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PEDIATRIC EMERGENCE AGITATION: BEST PRACTICE GUIDELINE FOR CERTIFIED REGISTERED NURSE ANESTHETISTS

by

Michael Kaleb Cockrell

A Doctoral Project
Submitted to the Graduate School,
the College of Nursing and Health Professions
and the School of Leadership and Advanced Nursing Practice
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

Approved by:

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ABSTRACT

The adverse effects of general anesthesia can vary significantly among groups of individuals. The pediatric population is no exception. Pediatric emergence agitation is a potential adverse effect observed following emergence from general anesthesia. The negative impacts from this adverse effect have the potential to decrease patient satisfaction, increased the cost of care, and increase the risk of post-operative complications. The exact etiology of pediatric emergence agitation remains unclear; however, it is thought to be multifactorial (Hoch, 2019). A targeted review of the current literature suggests a reduction in the incidence of pediatric emergence agitation could be achieved through alterations in anesthetic techniques. Currently, the literature identifies a gap existing between evidence-based techniques and actual anesthetic practice (Hoch, 2019).

This project utilized a systemic review of current, evidence-based literature to develop a best-practice guideline for reducing the incidence of pediatric emergence agitation. The guideline and supporting literature was presented to a panel of experts in the field of anesthesia. Panel members were asked to review the guideline and supporting literature, and offer feedback. Feedback from the panel of experts indicated they were receptive to the content of contained in the best-practice guideline. Data from the panel of experts was reviewed and considered in the final draft of this guideline. The final best-practice guideline was given to members of the panel of experts working at a hospital in Southeastern Mississippi for use in clinical practice.

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I would like to express my sincere thanks to my committee chair, Dr. Mary Jane Collins, for her knowledge, guidance, and extreme amount of patience throughout the course of this doctoral project. I would also like to extend my appreciation to my committee member, Dr. Michong Rayborn.

DEDICATION

I would like to dedicate this doctoral project to my entire family. To my parents, Kirk and Toni Cockrell, for their tireless support and encouragement, not just during these past three years, but throughout all of my ambitions, I am forever grateful. To my two beautiful daughters, Adaleigh Kate and Brady Claire Cockrell, for giving me a sense of purpose and a reason to keep moving forward. To my absolutely incredible wife, Chelsea Cockrell, without her unwavering support and countless sacrifices over the last three years, none of this would be possible.

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LIST OF ABBREVIATIONS

AACN	American Association for Colleges of Nursing
AANA	American Association of Nurse Anesthetists
CRNA	Certified Registered Nurse Anesthetist
DNP	Doctor of Nursing Practice
EA	Emergence Agitation
GABA	γ-Aminobutyric Acid
HCAHPS	Hospital Consumer Assessment of Healthcare Providers and Systems
IRB	Institutional Review Board
kg	Kilogram
MAC	Mean Alveolar Concentration
mcg	Microgram
mg	Milligram
TIVA	Total Intravenous Anesthesia
USM	The University of Southern Mississippi

CHAPTER I - INTRODUCTION AND BACKGROUND

The four pillars of general anesthesia include loss of consciousness and amnesia, analgesia, the abolishment of autonomic reflex responses, and muscle relaxation (Lerman & JÖhr, 2009). The effects of general anesthesia can vary greatly among different individuals. Therefore, each anesthetic intervention and technique must be individually tailored to meet the needs of the current patient being treated. The effects of general anesthesia on the pediatric population are substantially different in comparison to the effects seen in adults. Pediatric emergence agitation (EA) is one such effect routinely observed postoperatively in the pediatric setting following the administration of general anesthesia (Hoch, 2019). The consequences of this common complication have the potential to negatively impact the patient's and their family's perception concerning the quality of anesthetic care. Interventions aimed at reducing the risk of pediatric EA can potentially improve these negative perceptions, as well as lead to increases in patient satisfaction, and reduced instances of post-operative complications.

Problem Description

Background

Pediatric EA is a common postoperative side effect likely to be experienced by many patients in the pediatric setting following the administration of general anesthesia for surgical interventions. According to an article by the American Association of Nurse Anesthetists (AANA), the postoperative effects of pediatric EA are described as "a state of mental confusion, agitation, hyperexcitability, crying, restlessness, and hallucinations" (Hoch, 2019). Risk factors previously identified to correlate with an increased risk of developing pediatric EA following surgery include children between the ages of 2-5 years

old, the child's personality and level of preoperative anxiety, the type and length of surgery, use of inhalational anesthetics, rapid emergence from anesthesia, and intensity of postoperative pain (Hoch, 2019). Estimates concerning the incidence of PEA are approximated to be anywhere from 10%, to as high as 80% (Bajwa et al., 2010).

Significance of Project

Pediatric EA typically occurs approximately 30 minutes following surgery, and although considered to be a self-limiting complication, the effects can last for up to two days (Hoch, 2019). The risks associated with pediatric EA are typically benign in comparison to the more severe risks of general anesthesia such as hypoxia, cerebral ischemia, and/or death. However, the development of pediatric EA can lead to complications such as physical injury, removal or dislodgement of drains and catheters, and interruption of monitoring devices, all of which have the potential to adversely impact the patient's health and increase the overall cost of recovery. The effects of these complications also diminish patient and family satisfaction, as well as their perception of the quality of care (Hoch, 2019). An opportunity exists for anesthesia providers to implement interventions aimed at reducing the risk and overall occurrence of pediatric EA.

