SIGNIFICANCE OF CAPNOGRAPHY IN PEDIATRIC POST ANESTHESIA CARE

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Deborah Renee Whitley

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Lynchburg, VA

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Scholarly Project Chair Approval:

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DNP, FNP-BC, A.A.C.C. Date

ABSTRACT

Updated clinical guidelines and professional practice standards for pediatric post-anesthesia care call for the use of capnography until the patient is awake. The purpose of this project was to champion the implementation of capnography in the pediatric post-anesthesia care unit at the project site. Monitoring capnography in addition to pulse oximetry for all pediatric post-anesthesia patients until awake was the practice change implemented. Capnography led to an increase in the number of appropriate respiratory-related nursing care interventions provided, earlier response to changes in respiratory status, and a decrease in the pediatric post-anesthesia care unit length of stay. The implications for practice include increasing the efficiency and effectiveness of nursing care as well as increasing the affordability of healthcare in the pediatric post-anesthesia care unit.

Keywords: capnography, pediatric, post anesthesia, PACU.

Dedication

This manuscript is dedicated to Jesus Christ, my Lord and Savior, and to my supportive family. I am grateful to the Lord for the gift of learning and the privilege to attend a university dedicated to His service. I am grateful for my loving husband who supported my efforts and encouraged me to keep going. I am grateful for my children who believed in me and would tell me regularly that they were proud of me. I am grateful for my parents who love me and affirm my accomplishments.

Acknowledgments

I would like to acknowledge Dr. Dorothy Murphy, my project chair, and the team members at the project site. Dr. Murphy was so attentive, instructive, and encouraging throughout this process. I am grateful for her oversight and patience throughout project development, implementation and completion. The pediatric post-anesthesia care unit team was amazing. I am grateful for their support, engagement, and acceptance of this practice change. I could not have done it without their support.

Table of Contents

List of Tables

List of Abbreviations

American Society of Anesthesiologists (ASA)

American Society of PeriAnesthesia Nurses (ASPAN)

Certified Registered Nurse Anesthetist (CRNA)

Doctor of Nursing Practice (DNP)

Electrocardiogram (EKG)

End Tidal Carbon Dioxide (EtCO2)

Evidence-Based Practice (EBP)

Institutional Review Board (IRB)

Laryngeal Mask Airway (LMA)

Monitored Anesthesia Care (MAC)

Non-OR Area (NORA)OR (OR)

Oral Endotracheal Tube (OETT)

Post-Anesthesia Care Unit (PACU)

Random Controlled Trial (RCT)

Serious Adverse Events (SAEs)

Statistical Package for the Social Sciences (SPSS)

SECTION ONE: SIGNIFICANCE OF CAPNOGRAPHY IN PEDIATRIC POST-ANESTHESIA CARE

Patient safety and promoting positive patient outcomes are priorities in healthcare for all patient populations. Pediatric anesthesia patients have unique risks, which require specialized care delivery. Kurth et al. (2014) reported the incidence of serious adverse events (SAEs) for pediatric patients in the post-anesthesia care unit (PACU) was 48 per 1000, and most were respiratory-related SAEs. Interestingly, the incidence was lower in the operating room (OR) at 31 per 1000 (Kurth et al., 2014). According to the American Society of Anesthesiologists (2015), capnography is a basic standard during the administration of anesthesia; however, nurses in pediatric PACU do not routinely monitor capnography. The purpose of this evidence-based practice (EBP) project was to champion the implementation of capnography in pediatric PACU, evaluate the impact on pediatric PACU nurses' recognition of respiratory depression compared to pulse oximetry and measure the effect on the number of respiratory-related SAEs in pediatric PACU.

Background

Pediatric patients admitted to the pediatric PACU at the project site are routinely monitored with continuous electrocardiogram (EKG) and pulse oximetry. A temperature is taken at PACU admission and discharge. Blood pressure and respiratory rate are taken and documented every 15 minutes until the patient is discharged. The pediatric PACU nurse's priorities are airway management, hemodynamic maintenance, pain control, and recognition of procedure-related complications. Recognition and management of respiratory depression is the primary nursing priority in pediatric PACU.

Langhan, Li, and Lichtor (2016) found 44% of SAEs occurring in pediatric PACU

patients were related to respiratory depression. Observation, counting respiratory rate, and continuous pulse oximetry are the assessments used to monitor for respiratory depression by the pediatric PACU nurses at the project site. Given the nurse's multiple responsibilities, continuous pulse oximetry is the primary measure that prompts response to respiratory depression.

Adequate respiration depends on ventilation and oxygenation. Pulse oximetry measures oxygenation, but it does not measure ventilation. Oxygen desaturation in an apneic pediatric patient may take at least one minute and may be prolonged up to four minutes if the patient is on supplemental oxygen (Langhan et al., 2016). Capnography measures end tidal carbon dioxide (EtCO2) production or ventilation, and research evidence repeatedly found and conveyed that respiratory compromise was detected sooner with capnography (Coates, Chaize, Goodman, & Rozenfeld, 2014; Conway, Douglas, & Sutherland, 2016; Cote & Wilson, 2016; Iyer, Koziel, & Langhan, 2015; Langhan, Kurtz, Schaeffer, Asnes, & Riera, 2014; Langhan et al., 2016; Langhan, Li, & Lichtor, 2017; Saunders, Struys, Pollock, Mestek, & Lightdale, 2017).

