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# VALPO

EFFECTS OF PEDIATRIC EMERGENCE DELIRIUM EDUCATION ON ANALGESIC  
ADMINISTRATION BY PACU NURSES

by

**MELINDA C. NWANGANGA**

**EVIDENCE-BASED PRACTICE PROJECT REPORT**

Submitted to the College of Nursing and Health Professions

of Valparaiso University,

Valparaiso, Indiana

in partial fulfillment of the requirements

For the degree of

**DOCTOR OF NURSING PRACTICE**

2016

MCAwanganga 8/4/16  
Student Date

Christine Cavada 8/4/16  
Advisor Date

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**2016**

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**DEDICATION**

This project is dedicated to my father, Daniel L. Mason.

**ACKNOWLEDGMENTS**

I would like to thank my advisor, Dr. Christina Cavinder, for her much appreciated assistance and guidance throughout this project. Thank you to the clinical agency staff for their positive attitude and participation. Most of all, I would like to thank my husband, Frederick, whose support made this project possible.

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**ABSTRACT**

Emergence delirium (ED) is a behavioral disturbance as a result of general anesthesia that commonly occurs in pediatric patients. Adverse effects of ED lead to a complicated recovery from anesthesia due to the risk of self-inflicted injury of patients, the disturbance of surgical incisions, the development of postoperative maladaptive behaviors, and the increased use of sedatives and analgesics resulting in prolonged recovery time and delayed discharge from the post-anesthesia care unit (PACU). Due to the multiple ramifications of ED, appropriate care is needed to promote a safe recovery from anesthesia and an optimum perioperative experience for these patients. As PACU nurses are the primary providers of care to this population group during the occurrence of ED, it is imperative they are able to recognize and manage ED appropriately. The goal of this evidence-based practice project was to increase the knowledge of ED among PACU nurses and determine its effects on analgesic usage among pediatric surgical patients in the PACU. Using the Iowa model of evidence-based practice in developing quality care, an educational session on ED was developed and provided to PACU nurses of a large, Midwestern hospital in regards to the identification of the occurrence, associated risk factors, multifactorial causes, and effective treatment options for ED. A two-group comparative design was used based on medical records selected using a convenience sampling. Pre-intervention group data was collected from 28 samples prior to the educational sessions and post intervention group data was collected from 24 samples after the implementation. Findings revealed an overall decrease in analgesic use with a significant decrease in the use of stadol, while the use of acetaminophen and fentanyl increased. Data also demonstrated higher PAED scores correlated positively with weight and being of Hispanic race. The results of this EBP project lend limited support for the use of ED education to affect analgesic usage among PACU nurses.



## CHAPTER 1

### INTRODUCTION

Outpatient surgical procedures have grown in number in response to advances in technology and healthcare services. Improvements in short-acting general anesthetics have reduced operative and recovery times making it possible to perform more surgeries in the ambulatory care setting (American Academy of Orthopaedic Surgeons, 2010). This trend is especially advantageous for pediatric patients and their families because it offers a less invasive experience, and patients are able to return home the same day of surgery. Nevertheless, the perioperative experience is often a distressing one for young pediatric patients. Children and their parents face psychological stress when general anesthesia is required for necessary medical procedures. Although modern medicine has provided several approaches in minimizing some of the concomitant results of general anesthesia to make this experience more tolerable, complications such as emergence delirium still remain and must be managed appropriately to ensure the safe recovery from anesthesia for pediatric surgical patients.

Specialized skilled nurses provide direct postoperative care in the post anesthesia care unit (PACU). PACU nurses are trained in airway management, advanced cardiovascular life support, and the special needs of patients emerging from anesthesia. Children present a vulnerable population group that has special needs. Different equipment, adjusted medication doses, and training in pediatric advanced life support is essential in providing quality care for this population group. Pediatric patients also respond differently to general anesthesia, and PACU nurses must be familiar with these responses and knowledgeable in managing potential complications during the recovery process for this special population. Treatment for emergence delirium typically focuses on preventative efforts by preoperative staff or intraoperative medications administered by anesthesiologists. However, when it does occur, PACU nurses are in the position of managing it directly due to the fact they are the primary caregivers during the postoperative

phase. Being able to readily identify and understand this phenomenon, will direct the clinical decisions that nurses make regarding how to best treat it.

### **Background**

Emergence delirium (ED) has been established as a common occurrence after general anesthesia. First described by Eckenhoff in 1961, ED, also called emergence agitation (EA), is a post-anesthetic phenomenon. Although it can affect all populations receiving anesthesia, it is more prevalent in the pediatric population. The prevalence of ED in children ranges from 10-80%, depending on the definition of ED used to measure the experience (Nasr & Hannallah, 2011). When compared to other age population groups, ED occurs three to eight times more frequently among pediatric patients (Stamper, 2014). Its manifestation among pediatric patients is described as, “a dissociated state of consciousness in which the child is inconsolable, irritable, uncompromising or uncooperative, typically thrashing, crying, moaning, and incoherent,” (Hudek, 2009, p.510). ED is a transient condition occurring in the immediate postoperative period when the patient is emerging from general anesthesia. Although ED is typically self-limiting and generally resolves within 30 minutes, it is associated with several complications, adversely affecting the recovery process for pediatric surgical patients.

The risk factors for emergence agitation are multifactorial and are related to patient characteristics, the surgery being performed, and the type of anesthesia being used (Hudek, 2009). Patient related risk factors include the age, anxiety levels, and temperament of the child. ED is more prevalent in preschool age kids due to their vulnerability of being easily confused and frightened by unfamiliar experiences and surroundings (Vlajkovic & Sindjelic, 2007). Preoperative anxiety, experienced by both patient and parents, is also associated with an increased risk of postoperative emergence delirium (Kain, et al., 2004). Children who are more emotional, impulsive, less social, and less adaptable to environmental changes are at increased risk for developing ED (Kain, et al., 2004; Voepel-Lewis, et al., 2003).

The location of the surgery is also thought to be a risk factor for the development of ED. In a study by Voepel-Lewis, et al. (2003), otorhinolaryngology procedures were shown to be an independent risk factor for ED. There is a notion that surgeries on the head or neck, including ophthalmology procedures are associated with ED due to the “sense of suffocation” that these type of surgeries invoke (DaSilva, et. al, 2008). Although the reason remains unclear, patients undergoing surgery of the head and neck have a higher incidence of ED when compared to urologic, orthopedic, general surgical, and other procedures (Voepel-Lewis, et. al., 2003).

Anesthesia related risk factors include the use of volatile anesthetics such as sevoflurane. Several researchers have reported the use of sevoflurane and similar gases to be associated with ED when compared to intravenous anesthesia (Costi, et al., 2014; Dahmani et al., 2010; Zhang, et al., 2014). Sevoflurane has gained widespread popularity in pediatric anesthesia because of the rapidity of induction, hemodynamic stability, lower solubility in blood, and minimal airway side effects when compared to other potent inhaled agents (Abu-Shahwan & Chowdary, 2007; Cho, et al., 2014; and Ozcengiz, 2011). Unfortunately, in addition to the benefits of this anesthetic, the increased occurrence of ED is also associated with its use. Hence, among the evidence, the risks leading to the development of ED in children are numerous and have clearly been identified.

### **Statement of Problem**

**Literature Data.** One of the most significant dilemmas that ED presents is its potential to be misdiagnosed by clinicians. The first objective in addressing ED is to rule out other possible physiological causes for agitation such as hypoxia, hypoglycemia, urinary retention, sensory overload, or pain (Hudek, 2009). Although pain has been strongly implicated in the literature as being a confounding factor for ED, it may persist when pain is controlled and may even be present after non-painful procedures such as an MRI (Manworren, et al., 2004; Mohkamkar, et al., 2004; Sikich & Lerman, 2004; Voepel-Lewis, et al., 2005). Furthermore, the behavioral

manifestations of ED and pain are similar, making it difficult for clinicians to differentiate between the two. Researchers have indicated that incorrect medications may be administered if the cause of agitation is misdiagnosed (Slomka, et al., 2000). Mistaking ED for pain may cause pediatric patients to receive unnecessary analgesics. The increased administration of analgesics may prolong the LOS in the PACU which in turn may impact cost containment and patient satisfaction. There are several scales that have been developed to measure ED among pediatric surgical patients (Sikich & Lerman, 2004). However, few of which have been found to be valid or reliable. Identifying the specific features of ED that distinguishes it from other conditions is necessary to appropriately manage it and avoid the potential complications associated with it.

There are numerous complications associated with ED. Foremost is the risk for injury. An important goal for any delirious patient is safety, therefore managing ED is necessary to maintain the safety of patients in this vulnerable state. Children experiencing ED often wake up combative, thrashing around in bed, kicking, and crying (Corridore, 2013). The impulsive behavior associated with this phenomenon puts children at increased risk of unintentional self-injury and disturbance of the surgical site and any drains or catheters that may be present (Stamper, et al., 2014). As staff attempt to restrain the patient to keep the child from injuring his or herself, they are at increased risk for injury as well. The application of equipment such as a blood pressure cuff, pulse oximetry and telemetry leads is necessary to monitor the hemodynamic stability of patients emerging from anesthesia. However, such actions may make ED patients more agitated and combative (Hudek, 2009).

Management of patients experiencing ED also causes a disruption in the post-anesthesia care unit (PACU). Researchers showed 49% of children who develop ED postoperatively required extra PACU personnel to care for them (Faulk, et al., 2010). This places a strain on the nurse-to-patient ratio and resource allocation (Stamper, 2014). Another predicament ED brings

is that it may result in dissatisfaction with the quality of the recovery process (Costi, et al., 2015). This dissatisfaction is expressed among all members of the healthcare team, including parents (Sikich & Lerman, 2004). Although detailed elements of their satisfaction were not addressed, Boules and Hanna (2014), measured both parents' and nurses' overall satisfaction of the recovery process, and both group's responses indicated improved satisfaction outcomes among the group with the lower incidence of ED.

Furthermore, children who experience ED are seven times more likely to develop postoperative maladaptive behaviors such as night terrors, bed-wetting, general anxiety, and loss of appetite for up to two weeks following surgery (Kain et al., 2004; Kain et al., 2006). In a study by Kain et al. (2004), the odds ratio of having one or more of these postoperative maladaptive behavior changes is 1.43 for children who experience ED as compared with children with no symptoms of ED. Therefore, despite its short duration, several unnecessary complications can result from the occurrence of ED after general anesthesia.

**Clinical Agency Data.** Improving the management of emergence delirium among pediatric patients has compelling advantages for the clinical setting in which this project was implemented. The hospital in which implementation took place has been established as the region's only comprehensive children's hospital (Memorial Hospital, 2015a). This facility offers a wide variety of surgical treatments for pediatric patients in the local area as well as those referred from more than 20 surrounding hospitals in northern Indiana and southwest Michigan. The organization has begun an expansion of its children's hospital and is currently recruiting pediatric surgeons in an effort to better meet the special healthcare needs of children. The hospital attracts a wide range of pediatric specialty providers, including Child Life Specialists as part of its Child Life Program. This program advocates for the special healthcare needs of infants, children, teens, and their families; uses developmentally appropriate care methods to help patients understand medical treatments, procedures, and equipment needed for their care;

and offers emotional support and suggestions for coping with fear, anxiety and separation from family (Memorial Hospital, 2015b). The organization has the overall goal of improving the quality of care provided to pediatric patients, making it an ideal setting to for this evidence based practice (EBP) project which aims to better manage ED in pediatric surgical patients.

The PACU nurses in the clinical agency are currently not trained in the recognition or management of ED. Anesthesiologists provide a blanket of post-operative medication orders to be given on an as needed basis for the control of nausea and pain while in the PACU. Nurses currently use their clinical judgment to decide how to manage the patient's recovery process. When a child wakes up agitated, the cause of the agitation has to be carefully identified in order to appropriately manage. Sources of agitation include anxiety, pain, and delirium, among others and it may be difficult to differentiate between the various causes. Therefore, caring for the agitated child requires a thorough assessment and targeted nursing interventions (Voepel-Lewis, et al., 2005). This EBP project aims to provide information to PACU nurses to aid them in making informed clinical decisions regarding the care of the pediatric surgical patient with ED. Increased knowledge of ED may improve the outcomes of patients experiencing it and ultimately improve the overall perioperative experience for pediatric patients and their families.

### **Purpose of the EBP Project**

The purpose of this EBP project was to explore the effects of pediatric ED education on PACU nurses' administration of analgesics in the PACU. The goal was to provide an educational intervention on ED for PACU nurses in an effort to improve basic knowledge of the phenomenon and to more effectively measure and manage it. The educational intervention included written material, face to face discussion, and instructions on the use of the Pediatric Anesthesia Emergence Delirium (PAED) assessment scale. In an effort to evaluate the effects of the educational intervention, nurses' administration of analgesics was measured. In addition, because the use of analgesics, specifically those with sedative properties, may increase



recovery time, the patient's length of stay in the PACU was also measured. The measurement of these outcomes determined the effectiveness of nurses' ability to identify and appropriately treat ED. The goal of the intervention was to improve the process of recovery from anesthesia for this vulnerable population. The compelling clinical question addressed is "For registered nurses working in a post-anesthesia care unit, will providing emergence delirium education affect their usage of analgesics, compared to standard practice, over a 12-week period?" In this EBP project, each component of the PICOT question format is addressed and outlined:

P - The population of interest was PACU nurses of a hospital based, outpatient surgical center.

I - The intervention was an educational intervention which involves descriptions of risk factors, causes, behavioral symptoms, and interventions to treat ED. This involved written material, face-to-face discussion, and instructions on the use of the PAED assessment scale.

C - The intervention comparison was baseline data of analgesics administered by nurses in PACU and length of stay in the PACU.

O - The outcome was the management of ED as identified by nurses' use of analgesics and length of stay in PACU after implementation of the intervention.

T - The timing for this EBP project was over a 12-week period during October 2015 and February 2016.

### **Significance of the Project**

ED is a common behavioral disturbance as a result of general anesthesia in pediatric patients (Costi, et al., 2015). As PACU nurses are the primary providers of care to this population group during the occurrence of ED, education enabling them to readily identify this phenomenon will allow them to make informed clinical decisions regarding their care. Adverse effects of ED lead to a complicated recovery from anesthesia due to the risk of self-inflicted injury of patients, the disturbance of surgical incisions, the development of postoperative

maladaptive behaviors, and the increased use of sedatives and analgesics resulting in prolonged recovery time, delayed PACU discharge, and decreased patient satisfaction (Mohkamkar et al., 2014). These adverse outcomes also affect the PACU due to the risk of injury to staff and the increased strain on nurse-to-patient ratio and resource allocation (Stamper, 2014). Due to the multiple ramifications of ED, appropriate care is needed to promote a safe recovery from anesthesia and an optimum perioperative experience for these patients. The purpose of this EBP project was to explore the effects of pediatric ED education on PACU nurses' administration of analgesics in the PACU. The goal of this EBP project was to increase the knowledge of ED among PACU nurses in regards to the identification of its occurrence and effective treatment options. It was anticipated that the implementation of an educational intervention would help nurses improve the management of ED when compared to the standard of care. It was also anticipated that improved recovery outcomes, such as decreased use of analgesics and decreased length of stay, would enable the education of ED to be considered as the new standard of care for the organization.