Statement of Problem

The effects of pediatric emergence agitation have the potential to lead to decreased patient and family satisfaction, higher costs of care, and increased postoperative complications. Ultimately, the current incidence of pediatric emergence agitation remains elevated due to an existing gap between current evidence-based literature and actual clinical practice (Hoch, 2019). The goal of the project's best-practice

guideline was to develop a set of recommendations, through a systematic synthesis of peer-reviewed, evidence-based literature, to reduce the incidence of pediatric EA. Anesthetic interventions including pharmacological strategies and alterations in anesthetic methods, techniques, and management were examined and discussed throughout the entirety of this project.

Available Knowledge

Patient Satisfaction

The Centers for Medicare and Medicaid Services began the development of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey in 2002 (Tevis et al., 2015). The HCAHPS survey is designed to motivate hospitals to improve quality of care, provide publicly transparent survey results, and allow consumers to objectively compare hospitals. Hospitals are required to collect a minimum of 300 HCAHPS surveys each year for Inpatient Prospective Payment System. In 2005, Medicare reimbursement for a hospital has been linked to the hospital's performance on the HCAHPS survey (Tevis et al.,, 2015).

Inhalation Anesthetics

Inhalation anesthetics are considered to be the mainstay of general anesthesia. In the United States, four inhalational anesthetics are approved for use in pediatric anesthesia: Desflurane, Isoflurane, Sevoflurane, and Nitrous Oxide. These anesthetic gases provide easy to deliver, effective, and reliable anesthesia (Lerman & JÖhr, 2009). Inhalational anesthetics provide a means for the practitioner to induce general anesthesia without intravenous (IV) access. Inhalation induction is accomplished with relative ease, by having the patient breathe the anesthetic gas via facemask. Inhalation induction is

largely the most practiced technique for inducing general anesthesia in pediatric populations (Lerman & JÖhr, 2009).

Sevoflurane is the most commonly used inhalation agent for producing general anesthesia in the pediatric population. Sevoflurane is preferred for the induction of pediatric cases due to its non-pungent odor, relatively minimal irritant effect on the patient's airway, and the ability to produce a rapid onset and emergence of anesthesia (Key et al., 2010). These qualities make Sevoflurane an ideal anesthetic gas for performing an inhalation induction. Mean alveolar concentration (MAC) is used to express the dose of inhalational anesthetic required to produce surgical anesthesia and muscular relaxation in 50% of patients when exposed to a noxious stimulus (Nagelhout, 2017b). Monitoring this inhalational anesthetic for the appropriate depth of anesthesia is accomplished with relative ease and straightforwardness through calculated end-tidal percentage measurements. These calculations help the anesthetist ensure that adequate and safe level anesthesia is being delivered by providing real-time measurements taken at the end of each respiratory cycle. For adult patients, the MAC of Sevoflurane in oxygen is 2%. In pediatrics, the MAC requirements of Sevoflurane in oxygen can increase up to 3% in infants from six to 12 months of age. After 12 months of age, the MAC requirement can be slightly reduced, but remains at a higher value compared to the MAC requirement of adults. (Nagelhout, 2017a). The blood-gas coefficient describes the proportion of anesthetic gas's solubility in the blood (Nagelhout, 2017b). Furthermore, the blood-gas coefficient indicates the speed of uptake and elimination of anesthetic gas. Agents with lower blood-gas coefficients leave the blood quickly and spread into the tissues, producing a rapid onset of anesthesia. For example, Isoflurane has one of the

highest blood-gas coefficients (1.4) producing a slow onset and emergence, while Desflurane has one of the lowest (0.42) and has a very rapid onset and emergence. The blood-gas coefficient of Sevoflurane is 0.6, meaning that it produces a rapid induction as well as a relatively quick emergence (Nagelhout, 2017b). This effect can be particularly beneficial for many scenarios encountered in pediatrics, especially when the need to produce a rapid onset of anesthesia is warranted. However, the literature suggests increased rates of pediatric EA may occur following rapid emergence from general anesthesia with Sevoflurane. A recently published article examining the emergence delirium in children states that rapid emergence from Sevoflurane may produce a dissociative state in pediatric patients, resulting in altered cognition proception, excitement, and irritability (Locatelli et al., 2013).

Total Intravenous Anesthesia

Total Intravenous Anesthesia (TIVA) describes an anesthetic technique that uses IV medications to produce a level of surgical anesthesia comparable to that of inhalational techniques. Recent advancements in technology have made the use of TIVA more desirable for some pediatric cases. The advantages of TIVA include smooth emergence from general anesthesia, a reduction in the incidence of postoperative nausea and vomiting, and rapid onset (Lerman & JÖhr, 2009).

TIVA is typically accomplished through the administration of one or more combinations of IV medications. Currently, propofol is the most common medication used in pediatric cases for inducing and maintaining general anesthesia (Lerman & JÖhr, 2009). Propofol's mechanism of action is through the enhancement of γ-aminobutyric acid (GABA) chloride channels. This agonistic effect on GABA receptors produces

strong sedative effects that are considered ideal for IV maintenance of general anesthesia. Currently, the recommended dosage for IV administration of propofol in pediatric patients is 1-2 milligrams (mg) per kilogram (kg) given as a bolus. Propofol has several advantages in various settings of anesthesia and is generally associated with a calm, sometimes euphoric, rapid recovery from general anesthesia (Key et al., 2010). Anesthetic techniques using propofol TIVA have been shown to decrease the incidence of pediatric EA. One study compared the quality of recovery in a group of pediatric patients following inhalational anesthesia with sevoflurane to a group of pediatric patients following TIVA with propofol. This study found that the rates of pediatric EA were 46% for patients that received inhalational anesthesia with sevoflurane, and only 9% for patients that received propofol TIVA (Key et al., 2010). Propofol has also been shown to produce benefits in reducing the incidence of pediatric EA when used as an adjunct to inhalational anesthesia with sevoflurane. In patients receiving inhalational anesthesia with sevoflurane, recent evidence suggests administering a 1 mg per kg bolus dose of propofol at the end of surgery. This method was shown to decrease the incidence of pediatric EA to 19.5% in patients receiving the bolus dose of propofol compared to 46% in the group of patients to which the bolus dose was not given (Key et al., 2010).