A discussion with nursing leadership at the project site revealed they were unaware updated clinical guidelines and practice standards recommended monitoring capnography in addition to pulse oximetry for pediatric PACU patients until awake. Also, nursing leadership communicated that capnography modules were purchased in 2017 for each room in pediatric PACU at the project site, but the modules had not been installed. According to nursing leadership, turnover in the unit educator position hindered implementation of this new patient care technology. New information regarding clinical guidelines and practice standard updates along with the occurrence of three pediatric cardiopulmonary arrests precipitated by respiratory failure in the pediatric PACU in 2018 increased nursing leadership's urgency to implement capnography. Current evidence and practice standard updates indicated capnography in the

pediatric PACU was needed to ensure patient safety and promote positive patient outcomes. This EBP project championed the implementation of capnography in the pediatric PACU.

Problem Statement

A review of evidence-based guidelines and practice standards revealed that capnography in pediatric PACU should be monitored in addition to pulse oximetry as an additional standard of care (American Society of Anesthesiologists, 2014; 2018; American Society of PeriAnesthesia Nurses, 2016). The problem was leaders of the pediatric PACU at the project site were unaware of the new evidence related to capnography. The organization spent $115,000 in 2017 to equip each room in the pediatric PACU with capnography modules but lacked awareness of updated evidence, and turnover in the unit educator position hindered implementation of capnography. Three cardiopulmonary arrests precipitated by respiratory failure occurred in the pediatric PACU in 2018. Monitoring capnography could have potentially prevented these arrests.

Purpose of the Project

The purpose of this EBP project was to champion implementation of capnography in pediatric PACU at the project site. Pediatric PACU nurses were educated on the principles of capnography. They were taught how to initiate capnography monitoring. Accuracy of capnography measurement and interpretation was verified for each nurse. Lastly, the impact of capnography on pediatric PACU nurses' recognition of respiratory depression compared to pulse oximetry and the effect on the number of respiratory-related SAEs was measured.

Clinical Question

For PACU nurses who monitor respiratory status for pediatric patients, does capnography compared to pulse oximetry result in earlier recognition of respiratory depression and fewer respiratory-related SAEs?

SECTION TWO: LITERATURE REVIEW

When a trigger is recognized and the clinical question is formed, conducting a literature review follows to determine if sufficient evidence for translation exists to develop a practical intervention (Melnyk & Fineout-Overholt, 2015). This section will present the search strategy and literature review conducted for this scholarly project. An appraisal and synthesis of nursing research containing the strongest and most relevant evidence was completed. The conceptual model that guided application of this evidence to practice will be described followed by a summary of how the research informed an applicable evidence-based intervention to address the clinical question.

Search Strategy

A Boolean search using the keywords pedi* and capnography OR end tidal OR EtCO2 was conducted. An EBSCO search for peer-reviewed literature published in English between January 2014 and February 2019 using these search words was conducted using the following databases: CINAHL, MEDLINE, and Health Source: Nursing/Academic Edition. This search produced 199 results, and 156 remained after exact duplicates were identified and removed. A manual review of article titles and available abstracts led to the selection of 22 articles. Studies using capnography to test other variables or studies comparing different types of capnography for equipment performance were excluded. Quality improvement, EBP, and editorial articles were also excluded. As a result, five articles, including one clinical guideline and four research studies, were included.

Additionally, a search of PubMed for peer-reviewed literature published between January 2014 and February 2019 using pediatric and capnography as keywords yielded 96 articles. After scanning article titles and available abstracts, the project leader identified four additional articles.

After reviewing full-text, the project leader determined one article was not research; therefore, three articles from this search were included. A search of the Cochrane Library and the Joanna Briggs institute did not yield additional articles. A focused Internet search for professional practice guidelines and standards published by the American Society of Anesthesiologists (ASA) and the American Society of PeriAnesthesia Nurses (ASPAN) was conducted, and three relevant resources published after January 2014 were identified. One clinical practice guideline and one practice standard published by the ASA were included, and one practice standard published by ASPAN was included.

Critical Appraisal

Evidence examined included two clinical guidelines, two systematic reviews of randomized controlled trials (RCT), one single RCT, four non-experimental studies, and two professional practice standards. The articles are grouped and appraised from highest to lowest level of evidence consistent with Melnyk and Fineout-Overholt's (2015) descriptions categorizing evidence. A table of evidence arranged from highest level of evidence to lowest appraising the articles individually was compiled (see Appendix A for evidence table). Lastly, a collective appraisal of evidence will be provided in this section.

Two clinical guidelines representing Level 1 evidence were included and appraised. One clinical guideline was developed as a collaborative effort between the American Academy of Pediatrics and the American Academy of Pediatric Dentistry to provide a uniform, evidence-based standard of care for pediatric patients being sedated in any setting (Cote & Wilson, 2016). This guideline expires every five years, and this guideline update emphasized the necessity of capnography post sedation until the pediatric patient awakens (Cote & Wilson, 2016).

The second clinical guideline represented a multidisciplinary collaborative effort between six professional medical associations and defined parameters for sedation of adults and children in any setting (American Society of Anesthesiologists, 2018). This guideline was an update to a previous guideline, and the addition of capnography with recording every five minutes until the patient awakens was one of the seven new recommendations (American Society of Anesthesiologists, 2018). The clinical guidelines do not contradict; however, the process used to develop the clinical guideline published by the ASA was more transparent and defined compared to the other.