## CHAPTER 2

### THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

#### INTRODUCTION

Theory had a prominent role in the evolution of this EBP project. A theoretical framework was selected and used in the development of a strategy toward identifying potential avenues for achieving and implementing the change to practice. An EBP model was also used to organize the development of this project in an effort to utilize practical approaches in translating evidence into practice. From identifying the problem to monitoring the outcomes of the implementation of the project, the steps in the EBP model used helped to steer the direction of this project. This chapter will review how the theoretical framework and EBP model was applied to this project and how in searching the literature the best practice was determined.

#### **Theoretical Framework**

The theory selected to guide this project is Ida Jean Orlando's Nursing Process Discipline. In this theory, Orlando describes a nursing process that is based on the interaction between a patient and a nurse (George, 2011). Orlando's background was in mental health and psychiatric nursing, and though she applied her ideas to many other nursing specialty areas, the focus of her theory is the interaction between the patient and nurse. Major concepts of the theory include the function of professional nursing, presenting behavior, immediate reaction, nursing process discipline, and improvement. The function of the nurse is finding out and meeting the patient's immediate cry for help. Nurses are thought to be responsive to individuals who suffer, and therefore an experience with the patient invokes an immediate response to directly assist a patient in order to relieve or diminish the patient's suffering (Petiprin, 2015). According to Orlando's theory, the presenting behavior is the patient's problematic situation, regardless of how the presenting behavior appears, and may represent a cry for help from the patient. This presenting behavior is not only the patient's immediate reaction, but a stimulus

which causes an automatic internal response in the nurse, which in turn causes another reactionary response in the patient. Therefore, there is an exchange of responses between the nurse and patient, not necessarily through verbal communication, but through actions. The nursing process discipline is the investigation into the patient's needs. Observations of the patient's behavior is useful to the nurse for ascertaining and meeting the patient's needs. However, the nurse must explore the validity of her reaction by determining how the patient is affected by his or her reaction. The theory explains that automatic reactions are ineffective because the nurse's action is determined by reasons other than the meaning of the patient's immediate cry for help (George, 2011). Here, the nursing process discipline of Orlando's theory, similar to the standard nursing process, plays its role. The assessment begins with patient behavior causing the nurse to react. The reaction from the nurse is based on data collection. The data collected are direct data, comprising of thoughts or feelings from the nurse's own experience of the patient's behavior, and indirect data which come from sources other than the patient such as records, other health team members, or family members. During the analysis phase, the nurse makes a deliberate intellectual diagnosis of the patient's need. Here, the nurse must analyze his or her reaction to determine why he or she responded as he or she did. This analysis makes the process into a logical and disciplined reaction instead of an automatic intuitive one. During the outcome and planning phases, the nurse decides on an appropriate nursing action. Implementation involves carrying out that action. Lastly, the nurse must determine the effectiveness of the action in the evaluation phase.

### **Application of Theory to EBP project**

The framework of Orlando's Nursing Process Discipline theory coincides with the intended process of this EBP project. Nurses observe the behavior of pediatric patients emerging from anesthesia. Each patient is known to be unique and therefore will respond differently to the effects of anesthesia, and nurses must search for behavioral clues to ascertain

the patient needs. Often times anesthesia has a debilitating effect on patients' ability to verbally express their needs, and nonverbal behavior needs to be interpreted. As Orlando's theory states, the behavior may not effectively communicate the needs of the patient and may lead to misidentification of the need by the nurse. Therefore, the nurse cannot assume the patient's need, but uses a disciplined process to identify it and perform a consequent action. The nurse must understand her reaction to the behavior to respond logically rather than intuitively. In assessing the behavioral responses of pediatric patients experiencing ED, an efficient, yet sensitive tool is needed to help differentiate the behavioral patterns of different causative factors such as pain, anxiety, or delirium. The PAED assessment scale is a valid tool appropriate for this task. Informed decisions can then be made regarding how to effectively manage the need of the patient. Evaluation of the nursing action is then revisited to assess the need for further treatment of the condition and to ensure the effectiveness of the action taken. The behavioral responses of pediatric patients to anesthesia are variable, and nurses go through a process to decipher what the patient's needs are. This theory helps guide the EBP project to better equip nurses to interpret patient behavior in order to distinguish the needs of the agitated child emerging from anesthesia.

### **Strengths and Limitations to the Theoretical Framework**

A major strength identified in Orlando's Nursing Process Discipline theory is its applicability to all areas and specialties of nursing (George, 2011). The definition of nursing's function, being identifying and meeting patients' needs, helps the nurse focus on the patient rather than the demands of the work setting and other distractors. The use of this process avoids inaccurate diagnosis and ineffective treatment plans through the constant exploration of the patient's reactions. The theory also "guides the nurse to evaluate her care in terms of objectively observable patient outcomes" (George, 2011, p.176). Such objective data can be further

analyzed and contribute to the process of implementing evidence-based practices into the field of nursing.

A limitation of this theory is found in its focus on the interaction between the nurse and patient. This focus does not allow room for the other physiologic monitoring that nurses control and that can have an impact on the effectiveness of care in certain more technical settings. Another limitation is its neglect of the larger system that the patient is a part of, such as the family and community. The theory tends to focus on only the individual when the individual's other connecting parts can have a significant role in meeting the needs of the individual patient.

### **EBP model**

The Iowa Model of evidence-based practice aims to guide implementation of research into clinical practice in order to improve patient care (Titler, et al., 2001). The model offers a step by step process beginning with identifying a problem-focused trigger, such as a clinical problem, or a knowledge-focused trigger, such as a new research finding or new practice guideline, that initiates a need for change. When a trigger is identified, it needs to be determined whether the topic is a priority for the organization. If the organization identifies this topic as a priority, a team involving stakeholders needs to be formed. The next steps in the model involve reviewing and critiquing relevant literature and then identifying the evidence that supports the change in practice. Furthermore, it must be determined whether the collected data provides a sufficient research base to continue with the change in practice. If adequate research is found in the literature, the model suggests a pilot of the change before a decision is made to adopt it into practice. In piloting the change, baseline data are collected, outcomes to be achieved are selected, an EBP guideline is developed, and implemented on a pilot unit. Evaluation of the process and outcomes is made to determine if modifications to the practice guidelines are needed. If and when the change is instituted into practice, monitoring and analyzing outcome data are performed and the results are then disseminated (Titler, et al., 2001).

**Application of the EBP Model to the EBP Project**

The Iowa Model is applicable to the proposed project because of the number of pediatric surgeries that occurs in the selected facility's outpatient surgical unit, which presents a clinical problem. When ED occurs it poses increased risks of injury to the patient, requires increased staffing, and can cause stress to caregivers and staff alike (Costi, et al., 2015; Faulk, et al., 2010; Sikich & Lerman, 2004; Stamper, 2014;). Therefore, this problem-focused trigger initiated the model's process of knowledge transformation to clinical practice. It is determined that this topic is a priority for the organization because of the recent focus on providing family focused, quality care to children while expanding its pediatric surgical services. Following the steps of this model, a team of key stakeholders was formed. This team consisted of the director and manager of the PACU department and the PACU nurse educator. A literature search was conducted involving comprehensive databases and the expertise of a librarian. The search unveiled several relevant articles and sufficient evidence was found to support the change. As the next step in the Iowa Model is to implement change, an educational intervention was developed and implemented in a pilot program at the selected outpatient surgical care (OSC) unit of a mid-west US hospital. Evaluation of the effectiveness of the education was measured and evaluated by measuring nurses' choice of intervention, specifically their use of analgesics, and patient outcomes, specifically the LOS in PACU. Modifications to the practice guidelines were then incorporated as needed which follows the last step of the Iowa model.

**Strengths and limitations of EBP Model**

A strength that has been identified in using the Iowa EBP model is its collaborative approach to the use of research (Doody & Doody, 2011). This model has been recognized for its wide applicability by multidisciplinary healthcare teams. It highlights the importance of considering the entire healthcare team in incorporating evidence findings into practice. Likewise, the proposed protocol involves several key players in the perioperative experience. PACU

nurses as well as managers, educators, and informatics nurses will be involved in the change of practice in the proposed project. Another strength in using the Iowa model for this project is found in the more recent revisions that have been made to the model which is the key decision points that determine whether there is an institutional reason to focus on this problem, sufficient research to guide practice, and outcomes that deem it appropriate for adoption into practice (Titler, et al., 2001). Specifically, for this project, determining these key decision points helped to steer the project along the path of effective implementation. The institutional reason to focus on pediatric care services was important to determine and lead to, what was anticipated to be, the embrace of the change in practice due to its correlation with the organization's current goals of expanding its pediatric healthcare services. One potential weakness to this model is found in one of the model's strengths. The Iowa Model emphasizes the formation of a team incorporating a multidisciplinary approach. While its focus is on formal changes led by nurses in organizational settings, it does not mention changes in practice on the individual level (Gawlinski & Rutledge, 2008). Nevertheless, many other applicable settings make this model generalizable and very useful to the proposed project.

### **Literature Search**

Extensive searches were performed in the following databases: CINAHL, ProQuest Nursing and Allied Health Source, MEDLINE, Health Source: Nursing/Academic Edition, Web of Science, Cochrane Library, and the Joanna Briggs Institute (JBI) EBP Database. Key search terms included: *post anesthesia* OR *recovery* OR *PACU* AND *pediatric\** OR *child\** AND *emergence agitation* OR *emergence delirium* OR *agita\**. Inclusion criteria consisted of English language, publication between years 2005 and 2015, scholarly or peer-reviewed articles, and studies involving pediatric populations undergoing general anesthesia for both surgical or nonsurgical procedures. Results of the search yielded in CINAHL 62 articles, in MEDLINE 344, in Health Source 51, in ProQuest 69, in Web of Science 261, in Cochrane 21, and in the Joanna



Briggs Institute 19. Among methods to prevent ED were medications not within the scope of a PACU nurse to administer. Studies involving these medications, such as propofol, dexmedetomidine, and ketamine, were excluded. Also among the exclusion criteria were articles that did not include a research study. A total of nine relevant research articles were then found to meet inclusion criteria while a citation search of reference lists resulted in an additional two articles for a total of eleven. A complete list of the eleven included articles is summarized in Table 2.1.

### **Appraisal of the Levels of Evidence**

Melnik and Fineout Overholt's (2011) rating system for the hierarchy of evidence was used to rate the evidence found. According to the scale Level I evidence consists of systematic review or meta-analysis of all relevant random control trials (RCTs); Level II evidence consists of well-designed single RCTs; Level III evidence consists of well-designed controlled trials without randomization; Level IV consists of well-designed case-control and cohort studies; Level V consists of systematic reviews of descriptive and qualitative studies; Level VI consists of single descriptive or qualitative evidence; and Level VII consists of authoritative opinions and reports of expert committees. Among the relevant evidence found in the literature, two Level I studies, two Level II studies, and six Level IV studies were found. No Level III, V, VI, or VII studies were found.

Included articles were also assessed for quality using the John Hopkins Nursing EBP Rating Scale (Newhouse et al., 2005). According to the scale, a rating of high quality research consists of consistent results with sufficient sample size, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence. A high quality rating for an organizational type of study includes well-defined methods using a rigorous approach; consistent results with sufficient

Table 2.1

*Database Search Results*

---

Database	Hits	Relevant Articles Found	Duplicates	Included
CINAHL	62	1	0	1
Medline	344	6	1	5
Health Source	51	0	0	0
ProQuest*	69	1	1	0
Web of Science	261	7	6	3
Cochrane	21	1	1	0
JBI	19	0	0	0
Citation Search	N/A	2	N/A	2
Total				11

---

\* Nursing and Allied Health Database

sample size; the use of reliable and valid measures. A rating of good quality contains reasonably consistent results, sufficient sample size, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence. A good rating for organizational studies uses well-defined methods; reasonably consistent results with sufficient numbers; the use of reliable and valid measures and reasonably consistent recommendations. Furthermore, a rating of low quality consists of little evidence with inconsistent results, insufficient sample size, and conclusions cannot be drawn. These studies also include poorly defined results and measures that lack adequate reliability and validity. Among the included articles, six were found to be of good quality and five were high quality ratings. A summary of the evidence is provided in Table 2.2.

### **Level I**

Among the relevant evidence, a systematic review of the evidence was found. Costi, et al. (2014) compared sevoflurane with other general anesthetics and other adjunct treatments in regard to the occurrence of ED in children. This comprehensive study included all randomized or quasi-randomized controlled trials involving children less than 18 years of age undergoing general anesthesia. Any study including a sevoflurane anesthetic being compared to another general anesthesia or in which pharmacological and non-pharmacological adjuncts to sevoflurane compared to a placebo. There were no limitations to language or publication. Several databases were searched including Medline, Embase, CINAHL, EBMR and the Web of Science. Reference lists, ongoing clinical trials, and unpublished studies were also searched. To ensure the quality of the included studies two review authors independently searched the databases and resolved differences in their results by discussion. A total of 158 studies were included in this review involving 14,045 children. The studies were combined into two reasonable categories: those that compared sevoflurane with other general anesthesia and

Table 2.2

*Summary of Appraised Literature*

Author, Year, Study Design Level of Evidence, Quality	Sample	Major Variables/Measurements	Findings/ Recommendations	Strengths/Weaknesses
Bong & Ng, 2009  Prospective observational study Level IV Good quality	316 children, ages 2-12 years; elective outpatient surgery	Evaluation of the incidence of ED using the Pediatric Anesthesia Emergence Delirium (PAED) Scale in Asian children undergoing outpatient surgery	PAED assessment reliable in finding 28 (8.9%) cases of ED; 7 (25%) required medications, recovery in PACU prolonged by 14-23 minutes in ED patients	Strength: ROC curve analysis for the PAED scale suggests the tools is valid and reliable Weakness: All perioperative care was left to the discretion of the anesthesiologists and therefore variable.
Bortone, et al., 2014  Randomized controlled trial Level II, High Quality	87 children, lower abdominal surgery	Effect of intravenous clonidine or intravenous fentanyl on early postoperative negative behavior in children; incidence of ED as defined by a PAED score equal to or above 12, ED as defined as a Cravero score of equal to or above 4, and pain as defined as a score equal to or above 4 were measured	ED observed in 20 children Intravenous fentanyl modifies negative postoperative behavior in children, decreases postoperative pain	Strength: Study was random, double blinded, with similar participants in both control and intervention groups Weakness: Study distinguished EA from ED by the value of PAED score and the

			and increases postoperative nausea and vomiting	intervention was triggered when EA (a lower score) was present, making it difficult to determine whether these patients would have had ED.
Costi, et al., 2014 Systematic review Level I, High Quality	14,045 children, all <18 years of age, varied surgeries	Comparison of sevoflurane and other general anesthetics or other adjunct pharmacological agents to a placebo in the occurrence of ED in children.	Propofol, halothane, alpha-2 agonists, opioids, and ketamine reduce the risk of ED compared with sevoflurane anesthesia	Strength: overall risk of bias was low, quality of evidence included was moderate to high Weakness: variable scales to measure ED were used, different levels of cutoff were used, some studies involved children who were provided inadequate or no analgesia during painful procedures
Dahmani, et al., 2010 Meta-analysis Level I, Good Quality	3,172 children, varied surgeries	Effects of several medications on the prevention of ED in children under sevoflurane and desflurane anesthesia	Propofol, ketamine, and fentanyl are effective methods of ED prevention	Strength: all included studies were randomized and double-blinded with standardized anesthesia protocols and postoperative evaluation.