Prophylactic Medications

Preoperative anxiety is considered a factor likely to contribute to the development of emergence agitation in pediatric patients. Several different medications are typically used to reduce a patient's level of anxiety preoperatively with varying success. A detailed dosage summary of the preoperative medications discussed in this section is provided in Table 1.

Table 1.

Preoperative Pediatric Drug Dosages

Drug name	Oral dose	Nasal dose	IM dose
Dexmedetomidine	2-4 mcg/kg	3 mcg/kg	2-4 mcg/kg
Midazolam	0.25-0.75 mg/kg	0.1-0.2 mg/kg	0.1-0.2 mg/kg
Clonidine	4 mcg/kg		

Common pediatric preoperative drug dosages (Cote et al., 2019).

Dexmedetomidine is an alpha $_2$ adrenergic receptor agonist capable of producing sedative, anxiolytic, and analgesic effects (Mountain et al., 2011). One of the greatest advantages of using dexmedetomidine is that when compared to similar sedatives, dexmedetomidine's effect on respiratory function is minimal. The administration of dexmedetomidine is not likely to result in extreme hypoxia or hypercapnia (Cote et al., 2019). The most common side effects of dexmedetomidine include nausea and vomiting, fever, and bradycardia (Mountain et al., 2011). While the preferred route of administration continues to be IV, dexmedetomidine can be administered via oral, IM, or nasal routes as well. Research suggests that when administered preoperatively in oral doses between 1.0 and 4.2 micrograms (mcg) per kg, dexmedetomidine demonstrated an ability to produce anxiolysis, decrease the severity of postoperative pain, and reduce the risk of developing pediatric EA (Mountain et al., 2011). Further research also suggests that an IV bolus of dexmedetomidine dosed at 0.3 mcg per kg five minutes before emergence from inhalational anesthesia with sevoflurane significantly reduced the severity of post-operative pain as well as reduced the incidence of pediatric EA while observing no adverse effects such as bronchospasm, hypotension, bradycardia, or

respiratory depression (Guler et al., 2005). Due to variations across several different studies regarding IV bolus dosing of dexmedetomidine, no clearly defined dosing consensus has been reached. IV bolus doses of 0.5 mcg/kg and above have been used in clinical studies, however, it is recommended to avoid doses greater than 0.5 mcg/kg due to increased incidences of side effects such as hypotension, bradycardia, and delayed emergence (Begum et al., 2019).

Midazolam is a GABA receptor agonist that causes anterograde amnesia and anxiolysis following administration. Midazolam is the most common preoperative medication administered to pediatric patients. Several methods of administration including oral, intranasal, and IV can be used to provide a preoperative dose of midazolam. Typically, preoperative doses of midazolam are administered orally in doses between 0.25 – 0.75 mg/kg (Cote et al., 2019). The most common side effects observed following administration of midazolam include headache, drowsiness, amnesia, blood pressure changes, nausea and vomiting, and cough (Mountain et al., 2011). Some studies suggest a reduction in the incidence of pediatric EA has been demonstrated following the preoperative administration of midazolam, however, this result is believed to be the result of a prolonged awakening rather than a reduction in the levels of anxiety (Key et al., 2010). Although midazolam is considered to be the most commonly administered preoperative anxiolytic, current evidence suggests that midazolam's role in the prevention of pediatric EA is minimal at best. One study demonstrates that the preoperative administration of midazolam resulted in no clinically significant difference in pediatric post-operative behavior following general anesthesia with Sevoflurane. Furthermore, it has been reported that the incidence of pediatric EA in groups of children

receiving preoperative doses of Midazolam was nine times higher compared to groups of children who were not premedicated. In two separate studies, premedication with midazolam prior to general anesthesia with Sevoflurane produced a pediatric EA incidence of 38% to 60% (Key et al., 2010).

Clonidine causes dose-related sedative and analgesic effects through an agonistic effect on alpha $_2$ receptors (Cote et al., 2019). Research suggests that the use of oral clonidine as a premedication in the pediatric setting reduced postoperative pain scores and the need for supplemental analgesics for the first twelve hours following surgery (Cote et al., 2019). The recommended PO dose of Clonidine for pediatrics is 4mg/kg (Cote et al., 2019). Pediatric patients preoperatively medicated with Clonidine have been shown to demonstrate an overall reduction in the development of pediatric EA by 20% to 30% when compared to pediatric patients preoperatively medicated with Midazolam (Key et al., 2010). Although several benefits are observed with the use of clonidine as a premedication, the need to administer the medication an hour before anesthetic induction is largely impractical, especially in busy outpatient settings (Cote et al., 2019).

Existing Guidelines

Current review and research of the literature has not yet identified any single set-standard of guidelines for the prevention of pediatric EA. Primary risk factors thought to contribute to the development of pediatric EA are multifactorial. Likewise, the treatment recommendations for the prevention of pediatric EA require a multimodal approach. Currently, literature provides best-practice recommendations, however, no concrete guideline has been found to reduce the incidence of pediatric EA. The proposed best-

practice guideline aims to abridge current best-practice prevention recommendations into a guideline for a more strategic approach to reducing the incidence of pediatric EA.