Two systematic reviews of RCTs representing Level 1 evidence were included and appraised. Each study evaluated the evidence of capnography's use after sedation to prevent hypoxemia and reduce SAEs (Conway et al., 2016; Saunders et al., 2017). The studies reviewed by Saunders et al. (2017) included all studies reviewed by Conway et al. (2016); however, the systematic review conducted by Saunders et al. included seven more RCTs. The systematic review conducted by Conway et al. was neither as thorough nor as detailed as the review conducted by Saunders et al. Conway et al. found capnography reduced hypoxemia but was unable to link capnography to better outcomes. Saunders et al. found capnography reduced mild desaturation by 30% and severe desaturation by 40%, and they concluded that capnography monitoring until the patient awakens reduced SAEs by 50%.

One RCT representing Level 2 evidence was included and appraised. This capnography study was conducted in a pediatric PACU and evaluated the sensitivity of capnography compared to pulse oximetry to detect respiratory depression (Langhan et al., 2017). Capnography detected apnea in 29% of the sample; however, this respiratory status change was not captured by pulse oximetry (Langhan et al., 2017). Capnography has reportedly reduced the

occurrence of SAEs in the OR by 50%, and nearly one-third of the study sample in pediatric PACU had a decrease in respiratory status that was not detected with pulse oximetry (Langhan et al., 2017). Capnography in pediatric PACU demonstrated greater sensitivity to changes in respiratory status than pulse oximetry, and capnography was recommended to improve patient safety and decrease SAEs (Langhan et al., 2017). One weakness in Langhan et al.'s (2017) study was the average age of the sample was 10 years old, and more data for younger patients would have been beneficial.

Four non-experimental single studies representing Level 6 evidence were included and appraised. One descriptive study evaluated the accuracy of sidestream capnography in non-intubated pediatric patients in critical care and found a high correlation between capnography readings and arterial blood samples (Coates et al., 2014). Sidestream capnography is the type of capnography available at the project site. Coates et al.'s (2014) small convenience sample represented a study weakness, but the methodology was transparent and sound. One qualitative study evaluated barriers to capnography use and found consistent equipment availability, expectation of use, and ongoing education were facilitators for capnography use (Iyer et al., 2015). The study sample was small and based on the experiences of those with little practice with capnography, which is a study weakness; however, the participants in the study were very similar to those at the project site (Iyer et al., 2015). This evidence was helpful when planning implementation.

One mixed-methods study identified barriers and facilitators to capnography use in acute care, and Langhan et al. (2014) found equipment availability, understanding impact, and ongoing education were key facilitators, which was similar to the study conducted by Iyer et al. (2015). Lastly, one prospective cross-sectional study described the frequency of hypoventilation and

apnea detected by capnography in pediatric PACU and found capnography captured hypoventilation or apnea in 56% of the sample while oxygen desaturation occurred in 19% of the sample (Langhan et al., 2016). The definition of hypoventilation was based on moderate sedation parameters; however, the participants had general anesthesia, which may inflate the percentage deemed to have hypoventilation or apnea (Langhan et al., 2016). Otherwise, this was an excellent study that further substantiated the ability of capnography to detect respiratory depression sooner than pulse oximetry.

Two applicable professional practice standards representing Level 7 evidence were included and appraised. The ASA (2014) published one practice standard for post-anesthesia care for all patient populations, which emphasized ventilation should be continuously monitored by an appropriate quantitative method. Capnography was not specifically mentioned. ASPAN (2016) published a document defining standards, practice recommendations, and interpretative statements, and practice recommendation two indicated capnography should be monitored in PACU for all patient populations when it is available. Capnography modules were available for each room at the project site, but they had not been installed for use, which was inconsistent with the ASA and ASPAN standards of practice.

Synthesis

Insight gained from the literature review revealed that the problem identified at the project site has evidence-based support for change in practice. Capnography must be implemented and sustained in order to align practice at the project site with current clinical guidelines, best evidence, and professional practice standards. The evidence was clear and unequivocal that pediatric anesthesia patients are at greater risk for SAEs than adult anesthesia patients. Capnography in the OR reduced the incidence of SAEs by 50%, and all studies agreed

capnography monitoring post sedation was more sensitive to changes in respiratory status than pulse oximetry, leading to quicker and more effective intervention. The literature review revealed that positive facts and evidence supporting the use of capnography post sedation did not ensure implementation even when the equipment was readily available. Proactive planning, expectation of use, support during implementation, and ongoing education, including the impact on outcomes, are needed to change the culture of capnography use. A synthesis of evidence concluded that capnography monitoring in the pediatric PACU will enhance patient safety, promote positive patient outcomes, and align practice with current professional practice standards and clinical guidelines for pediatric post-anesthesia care.

Conceptual Framework

A conceptual framework developed by the Iowa Model Collaborative (2017) guided this project, and permission to use this model was obtained (see Appendix B for conceptual model). This model supports incremental guidance for EBP that begins with trigger recognition and clinical question formation. The triggering issue for this project was a new awareness that updated clinical guidelines and practice standards recommended monitoring capnography in addition to pulse oximetry in pediatric PACU. This information along with the occurrence of three cardiopulmonary arrests precipitated by respiratory failure in 2018 in pediatric PACU at the project site and the absence of return on investment for capnography modules purchased in 2017 created urgency for capnography implementation. The clinical question formed for this project was: For PACU nurses who monitor respiratory status for pediatric patients, does capnography compared to pulse oximetry result in earlier recognition of respiratory depression and fewer respiratory-related SAEs?

The next step on the Iowa model is to determine if the issue is an organizational priority.