				Weakness: Variations in pre-medications given and evaluation tools used to quantify ED.
Gooden et al., 2014	145 children, ages 3-10 years, elective day procedures	Identification of possible contributing factors of the occurrence of ED while measuring the need for pharmacological treatment and complications related to ED	ED in 19.3% using Cravero's scoring, 46% required medications, ED associated with 20 min prolonged recovery time	Strength: Patient characteristics were similar Weakness: lack of standardization of the concentration of sevoflurane used, doses and timing of adjunctive medications
Cross-section, Observational Level IV, Good Quality				
Liang, et al., 2014	90 children, ages 3-7	Effects of a dose of sufentanil or fentanyl in reducing the incidence of emergence agitation after anesthesia with sevoflurane in preschool children undergoing ophthalmologic surgery	incidence of ED after sevoflurane anesthesia in children undergoing ophthalmology surgery is 63.33%; single dose of sufentanil or fentanyl can reduce ED with no adverse effects	Strength: No significant differences in demographic variables, pre- or intraoperative variables Weakness: No mention of reliability of scale used to measure ED
Randomized control trial Level II, High Quality				
Mohkamkar et al., 2014	747 children, ages 3-7	Exploration of the prevalence of EA and associated risk factors in pediatric patients undergoing general anesthesia using PAED and	134 cases of EA using PAED and FLACC scales;	Strength: large sample size, pain was differentiated from EA

Cross-section, descriptive study Level IV, High Quality	years, various elective surgeries	the Face, Legs, Activity, Cry, and Consolability (FLACC) scales	6.7% required medications, EA associated with a prolonged PACU stay	with the use of both PAED and FLACC tools to assess Weakness: None identified
Saringarinkul, et al., 2008  Prospective, observational study Level IV, Good Quality	250 children, ages 2-9, years, various operative procedures	Incidence and factors associated with EA in pediatric patients undergoing general anesthesia was explored; Parental separation, pharmacologic and nonpharmacologic interventions, and adverse events were considered	108 (43.2%) positive for ED, 33% required psych support, 47% required both psych support and opioid medication	Strengths: Measured children who required pharmacological interventions, non-pharmacological, and both interventions. Weakness: variations in protocols and definition of EA made it difficult to make comparisons with other studies
Stamper, 2014  Observational study Level IV, High Quality	400 children, ages 1-17 years, surgical or diagnostic procedures	Implementation of the PAED Scale was evaluated for effectiveness in identifying pediatric ED in comparison to a standard Level of Consciousness-Richmond Agitation and Sedation Scale (LOC-RASS)	Incidence of ED 7.5% using LOC_RASS scale, 11.5% using PAED scale; 46.2% of those with ED required medication	Strength: Findings suggests PAED is a sensitive test in identifying ED Weakness: Pre-medications administered by anesthesiologists was not recorded
Voepel-Lewis, 2005	194 children,	Explored nurses' diagnoses and treatment decisions regarding care of the agitated child	42% of cases reuniting with	Strength: Study supports the

Observational study Level IV, Good Quality	varied procedures		parent was most effective, 31% of cases analgesic medication was most effective interventions	multifactorial etiology of postoperative agitation and provides insight to sources and treatments Weakness: generalizability is limited due to nurses being highly experienced; efficacy of treatment difficult to determine with multiple or combined treatments
Voepel-Lewis, 2003  Prospective, Cohort study Level IV , Good Quality	521 children, ages 3-7 years, elective, outpatient procedures	Incidence of ED was explored along with associated risk factors and outcomes among pediatric patients	ED associated with a prolonged PACU stay, ED in 96 (18%) cases, 52% of cases required medication	Strength: consecutive sampling over two time periods was used to reduce possibility of secular trends in practice, sample size sufficient to detect incidence of ED with a CI 99% Weakness: subject to observer bias because blinding not present in this study design; dosing and timing of analgesics was not controlled



those that compared the use of an adjunct with sevoflurane to those without an adjunct. There were similar results among the studies including high quality of evidence of halothane and propofol associated with a lower risk of EA than sevoflurane. Other high level evidence studies had a consistent finding of dexmedetomidine, clonidine, opioids, and a bolus of propofol, ketamine, or midazolam at surgery end, being effective in preventing ED when recovering from sevoflurane anesthesia. The confidence interval for these results is 95% ensuring the precision of these results. These results are helpful to the proposed project due to the high level of evidence that many of the included studies had. This ensures that further data would not likely change the estimate of effect, making this review reliable. This systematic review is high quality due to its extensive literature review and consistent results. Adequate control and definitive conclusions were identified in the included studies. The study is applicable to this project due to findings that identify several pharmacologic agents, including opioids, improve the management of ED. For these reasons, this study is considered high quality according to the John Hopkins Nursing EBP Rating Scale.

In a meta-analysis by Dahmani et al. (2010), the effects of several medications on prevention of ED in children under sevoflurane and desflurane anesthesia were explored. Thirty-seven articles met the inclusion criteria of randomized control trial, double-blinded, sevoflurane or desflurane anesthesia, absence of neurological disease, a control group, and standardized anesthesia protocols and definitions of ED. There was no mention of which databases were searched. The study excluded non-English studies, and there was no mention of unpublished studies. The studies were compared clearly in a table format with the CI and OR for each study plotted appropriately. Although results were clearly identified, the rigor of the studies were not mentioned therefore the quality of the included studies is unknown. The results of the studies were similar and therefore appropriate to be combined throughout the analysis discussion. The bottom line results of the analysis are clearly made and applicable to practice.

More information on the dosage and time of administration of the medications and the degree of the effect could have provided more insight into the generalizability of the results of this analysis. However, the precision of the confidence intervals provides reliability of the included studies and supports the results of the review.

## **Level II**

In a study by Liang et al. (2014), the effects of a dose of sufentanil or fentanyl in reducing the incidence of emergence agitation after anesthesia with sevoflurane in preschool children undergoing ophthalmologic surgery was explored. Ninety children, ages 3 to 7 years in good health based on the American Society of Anesthesiologist (ASA) classification of which subjectively measures overall health based on five classes ranging from I, indicating a healthy person without systemic disease, to V, indicating a morbidly diseased person not expected to survive. Children with a classification of I-II, were randomly assigned to three groups to receive sufentanil, fentanyl, and intravenous saline at the end of surgery. All observers were blinded to the contents of the study drug. Demographic variables including age, sex, weight, and preoperative behavior scores were not significantly different among the three groups. There was also no significant difference between time of induction, duration of surgery and anesthesia, and time to intubation among all three groups. This minimized sample bias. Outcomes were measured based on scores of ED based on a 4-point grading scale: grades 0 and 1 considered no agitation, grades 2-4 were considered agitated with 3-4 being severely agitated. Outcomes were also measured based on incidence of ED, and satisfaction evaluation made by the anesthesiologist. The results showed scores for ED as well as incidence of ED were lowest in the sufentanil and fentanyl groups. Satisfaction evaluation by anesthesiologists were highest in the sufentanil group and lowest for the control group. This study concluded that the incidence of

emergence agitation after sevoflurane anesthesia in pediatric ophthalmology was very high at 63.33% while the sufentanil and fentanyl groups were 30 and 36.67% respectively. There was no evidence of selective reporting of outcomes. The authors did mention the time to emergence was longer in the sufentanil and fentanyl groups, but length of stay in PACU was shorter than the control group. This finding is applicable to the local population due to the similarities of the population of interest, and the benefits are worthy to be considered in practice.

In a study by Bortone et al. (2014), a prospective double blind, randomized, placebo-controlled trial was evaluated to determine whether intravenous clonidine or intravenous fentanyl modifies early postoperative negative behavior in children. This trial focused on a clear issue based on the population studied, the intervention given, the comparator and outcomes considered. The randomization sequence was computer generated and prepared in a double blinded method. Each drug was prepared in a coded syringe and labeled with the child's study number by a research nurse not involved in the study's assessments. This ensured the allocation of treatments was concealed to observers and researchers. There were no significant differences among the three groups in regards to age, weight, sex, premedication used, parental presence during induction, and type of surgery and anesthesia, emergence time, or PACU discharge time. Early negative postoperative behavior was assessed by two trained physicians or nurses. Outcome measurements were incidence of ED as defined by a PAED score equal to or above 12, ED as defined as a Cravero score of equal to or above 4, and pain as defined as a score equal to or above 4. Three children were excluded from the study due to deviance from protocol, leaving 87 patients available for analysis. The incidence of ED was lower in the fentanyl group, no significant difference in the incidence of ED between the three groups. The fentanyl group also had less postoperative pain, but had greater incidence of postoperative nausea and vomiting. A confounding factor mentioned by the authors indicated that a rescue intervention was triggered by elevated ED scores, making it impossible to

determine if the patient would have had a high PAED score later indicating ED without the intervention. Despite this factor, the results are significant and applicable to a local setting. The benefit of decreasing the incidence of ED would have to be weighed with the increased incidence of nausea and vomiting when applying results to clinical practice.

#### **Level IV**

Among the relevant research, a prospective observational study by Bong and Ng (2009) sought to evaluate the incidence of ED using the PAED Scale in Asian children undergoing outpatient surgery. Three hundred sixteen children between the ages of 2 and 12 years undergoing general anesthesia for elective outpatient surgery were included. Participants were considered healthy based on the ASA I classification. Children who were pre-medicated were excluded from the study. Behavior upon emergence from anesthesia was recorded and points were given based on the PAED Scale. A ROC curve for the PAED Scale was performed and showed a sensitivity of 0.88 and specificity of 0.961 for a score over 10 indicative of ED. PACU nurses trained by the authors of the study and blinded to anesthetic agents and techniques, assessed emergence behavior of the participants. Thirty-three children exhibited agitated behavior including seven who were agitated for reasons other than ED, such as pain. Twenty-six children exhibited clinical signs of ED with PAED scores equal or greater than 10. Seven of the twenty-six children required pharmacologic intervention. Mean duration from the time of awakening to discharge from PACU was 24 minutes in patients who were agitated compared to 10 minutes in children who were not agitated. All children with ED demonstrated decreased agitation within 10 minutes of awakening.

The population included in this study was focused although limited to Asian children (Bong & Ng 2009). The risk factors were identified and biases were accounted for throughout the implementation of the study such as the assessment of preoperative behavior and PACU nurses who were blinded to type of anesthesia. The goal of this study was clearly stated to be

identifying ED in Asian children using the PAED Scale. It was not clear whether the study attempted to detect a beneficial or harmful effect. Although its importance was not clearly stated, the effectiveness of this tool in identifying ED among different cultural characteristics is important to determine the tool's usefulness among the general population. Researchers stated the PAED Scale is the only validated tool used in detecting ED and its clinical use is subjective, indicating an observational study was an appropriate method in meeting the goal of the study. Because the aim of the study was to determine the prevalence of ED in Asian children, limiting the recruitment of participants to those of Asian ethnicity was appropriate. The risk of bias was minimized by eliminated participants whose exposure was different such as the exclusion of children who were pre-medicated. Bias was limited in the measurement of ED with the use of a validated tool, the PAED Scale. Validation of this tool was determined within this study and was comparable to previous studies. Use of the PAED Scale did involve a subjective scoring of behavior which the authors considered. However, a score greater than 10 corresponded to the greatest sensitivity and specificity for ED and suggests the scale is consistent and reproducible and therefore reliable. The results of this study showed a 10.4 percent incidence of ED among Asian children while it is reported to be 24 to 66 percent in the general population. Sixty percent of the participants were young boys undergoing religious circumcision. The authors pointed out that the significance of this ritual may have prompted preparations by families before undergoing general anesthesia for surgery. Preparation may have decrease any anxiety and affected their behavior upon emergence. Since the identification of PAED was limited to Asian children it makes it difficult to apply toward a local setting. This study supports the use of the assessment tool into practice.

In a study by Gooden, et al. (2013), the risk factors and incidence of ED was explored among a pediatric population in Kingston, Jamaica. The aim of the study was to identify possible contributing factors of the occurrence of ED while measuring for the need for pharmacological

treatment and complications related to emergence delirium. A cross-sectional sample of participants included pediatric patients ages 3 to 10 years with an ASA physical status score of I or II, undergoing anesthesia for elective surgery. Children with neurological dysfunction, ear, nose, and throat surgeries (ENT), ophthalmic procedures, major procedures or those with visual or hearing impairments were excluded due to these circumstances having the potential to cause increased disorientation or to interfere with emergence behavior. In this way classification bias was limited. Cravero's agitation scale and the modified Yale Preoperative Anxiety Scale (mYPAS) were used, but there was no mention of the reliability or validity of these tools. Neither was there mention of the subjectivity or objectivity of the outcome measurements. The results of the study showed an association between age, moderate to severe anxiety levels, and the development of ED. Confidence interval were 1.2 to 8.6 for age and 2.3 to 8.6 for anxiety prior to inductions. Lack of standardization of the concentration of sevoflurane used, doses, and timing of adjunctive medications were mentioned as confounding factors identified by the authors. Other findings include an ED incidence of 19.3%, 46% of which required pharmacological intervention. ED was associated with a 20 minute prolonged recovery time. Nineteen percent of ED patients also experienced recovery complications related to agitation such as removal of an intravenous line, increased bleeding at the surgical site, and removal of a surgical dressing. These findings are consistent with others studies. The methods used in this study are appropriate and are generalizable to the local population.

Mohkamkar, et al. (2014), explored the prevalence of EA and associated risk factors in pediatric patients undergoing general anesthesia. This was a cross-sectional descriptive study in which a non-probability quota sampling technique was performed on 747 pediatric patients ages 3-7. This selection process compromises the generalizability of the findings. Each of the subjects underwent general anesthesia for an elective surgery and emergence behavior was assessed using the PAED scale. Because the PAED scale is both valid and reliable,

measurement and classification bias were minimized. Differentiating EA from the symptoms of postoperative pain was done using FLACC behavioral scale. This helped to eliminate the potential confounding factor of pain. Pharmacological and nonpharmacological interventions duration of PACU stay were recorded. Findings of the study found a total of 17.9% of patients experienced EA. A logistic regression analysis of the factors affecting the incidence of EA, revealed pain and children's induction behavior were associated with the increased incidence of EA. The authors concluded that while EA was associated with a prolonged PACU stay, only 6.7% of cases required pharmacologic intervention. The findings in this study are consistent with other studies and the association made between pain and EA are significant to consider in the local clinical setting.