Summary of Available Knowledge

Pediatric EA is characterized by acute mental disturbances consisting of confusion, agitation, hallucinations, and delusions. These disturbances are typically manifested through inconsolable crying and moaning, restlessness, involuntary movements, and thrashing around in the bed postoperatively (Key et al., 2010). Issues resulting from this common complication are known to cause decreases in patient satisfaction, increased postoperative complications, and increased costs of care. Risk factors shown to increase the incidence of developing pediatric EA following surgery include patients between the ages of two and five, increased anxiety preoperatively, type and length of surgery, use of inhalational anesthetic gases, and the patient's post-operative pain level (Hoch, 2019). Several efforts to mitigate the risks of developing pediatric EA have shown some promise, but lack a comprehensive approach to successful prevention. Studies suggesting the use of propofol TIVA have shown dramatic reductions in the incidence of pediatric EA. However, the ability to monitor appropriate anesthetic depth, lack of standardized drug use, and dosage, along with potential patient interactions, TIVA can be seen as disadvantageous and unsafe by some anesthesia providers when used as the sole means of achieving surgical anesthesia (Lerman & JÖhr, 2009). Conversely, inhalational anesthesia with sevoflurane provides rapid induction and emergence, ease of monitoring for appropriate anesthetic depth, and a reliable and proven means of achieving surgical anesthesia without IV access. However, numerous studies have indicated that inhalational anesthesia substantially increases the risk of developing

pediatric EA. Throughout a review of the literature, evidence suggesting a holistic guideline shown to eliminate the development of pediatric EA has not been demonstrated. Risk factors shown to correlate with an increased incidence of developing pediatric EA have been shown to be multifactorial and thus a multimodal treatment strategy is likely warranted.

Rationale

Policy Expectations

Through the proper use and implementation of policy, anesthesia providers can develop better strategies and techniques aimed at reducing the risks of complications, and improving patient outcomes. Healthcare policy development is aimed at assisting healthcare providers in achieving an expected standard of care through evidence-based research (Collins & Patel, 2009). In the area of healthcare effective policy development requires a multifactorial and multistep approach. A multistep approach involves identification of a particular issue or problem, analysis of how a particular policy will address the issue and impact outcomes, standardized development of the proposed policy, implementing the proposed policy into practice, and an evaluation of how the policy affected practice (Friedman, 2003). Through the appropriate use of policy, anesthesia providers can develop better plans and techniques to potentially improve the quality of patient care and reduce the occurrence of complications.

Theoretical Framework

A conceptual model for effecting provider behavior change was used to guide the development of this project. In the conceptual model, four phases identify factors affecting policy implementation. The four phases include exploration, decision to adopt,

active implementation, and sustainment (Aarons et al., 2011). The conceptual approach examines the roles that different variables may play during the implementation process of evidence-based practice guidelines. The exploration phase involves the identification of a problem or issue that needs a resolution or improvement. The evidence-based best-practice guideline identifies the primary issue to be frequent occurrences of pediatric EA due to gaps existing between current knowledge and everyday practice. The decision to adopt occurs when an individual or organization experiments with new innovations before broad implementation is initiated. In the evidence-based best-practice guideline, recommendations were presented, and the panel of experts had the option to institute changes and/or revisions. During the active implementation phase innovation is more broadly implemented across platforms, and factors affecting implementation are assessed. Following feedback from the panel of experts, a final draft of the guideline was developed. Finally, in the sustainment phase factors were examined to determine the effectiveness of long-term implementation and maintenance (Aarons et al., 2011).

Triple Aim

The Institute for Healthcare Improvement introduced the Triple Aim in 2008. The Triple Aim focuses on three specific areas in order to improve healthcare. The areas included in the collaborative approach are: improving the overall health of a population, improving the patients' experience of care, and reducing the cost of healthcare (Whittington et al., 2015). The Triple Aim requires healthcare organizations to focus on organizing care in order to meet the health needs of a specific population. Without attention to the three areas outlined in the Triple Aim, healthcare organizations could potentially misalign the balance between improving quality of care, and the reduction of

healthcare costs (Whittington et al., 2015). Through the use of Triple Aim, the evidence-based best-practice guideline could potentially improve the patient's experience of care, while also reducing health care costs.

DNP Essentials

The American Association of Colleges of Nursing (AACN) outlines eight essential Doctor of Nursing Practice (DNP) competencies deemed fundamental to the various roles of nurses in the advanced practice setting. All eight essentials outlined by the AACN were considered in the completion of this doctoral project. However, a particular emphasis was placed on Essentials III and VIII thought the entirety of this doctoral project. Essential III (Clinical Scholarship and Analytical Methods for Evidence-Based Practice) describes the use of evidence-based research investigation to guide advancements in clinical practice. Essential VIII (Advanced Nursing Practice) specifies a foundation of competencies required for doctoral nursing practice. A complete listing of DNP essentials outlined by the AACN is listed in Appendix A.

Specific Aims

The purpose of this doctoral project was to develop an evidence-based, best-practice guideline aimed at reducing the risk of pediatric EA following general anesthesia in pediatric populations. The best-practice guideline provides anesthesia providers with the literature reviewed, and evidence-based recommendations regarding anesthetic techniques and pharmacology use shown to successfully reduce the incidence of pediatric EA. Pediatric patients that develop pediatric EA have been shown to demonstrate low levels of patient satisfaction, increased incidence of postoperative complications, and increased costs of care associated with adverse events arising from pediatric EA. This

guideline was developed through the use of evidence-based research regarding best practice advisories on the prevention of pediatric EA. The guideline was then presented at The University of Southern Mississippi (USM) to a panel of experts in the field of anesthesia. The feedback gained from the panel of experts was used to refine areas of the guideline in order to provide a more strategic means of improving the quality of anesthetic care. The best-practice guideline has the potential to provide a means of improving anesthetic care outcomes and patient satisfaction at a hospital in Southeastern Mississippi.