The organization paid $115,000 dollars in 2017 for capnography modules; however, they had not been installed, and capnography had not been implemented. The hospital was not receiving a return on investment; therefore, capnography implementation in pediatric PACU was an organizational priority. A strategic nursing priority for the organization is to increase affordability of care by practicing to the highest clinical standards to improve effectiveness of care. This project was in alignment with current organizational and strategic nursing priorities.

Team formation is the next step on the Iowa Model. Key stakeholders were identified. Leadership and pediatric PACU nurses were the primary stakeholders. Pediatric anesthesiologists, certified registered nurse anesthetists (CRNA), pediatric preoperative nurses and the child life specialist were also key stakeholders. One member from the pediatric PACU team, one pediatric anesthesiologist, one CRNA, one pediatric preoperative nurse, and the child life specialist were enlisted as part of the implementation team.

The next step on the Iowa Model is to conduct a literature search to determine if sufficient evidence for change exists. The literature search yielded two professional clinical guidelines, two systematic reviews of RCTs, one RCT, four non-experimental studies, and two professional practice guidelines. Sufficient, quality evidence existed to support implementation of capnography in pediatric PACU. At project onset, no quantifiable method was being used to measure ventilation in pediatric PACU. Evidence demonstrated that capnography was a quantifiable method of ventilation measurement and more sensitive to changes in respiratory status than pulse oximetry. Capnography should be monitored post sedation and recorded every five minutes on pediatric patients until they awaken (American Society of Anesthesiologists, 2018; Cote & Wilson, 2016). Sustaining the use of capnography requires a change in practice culture and is best supported with advanced planning, expectation of use, support during

implementation, ongoing education, and awareness of impact on outcomes (Iyer et al., 2015; Langhan et al., 2016).

The next step in the Iowa Model is to design and pilot the practice change. Literature emphasized the importance of education to implementation and effective use of capnography. Interactive education as well as educational materials were developed and made available during implementation. A capnography resource guide was developed and distributed as part of the pilot process because resources like this guide and support implementation of practice change (Melnyk & Fineout-Overholt, 2015). Having support personnel during capnography implementation was also found to be important; therefore, members of the implementation team were available during the pilot period. When Institutional Review Board (IRB) approvals were obtained, project timeline, progress, and next steps were communicated to pediatric PACU nurses daily during huddle, and impromptu staff needs for communication were met using the Halo application. Halo was the organization's approved communication application for secure calls, photo, and video messaging. Staff was able to contact the project leader through Halo during the pilot study period.

The next step in the Iowa Model is to examine pre- and post-pilot data to evaluate the performance of EBP change. When research evidence is translated and implemented into practice, the outcome may be different than expected or reported in the research studies (Melnyk & Fineout-Overholt, 2015). Evaluating pilot data helped to determine expression of the evidence-based change in the unique practice setting. This project evaluated capnography data to determine if appropriate respiratory-related nursing interventions increased and if pediatric PACU nurses recognized respiratory depression earlier compared to pulse oximetry. Additionally, capnography data was examined to determine if a reduction in respiratory-related

SAEs occurred.

The final step in the Iowa Model is to maintain practice change and disseminate results. Statistically significant differences existed between the pre- and post-capnography groups. Efforts will be made to change policy and make capnography a standard measurement of ventilation in pediatric PACU. The perioperative medical director at the project site requested to review project data analysis in order to construct new capnography orders that will be added to the standardized pediatric PACU order set. Additionally, the project will be submitted as a poster presentation at the facility's annual research sharing event in October 2019.

Summary

In summary, discovery of updated clinical guidelines and practice standards recommending that nurses monitor capnography in addition to pulse oximetry in pediatric PACU was brought to the attention of leadership at the project site. They were unaware and communicated that capnography modules were purchased for every pediatric PACU room in 2017, but turnover in the unit educator position hindered implementation. A review of current evidence and professional practice guidelines and standards revealed capnography should be monitored for all post-anesthesia pediatric patients and recorded every five minutes until the patient awakens. Capnography improved patient safety and decreased SAEs in the OR; however, risk for respiratory compromise, to which pediatric patients are especially vulnerable, persists in PACU. Awareness of this new evidence and the occurrence of three cardiopulmonary arrests precipitated by respiratory failure in pediatric PACU in 2018 created urgency to act. Implementation of capnography post sedation for pediatric patients enhances patient safety and promotes positive outcomes. The purpose of this project was to champion implementation of capnography in pediatric PACU at the project site to align current practice with updated

standards of care, promote earlier recognition of respiratory depression and reduce the incidence of respiratory-related SAEs.

SECTION THREE: METHODOLOGY

Design

This study was an EBP project, and the Iowa Model was the conceptual framework used to guide this work. In accordance with the Iowa Model Collaborative (2017), a pilot study was conducted to evaluate the appropriateness of this practice change to become permanent. A non-randomized quasi-experimental design was used. Patterns of appropriate respiratory-related nursing interventions and numbers of respiratory-related SAEs were evaluated pre- and post-capnography implementation in the pediatric PACU.

Measurable Outcomes

1. The addition of capnography monitoring will increase the number of appropriate respiratory-related nursing interventions in pediatric PACU.
2. The addition of capnography monitoring will decrease the number of respiratory-related SAEs in pediatric PACU.
3. The addition of capnography monitoring will generate an earlier response to respiratory depression in pediatric PACU.

