-two patients receiving total intravenous anesthesia (TIVA) with propofol and remifentanil infusion. The incidence of emergence delirium decreased in both groups. However, group I was faced with bradycardia, hypotension and a higher incidence of post-operative nausea and vomiting (PONV). Although group II had less adverse effects, the recovery time was significantly shorter in group I.

Thematic Analysis Key Themes or FSP related significance:

1. The incidence of emergence delirium was decreased when dexmedetomidine was added in adjunct with sevoflurane for pediatric patients receiving general anesthesia.

2. The incidence of emergence delirium was decreased in pediatric patients receiving general anesthesia when inhalational gases were not used and the drug of choice for TIVA was propofol.
3. There was a decrease in heart rate and mean arterial pressure at ten and twenty minutes after the administration of dexmedetomidine requiring the use of rescue atropine in 33% of children in this group.
4. When compared with sevoflurane, TIVA and remifentanil reduced the risk of PONV by 26%.
5. TIVA with propofol significantly decreases the incidence of PONV and vomiting when compared to the use of volatile anesthetics.

APA Citation:

Sobol, M., & Sobol, K. S. (2022). Parents' time perspective as a predictor of child's postsurgical pain, emergence delirium, and parents' posttraumatic stress disorder symptoms after child's surgery. *Children, 9*(4), 539. https://doi.org/10.3390/children9040539

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
N/A	Prospective study	A total of 98 (40 girls and 58 boys; Caucasian 100%) children undergoing outpatient surgery with general anesthesia,	Parents' time perspective as a variable significant to parents' influence on the child's level of postsurgical pain, emergence delirium, and parents' posttraumatic stress disorder symptoms after surgery.	The Zimbardo Time Perspective Inventory (ZTPI), The Dark Future Scale (DFS) was used to test the tendency to focus on the negative	Linear aggression analysis, SD, and Cronbach's Alpha	Parents' future-negative perspective was a predictor of emergence delirium in the group of children aged 8–15 years. Low parents' past-positive perspective turned out to be a	III	The results should be carefully generalized to other cultures. A further limitation of this study is the heterogenei ty of the

		aged 2 to 15, and their accompanying parents participated in this study. This research was conducted at the pediatric hospital in Bielsko-Biala, Poland.	Time perspective is understood as a cognitive style connected with a tendency to focus on a particular area of time: past, present, or future Six types of time perspective are analyzed: past-positive perspective, a tendency to focus on the positively evaluated past; past-negative perspective, a tendency to focus on the negatively evaluated past; future perspective, a tendency to focus on the positively evaluated future; present-fatalistic perspective, a passive attitude, stemming from the belief that life is governed by fate; present-hedonistic perspective, a tendency to focus on pleasure "here	aspects of the future, The EVENDOL Scale was used to measure the level of postsurgical pain, the Paediatric Anaesthesia Emergence Delirium Scale (PAED) was used to measure the intensity of postsurgical agitation. The questionnaire PTSD-K was used to evaluate the symptoms of posttraumatic stress in parents after a child's surgery.		predictor of parents' posttraumatic stress disorder symptoms after child's surgery.		pediatric sample. Another limitation is that no data were collected on the parents' traumatic past experiences .

			and now" and future-negative perspective, a tendency to focus on the negatively evaluated future					

Annotated Bibliography statement:

A prospective study was performed focusing on a total of ninety-eight children, aged two to fifteen, along with their parents and/or caregivers. The aim of the study was to test hypotheses regarding the associations of parents' time perspective with a child's postoperative pain, emergence delirium, and parents' posttraumatic stress disorder symptoms following the child's surgery. The study measures parents' time perspective and posttraumatic stress disorder (PTSD) symptoms obtained from post-operative questionnaires. The level of children's postoperative pain and delirium were rated by nurses and anesthesiologist. The results provide evidence for associations between parents' time perspective with child's emergence delirium and parents' posttraumatic stress disorder symptoms after their child's surgery.

Thematic Analysis Key Themes or FSP related significance:

1. A parent's tendency to focus on the negatively perceived future and focusing on threats may significantly intensify the child's emergence delirium after surgery, which is dangerous for the child and a difficult environment.
2. A parent's past-positive perspective can prevent children from experiencing PTSD symptoms after a child's surgery.
3. A parent's negative or exaggerated attitude expressed to a child preoperatively increased the level of stress in children experiencing a situation of painful medical procedures.
4. A parent's behavior towards their child before surgery was related to the level of child emergence delirium in children aged two to eight years of age.

5. The associations of parent behavior with child emergence delirium were much weaker in the group of older children aged none to seventeen years of age.