Summary

Pediatric EA is a relatively common complication following the administration of general anesthesia in pediatric patients. The incidence is estimated to be anywhere from 10% to 80%, and can likely be attributed to several different factors. Risk factors commonly associated with the development of pediatric EA include the age of the child, the child's current level of anxiety and individual personality, the type and length of surgery, use of inhalational anesthetics, a rapid emergence from general anesthesia, and the child's postoperative pain level (Hoch, 2019). Several of the risk factors previously mentioned are unable to be altered through anesthetic management. However, through alterations in the anesthetic technique and approach, several other risk factors could potentially be minimized. An evidence-based best-practice guideline for reducing the risk associated with the development of pediatric EA can potentially improve patient satisfaction, reduce recovery times in PACU, and improve the quality of anesthetic care. An outline detailing the process and methodology for developing the evidence-based best-practice guideline is described in Chapter II.

CHAPTER II - METHODOLOGY

Introduction

The requirements for the DNP project for the USM College of Nursing and Health Professions include meeting the AACN DNP Essentials. The evidence-based best-practice guideline for reducing the risk of developing pediatric emergence agitation meets several DNP essentials outlined by the AACN, with particular focus on DNP Essential III and DNP Essential VIII. The evidence-based best-practice guideline was submitted to the USM Institutional Review Board (IRB) for review and approval. IRB approval status according to protocol is listed in Appendix B (IRB-20-297). Important components associated with pediatric EA are addressed in the evidence-based best-practice guideline and warrant attention. These components include: (a) current provider practices, (b) knowledge of evidence-based literature regarding pediatric EA, and (c) proposed benefits concerning the acceptance of the evidence-based best-practice guideline.

Context

The evidence-based best-practice guideline is targeted toward anesthesia providers working in a hospital in Southeastern Mississippi. The hospital's profit election is a business corporation (Mississippi Secretary of State, 2014). Currently, the hospital employs anesthesiologists and Certified Registered Nurse Anesthetists (CRNAs) with varying years of clinical anesthesia experience. The hospital is also a teaching institution facilitating the education of medical residents, as well as student nurse anesthetists.

Pediatric surgery cases are performed at the hospital on a weekly basis. The hospital has approximately 500 inpatient beds and 14 main operating rooms that are utilized for a variety of both adult and pediatric cases. The pediatric surgical services

performed at the hospital include general surgery, ear, nose, and throat surgery, and dental surgery. The hospital has a history of adhering to quality improvement protocols in the past, and the anesthesia department has been supportive of the facility's effort. Currently, no formal process is in place that would affect the implementation of the evidence-based best-practice guideline.

Intervention

Recent evidence states that the incidence of pediatric EA is anywhere from 10% to 80% following the administration of general anesthesia (Bajwa et al., 2010). The purpose of the evidence-based best-practice guideline is to reduce the risk of pediatric EA following general anesthesia in pediatric populations. A systematic review of current evidence-based practice policy concerning the prevention of pediatric EA was performed. Information gathered from the literature was synthesized and used to guide the formation of the guideline. A synthesized review of the literature demonstrated a correlation existing between the development of pediatric EA and lower levels of patient satisfaction, increased postoperative complications, and increased costs of care associated with adverse events arising from pediatric EA. The literature also identified a gap between best practice recommendations and actual anesthesia provider practice (Hoch, 2019). The guideline provides anesthesia providers with evidence-based best-practice recommendations that have been shown to reduce the overall incidence of pediatric EA.

A targeted review of evidence-based peer-reviewed literature was accomplished by using several online research databases: CINHAL, EBSCOhost, MEDLINE, and PubMed. Primary key search terms included: pediatric anesthesia, pediatric emergence agitation, dexmedetomidine, midazolam, clonidine, total intravenous anesthesia, volatile

anesthetics, and best practice recommendation. Current policies, interventions, and information concerning pediatric EA, anesthesia provider practice, and guideline development was compiled and synthesized for use in the production of the evidence-based best-practice guideline. Following the synthesis of data, a panel of experts in the field of anesthesia was assembled. An email announcement to the panel of experts was created requesting informed consent for participation. The panel of experts included four CRNAs currently practicing at a hospital in Southeastern Mississippi, one pediatric professor at USM NAP, and the DNP project chair. The members of the panel of experts were chosen based on each member's advanced knowledge in the field of anesthesia, particularly as it relates to the area of pediatrics. Upon assembly of the panel of experts, a survey was composed to obtain critical feedback from the panel. Following the completion of the survey, approval was sought from the DNP project chair. Once approval was obtained, the IRB application was submitted for review. After IRB approval was received, an email containing informed consent, a PowerPoint© presentation detailing the purposed best-practice guideline, and an anonymous link to the survey was sent to the panel of experts. Qualtrics© was be used as the anonymous survey tool, and there were no repercussions for non-participants. Data included in the PowerPoint© presentation was derived from a review of evidence-based literature on the prevention of pediatric EA and included information concerning current practice recommendations from the literature, alternative methods of anesthesia, and pharmacological interventions. The panel of experts was asked to view the presentation and offer feedback via the anonymous post-presentation survey. The survey examined the panel's knowledge of current literature involving pediatric EA, as well as each panel member's overall

willingness to adopt the proposed recommendations. Data from the survey was then collected and entered into a summarized table. The data collected was both quantitative and qualitative, and followed a mixed-methods approach. Quantitative data was expressed as narrative descriptions, and qualitative data was examined for similarities and common themes. Following the synthesis of the data, the best-practice guideline was re-assessed and refined. Final approval was sought from the DNP project chair. Once final approval from the DNP project chair was obtained, the best-practice guideline was presented to the panel of experts working at a hospital in Southeastern Mississippi. The research was disseminated at USM School of Leadership and Advanced Nursing Practice Scholarship Day in September of 2020. All electronic data was permanently deleted from the computer, and the trash file was emptied. The physical data was destroyed by shredding.