Setting

The project took place in a healthcare system located in the Southeastern United States. Specifically, the project was conducted at the system's largest facility. It is a Level I trauma center with Magnet designation and a capacity of 1,000+ beds. The organization's mission is to be the best and first choice for healthcare. Increasing the affordability of care by practicing to the highest clinical standards to improve effectiveness of care was a strategic nursing goal for the

system. The project site within the organization was a pediatric PACU with 15 individual rooms. Capnography should be monitored in pediatric PACU according to updated clinical guidelines, practice standards and current research studies. This project aligned current practice at the project site with the highest clinical standards. Project stakeholders were the pediatric perioperative leadership team, staff, anesthesiologists, CRNAs, and the child life specialist.

Population

The population from which data was collected was the pediatric perianesthesia nursing staff. This population consisted of 38 pediatric perioperative nurses, including the unit's nursing leadership team who were educated and validated on the use of capnography. This team cared for approximately 25 patients per day Monday through Friday who received anesthesia for surgical/interventional treatments or diagnostic testing in the OR or a non-operating-room area (NORA). The patients for whom these nurses provided care were typically 18 years old or younger. Patient acuities ranged from critical care to outpatient and included a variety of subspecialties.

Purposive sampling was used to collect data for the pre- and post-capnography groups. Seventy-one observations of pediatric PACU nurses providing care in pediatric PACU were recorded for each group. In total, 142 observations of nursing care in pediatric PACU were recorded. Pediatric PACU nurses comprised the primary population, and pediatric PACU patients comprised the secondary population. Observations of pediatric PACU nurses providing patient care were pace driven by the project leader to ensure accurate and consistent observation. Consenting nurses chosen for observation were identified and included consistent with the project leader's pace and capacity to accurately observe. Just as nurses monitor pulse oximetry on all patients in the pediatric PACU, capnography was monitored for all patients in the pediatric

PACU when implemented. The project leader conducted and recorded all observations. Nurses caring for patients with an atypical baseline oxygenation status, such as those with cardiac anomalies, those over 18 years old, and patients recovered by a pediatric PACU nurse who did not complete the capnography training and competency validation were excluded from this study. Additionally, nurses caring for patients who were awake on arrival to pediatric PACU and intolerant of nasal cannula placement were excluded.

Ethical Considerations

Research ethics training was completed to ensure human subjects were protected (see Appendix C for training certificate). A letter of support was obtained from the nurse leader at the project site (see Appendix D for nurse leader support letter). A letter of support from the anesthesiologist serving as the pediatric perioperative medical director at the project site was obtained (see Appendix E for anesthesiologist support letter). IRB approval was obtained from Liberty University (see Appendix F for university IRB approval) and the project site's organization (see Appendix G for project site IRB approval). Immediately following receipt of IRB approvals, the project leader emailed a recruitment letter to all pediatric PACU nurses at the project site (see Appendix H for recruitment letter). When the pediatric PACU nurses completed capnography training and competency validation, they were provided with a consent form (see Appendix I for consent form).

Participating pediatric PACU nurses were assigned a code, and the master list containing codes assigned was stored as an Excel spreadsheet in a password protected file (see Appendix J for master list). Only the project leader knew the password for the file. Only the pediatric PACU nurse's code was recorded on the pre- and post-capnography data collection tools. All paper consents and data collection tools were secured in a locked drawer in the project leader's

office, which was accessible only to the project leader. The Human Resources department at the project site was made aware of this project, and the nurse leader responsible for completing performance appraisals for all nursing staff at the project site provided a statement affirming that observations of nursing care documented for this project would not impact performance appraisals for the nurses observed (see Appendix K for Human Resource and nurse leader affirmation).

On admission, patients or their legal representatives signed a general treatment consent form and acknowledged receipt of the organization's privacy practices to protect personal healthcare information (see Appendix L for general treatment consent form). Within the privacy practices, one section informed the patient that the organization may collect data and use their health information to improve quality and assess effectiveness of new services, which may be shared for educational purposes (see Appendix M for privacy practices). No identifiable personal health information was collected, and the intervention was noninvasive as confirmed in the anesthesiologist's letter of support. Capnography was monitored in addition to pulse oximetry, which represented an additional safety measure. No safety risks were associated with capnography monitoring. Nasal cannulas were routinely used and well tolerated in the pediatric PACU at the project site. The only difference was that capnography-equipped nasal cannulas were used instead of standard nasal cannulas.

Data Collection

The project leader observed and recorded all data to ensure consistent interpretation of nursing interventions and SAEs. With a typical daily case load of 25 patients having recovery time requirements between 30 and 60 minutes depending on the type of anesthesia received, the number of cases per day on which data was collected varied. Two weeks were allotted to collect

71 pre-capnography observations, and two weeks were allotted to collect 71 post-capnography observations. Baseline data observing the pattern of nursing interventions and the presence of SAEs for patients monitored with pulse oximetry alone was recorded during the first two-week period. Capnography was implemented during the second two-week period. After a two-week implementation and acclimation period, post-capnography data was recorded during the final two-week period.

Tools

During the two-week baseline data collection period, observations of nursing care were recorded on a baseline data collection form (see Appendix N for baseline data collection form). Sample characteristics of patients to whom the observed nurses provided care were recorded and evaluated to determine if additional statistical analyses could be conducted to further understanding of capnography compared to pulse oximetry for groups with the same characteristics. The pediatric PACU nurse's code, pilot study day, patient's age, ASA airway classification, anesthesia start time, anesthesia stop time, and NORA versus OR was recorded.