In a study by Saringcarinkul, et al. (2008), the incidence and factors associated with EA in pediatric patients undergoing general anesthesia were explored. Parental separation, pharmacologic and non-pharmacologic interventions, and adverse events were considered. The prospective observational study was conducted in 250 pediatric patients, ages 2-9 years with ASA physical status levels of I or II. Exclusion criteria consisted of patients scheduled for major cardiothoracic or major vascular surgery, neurosurgery, and children with developmental delays. During post anesthesia recovery, a PACU nurse who was blinded to the anesthetic technique recorded behavior on a 5-point scale. Patients were then divided into one of two categories: non-agitated patients (scores of 0-3) and agitated patients (scores of 4-5). There was no mention of the reliability or validity of this scale which created classification bias. Patients were then treated with psychological support, medications, or both. Types of medications were described but there was no description as to what the psychological support entailed and whether staff or parents were providing it. Therefore, the treatment of psychological support is susceptible to subjective measurements. No confounding factors were mentioned by the authors. The results of the study indicated agitation occurred in 108 patients, accounting for

43.2% of total participants. Associated factors included age, difficult parental separation behavior, and sevoflurane anesthesia. These findings demonstrate a 95% confidence interval and are consistent with other such studies. Another finding of this study demonstrated that 33.3% of agitated patients required only psychological support, 8.3% opioid administration, and 47.2% of agitated patients needed both psychological support and pharmacologic intervention. This finding demonstrates the need for multiple treatment regimens to most effectively treat EA. The study appears to be generalizable to a local population and these findings are worthy to be considered in practice.

In a pre-post observational design study by Stamper et al. (2014), the implementation of the PAED Scale was evaluated for effectiveness in identifying pediatric ED in comparison to a standard Level of Consciousness-Richmond Agitation and Sedation Scale (LOC-RASS). A convenience sampling was used to select participants. Any patient 17 years of age or younger undergoing general anesthesia for a surgical or diagnostic procedure was included. Patients transferred to intensive care or anywhere else outside of the PACU after surgery were excluded. Retrospective data were retrieved from chart reviews were compared to chart reviews during the implementation period. Both the PAED Scale and the LOC-RASS are validated tools that provided objective measurements. Fidelity of the use of these tools was measured by examining the number of scores for each relative to the total number of patients who presented to the PACU. This process established a reliable system to minimize bias among the outcomes. Comparisons were made to secondary data such as gender, premedication, parental presence at induction, and type of maintenance anesthetic. Logistic regression models were used to determine any significant differences between group variables or patient characteristic data collected. These actions provided control for confounding factors. Results showed the overall incidence of pediatric ED to be 11.5% using the PAED Scale and 7.5% using the LOC-RASS during the implementation period compared to 3% during the retrospective period. One



confounding factor not accounted for involved the use of the LOC-RASS and PAED Scale simultaneously which may have influenced the scores of these tools. The decision to administer fentanyl or dexmedetomidine was based on the preference of the anesthesiologist. Providers were not asked to document an ED assessment; therefore, it could not be determined whether they chose to administer medication based on the presence of the patient's pain or the presence of ED. The comparison between the incidence of ED using the PAED Scale and that found by using the LOC-RASS during the implementation period resulted in a CI of 0.810-3.171 indicating the PAED Scale may be a more sensitive measure for pediatric emergence delirium than the LOC-RASS. The population and methods used in the study are similar to the local setting and are consistent with other evidence. Methods used to control for confounding factors and bias were sufficient and contributed to the reliability of the study and its application should be considered in practice.

In a study by Voepel-Lewis, et al. (2003), the incidence of ED was explored along with associated risk factors and outcomes among pediatric patients. Participants consisted of 3 to 7 year olds undergoing general anesthesia for an outpatient surgical procedure. Selection process was a nonprobability, consecutive-sampling technique involving children with an ASA status of I or II without any cognitive deficits. Routine perioperative care was equally provided to all participants minimizing classification bias. Outcome measurements were recorded by experienced PACU nurses and trained observers using a comprehensive checklist. However, the authors did not specify the reliability of the checklist used. Discharge criteria was stated to be similar to Chung's modified post-anesthesia discharge scoring system. However, there is no description of a standardized tool used which limits the objectivity of measuring the patient's readiness for discharge. The authors did recognize the possibility of observer bias because the observers were not blinded. The doses and timing of analgesics were also not controlled. These limitations reduce the generalizability of the findings. The finding of this study suggests the

incidence of ED significantly prolongs the PACU stay. It is unclear as to whether this was a result of the pharmacologic treatment used or the complications associated with ED that occurred such as increased bleeding at the surgical site, pulling out of a drain or IV, increased pain at the operative site, and minor injury of the nurse. Pharmacologic intervention was required in 52% of cases in the study. The study does not provide evidence of a relationship between analgesics and prolonged PACU stay but does suggest those with ED have prolonged stays.

Another study by Voepel-Lewis, et al. (2005), explored nurses' diagnoses and treatment decisions regarding care of the agitated child. An observational study involving nurses in a tertiary care pediatric PACU was conducted. Data collected included the incidence and timing of agitation as interpreted by nurses and observers, the timing of all pharmacologic and non-pharmacologic interventions, consultations with other caregivers and parents. Nurses also reported their thought processes regarding objective or subjective signs used to identify or rule out causes of agitation. A high correlation between agitation scores of observers and nurses support the reliability of the agitation scale. In 42 percent of cases, nurses administered analgesics as the initial intervention. Reuniting with parents was the second most common initial intervention at 32 percent. The most effective intervention was reuniting with the parent. Also time to reuniting with a parent correlated positively with duration of agitation. The second most effective intervention was the use of analgesics. There was no difference in types of diagnoses, initial interventions, or efficacy of initial interventions based on the nurses' years of experience or level of education. Although nurses with 15 years or more of experience reunited the agitated child with a parent earlier than those with less experience, the difference was not statistically significant. The authors recognized the efficacy of multiple or combined treatments was difficult to differentiate which provided a confounding factor. Another confounding factor involves the nurse participants were highly experienced with an average of 21 years of experience. This may

limit the generalizability of this study in other populations. Implications of this study suggest the assessment and treatment decisions are complex and a combination of interventions, such as analgesics and reuniting with parents, may be required to manage postoperative agitation in pediatric patients.

### **Best Practice Model Recommendation**

Although the mechanisms surrounding ED are poorly understood, there is sufficient evidence available to improve the management of ED in pediatric patients recovering from anesthesia. Consistent among the literature about ED are the multifactorial risks associated with its occurrence as well as the observed behavior. In accordance with evidence in the literature, best practice recommendations include identifying the occurrence of ED (Mohkamkar, et al., 2014, Stamper et al., 2014). Some characteristics of ED are comparable to postoperative pain and while this can be confounding factor of ED, it is still necessary to differentiate between the two. Various assessment scales and tools have been used to identify ED. However many involve the rating of behavior that is not specific to ED. More recently Sikich and Lerman (2004) developed the PAED assessment scale which has proven to be a more sensitive test for the measure of pediatric ED as evidence in the literature (Bong & Ng, 2009; Bortone et al., 2014; Mohkamkar et al., 2014; Stamper et al., 2014). Consistent with the nursing process, correctly identify the incidence of ED will lead to more informed clinical decision making regarding intervention to manage this condition.

Best practice recommendations to treat ED include both nonpharmacological and pharmacological treatments. Both methods explored in the literature and have been found to be effective in preventing and treating ED. Non-pharmacological interventions, such as psychological support of comfort measures from nurses and parents and reuniting children with parents have been shown to be effective among the literature (Saringcaringkul et al., 2008; Voepel-Lewis et al., 2005). In a study by Voepel-Lewis et al. (2005) reuniting the pediatric

patient with their parent was the most effective intervention and correlated positively with duration of agitation. In that same study the second most effective intervention was analgesic medication. The use of opioids and benzodiazepines has been proven to be effective in the management of ED, but not solely due to their analgesic and sedating effects. In a study by Bonhomme et al. (2012), pediatric patients undergoing non-painful procedures such as an MRI, had a dramatic reduction in the frequency of ED when these pharmacological agents were used. While the literature mentions medications beyond the scope of practice of the PACU nurse, several studies support the use of fentanyl, an opioid commonly administered by PACU nurses, for the management of ED (Bortone et al., 2014; Costi et al., 2014; Dahmani et al., 2010; Liang et al., 2014).

The critical appraisal of current evidence suggests that the implementation of these recommendations could improve the management of ED. Consequently, in appropriately managing ED, a potential outcome includes the avoidance of some of the complications of ED. Potential outcomes may include increased safety of the patient and clinical staff, maintained integrity of any surgical incision, no additional PACU personnel needed for the recovery of pediatric patients, decreased LOS in PACU, and improved satisfaction with anesthesia care and the recovery process among parents and nurses alike. Further anticipated outcomes also include an improved perioperative experience for pediatric surgical patients and their families.

### **CHAPTER 3**

#### **IMPLEMENTATION OF PRACTICE CHANGE**

The Iowa Model for evidence based practice used to guide this EBP project involves implementation of a practice change. Due to the tendency of ED being mistaken for pain, the practice change involved the identification of ED to promote better management of the phenomenon. The ED educational change that was implemented in this project is described in detail.

#### **Setting and Participants**

The clinical setting of this evidence-based practice project took place at a 526-bed, tertiary care hospital located in northern Indiana (Memorial Hospital, 2015a). The hospital serves as a Level II Trauma Center and provides extensive surgical services, both inpatient and outpatient. The organization also includes a children's hospital within the general hospital facility. The implementation of this project took place in the PACU of the outpatient surgical unit (OSC) which performs approximately 20 surgeries a day with around six or seven of those being pediatric cases.

The participants of this EBP project consisted of registered nurses in the PACU department who rotate to the outpatient surgical care unit. There are 33 nurses in the post-anesthesia department. Eighteen of these nurses regularly recover pediatric surgical patients emerging from general anesthesia in the OSC department. All of these nurses have worked in the OSC for more than a year and 94% of them were female. Nurses who work predominantly in another unit such as pre-operative unit and only occasionally float to PACU and those working night shift for patients staying overnight in the PACU were also not included due to their limited experience working with children in the OSC department. Other staff in the unit such as patient care assistants were also not included. OSC PACU nurses were informed of the educational

session during the unit meeting prior to its occurrence and reminded with an email message the day before.

### **Outcomes**

The purpose of this EBP project was to explore the effects of pediatric ED education on PACU nurses' administration of analgesics in the PACU. The outcomes of the project were measured by conducting chart reviews on data both before and after the educational intervention. Outcomes were measured by data collected on the number of pediatric patients identified as experiencing ED, the pharmacological agents administered by PACU nurses, and the length of stay in PACU. Pharmacological interventions and length of stay were measured before and after the implementation of the ED education for comparison and to determine the effectiveness of the interventions of the project. The use of analgesics and length of stay in the PACU were compared to determine the influence of the educational intervention on the treatment of ED by PACU nurses.

### **Intervention**

The intervention of this project included an education presentation that was provided to PACU nurses. All information presented in the educational intervention, which included definition of ED, associated complications, risk factors, and a summary of management methods, was obtained from reliable sources found in the literature review. Presentation of the information was compiled by the project manager. Education techniques included a staff in-service using face to face discussion, a PowerPoint Presentation, and handouts. Nurses were taught how to use Sikich and Lerman's (2004) PAED scale and were given a laminated, pocket sized card featuring the scale. Permission was obtained by the project manager to use the validated PAED scale for this project. After the presentation, PACU nurses had the opportunity to assess a case study scenario to demonstrate proper utilization of the PAED assessment tool, practice utilization of the scale on patients and ask any further questions regarding ED. The

educational session took 30 minutes. Copies of the PowerPoint were sent electronically by email to those nurses who were unable to attend to be viewed at a later time. Permission to implement the change in practice was obtained from the institutional review board (IRB) of the selected facility and Valparaiso University. Nurses were then asked to assess and record PAED scores all pediatric patients recovering from general anesthesia in the OSC PACU department.

### **Planning**

The initial planning for the implementation of the proposed project began with collaborating with key stakeholders. Contact was made with the Director of the Preoperative and Post Anesthesia Care Units, the PACU Nurse Educator, and the OSC PACU manager. Upon discussion regarding the ED educational session, general support for the project topic was enthusiastically received. Recommendations of how to best implement the proposed intervention were encouraged and then considered. Suggestions include location, time allotment, and scheduling of the intervention. Collaborative effort between clinical agency's administration and the project manager was made to facilitate the project implementation. Although familiar with the occurrence of ED among pediatric patients, providing the administration and PACU nurses further education on the phenomenon with supportive evidence in the literature about its management was essential in the nurses' participation in the adoption of the change.

### **Data**

**Measures, reliability and validity.** The PAED scale was used to measure the incidence of ED in pediatric surgical patients emerging from general anesthesia. The scale is an instrument developed by Sikich and Lerman (2004) to identify ED in children. The scale consists of five behavioral categories: the child makes eye contact with caregiver, the child's actions are purposeful, the child is aware of his/her surroundings, the child is restless, and the child is inconsolable. The first three categories are reversed scored as follows: 4 = not at all, 3 = just a

little, 2 = quite a bit, 1 = very much, 0 = extremely. While the fourth and fifth items on the scale are scored as follows: 0= not at all, 1 = just a little, 2 = quite a bit, 3 = very much, 4 = extremely. The scores are then summed to obtain a total PAED score. The degree of ED was proven to increase directly with the PAED scale score. The internal consistency of the PAED scale has been measured at 0.89 and the reliability has been measured at 0.84 with a confidence interval of 95%.

### **Data Collection**

Data was collected through chart reviews of pediatric surgical patients treated during the 12-week time period of the project implementation. Data included type of surgery, type of anesthesia, intraoperative medications administered by anesthesiologists, postoperative analgesics administered by PACU nurses, length of stay in PACU, and demographic information such as gender and age. Once PACU nurses assessed patients, scores were recorded on a clipboard secured at the nurses' station. A patient encounter number assigned by the clinical site was the only personally identifiable information collected and was protected using a coding system. Patient data was coded by replacing the encounter number with a research identification code using numbering system in numerical order of collection. Access to the master code list was limited to the project manager and kept locked in the project manager's personal file. Data was stored separately in the project manager's personal computer using password protected SPSS software. Data was also electronically provided by the agency's surgical services informatics nurse using encrypted software. Data is being stored for three years from completion of the project, at which time all electronic data will be deleted and master code list will be destroyed by shredding.

### **Protection of Human Subjects**

The project manager obtained approval from the clinical agency's internal review board (IRB) for implementation of the project. Permission was also obtained by Valparaiso University's



IRB prior to implementation of the project. The project manager also received a certificate from the National Institute of Health (NIH) Office of Extramural Research. The certificate indicated successful completion of the NIH Web-based training course “Protecting Human Research Participants”. Nurses were informed during the educational session that their participation was strictly voluntary and they could withdraw their participation at any time during the project without consequence. The project manager’s contact information was provided to all participants in the case they decided to withdraw.