Appendix A: Evidence Review Worksheet

APA Citation:

Talih, G., Yüksek, A., & Şahin, E. (2020). Evaluation of emergence agitation after general anaesthesia in rhinoplasty patients: inhalation anaesthesia versus total intravenous anaesthesia. *American Journal of Otolaryngology*, 41(3), 102387. https://doi.org/10.1016/j.amjoto.2020.102387

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
N/A	Single Randomized Controlled Trial	90 rhinoplasty patients undergoing general anesthesia were assigned to two groups. The first group was the TIVA group receiving propofol and the second group was a SEVO group	Independent variables: Intraoperative use of TIVA with propofol versus inhaled sevoflurane. Dependent variables: Early emergence times, Richmond agitation-sedation scale (RASS), Boezaart scale, Likert scale, and postoperatively incidence of nausea/vomiting.	Richmond agitation-sedation scale (RASS), Boezaart scale, Likert scale and incidences of nausea/vomiting were	Power analysis, Statistical Package for the Social Sciences software package, Chi-square ($\chi 2$) and Fisher exact tests	Early emergence was significantly shorter in the TIVA group than in the SEVO group ($p<0.0001$), intraoperative bleeding was significantly lower in the TIVA group than in the SEVO group ($p=0.0005$), and surgical field image quality and surgeon satisfaction were better in the TIVA group ($p=0.016$, $p<0.001$). The	II	The results of this study are helpful but limited to a specific population of patients undergoing a particular type of procedure. Healthcare providers also need to consider the sample limitation if applying this study for any

		receiving sevoflurane with a fresh gas flow of one liter per minute.				ratio of patients with a RASS>+1 for all patients was 35.6% at 0 minutes postoperatively. This rate was 12.2% in the TIVA group and 23.3% in the SEVO group.		changes in practice.

Annotated Bibliography statement:

A single randomized controlled trial was performed focusing on a total of ninety rhinoplasty patients, undergoing general anesthesia for Rhinoplasty surgery. The patients were divided into two groups. One group was placed on a propofol infusion immediately after induction. The second group was administered sevoflurane with a fresh gas flow of 1 l/min and minimum alveolar concentration (MAC) of 1 to 1.1. The total intravenous anesthesia group receiving only propofol had earlier emergence times, less bleeding, high surgeon satisfaction, and lower incidence of emergence delirium when compared to the low flow sevoflurane group. It is accepted that volatile anesthetics are well-established risk factors for emergence delirium.

Thematic Analysis Key Themes or FSP related significance:

1. TIVA using propofol is superior to volatile anesthetics as evidenced by decreased incidence of emergence delirium.
2. Volatile anesthetics are risk factors for emergence delirium.
3. TIVA results in shorter, earlier emergence times when compared to the use of volatile agents.
4. TIVA may be superior for rhinoplasty surgeries, due to less PONV and shorter, early emergence times.
5. The frequency of emergence delirium has been found to be higher after ear-nose-throat surgeries in both children and adults.

APA Citation:
Urits, I., Peck, J., Giacomazzi, S., Patel, R., Wolf, J., Mathew, D., Schwartz, R., Kassem, H., Urman, R. D., Kaye, A. D., & Viswanath, O. (2020). Emergence delirium in perioperative pediatric care: a review of current evidence and new directions. *Advances in Therapy*, 37(5), 1897–1909. https://doi.org/10.1007/s12325-020-01317-x

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
N/A	Expert Opinion	N/A	No variables noted.	Pediatric Anesthesia Emergence Delirium Scale (PAED), Level of Consciousness –Richmond Agitation and Sedation Scale (LOC-RASS)	N/A	Although there are multiple options to mitigate the possibility of developing ED, there has yet to be a general consensus as to which method is most reliable, and more large prospective trials are needed. There remains to be scarce evidence about the ideal combination of medications used to prevent ED and whether there is a synergistic effect	V	The article is beneficial for educating healthcare professionals regarding the background of emergence delirium and current opportunities for providers. However, expert opinions can be considered to have a low level of evidence, and readers should use caution when utilizing only expert opinions for their research.

						or if it will lead only to increased side effects. Future directions for prevention of ED in the pediatric population should focus on identifying at risk patients, earlier recognition, and effective treatment modalities to provide a safe perioperative experience for children and their families.		Nevertheless, this expert opinion is relevant, with a total of 50 references.

Annotated Bibliography statement:

The purpose of this expert opinion article is to provide a comprehensive review of anesthetic considerations for pediatric emergence delirium. The goal is to provide an update on practices that have been found to be effective in reducing the overall risk of developing postoperative emergence delirium in pediatric patients receiving general anesthesia. The article focuses on pharmacological and non-pharmacological interventions that have been shown to result in optimal post-operative recovery, free from emergence delirium.