The evidence-based best-practice guideline is aimed at providing the panel of experts with recommendations supported by peer-reviewed literature which demonstrates that adoption of the best-practice guideline could potentially decrease the overall incidence of pediatric EA, potentially resulting in increased patient satisfaction, lower costs of care, and decreased postoperative complications.

Survey Tool

Data was collected from the panel of experts via an anonymous online survey. Qualtrics© was used as an anonymous survey tool. A link to the online survey was emailed to the panel following the PowerPoint presentation of the purposed best-practice guideline. Participation from the panel of experts was completely voluntary, and the

panels' responses to the survey were kept anonymous. There were no consequences or repercussions for not participating.

Due to the relatively small sample size, data obtained from the survey was not statistically significant. Data collected from the survey was both quantitative and qualitative and followed a mixed-methods approach. The quantitative data was examined and expressed as narrative descriptions. The qualitative data was also examined and common themes were reported. All data was thoroughly examined and summarized into table format. All information received from the voluntary participation of the panel of experts was kept strictly confidential and remained anonymous. Following a review of data obtained from the survey, final approval of the best-practice guideline was sought from the DNP project chair. After obtaining DNP chair approval, all information stored on the computer was permanently deleted, and the trash folder was emptied. Additionally, all information stored in paper form was destroyed via shredding.

Ethical Considerations

The primary ethical consideration for this project was the inability of individual providers to adhere to the recommended guideline following approval. If permanently adopted, the purposed evidence-based best-practice guideline will provide recommendations for reducing the incidence of pediatric EA. If some individual providers are unable to follow the recommendations outlined in the purposed guideline, two standards of pediatric anesthetic care will exist at the facility. Patients cared for by anesthesia providers that do not adhere to the policy could potentially be at a greater risk for developing pediatric EA following the administration of general anesthesia.

Summary

In summary, the purposed evidence-based best-practice guideline is targeted at reducing the overall incidence of pediatric EA, resulting in increased patient satisfaction, decreased risk for postoperative complications, and decreased cost of care. A panel of experts in the field of anesthesia was assembled and presented with a slide-show presentation outlining the guideline's recommendations. An anonymous survey link was distributed among the panel in order to gain valuable feedback concerning the recommendations listed in the guideline. Panel participation was voluntary, and there were no repercussions for non-participants. Data gained from the survey was both quantitative and qualitative, and a mixed-methods approach was used for analysis. Information from the analysis of data was then evaluated and considered in the final draft of the evidence-based best-practice guideline. The final draft of the best-practice guideline was presented to members of the panel of experts currently working at a hospital in Southeastern Mississippi for use in practice.

CHAPTER III - RESULTS

Introduction

The effects of pediatric emergence agitation have the potential to lead to decreased patient and family satisfaction, higher costs of care, and increased incidences of postoperative complications. Currently, it is believed that the incidence of pediatric emergence agitation remains elevated due to a gap existing between current evidence-based literature and actual clinical practice. The goal of the project was to develop an evidence-based best-practice guideline for the prevention of pediatric emergence agitation. The guideline was synthesized from currently available literature and disseminated to a panel of experts to review and provide feedback.

Steps of the Intervention

Following the proposed methodology, the project began with a systematic review of current literature pertaining to the prevention of pediatric EA. Following a review of the literature, a guideline for the prevention of pediatric EA was constructed. A panel of experts in the field of anesthesia was then assembled. The panel consisted of four practicing CRNAs, one pediatric professor, and the DNP chair. Once the panel of experts was assembled, a PowerPoint© outlining the literature contained in the guideline, along with an anonymous survey in order to gain feedback from the panel, was created. After informed consent was obtained, an email was then sent to the panel of experts containing the letter of informed consent, the PowerPoint©, the proposed best-practice guideline, and a link to the anonymous survey. The panel of experts was asked to review the material and offer feedback via the anonymous survey. All responses as well as the identity of the participants were kept completely anonymous during the entirety of the project. The

survey consisted of five questions pertaining to the participants' current knowledge of pediatric EA, willingness to adopt the best-practice guideline as well as any foreseeable barriers to implementation, and participants' current practices to prevent pediatric EA. Additional space was also provided to allow for the participants to provide additional feedback by means of guideline improvement, personal practices, and additional barriers. Questions contained in the survey are listed in Appendix C.

Five out of six participants from the panel of experts responded to the survey. The first question asked participants if the information contained in the presentation was informative concerning the evidence based risks associated with pediatric emergence agitation. Five out of five participants responded yes. The second question asked participants if the contents of the presentation were consistent with doctoral-level work. Five out of five participants responded yes. Question three asked participants if they used any additional measures to prevent the incidence of pediatric emergence agitation. Five out of five participants answered no. The fourth question asked if participants would consider implementing the purposed best-practice guideline into their practice. Five out of five participants answered yes. Question five asked participants if they foresaw any potential barriers to the implementation of the purposed best-practice policy. Four out of five participants responded no, and one out of five answered yes. The participant answering yes to question five listed time constraints, current hospital policies, and individual practitioner's unwillingness to adopt the proposed guideline as potential barriers to implementation. The sixth question was qualitative and asked participants to provide any additional comments or recommendations to the proposed guideline. Two out of five participants provided additional comments concerning the quality of the

proposed guideline. None of the participants listed any recommendations concerning suggestions or improvements to the proposed guideline. Individual responses to the anonymous survey are listed in Appendix C. Information obtained from the survey was subsequently reviewed and the panel's recommendations were considered. No alterations were made in the final draft of the proposed guideline. The final draft of the guideline was then provided via email to members of the panel of experts currently practicing at a hospital in Southeastern Mississippi. Research and data from the project was disseminated at USM School of Leadership and Advanced Nursing Practice Scholarship Day in September of 2020. No changes were made from the original steps outlined in Chapter II.