## CHAPTER 4

### FINDINGS

The purpose of this EBP project was to explore the effects of pediatric emergence delirium education on PACU nurses' administration of analgesics in the PACU. Demographic information of the nursing participants was collected. In addition, the patient chart reviews were analyzed and compared for differences between the pre-intervention and post-intervention groups. The primary outcome of the project involved the comparison of analgesics administered post-operatively between the two groups. Secondary outcomes measured included PAED scores compared to several variables, including the type of procedure performed, age, race, weight, and length of stay (LOS) in PACU.

#### **Participants**

**Size.** In the PACU of the clinical agency, 18 PACU RNs were eligible for participation in the EBP project. An email was sent to all PACU nurses informing them of the project and the upcoming educational presentation. Five ED educational sessions were presented over the course of three days. A total of 14 (78%) nurses attended the educational presentation while the remaining four were given a handout and an electronic copy of the PowerPoint presentation via email. A convenience sampling was used to select the medication administration record of patient charts for review. A total of 52 patient charts were reviewed and from this base data set, two additional datasets were derived, the non-PAED data set consisting of 28 records from the pre-intervention group and the PAED data set consisting of 24 records from the post-intervention group.

**Characteristics.** All of the nursing participants were female nurses employed full time in the perioperative department. Twelve (86.8%) of the nurses spent all of their working hours in the PACU department, while two (14.3%) rotated to both the PACU and preoperative areas. All

participating nurses provided direct patient care to pediatric children recovering from general anesthesia. The majority (78%) of nurses had over five years of experience in PACU. All of the nurses denied ever receiving formal education or training regarding the management of ED prior to the educational intervention. The summary of participant characteristics is found in Table 4.1.

Descriptive analysis was also performed on the sample of patients in which chart reviews were conducted. Demographic comparisons were made between the pre-intervention group and post-intervention group. No significant differences were found among the patient groups for age, weight, race and LOS as shown in Table 4.2, Table 4.3, and Figures 4.1 - 4.5. The mean age for participants in the pre-intervention group was 6.14 years, while the post-intervention group was 5.88 years. Based on a two-tailed hypothesis, the t-value for the two means is 0.31012. The p-value is 0.757762. The difference is not significant at  $p < 0.10$ . The mean weight in the pre-intervention group was 22.61 pounds, while the post-intervention group was 31.1 pounds. Based on a two-tailed hypothesis, the t-value is -1.7225. The p-value is 0.091161. The difference is significant at  $p < 0.10$ . The distribution of race between the two groups was also similar, the majority being Caucasian, followed by African American, Hispanic, and Asian with the exception of African Americans and Hispanics being equal in number in the post-intervention group and no Asians were present in the post-intervention group. The chi-square statistic is 3.834 and the p-value is 0.428931. The difference between the populations is not significant at  $p < .05$ . The mean LOS in the pre-intervention group was 30.36 hours, while the post-intervention group was 34.5 hours. Based on a two-tailed hypothesis, the t-value is -0.84356. The p-value is .402934. The difference is not significant at  $p < .10$ .

**Instrument Reliability.** The PAED Scale (Sikich & Lerman, 2004) was utilized to measure the incidence of ED among pediatric surgical patients recovering in the PACU. It is a five

Table 4.1 Participant Data

	Female	Employed Full-time	PACU (Exclusive)	>5 Years of Experience in PACU	Previous ED Education/training
Number of Participants	14	14	12	11	0
Percentage of Total Participants	100%	100%	86.8%	78%	0%

Table 4.2 Pre-Intervention/Post-Intervention Patient Data

	Min	Max	Mean	Median	SD
Age					
Pre-Intervention	5	8	6.14	6	1.01
Post-Intervention	1	18	5.88	4.5	4.45
Weight					
Pre-Intervention	15.4	36.7	22.61	20.15	6.186
Post-Intervention	8.9	88.3	31.1	19.7	25.25
LOS					
Pre-Intervention	14	85	30.36	26	16.7
Post-Intervention	11	85	34.6	27.5	18.67
PAED Score					
Pre-Intervention	--	--	--	--	--
Post-Intervention	0	20	9.67	10.5	5.97

TABLE 4.3 Statistical Data on Race

	Pre-Intervention	Post-Intervention	Total
Asian	1 (0.54) [0.40]	0 (0.46) [0.46]	1
Black	6 (4.85) [0.27]	3 (4.15) [0.32]	9
Hispanic	2 (3.77) [0.83]	5 (3.23) [0.97]	7
Other	1 (1.62) [0.23]	2 (1.38) [0.27]	3
White	18 (17.23) [0.03]	14 (14.77) [0.04]	32
	28	24	52

The contingency table above shows the observed value, (the expected value) and [the chi-square statistic] for each group.

Figure 4.1. Age Distribution

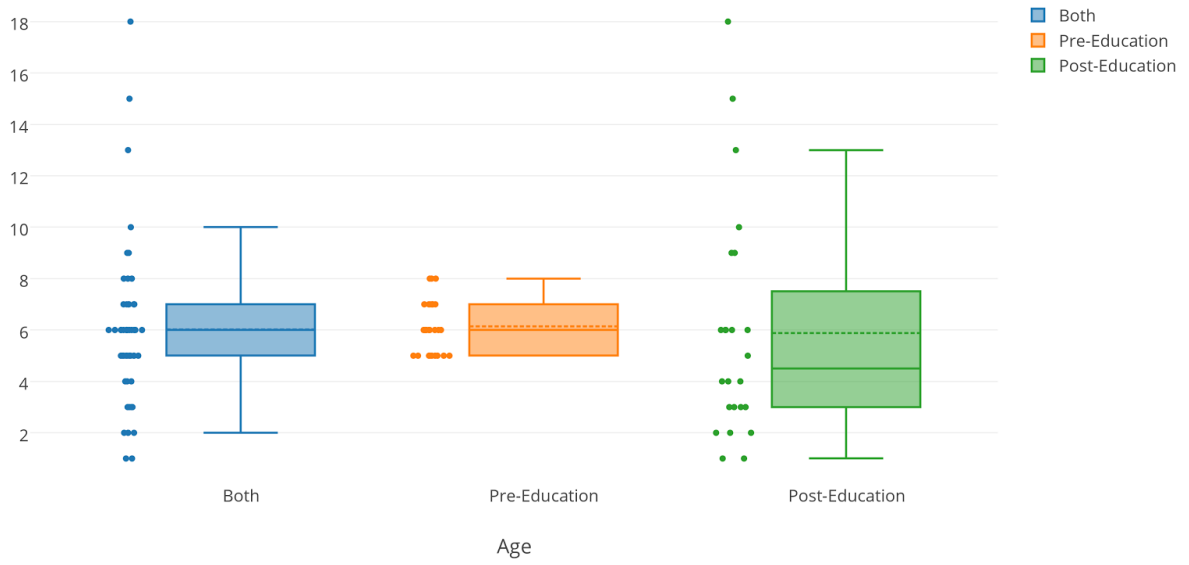


Figure 4.2. Weight Distribution

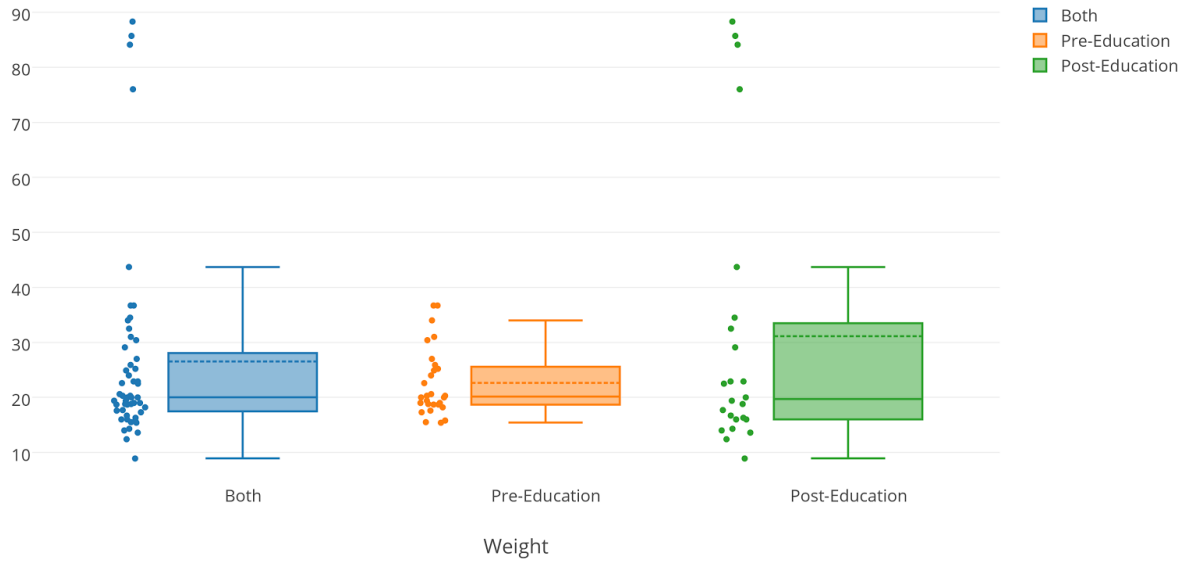




Fig. 4.3 Race Distribution – Pre-Intervention Group

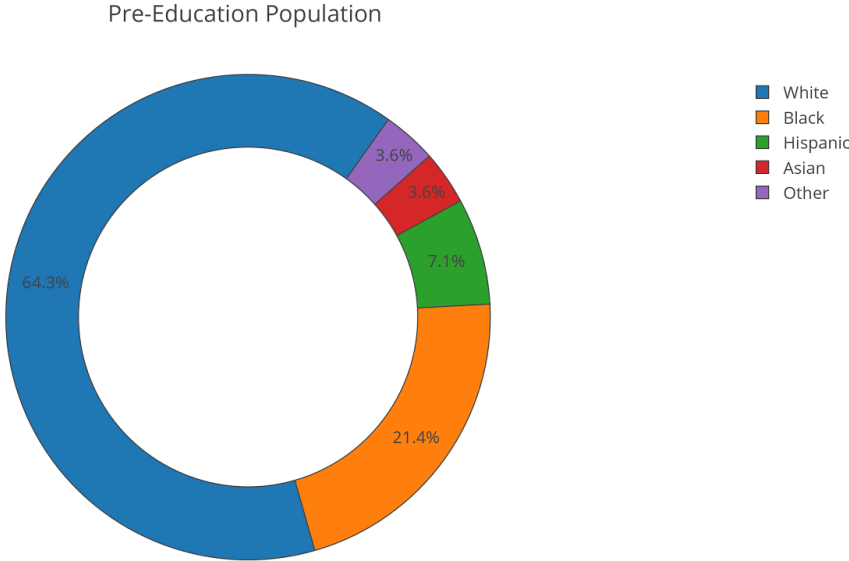


Fig. 4.4 Race Distribution – Post-Intervention Group

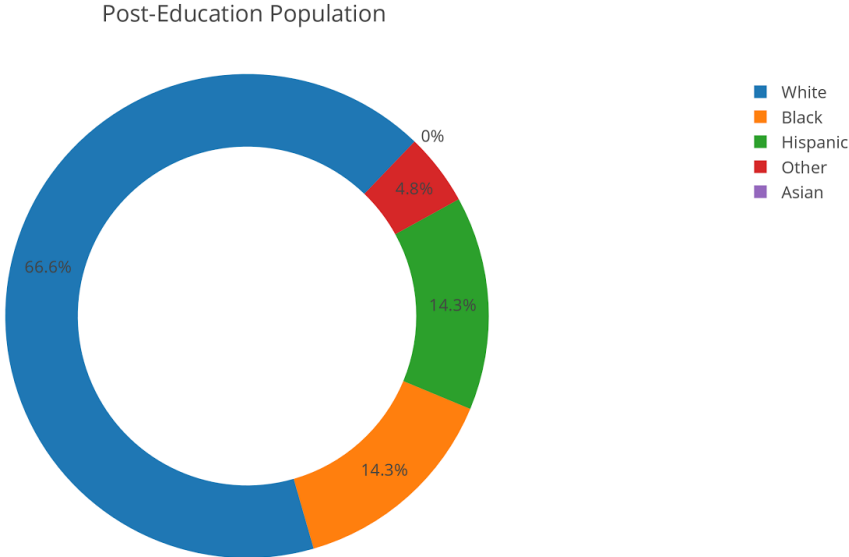
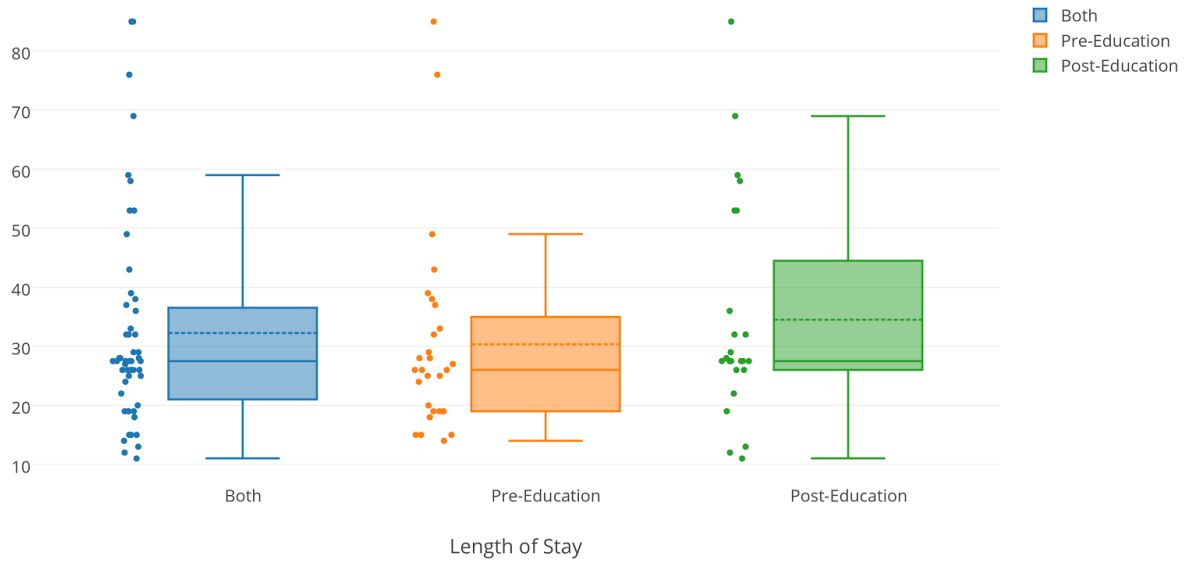


Fig. 4.5 Length of Stay Distribution



component rating scale based on a nurse evaluation of a child's behavior. The components include: The child makes eye contact with the caregiver, the child's actions are purposeful, the child is aware of his/her surroundings, the child is restless, and the child is inconsolable. The child was given a score between zero and four with the first three items requiring reverse scoring. Scores on each item are summed to obtain a total PAED score. The threshold score for the presence of ED was greater than or equal to 10. The reliability of this instrument was determined in a previous study using one-way analysis of variance random effects model (Sikich & Lerman, 2004). The reliability of the scale was measured at 0.84 with a 95% confidence interval. Five of the 27 items that satisfied the content validity and statistical analysis make up the PAED scale. Three hypothesis supported the validity of the scale: scores correlated negatively with age and time to awakening and scores were greater after sevoflurane anesthesia than halothane. A PAED score of 10 or greater corresponds to a sensitivity of 0.64. These results support the reliability and validity of the PAED scale in measuring ED.