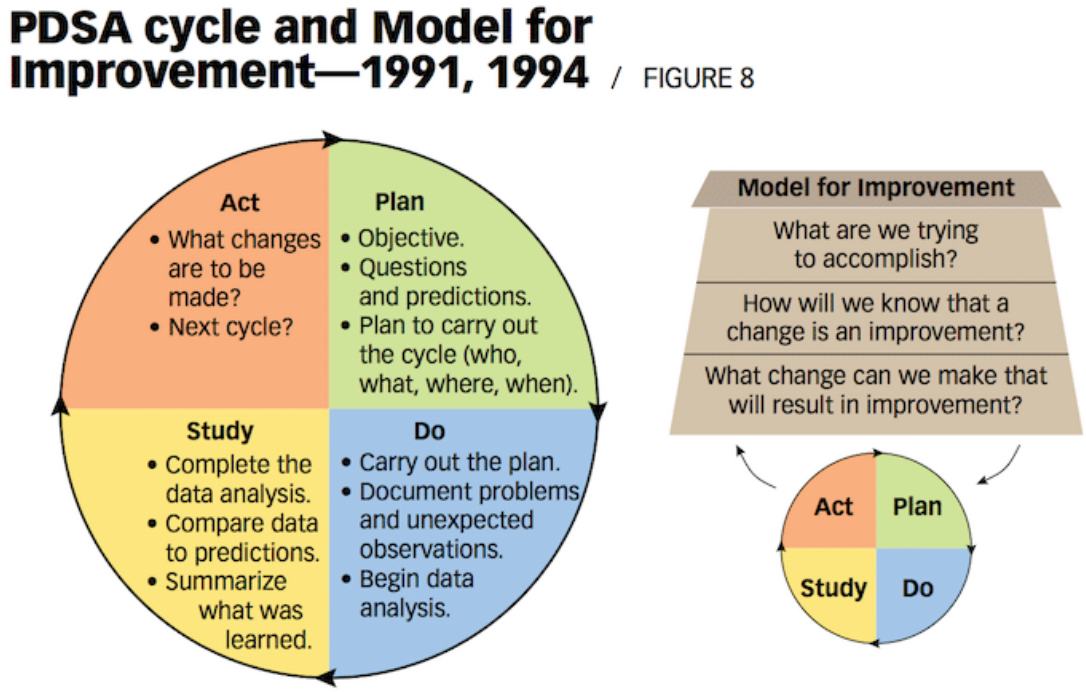
Thematic Analysis Key Themes or FSP related significance:

1. A high incidence of emergence delirium in the pediatric patient population undergoing general anesthesia contributes to increased morbidity and higher perioperative costs.

2. Non-pharmacological interventions such as using a recording of mothers' voice for emergence, having a parent present at the time of induction, video distraction during induction or tablet-based interactive distraction (TBID) during induction have all been shown to help decrease the incidence of emergence delirium in pediatric patients.
3. Regional anesthesia, if applicable, has a lower incidence of emergence delirium than traditional volatile anesthetics.
4. Midazolam administered pre-operatively or within 20-30 minutes of the administration of inhaled anesthetics reduces the incidence of ED.
5. Remifentanil administered to children undergoing ophthalmic surgery under sevoflurane anesthesia reduced the incidence of ED without clinically significant hemodynamic changes.
6. Propofol administration during sevoflurane anesthesia has been shown to decrease the incidence of ED. However, a continuous infusion intraoperatively has been shown to be more effective than a single administration of propofol.
7. Dexmedetomidine administered in adjunct with sevoflurane has shown the most significant decrease in the incidence of ED and decreases the amount of sevoflurane needed for sedation.

Appendix C

PDSA Cycle and Model for Improvement



Note. Image of the model for improvement with the PDSA Cycle via Clearing Up Myths About the Deming Cycle.

Appendix D

PAED Scale

Criteria	Not at all	Just a little	Quite a bit	Very much	Extremely	Score
The child makes eye contact with the caregiver/parent	4	3	2	1	0	
The child's actions are purposeful	4	3	2	1	0	
The child is aware of his/her surroundings	4	3	2	1	0	
The child is restless	0	1	2	3	4	
The child is inconsolable	0	1	2	3	4	
Total score						

Table 1: Paediatric anaesthesia emergence delirium scale.

Note: (Lee, 2017).

Appendix E

Timeline

Months	1	2	3	4	5	6	7	8	9	10	11	12
Education												
Implementation & Monitoring												
Data Collection & Analysis												
Guideline Adjustment												
Reimplementation												
Adoption of Guidelines												

Appendix F

Salary Budget

Position	Quantity	Average Hourly Rate	12-Month Budget
Perioperative Project Nurses	7	$40 per hour	$2080
Director of Nursing	1	$58 per hour	$232
CRNA	1	$99 per hour	$400
Anesthesiologist	1	$ 199 per hour	$800
IT Specialist	1	$33 per hour	$132
Quality Assurance Specialist	1	$38 per hour	$1520
Surgeon	1	$230 per hour	$920
Estimated Total 12-Month			$6,084

Note: Ohio average salaries obtained from Salary.com