Details of Process Measures and Outcomes

In summary, an evidenced-based best-practice guideline for the prevention of pediatric EA was developed in order to decrease the incidence of pediatric EA. The adverse effects of pediatric EA include decreased patient satisfaction, increased costs of care, and higher incidences of postoperative complications. The proposed guideline attempts to bridge a gap between literature recommendations and anesthetic provider practice by providing practitioners with evidence-based interventions aimed at the prevention of pediatric EA.

CHAPTER IV – DISCUSSION

Summary

Pediatric EA is a relatively common complication following the administration of general anesthesia in pediatric patients. Currently, the incidence of pediatric emergence agitation remains elevated due to a preexisting gap between current evidence-based literature and the clinical practice of many anesthesia providers. The evidence-based best-practice guideline outlined in this project attempts to provide anesthetists with current practices supported by literature to decrease the prevalence of pediatric emergence EA.

Interpretation

During the review of the literature, a comprehensive guideline outlining intervention to decrease the incidence of pediatric EA was not found. However, the literature did identify an existing gap between current recommended practices for the prevention of pediatric EA, and actual anesthesia provider practice. The proposed guideline attempts to bridge this gap by providing an evidence-based best-practice guideline for the prevention of pediatric EA. The proposed guideline was developed and a panel of experts was asked to review the information and offer feedback. The data provided from responses to the survey established that the panel of experts were accepting of the knowledge provided by current literature, and were willing to implement the practices contained in the guideline. Responses also established that several participants routinely implement interventions from the guideline into their clinical practice. However, the specific interventions were not made explicit by the participants. Implementation of the proposed guideline into clinical practice has the potential to decrease the prevalence of pediatric EA by providing anesthetists with evidence-based

knowledge concerning current practices shown to decrease incidences of pediatric EA. Decreasing the incidence of pediatric EA could potentially lead to higher patient satisfaction scores, decreased costs of care, and fewer post-operative complications.

Limitation

Limitations of the project are inflated by the relatively small sample of five respondents. However, efforts were made to optimize the quality of data collected by focus focusing on the selection quality for the panel of experts. Members of the panel of experts consisted of clinical practitioners of pediatric anesthesia, published authors of peer-reviewed research, and professors of nurse anesthesia. The number of questions contained in the survey was also limited with respect to time, in order to encourage more meaningful responses. Questions were targeted and to collect the data needed for the project. For future studies, increasing the sample size of the project could offer a wider range of feedback for the development of the project's guidelines. Also, the inclusion of non-pharmacologic interventions and alternative methods of prevention could provide anesthetists with a wider range of available strategies to implement into clinical practice.

Conclusions

The proposed guideline was presented to a panel of experts for review. Following a review of the proposed guideline, the panel of experts was asked to provide feedback via an anonymous survey. Data gathered from participants' responses to the survey was collected over a period of one week. Feedback suggested the panel of experts had a willingness to incorporate the guideline into clinical practice. The literature outlined in the project, along with data obtained from the survey was used to develop the guideline for the prevention of pediatric EA. The proposed guideline could be used to limit the

adverse effects and consequences resulting from pediatric EA. As one participant suggested, barriers to implementation affecting the overall sustainability of the proposed guideline could be influenced by factors such as the cost of medications, current provider practice, and time constraints. However, the proposed guideline could potentially filter into other contexts within the area of healthcare. The proposed guideline could be used as a basis to develop an Objective Structured Clinical Examination (OSCE) to be used in a pediatric anesthesia course. Because the proposed guideline is not specific to CRNAs and can apply to all anesthesia providers, hospital administration could also use information from the project as a means for continuing education for anesthesia providers. Further recommendations for the ongoing research into decreasing the incidence of pediatric EA should include a more comprehensive approach using alternative modalities to pharmacologic interventions. Additional recommendations for further research could include the development of an OSCE and identification of barriers to implementation. The advancement of knowledge and continual research into pediatric EA is vital in order to develop effective prevention strategies and increase the overall quality of anesthetic care in the pediatric population.

APPENDIX A – DNP Essentials

Doctor of Nursing Essential	How the Essential is Achieved
Essential One: Scientific Underpinnings for Practice	This doctoral project applied an in-depth review of evidenced-based literature to identify best practices supporting the use of preemptive treatments in the reduction of POST. The recommendations offered in this project are founded upon the findings of scientific works.
Essential Two: Organizational and Systems Leadership for Quality Improvement and Systems Thinking	This doctoral project aimed to improve quality through policy recommendations to a team of experts that would review the recommendations, disseminate the information, and provide feedback that could lead to policy implementation.
Essential Three: Clinical Scholarship and Analytical Methods for Evidence-Based Practice	This doctoral project used analytical methods during a targeted review of the literature to appraise the best practices available to be included in the development of a policy recommendation to a team of experts.
Essential Four: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This essential is met through the development and implementation of a questionnaire to evaluate the anesthesia providers use and knowledge of preemptive treatments for POST
Essential Five: Healthcare Policy for Advocacy in Health Care	This essential is met through the identification of a patient care area that lacks a policy. This project could foster the implementation of a new policy and improve the quality of anesthesia care.
Essential Six: Interprofessional Collaboration for Improving Patient and Population Health Outcomes	This doctoral project utilized professional communication and collaboration among anesthesia experts to develop and implement a change in the healthcare system.