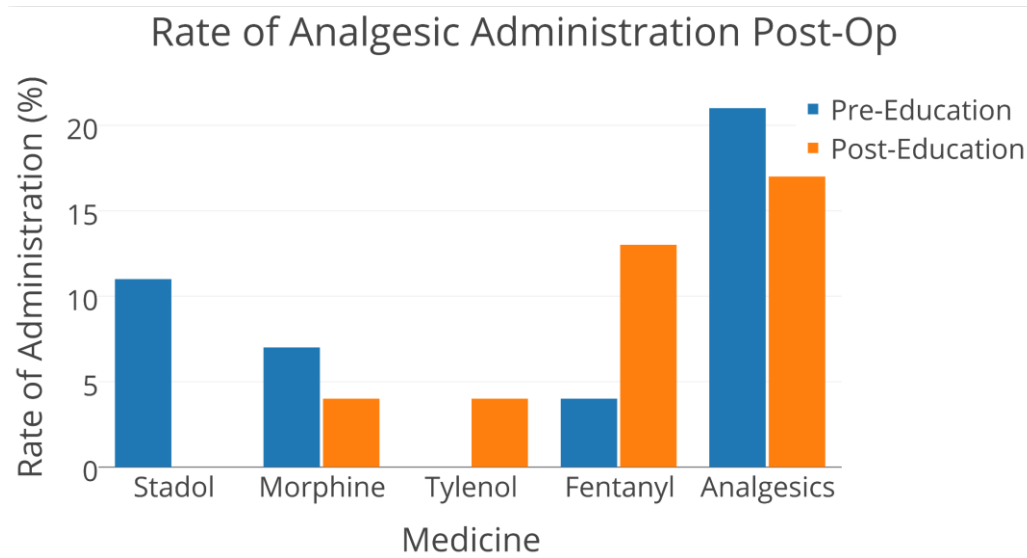
A Cronbach's alpha analysis was performed for the PAED assessment scale used in this project. Cronbach's alpha provides a value that indicates the overall reliability of a measure. The acceptable values for the Cronbach's alpha are 0.7 to 0.8, lower values are indicative of lower reliability. The Cronbach's alpha for the PAED assessment scale for this EBP project was 0.902 which demonstrates internal consistency of the scale used.

**Changes in Outcomes.** The PICOT question for this EBP project was, "For registered nurses working in a post-anesthesia care unit, will providing emergence delirium education affect their usage of analgesics, compared to standard practice, over a 12-week period?" Chart reviews of 52 patients were completed to measure analgesics administered in pre-intervention and post-intervention groups. The SPSS statistical software and Excel programming were utilized to perform statistical analysis of the data. The level of measurement of the data analyzed is a combination of nominal, ratio, and ordinal data. The data was analyzed using

descriptive statistics in the measure of frequency and Pearson's correlation. Variables were labeled for the medications administered as follows: sedatives (versed), anesthesia-inhalation (desflurane, sevoflurane), anesthesia-intravenous (propofol), steroid (decadron), analgesic (stadol, morphine, tylenol, meperidine, and fentanyl), anti-nausea (ondansetron), and anti-cholinergic (glycopyrroate).

The primary outcome measured was the number of times, or the rate, in which PACU nurses administered analgesics in the PACU. This rate declined from 43% (n=12) to 33% (n=8) between pre-intervention and post-intervention groups (See Fig. 4.6). The two-tailed Z-Score for this change is 0.7037 and the p-value is 0.48392. The change was not statistically significant at  $p < 0.10$ . The overall rate of all analgesics administered declined following the educational intervention. The frequency of analgesics declined among all analgesics with the exception of fentanyl and tylenol, which both increased. The rate at which fentanyl was administered increased from 4% (n=1) to 13% (n=3) between pre-education and post-education. This is a 9% change. The two-tailed Z-Score for this change is -1.2045 and the p-value is 0.23014. The change is not statistically significant at  $p < 0.10$ . The rate at which stadol is administered post-surgery decreased from 11% (n=3) to 0% (n=0) between pre-education and post-education. The two-tailed Z-Score is 1.6519. The p-value is 0.09894. The result is significant at  $p < 0.10$ . The rate at which morphine is administered post-surgery decreased from 7% (n=2) to 4% (n=1) between pre-education and post-education. The two-tailed Z-Score is 0.4589. The p-value is 0.64552. The result is not significant at  $p < 0.10$ . The rate at which acetaminophen is administered post-surgery increased from 0% (n=0) to 4% (n=1) between pre-education and post-education. The two-tailed Z-Score is -1.0907. The p-value is 0.27572. The result is not significant at  $p < 0.10$ . Demerol was not administered post-surgery.

Fig. 4.6. Rate of Post-Operative Analgesic Administration



A number of secondary outcomes were measured in comparison to PAED scores using the Pearson correlation coefficient. The Pearson correlation coefficient is used to measure the strength of a linear association between two variables, where the value  $r = 1$  means a perfect positive correlation and the value  $r = -1$  means a perfect negative correlation. The Pearson correlation coefficient (R) for the relationship between age and PAED score is -0.3408. Although technically a negative correlation, the relationship is weak (Fig 4.7). With a sample size of  $n=24$ , the p-value is 0.104038 and is not statistically significant at  $p < 0.05$ . The Pearson correlation coefficient (R) for the relationship between weight and PAED score was analyzed using the data of smaller children, with a weight of 30 pounds or below and resulted in a score of 0.6787, which indicates a moderately strong positive correlation (Fig. 4.8). With a sample size of  $n=17$ , the p-value is 0.00274 which is statistically significant at  $p < 0.01$ . The Pearson correlation coefficient (R) for the relationship between LOS and PAED score is 0.0575. Although technically a positive correlation, the relationship is weak (Fig. 4.9). With a sample size of  $n=24$ , the p-value is 0.789566 and is not statistically significant at  $p < 0.05$ .

In comparing PAED scores against type of procedure, scores were highest among tonsillectomy and adenoidectomy (T&A) procedures and lowest among bronchoscopy procedures (Fig. 4.10). Significant differences were found between the mean PAED scores of patients undergoing T&A compared to patients having a bronchoscopy; as well as patients undergoing T&A and patients have dental cleaning done (Table 4.4a and 4.4b). Mean PAED scores among racial groups demonstrated scores that were lowest among those of white race (Fig. 4.11). However significant differences were found between white patients and Hispanic patients (Table 4.5a and Table 4.5b).

Fig. 4.7 PAED score vs. Age

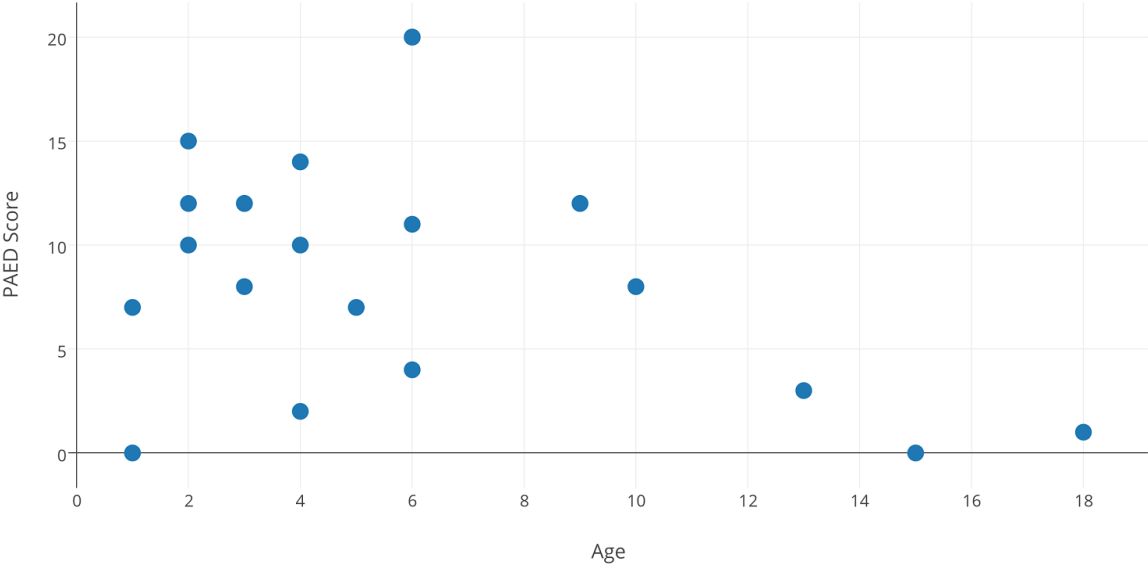




Fig. 4.8 PAED Score vs. Weight <= 30 pounds

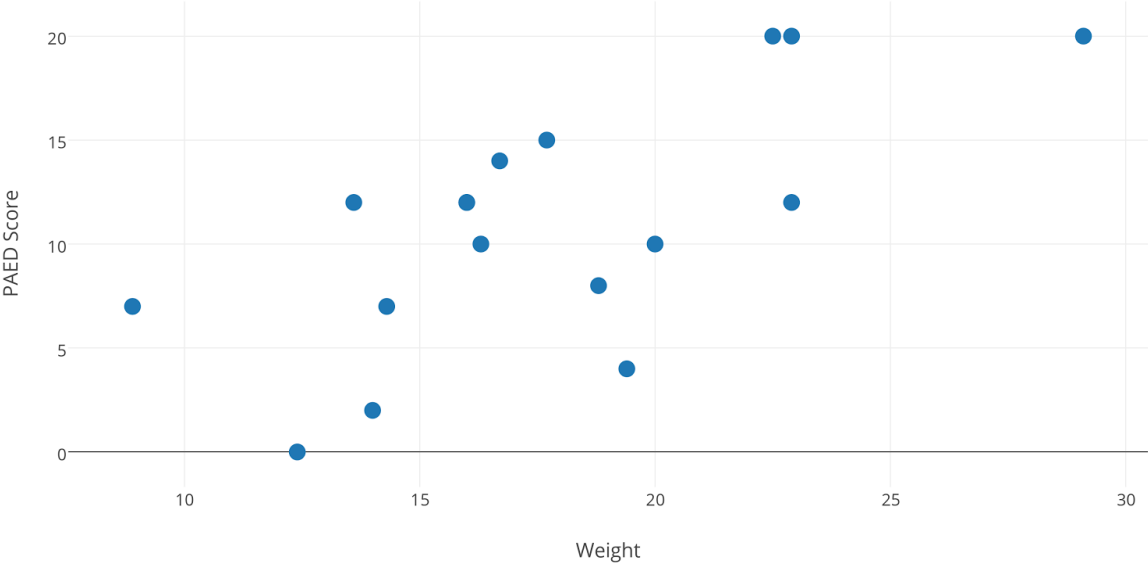


Fig. 4.9 PAED Score vs. PACU LOS

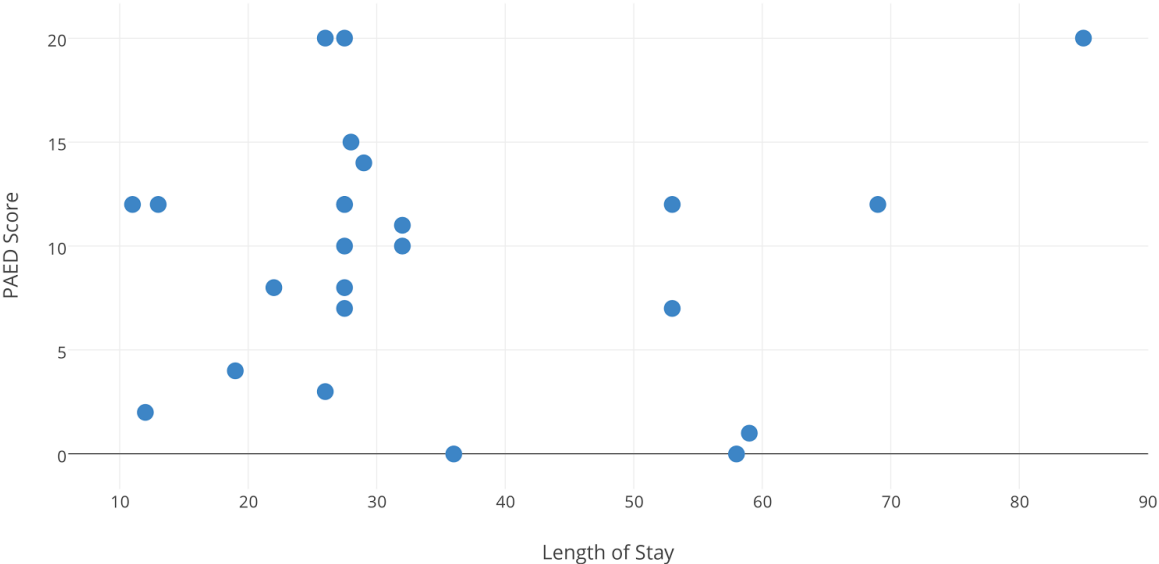


Fig. 4.10 PAED Score vs. Race

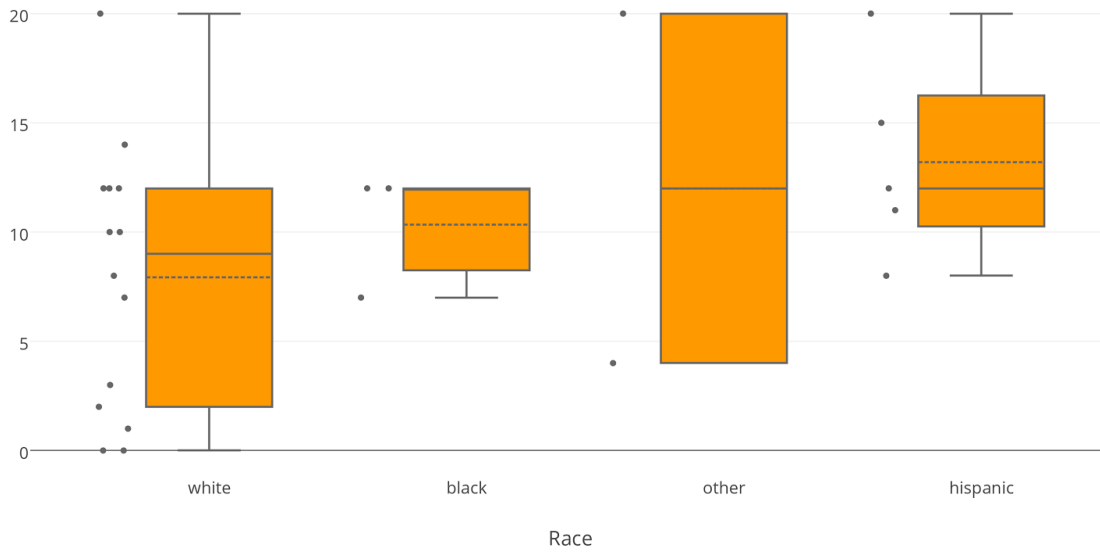


Table 4.4a PAED Score by Procedure

Procedure	Min	Max	Mean	Median	Std. Deviation
T & A*	11.00	20.00	14.50	12.00	4.28
Bronchoscopy	4.00	7.00	5.50	5.50	2.12
Dental Cleaning	2.00	15.00	10.25	12.00	4.30
Eye Resection	8.00	10.00	9.00	9.00	1.41