The type of airway management used during anesthesia was recorded. Per unit policy, patients managed with a laryngeal mask airway (LMA) or oral endotracheal tube (OETT) remained in pediatric PACU a minimum of 60 minutes post extubation. Patients managed using a shared airway technique, which was common for bronchoscopy, remained in pediatric PACU a minimum of 60 minutes after the procedure stop time because of the increased risk for stridor related to instrument passage through the vocal cords. Patients managed using mask ventilation or those who received monitored anesthesia care (MAC) had a lower risk of stridor and were discharged from the pediatric PACU after 30 minutes if criteria for discharge were met.

Lastly, the time admitted to Phase I recovery, the time discharged from Phase I recovery,

the time admitted to Phase II recovery, and the time discharged from Phase II recovery were additional sample characteristics recorded, depending on applicability. Not all patients had Phase I and Phase II admission and discharge times. Inpatients had Phase I times only. Outpatients managed with LMA, OETT, or shared airway had Phase I and Phase II times. Outpatients managed with mask ventilation or those who received MAC had Phase II times only.

The time and type of appropriate respiratory-related nursing intervention was recorded. Observation of the following interventions was documented: oral airway removal, head position adjusted, jaw thrust/chin lift, oral airway placed, oxygen increased, oxygen decreased, oxygen discontinued, verbal stimulation, and tactile stimulation. Additionally, the time and type of respiratory-related SAE was recorded. Observation of the following SAEs was documented: pulse oximetry < 92% for Phase I, pulse oximetry < 94% for Phase II, call to anesthesia, required bagging, bradycardia, intubation, and code. Standing physician orders for the pediatric PACU required pulse oximetry readings greater than or equal to 92% for Phase I and greater than or equal to 94% for Phase II. For this reason, these pulse oximetry measures defined parameters for SAEs.

During the two-week period of post-capnography data collection, observations of nursing care were recorded on a capnography data collection form (see Appendix O for capnography data collection form). The same sample characteristic data recorded during the pre-capnography data collection period were recorded in the post-capnography data collection period. In addition, the time capnography began and was discontinued was recorded. Observations for and documentation of the same interventions and SAEs were recorded. Observations for and documentation of end $EtCO_2$ below 30 mmHg or above 50 mmHg were added to post-capnography data collected for SAEs. Normal $EtC0_2$ levels are 35 to 45 mmHg; however,

standards for SAEs were defined using the same parameters Langhan et al. (2017) used in a similar study of capnography conducted in pediatric PACU.

Intervention

A step-by-step chronology of the project will be provided. First, a complete project proposal was submitted to the project chair. The project chair approved, and an application was completed and submitted to Liberty's IRB. Upon receiving Liberty IRB approval on April 25, 2019, the project leader completed and submitted an application to the project site's IRB for approval. Upon receiving the project site's IRB approval on May 8, 2019, a meeting was scheduled to present the project to the project site's leadership, answer questions, identify an implementation team and come to an agreement on a six-week period for project completion.

The time period between 5/20/2019 and 6/28/2019 was chosen. After agreement was reached, the recruitment letter was emailed to all pediatric PACU nurses. Staff was made aware of the Halo application that could be downloaded for free to their mobile device. Halo was used by the organization for secure messaging and facilitated communication via phone, photo or video messaging between staff members and the project leader for questions. The project leader sent an email introducing the project and the project timeline to the lead pediatric anesthesiologist and the lead pediatric CRNA to distribute to their teams. The project leader provided ongoing project communication and updates during leadership's daily staff huddle routine.

Capnography modules were stored in a locked office. When agreement for the project timeframe was reached, maintenance was contacted and a date to install and secure capnography modules was confirmed. Capnography modules were installed after pre-capnography data was collected immediately before the implementation period. Additionally, materials management

was notified to begin stocking capnography-equipped nasal cannulas in the project site's supply room. Nasal cannulas were available in two sizes, and 20 of each size were added to the supply room inventory and replenished daily.

Following distribution of the recruitment letter via email prior to the two-week pre-capnography data collection period, staff attended capnography education, demonstration, simulation, and skill assessment sessions. The busiest times in pediatric PACU were between 0900 and 1400, and the probability of using an empty pediatric PACU room for demonstration and simulation was low. Demonstration, simulation, and skill assessment was conducted from 0600 to 0900 and again at 1400 to 1800. This strategy allowed training to be consistently offered during the times of day that increased feasibility for nurse attendance.

One unused pediatric PACU room was set up for face-to-face capnography demonstration and simulation, using a capnography module, waveform, and nasal cannula. Capnography competency assessment was verified using return demonstration. Nurses who successfully completed the training and competency assessment were offered the opportunity to participate in the EBP project, and those interested were provided with a consent form. Nurses signing the consent form were the nurses observed during the data collection periods. The project leader took responsibility for the capnography module used and returned the module to the locked office daily when demonstration and simulation were finished.

The pediatric preoperative area had one dedicated child life specialist. This team member assisted with education for all pediatric patients in this area. During the two-week pre-capnography data collection period, the project leader met with the child life specialist to inform about implementation of capnography. Discussion and agreement was reached regarding appropriate patient teaching for capnography that was provided by the child life specialist in the

preoperative area. Additionally, one staff member managed and restocked contents of the carts in each pediatric PACU room. During the two-week pre-capnography data collection period, the project leader met with this staff member and ensured that two small and two regular-sized capnography-equipped nasal cannulas were added to each cart and maintained daily.