Essential Seven: Clinical Prevention and Population Health for Improving the Nation's Health	The goal of this project was to improve the outcomes and perioperative experiences of patients via the propagation of the evidenced-based practices described in this project for possible future implementation.
Essential Eight: Advanced Nursing Practice	This essential is met through the appraisal of current scientific literature, the delivery of a presentation regarding contemporary practice recommendations, and the collaboration of health professionals to work towards the implementation of new healthcare policy.

APPENDIX B – IRB Approval Letter

Office *of*
Research Integrity

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

The project below has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and University Policy to ensure:

- **The risks to subjects are minimized and reasonable in relation to the anticipated benefits.**
- **The selection of subjects is equitable.**
- **Informed consent is adequate and appropriately documented.**
- **Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.**
- **Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.**
- **Appropriate additional safeguards have been included to protect vulnerable subjects.**
- **Any unanticipated, serious, or continuing problems encountered involving risks to subjects must be reported immediately. Problems should be reported to ORI via the Incident template on Cayuse IRB.**
- **The period of approval is twelve months. An application for renewal must be submitted for projects exceeding twelve months.**
- **FACE-TO-FACE DATA COLLECTION WILL NOT COMMENCE UNTIL USM'S IRB MODIFIES THE DIRECTIVE TO HALT NON-ESSENTIAL (NO DIRECT BENEFIT TO PARTICIPANTS) RESEARCH.**

PROTOCOL NUMBER: IRB-20-297
PROJECT TITLE: Pediatrics Emergence Agitation: Best-Practice Guidelines for Certified Registered Nurse Anesthetists
SCHOOL/PROGRAM: School of LANP, Leadership & Advanced Nursing
RESEARCHER(S): Michael Cockrell, Mary Jane Collins

IRB COMMITTEE ACTION: Exempt
CATEGORY: Exempt
Category 2.(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation.

APPROVED STARTING: July 6, 2020

APPENDIX C – Survey Questions

Survey Questions
1.) Was this presentation informative concerning the evidence-based incidence and risks associated with pediatric emergence agitation? o Yes o No
2.) In your opinion, is the information in this presentation consistent with doctoral-level work? o Yes o No
3.) Do you take any additional measures to prevent the incidence of pediatric emergence agitation? (If Yes, please state what additional measures you take) o Yes o No _____
4.) Would you consider implementing the best-practice guideline from the presentation into your practice? o Yes o No
5.) Do you foresee any potential barriers to the implementation of this best practice guideline? (If Yes, please briefly describe) o Yes o No _____
6.) Please provide any additional comments regarding suggestions, improvements, or recommendations to this guideline. _____

APPENDIX D – Survey Responses

	Question 1	**Question 2**	**Question 3**	**Question 4**	**Question 5**	**Question 6**
Responses						
Participant #1	Yes	Yes	No	Yes	Yes -Provider routine, cost of drugs, the time needed for pre-operative treatment.	-Much needed!
Participant #2	Yes	Yes	No	Yes	No	-It will benefit more pediatric age ranges. Thank you.
Participant #3	Yes	Yes	No	Yes	No	-This is probably outside the scope of this research project, however, if one technique demonstrated superiority in decreasing post-operative recovery

						time (time from anesthesia emergence until discharge from the facility), I think more anesthetists would be willing to change their practice from the traditional approach. This could provide a means to decrease the overall cost and improve patient satisfaction scores.
Participant #4	Yes	Yes	-	Yes	Yes	-
Participant #5	Yes	Yes	No	Yes	No	-

APPENDIX E – Best-Practice Guideline

BEST-PRACTICE GUIDELINE FOR REDUCING THE INCIDENCE OF PEDIATRIC EMERGENCE AGITATION

This Guideline is aimed at preventing the incidence of pediatric emergence agitation. Review of literature suggests several recommendations which demonstrate varying levels of success.

Premedication

Premedication goal is to provide sedation and anxiolysis prior to induction of anesthesia. The three medications recommended for use are:

- **Dexmedetomidine** – Studies suggest dexmedetomidine provides sufficient anxiolysis and sedation for pediatric patients prior to induction with minimal risk of respiratory compromise. Recommended dosing for pediatric patients prior to induction is (PO- 1-4.2 mcg/kg) (Cote, Lerman, & Anderson, 2019).
- **Midazolam** – Research demonstrates several discrepancies regarding the administration of midazolam and its effects on preventing the incidence of pediatric EA. Recommended dosing for pediatric patients prior to induction is (PO- 0.25-0.75 mg/kg) (Cote, Lerman, & Anderson, 2019).
- **Clonidine** – Review of research shows that clonidine provides excellent sedation as well as prolonged analgesia following surgery. However, administration of clonidine should occur at least one hour prior to induction, and may not be preferred in busy settings. Recommended dosing prior to anesthetic induction is (PO- 4 mcg/kg) (Cote, Lerman, & Anderson, 2019).

Intraoperative Interventions

- Methods of Anesthesia – The use of inhalational anesthetics has been shown to significantly increase the incidence of pediatric EA. Therefore, the recommended anesthetic technique is to reduce the percentage of inhalational anesthetic administered. This should be accomplished in two ways:
    - **TIVA following Inhalational Induction** – Following anesthetic induction, maintenance anesthesia will be achieved via propofol TIVA (Lerman & JÖhr, 2009).
    - **TIVA/Inhalational Anesthetic Hybrid (50/50)** – Following anesthetic inhalational induction, maintenance anesthesia will be achieved using low percentage inhalational anesthetic with supplemental IV bolus doses of propofol (1-2 mg/kg) or dexmedetomidine (0.2-0.3 mcg/kg) (Key, et al., 2010).

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