\*tonsillectomy and adenoidectomy

Table 4.4b PAED Scores by Procedure

	Tonsillectomy and Adenoidectomy (n=6, $\mu = 14.5$ )	Bronchoscopy (n=2, $\mu = 5.5$ )	Dental Cleaning (n=8, $\mu = 10.25$ )	Eye Resection (n=2, $\mu = 9$ )
Tonsillectomy and Adenoidectomy (n=6, $\mu = 14.5$ )	-	<b>The t-value is 2.75568. The p-value is .033043. The result is significant at <math>p &lt; .10</math>.</b>	<b>The t-value is 1.83375. The p-value is .091598. The result is significant at <math>p &lt; .10</math>.</b>	The t-value is 1.70639. The p-value is .13881. The result is not significant at $p < .10$ .
Bronchoscopy (n=2, $\mu = 5.5$ )	<b>The t-value is 2.75568. The p-value is .033043. The result is significant at <math>p &lt; .10</math>.</b>	-	The t-value is -1.46807. The p-value is .180271. The result is not significant at $p < .10$ .	The t-value is -1.94145. The p-value is .19171. The result is not significant at $p < .10$ .
Dental Cleaning (n=8, $\mu = 10.25$ )	<b>The t-value is 1.83375. The p-value is .091598. The result is significant at <math>p &lt; .10</math>.</b>	The t-value is -1.46807. The p-value is .180271. The result is not significant at $p < .10$ .	-	The t-value is 0.38999. The p-value is .706723. The result is not significant at $p < .10$ .
Eye Resection (n=2, $\mu = 9$ )	The t-value is 1.70639. The p-value is .13881. The result is not significant at $p < .10$ .	The t-value is -1.94145. The p-value is .19171. The result is not significant at $p < .10$ .	The t-value is 0.38999. The p-value is .706723. The result is not significant at $p < .10$ .	-

Fig. 4.11 PAED Score vs. Procedure

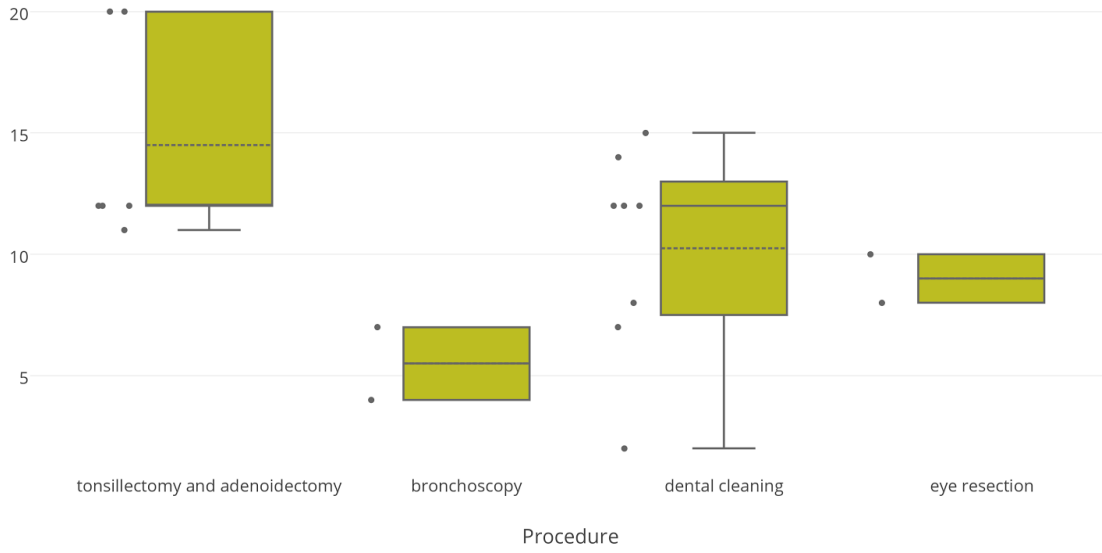


Table 4.5a PAED Scores by Race

Race	Min	Max	Mean	Median	Standard Deviation
White	0.00	20.00	7.93	9.00	6.04
Black	7.00	12.00	10.33	12.00	2.89
Hispanic	8.00	20.00	13.20	12.00	4.55
Other	4.00	20.00	12.00	12.00	11.31

Table 4.5b PAED Score by Race

	Black (n=3, $\mu$ = 10.33)	Hispanic (n=5, $\mu$ = 13.2)	White (n=14, $\mu$ = 7.93)	Other (n=2, $\mu$ = 12)
Black (n=3, $\mu$ = 10.33)	-	The t-value is -0.96408. The p-value is .372235. The result is not significant at $p < .10$ .	The t-value is 0.66026. The p-value is .519099. The result is not significant at $p < .10$ .	The t-value is -0.26292. The p-value is .809638. The result is not significant at $p < .10$ .
Hispanic (n=5, $\mu$ = 13.2)	The t-value is -0.96408. The p-value is .372235. The result is not significant at $p < .10$ .	-	<b>The t-value is 1.7665. The p-value is .095261. The result is significant at <math>p &lt; .10</math>.</b>	The t-value is 0.22089. The p-value is .833913. The result is not significant at $p < .10$ .
White (n=14, $\mu$ = 7.93)	The t-value is 0.66026. The p-value is .519099. The result is not significant at $p < .10$ .	<b>The t-value is 1.7665. The p-value is .095261. The result is significant at <math>p &lt; .10</math>.</b>	-	The t-value is -0.82072. The p-value is .425558. The result is not significant at $p < .10$ .
Other (n=2, $\mu$ = 12)	The t-value is -0.26292. The p-value is .809638. The result is not significant at $p < .10$ .	The t-value is 0.22089. The p-value is .833913. The result is not significant at $p < .10$ .	The t-value is -0.82072. The p-value is .425558. The result is not significant at $p < .10$ .	-



Overall, there was a decrease in overall analgesic usage, while the use of fentanyl and Tylenol increased. However, the only significant finding was the decrease in the amount of stadol administered. A statistically significant finding was found among PAED scores and weight equal or less than 30 pounds, demonstrating a moderately strong positive correlation. There was also significantly PAED scores among patients of Hispanic race compared to those of white race. A number of the significant findings of this study supported findings in the literature, while others did not.

## CHAPTER 5

### DISCUSSION

The purpose of this EBP project was to explore the impact of emergence delirium education on PACU nurses' administration of analgesics to pediatric surgical patients. The project was implemented at an outpatient surgical care unit setting to determine if an educational intervention, including risk factors, manifestations, and treatment options for ED, would impact nurses' behavior in regards to the frequency in which analgesics were administered. Explanation of the project findings and implications for future projects, along with the evaluation of the theoretical and EBP framework utilized to guide this EBP, is discussed.

#### **Explanation of Findings**

ED is well established in the literature as a common phenomenon in the post-operative period for pediatric surgical patients. Recommendations in the literature support identifying the occurrence of ED in order to appropriately manage it. There are confounding factors that make it difficult to differentiate ED from other causes of agitation in the post-operative period. Pain has been strongly implicated in the literature as being one of those confounding factors. Multiple assessment scales have been used to identify ED, few of which have been able to effectively differentiate between pain and delirium, as both present with similar characteristics (Nasr & Hannallah, 2011). Although treatment for ED involves the use of analgesics such as fentanyl, this type of medication should only be used for more severe presentations of ED. In mild cases, nonpharmacological methods to manage ED should be used, such as psychological support, comfort measures, and reuniting children with parents. There is evidence that demonstrate the variability in nurses' approach to patient assessments as well as management practices related to pain and delirium among pediatric patients (Voepel-Lewis, et al., 2005). This was evident in the clinical setting of the PACU in which this project was implemented. Prior to the project

implementation, assessing for ED was not a component of standard practice. A pediatric pain scale was used to assess pain and nurses were left to their own individual inferences of patient behavior to make clinical decisions regarding the administration of analgesics within an order set provided by an anesthesiologist. Sikich and Lerman's (2004) PAED scale was supported in the literature to be a reliable and valid rating scale and recommended for the clinical evaluation of ED in pediatric patients. Therefore, the educational intervention for this project included instruction on the use of this scale.

Following the intervention, participant nurses demonstrated proper utilization of the assessment tool. Of the 14 PACU nurses who attended the educational presentation, only 5 participated in assessing patients for ED using the PAED scale during implementation of the project. The low number of nurses completing the assessments is a contributing factor to the small sample size for this project.

A possible explanation for the low compliance among nurses in assessing patients for ED may have been related to time constraints in the PACU. The average length of stay in the PACU is between 30 and 60 minutes. Nurses are expected to assess hemodynamic stability, manage pain control, and document findings in this limited amount of time. Although the PAED scale has only five behaviors to assess for in a child, there are competing tasks nurses need to accomplish in a short time frame. Therefore, completing and documenting an assessment for ED may have been challenging due to the rapid flow of this particular unit. An attempt was made to incorporate the PAED scale into the electronic medical record, however it was not approved by administration to do so within the time frame of the project's implementation. Having a prompt on the electronic medical record where nurses are already documenting other information may have improved the ease of use and helped compliance among nurses in using the assessment tool.

Another possible barrier to implementing the use of the assessment tool into standard care was the resistance to change current practice among nurses. The majority (over 75%) of nurses had over five years of experience in the PACU and over 15 years of general nursing experience. The high level of experienced nurses involved in this project may have affected how readily they would accept a new approach to care. While clinical decision-making skills are gained from education and training, it is also heavily influenced by experience. Experienced nurses may rely more on previous experiences to rule out problems rather than new tools they have no experience with. This project was presented to the nurses as a pilot project as opposed to a change in policy. This also may have been a barrier for nurses. Although encouraged by the clinical site facilitator, it was not mandatory and therefore may have been perceived as optional for the nursing staff to complete.

The time frame of data collected after the intervention was six weeks. The OSC PACU unit on average recovers six pediatric patients emerging from general anesthesia a day. Because the unit is closed on the weekend, with the exception of emergent cases, thirty days would have been available to assess patients during the implementation period, for a total of approximately 180 patients. Following the educational intervention, PACU nurses assessed 24 pediatric surgical patients. Of the 24 patients that were assessed for ED after the implementation of the project, 15 were found to have a PAED score equal to or above 10 indicating the presence of ED. According to the literature, ED ranges from 25-80%, depending on the definition used to measure it (Sikich & Lerman, 2004). The incidence in this study was 63% which is consistent with the incidence of ED as reported in the literature.

The principal outcome measured for this EBP project was nurses' administration of analgesics to pediatric surgical patients. This rate declined from 43% (n=12) to 33% (n=8) between pre-intervention and post-intervention groups, however, the decrease was not statistically significant ( $p < 0.10$ ). Although the overall rate of analgesics declined, the use of

fentanyl and acetaminophen increased. Among the literature, fentanyl was repeatedly found to be an effective treatment for ED. This treatment option was discussed in the educational intervention and this may explain why the increase in fentanyl administration, although the increase was not statistically significant. Another point highlighted in the educational intervention was the potential for mistaking manifestations of ED for pain and the consequent inappropriate treatment. This may explain the significant decrease in the use of *stadol*. Furthermore, a possible explanation for the increase in acetaminophen administration could be that nurses were more aware of the possibility of overmedicating and chose a less potent analgesic to manage pain to avoid administering unnecessary narcotics.

It was evident in the literature that ED occurs more frequently in pediatric patients, particularly those of preschool age due to their vulnerability of being easily confused and frightened by unfamiliar experiences and surroundings (Vlajkovic & Sindjelic, 2007). In a study by Gooden et. al. (2013), 26% of patients aged 3 to 6 years experienced ED compared to 10% of patients aged 7 to 10 years. Data analysis for this project showed no statistically significant association between age and PAED score ( $p = -0.3408$ ). However, the highest scores among assessed patients were demonstrated by children ages 2 to 6 years of age. Therefore, the association from this aspect is consistent with the literature. The evidence in the literature supported several factors that influence the occurrence of ED, such as type of anesthesia administered, intraoperative medications administered, and anxiety level of the patient. These factors were not accounted for in this project and may explain the lack of significance in this finding. Another possible explanation for the lack of significant findings is the small sample size included in the project. Another potential cause to this variance may be that children with developmental challenges were not excluded from this project. A child with developmental delays may exhibit characteristics of a younger child despite being older than preschool age. Many children who have developmental delays require general anesthesia for routine dental

procedures. In the clinical site where this project was conducted, the majority of the procedures included in this study were dental cleanings and restorations. Therefore, patients with developmental delays were likely to have been among the included cases and may have influenced the results of this study.

Additionally, weight was also considered as a possible influencing factor for the development of ED. Limiting the data to only subjects with a weight of 30 pounds or below, there is a moderately strong positive correlation ( $p = 0.00274$ ). This was an unexpected finding because no evidence in the literature supported a correlation between weight and the incidence of ED. Potential reasons for this finding may be related to the correlation between age and the incidence of ED. Because ED occurs more often in preschool age children, who on average weigh in the range of 20 and 30 pounds, this correlation may be similarly linked.

Another secondary outcome analyzed was the relationship between the LOS and PAED score. Despite the absence of a correlation, the findings of this project demonstrated a weak, positive relationship between the LOS and PAED score ( $p < 0.789566$ ). Although not statistically significant, this finding is consistent with evidence in the literature that suggest the incidence of ED is associated with increased LOS in the PACU (Bong & Ng; Gooden, Mohkamar; Voepel-Lewis;). Prolonged recovery times have been described in the literature to be related to removal of intravenous lines, increased bleeding at the surgical site, and removal of surgical dressings among children with ED. Reasons for increased LOS were not explored in this project, however should be considered for future study.

The literature also supports that head and neck surgeries are associated with an increase occurrence of ED. In a study by Voepel-Lewis, et al. (2003), otorhinolaryngology procedures were shown to be an independent risk factor for ED. Within the findings of this project, patients undergoing tonsillectomy and adenoidectomy ( $n = 7$ ) surgeries had a mean

PAED score of 14.5. Patients undergoing other procedures had significantly lower mean PAED scores. This finding is therefore consistent with the literature in that higher PAED scores were associated with surgeries in the head and neck region.