After pre-capnography data were recorded for observations of nursing care provided to 71 cases, maintenance installed and secured capnography modules prior to the implementation phase. Capnography implementation took place during the next two-week period. A capnography resource guide developed using information compiled from a source included in the literature review was placed on every mobile documentation station (see Appendix P for capnography resource guide). Staff was reminded of the option to contact the project leader via the Halo application to assist with capnography when the project leader was not on site. The project leader was on site from 0900 to 1400 for the first week during implementation.

After the two-week implementation and acclimation period was complete, post-capnography data were collected during the final two-weeks of the pilot study. Observations of nursing care provided to 71 cases were conducted, and data were recorded. After pre- and post-capnography observations were recorded, data collection tools were assembled, and data were entered into an Excel spreadsheet.

Feasibility Analysis

The greatest threat to feasibility of this project was the pediatric patient's resistance to the capnography-equipped nasal cannula. Although pediatric patients were resistant to and intolerant of equipment even when noninvasive, the nurses were key to overcoming this feasibility concern. The nurses received education prior to implementation and were eager to use capnography. They appreciated and articulated to patients and parents of patients the benefit of

capnography to patient safety to mitigate this feasibility threat.

The second threat to feasibility was coordination of capnography module installment. The capnography equipment was purchased in 2017. The modules were $10,000 each, and the nurse leader did not want them placed in the rooms until maintenance could provide a strategy to secure the modules to the monitors. Proactive and face-to-face communication with maintenance mitigated this feasibility threat. The same strategy used to secure other modules for this monitor was duplicated for the addition of this new module.

The third threat to feasibility was coordination of the educational intervention for the nurses. Pediatric PACU nurses at the project site received capnography education in 2018 in preparation for capnography implementation prior to turnover occurring in the unit educator role. The information provided for this project was a refresher; however, this was the nurses' first hands-on training. Capnography education, training, and skills assessment were purposefully planned for early morning and late afternoon when the caseloads were low. The project leader conducted the sessions on site in an unoccupied pediatric PACU room to increase accessibility for the nurses. The pediatric PACU nurses were receptive and proactively attended the sessions. Not all pediatric PACU nurses signed consent to be observed during the pilot study, but they were interested and accepted capnography implementation. The perioperative nursing leadership team and the pediatric anesthesiologists wanted capnography in the pediatric PACU, which increased feasibility considerably.

Data Analysis

Three measurable outcomes were identified for this project. Pre- and post-capnography data collected during the pilot study were compiled into an Excel spreadsheet. Data were transferred to and analyzed using the Statistical Package for the Social Sciences (SPSS) software

version 24. Descriptive statistics were used to analyze sample characteristics, appropriate respiratory-related nursing interventions, and respiratory-related SAEs. Additionally, statistical analysis was used to evaluate each measurable outcome to determine if a statistically significant difference existed between the pre- and post-capnography groups. Data were evaluated to determine if descriptive analysis of the sample characteristics allowed for additional statistical analyses not initially identified for this project. The data analysis strategy will be explained for each measurable outcome.

Measurable outcome one. The first measurable outcome measured the impact of adding capnography on the number of appropriate respiratory-related nursing interventions. Frequencies for each listed intervention were measured, and the total frequency for all interventions was measured for each sample statistic in the pre- and post-capnography groups. Frequencies of appropriate respiratory-related nursing interventions represented scale data, and a histogram of data was created to determine if data were normally distributed (Marshall & Boggis, n.d.). Data were found to be skewed; therefore, the Mann-Whitney U test was used for data analysis (Marshall & Boggis, n.d.). These samples were independent, and this test was appropriate to compare groups since the post-capnography group was different from the pre-capnography group (Sullivan, 2018). The alpha was set at 0.05, which estimated a 95% confidence interval (Sullivan, 2018).

Measurable outcome two. The second measurable outcome measured the impact of adding capnography on the number of respiratory-related SAEs. Frequencies for each SAE were measured, and the total frequency for all SAEs was measured for each sample statistic in the pre- and post-capnography groups. Frequencies of respiratory-related SAEs represented scale data, and a histogram of data was created to determine if data were normally distributed (Marshall &

Boggis, n.d.). Data were found to be skewed; therefore, the Mann-Whitney U test was used for data analysis (Marshall & Boggis, n.d.). These samples were independent, and this test was appropriate to compare groups since the post-capnography group was different from the pre-capnography group (Sullivan, 2018). The alpha will be set at 0.05, which estimated a 95% confidence interval (Sullivan, 2018).

Measurable outcome three. The third measurable outcome measured the impact of adding capnography on the number of minutes between pediatric PACU admission time and the time of first appropriate respiratory-related nursing intervention. The number of minutes between pediatric PACU admission time and the time of the first appropriate respiratory-related nursing intervention was calculated for each sample statistic in pre- and post-capnography groups. The number of minutes between pediatric PACU admission time and the time of first appropriate respiratory-related nursing intervention represented scale data, and a histogram of data was created to determine if data were normally distributed (Marshall & Boggis, n.d.). Data were found to be skewed; therefore, the Mann-Whitney U test was used for data analysis (Marshall & Boggis, n.d.). These samples were independent, and this test was appropriate to compare groups since the post-capnography group was different from the pre-capnography group (Sullivan, 2018). The alpha was set at 0.05, which estimated a 95% confidence interval (Sullivan, 2018).