Another result from this project associated higher PAED scores with being of Hispanic race. There was no evidence in the literature to support this. However, a possible reason for this may be linked to anxiety being a known risk factor for ED. If the primary language spoken in a home where English is not the primary language, it may be possible that preschool age children in these homes may have increased anxiety during their perioperative experience and therefore may be at higher risk for developing ED. Further study is warranted to determine if such a link exists.

### **Applicability of Theoretical Framework**

The theory selected to guide this project was Ida Jean Orlando's Nursing Process Discipline. This theory was selected because of its foundation in the patient-nurse interaction. In this theory, a patient who is in distress has a need that has not been met. The function of a nurse is finding out and meeting the patient's immediate need. A behavior from the patient invokes an immediate response from the nurse to directly assist a patient in order to relieve or diminish the patient's suffering (Petiprin, 2015). However, the patient's behavior may not represent the true need. From an exchange of reactionary responses, whether through verbal or nonverbal communication, the nurse is able to ascertain the patient's need and appropriately meet that need. The nurse then reevaluates the patient's need based on the patient's behavior. The outcome is based on a change in the patient's behavior indicating either relief from distress or an unmet need. This theory involves an investigation into a patient's behavior using the nursing process.

This theory was applicable to the implementation of this project because of its emphasis on the process of care in an immediate experience. In the PACU, the patient's behavior is

observed in order to identify the immediate needs of the patient. The effects of anesthesia compromise a patient's ability to verbally express his or her needs, and nonverbal behavior needs to be interpreted by the nurse. According to Orlando's theory, the behavior may not effectively communicate the needs of the patient and may lead to misidentification of the need by the nurse. Likewise, behavior of a patient with ED emerging from anesthesia is similar to and therefore can be mistaken for pain. Therefore, the nurse cannot assume the patient's need, but uses a disciplined process to identify it, such as a tool to differentiate ED from pain. For this project, the PAED scale was that tool and allowed the nurse to respond logically rather than intuitively. Appropriately identifying the occurrence of ED allowed the nurse to make an informed decision regarding how to effectively manage the needs of the patient. This theory helped guide the EBP project to better equip nurses to interpret patient behavior in order to determine the needs of the agitated child emerging from anesthesia.

### **Strengths and Limitations to the Theoretical Framework**

A strength in Orlando's Nursing Process Discipline theory for this project is its applicability to the PACU setting. The focus is to observe the patient's behavior in order to understand the patient's immediate need and treat appropriately. The use of this process avoids inaccurate diagnosis and ineffective treatment plans by using the PAED scale, a reliable and valid tool, to distinguish ED from other causes of agitation. The frequent assessments performed by the nurse in PACU are necessary to explore the patient's reactions to the care that is provided. Reevaluation of patient behavior allows the nurse to evaluate the outcome of the intervention.

A limitation of this theory is that it does not consider other environmental factors in the exchange process. The many distractions of the PACU setting may interfere with the nurse-patient exchange. Distractions such as interruptions to care by the patient, such as pulling on lines, surgical dressings, and monitoring equipment. Nurses also have to monitor the hemodynamic stability of the patient while assessing for behavioral patterns associated with ED.



Documentation and general nursing care activities must be done simultaneously while assessing for ED and reevaluating after care is provided, all during an average LOS of 30-60 minutes. The method of exchanges suggested in this theory is limited within the time allotted in the PACU.

### **Applicability of EBP Model**

The Iowa Model of Evidence-Based Practice was used as a framework for this EBP project. The model begins with identifying a problem-focused trigger or a knowledge-focused trigger that initiates a need for change. If the organization identifies this change as a priority, a team involving stakeholders is formed. After gathering and critiquing relevant literature and identifying the evidence that supports the change in practice it must be determined whether the evidence is a sufficient research base to continue with the change in practice. A pilot of the change is recommended before a decision is made to adopt it into practice. In piloting the change, an EBP guideline is developed and implemented. An evaluation of the processes and outcomes is made to determine if modifications to the practice guidelines are needed. Lastly, the change is instituted into practice, monitoring and analyzing outcome data is performed, and the results are disseminated (Titler, et al., 2001).

In this EBP project, a problem focused trigger was identified when the project leader observed frequent occurrences of ED among pediatric surgical patients and variances in the approach of care for these patients among PACU nurses. Further discussions with the management team of the department confirmed that the problem would be a priority for the organization because of its alignment with the organization's goal to expand and improve surgical services to pediatric patients and their families. A team of key stakeholders, such as the director, manager, and educator for the unit, an informatics RN, and a child life specialist, were involved in the plan of making the change. The project leader reviewed relevant literature and identified the evidence that supported the change. After critical analysis of the evidence an EBP

guideline was developed, consisting of an educational intervention on ED for nurses and instructions on the use of the PAED scale as well as a cue card to promote its use. Before implementation, key stakeholders agreed to the planned intervention and a decision was then made to implement the change into practice. Baseline data was collected and included the frequency of analgesic administration by nurses in the PACU as well as other secondary outcomes. The project was then implemented in the PACU of the selected clinical site and results were compared to baseline data. Evaluation of the outcomes were determined by reviewing frequency of use of PAED scale and changes to the frequency of analgesic administration by PACU nurses to pediatric patients.

### **Strengths and Limitations of the EBP Model**

The Iowa Model involves selecting a change that is in alignment with the organization as a whole. This feature of the model was ideal for this project because it provided the necessary framework for the process of implementing a needed change in the current practice. The Iowa model was effectively applied to the problem-focused trigger, which was the lack of standardization in identifying ED and the variance among PACU nurses to treating ED. The process of implementing the project naturally fit into the process suggested by the model. A modification was made to the location and timing of the intervention. Originally the educational presentation was to be presented at a regularly scheduled staff meeting. However due to time constraints and lack of staff attendance in the staff meetings, arrangements were made to present the educational material to nurses directly on the unit. This modification allowed more accessibility to nurses and supported attendance of the presentation. Although participation in attending the presentation was excellent, compliance in the use of the assessment tool was lacking. A weakness to the model is the lack of detail in guiding the implementation process, such as the process of identifying and managing barriers to implementation that might exist. A modification needed if the project was repeated would include more frequent monitoring of

nurse utilization of the tools and explorations into the barriers that existed in using the tool. More focus on methods to break through these barriers would have been an improvement to this project's implementation. A longer implementation and evaluation time period would also be considered in modifying this project in the future.

### **Strengths and Weaknesses of the EBP project**

A strength of the project was the high volume of pediatric surgical cases available for study in the clinical site selected. The facility provided extensive surgical services to pediatric patients with future goals of expansion. This provided a wide range of surgical cases and great potential to improve the practice of care for this population group. The support given by the administration of the unit was also a great strength. The cooperation and insight of the administration into the dynamics of the unit was essential and made the implementation of this project possible. The project leader's interaction with staff and knowledge of both the unit practices and the literature on the subject of the practice change needed also helped the implementation of the project. A weakness in the project was the lack of the interaction between leaders and the nurses. Although the administrative leaders were supported and involved in the planning of the project, they were less involved and less visible during its implementation. This may have affected the nurses' views of the importance of the change itself and their role in the change. Direct interaction with the administrative leaders, the project leader, and the nurses would have been more effective in engaging nurses in implementing the change of this project. Another weakness of the project was the barrier of not having the assessment tool as part of the electronic health record. Having the PAED scale listed among the other assessments nurses were already documenting on would have improved compliance with its use. Another weakness to the project was the lack of involving more stakeholders. The inclusion of anesthesiologists in developing a guideline for the treatment of ED would have provided nurses a more standard approach to direct their decisions regarding how to appropriately manage the occurrence of ED.

This project would have also benefited from a larger sample size and more baseline data. It would have been beneficial to identify PAED scores before implementation to compare with scores and treatment offered after implementation.

### **Implications for the future**

**Practice.** ED is well documented in the literature as being a common phenomenon.

Although the exact mechanism behind ED remains unclear, there is sufficient evidence to identify and manage it. By implementing what is shown in the literature about ED into nursing practice, nursing care to pediatric surgical patients can be improved. If nurses are able to recognize ED, using a reliable standardized tool, such as the PAED scale, they can determine the severity of ED the child is experiencing and make a more informed choice as to how to best manage it. In a unit where the occurrence of ED is seen on a regular basis, the implementation of a protocol can help develop nurses' clinical skills and avoid misjudgments about a child's behavior on emerging from anesthesia. APNs are leaders in the field of nursing and help to evolve nursing practice. APNs are essential in facilitating the transition of research into practice through the development and implementation of such evidenced-based protocols. APNs are needed to improve the standard of care through the identification of and continued pursuit of discrepancies in the quality of care such as the variances in the treatment for ED. The focus on objective data rather than subjective data can be further analyzed and contribute to the process of implementing evidence-based practices into the field of nursing.

**Theory.** Theory gives nurses a sense of identity by focusing on their unique purpose and role in the healthcare setting. The use of theory in nursing is essential in providing direction for nursing practice. For this project, using Orlando's Nursing Process Discipline Theory helped to guide the assessment, intervention, and evaluation of nursing care. The Iowa EBP Model for this project provided a systematic approach to identifying questions for study, reviewing evidence, interpreting findings, and validating nursing interventions. This project focused on

identifying and managing ED. The findings of this project supported the prevalence of ED in pediatric patients and the impact of nursing education on treatment approaches. Since this population is vulnerable to this phenomenon, approaches to care should focus on the unique characteristics of children. Among the causes of ED in the literature, preoperative anxiety, also common among children, was prevalent in the development ED. Further theory development is needed for a more preventative approach to nursing care for patients at risk of developing ED. Future theory development must include a holistic approach to preventative care that encompasses influences such as the child's family, prior experience, and environmental factors. Further theory on nursing's role in addressing preoperative anxiety, and consequently preventing ED, is needed to continue the progress in caring for this special population group.

**Research.** The focus of this EBP project was on ED education for PACU nurses and their use of analgesics in pediatric patients. In the PACU setting where this project took place, nurses are commonly left with a standing order for titration of analgesics and other medications as needed. Decisions to administer these medications are made at the discretion of the nurse in adherence to the anesthesiologist's orders. The assessment and treatment decisions is part of a complex process with multiple sources of knowledge. Benner's Novice to Expert Theory describes the different stages of this complex process through the professional development of nurses. In her description, novice nurses use learned rules to guide analyses, action, and intervention and move toward expert practice, where a broad, complex understanding of situations gained through clinical experience often guides decision-making processes (Voepel-Lewis et al., 2005). Therefore, among the several factors that may influence a nurse's decision to medicate a child that is perceived to have ED, experience plays a key role. Voepel-Lewis et al. (2005) states that clinical decision-making among nurses is framed by education and theory, but is largely dependent upon experience. Further research is needed to evaluate the clinical

decision-making process of nurses in administering medications in the immediate post-operative period to explore possible ways to improve that process.

In a study by Voepel-Lewis et al. (2005), an algorithm based on real PACU nursing experience and observations was developed to guide the management of agitation among pediatric patients in the PACU setting. The algorithm involves a thorough assessment and targeted nursing interventions to care for the agitated child. Further study on the effectiveness of such an algorithm would be necessary before its implementation into practice. Among the literature there was no absolute resolution in treating postoperative agitation with specific pharmacological interventions, suggesting that ED is a complex phenomenon with many contributing factors and etiologies. Likewise, the treatment for ED is a complex process that requires further study.

**Education.** Education is a fundamental piece in treating patients with ED. ED education is necessary for all team players involved with care of the pediatric patient. Preoperative nurses, anesthesiologists, PACU nurses, and parents all need to be informed of the potential development of ED in order to best manage it. Although ED is usually self-limiting it has the potential to cause complications that can be avoided. Knowledge of risk factors, symptoms, treatment for ED can help all members of the healthcare team prepare for its occurrence. A child's perioperative experience may have residual effects on a child's perception of healthcare in the future. APNs can play a prominent role in forming a positive and trusting relationship between the pediatric patient and the healthcare team by preparing both through education.

Each role the APN plays, whether as a practitioner, theorist, researcher, or educator, there is more that can be improved, developed, discovered, and disseminated throughout the field of nursing. There will always be future implications in the unique care needs of patients as healthcare is constantly evolving. APNs play an important role in pursuing these implications.

## CONCLUSION

The development of ED in the immediate post-operative period continues to be a common occurrence among pediatric surgical patients emerging from general anesthesia. Although its underlying cause remains unknown, age, preoperative anxiety, anesthetic techniques or agents, surgical procedure, pain, and the use of adjunctive medication have all been suggested to play a role in its development. ED is also known to cause several complications such as injury to the patient and staff, disturbance of the surgical site, delayed discharge, parental dissatisfaction, and unnecessary administration of analgesics. It has been observed and supported in the literature that there are variances in the methods used to treat ED among nurses in the PACU setting. This EBP project sought out to answer the PICOT question “For registered nurses working in a post-anesthesia care unit, will providing emergence delirium education affect their usage of analgesics, compared to standard practice, over a 12-week period?” The findings of this project demonstrate that ED education offers limited support in influencing PACU nurses’ usage of analgesics. PACU nurses’ knowledge of the phenomenon, use of a valid and reliable assessment scale, and effective treatment options may help to provide appropriate care of this vulnerable population group. ED continues to be a complex phenomenon and the influence of ED education on its management remains open to further investigation.

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## **BIOGRAPHICAL MATERIAL**

### **Melinda C. Nwanganga**

Melinda began her career in healthcare when she was sixteen years old volunteering at a hospital in Cleveland, Ohio. She then moved to Berrien Springs, Michigan and attended Andrews University where she graduated with a Bachelor of Science degree in Nursing. Melinda began her first nursing job on a stepdown telemetry unit at Memorial Hospital of South Bend and continues to work at Memorial in the post-anesthesia care unit. She has also worked as an agency nurse working on medical surgical units in rural community hospitals in northern Indiana. After 12 years in acute care nursing, Melinda decided to further her education by pursuing a Doctorate of Nursing Practice (DNP) degree at Valparaiso University. She is a member of Sigma Theta Tau and the American Association of Nurse Practitioners. Through experiences during her undergraduate and graduate training, her nursing career, and her own family background, she has developed an interest in providing care for underserved communities. As a family nurse practitioner, it is Melinda's goal to have a positive and significant impact on the nursing profession through improving current health care disparities by providing quality care to underserved patient populations.

**ACRONYM LIST**

ASA: American Society of Anesthesiologists

CI: confidence interval

EA: emergence agitation

EBP: evidence based practice

ED: emergence delirium

ENT: ear, nose, and throat

FLACC: Face, Legs, Activity, Cry, and Consolability

JBI: Joanna Briggs Institute

LOC-RASS: Level of Consciousness-Richmond Agitation Sedation Score

LOS: length of stay

mYPAS: Modified Yale Preoperative Agitation Scale

NIH: National Institute of Health

OSC: outpatient surgery center

PACU: Post Anesthesia Care Unit

PAED: Pediatric Anesthesiologist Emergence Delirium

RCT: randomized controlled trial

SPSS: Statistical Package for the Social Science

T&A: tonsillectomy and adenoidectomy