SECTION FOUR: RESULTS

An EBP pilot study measuring the significance of capnography in the pediatric PACU was completed. Nineteen nurses signed consent and agreed to participate in the pilot study. Participants had between five and 38 years of nursing experience. Pre-capnography observations of nursing care were recorded for 71 cases, and post-capnography observations of nursing care

were recorded for 71 cases. Nursing care observed was provided to pediatric PACU patients ranging from seven weeks to 17 years of age who had anesthesia administered in a NORA or an OR setting. ASA risk levels ranged from I to IV, and the types of airway management used during anesthesia administration included LMA, OETT, shared airway, general mask or MAC. Using SPSS version 24, Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted and histograms were generated to test the assumption of normally distributed data. The level of significance for each variable was $\alpha = 0.05$, which indicated the dataset was not normally distributed. As a result, nonparametric tests were used for statistical analysis. A descriptive analysis and the results of nonparametric testing for each measurable outcome will be provided.

Descriptive Statistics

Observations of nursing care provided to 142 pediatric PACU patients were collected. Descriptive statistics using SPSS version 24 for the entire sample were analyzed for the following variables: total anesthesia time, total PACU time, patient age, total number of appropriate respiratory-related nursing care interventions, time between PACU admission and the first appropriate respiratory-related nursing care intervention other than discontinuing oxygen, and total number of respiratory-related SAEs. Patients receiving care had a mean total anesthesia time of two hours and five minutes and a mean pediatric PACU time of one hour and 18 minutes. The mean patient age was 7.7 years old. Nurses provided an average of 2.42 appropriate respiratory-related nursing care interventions per patient. The average time between PACU admission and the first appropriate respiratory-related nursing care intervention other than discontinuing oxygen was 12.11 minutes. Patients experienced an average of 0.54 respiratory-related SAEs.

Measurable outcome one. The first measurable outcome measured the impact of adding

capnography on the number of appropriate respiratory-related nursing interventions. The pre-capnography group mean for this variable was 1.79. The post-capnography group mean for this variable was 3.06. Since the dataset was skewed, means for the total number of appropriate respiratory-related nursing care interventions and for each appropriate respiratory-related nursing care intervention from the two independent samples were analyzed using the nonparametric 2-tailed Mann-Whitney U test (see Appendix Q Table Q1). With the level of significance set at $\alpha = 0.05$, the analysis of means revealed that $p < 0.001$ for the total number of appropriate respiratory-related nursing interventions provided to the pre- and post-capnography groups. A statistically significant difference existed in the number of appropriate respiratory-related nursing care interventions provided to the pre- and post-capnography groups. An analysis of means for each appropriate respiratory-related nursing intervention separately revealed $p < 0.05$ for repositioning the head, verbal stimulation, tactile stimulation, and the number of minutes between PACU admission and the first appropriate respiratory-related intervention; therefore, this represented a statistically significant difference in these appropriate respiratory-related nursing interventions provided to the pre- and post-capnography groups.

Measurable outcome two. The second measurable outcome measured the impact of adding capnography on the number of respiratory-related SAEs. The pre-capnography group mean for this variable was 0.66. The post-capnography group mean for this variable was 0.42. Because the dataset was skewed, means for the total number of respiratory-related SAEs and each respiratory-related SAE present in the two independent samples were analyzed using the nonparametric 2-tailed Mann-Whitney U test (see Appendix Q Table Q2). With the level of significance set at $\alpha = 0.05$, the analysis of means revealed that $p > 0.05$ for total number of respiratory-related SAEs present in the pre- and post-capnography groups. A statistically

significant difference did not exist in the number of respiratory-related SAEs present in the pre- and post-capnography groups. An analysis of means for each respiratory-related SAE separately revealed $p < 0.05$ for pulse oximetry readings less than 92% and EtCO2 readings greater than 50mmHg; therefore, a statistically significant difference existed in the presence of these respiratory-related SAEs in the pre- and post-capnography groups.

Measurable outcome three. The third measurable outcome measured the impact of adding capnography on the number of minutes between PACU admission time and the time of the first appropriate respiratory-related nursing intervention other than discontinuing oxygen. The pre-capnography group mean for this variable was 16.62 minutes. The post-capnography group mean for this variable was 9.91 minutes. Because the dataset was skewed, means for the number of minutes between PACU admission and the first appropriate respiratory-related intervention other than discontinuation of oxygen for the two independent samples were analyzed using the nonparametric 2-tailed Mann-Whitney U test (see Appendix Q Table Q1). With the level of significance set at $\alpha = 0.05$, the analysis of means revealed that $p < 0.014$ for the number of minutes between PACU admission and the first appropriate respiratory-related nursing intervention other than discontinuation of oxygen provided to the pre- and post-capnography groups. A statistically significant difference existed in the number of minutes between PACU admission and the first appropriate respiratory-related nursing intervention other than discontinuation of oxygen provided to the pre- and post-capnography groups.

Expanded Analysis

Descriptive statistics were obtained, and an analysis of means for explanatory variables was conducted using the nonparametric 2-tailed Mann-Whitney U test (see Appendix Q Table Q3). Patient age, anesthesia risk, total time under anesthesia, and total time in PACU were the

variables examined. The mean patient age for the pre-capnography group was 80.6 months old or 6.72 years old compared to the post-capnography group mean patient age of 103.5 months old or 8.63 years old. An analysis of these means revealed $p < 0.18$, which indicated a statistically significant difference existed in the ages of the pre- and post-capnography groups.

The mean anesthesia risk for the pre-capnography group was 2.14 compared to the post-capnography group mean of 2.10. An analysis of these means revealed $p > 0.05$; therefore, a statistically significant difference in anesthesia risk level for these groups did not exist. The mean total time under anesthesia for the pre-capnography group was two hours and four minutes compared to the post-capnography group mean of two hours and seven minutes. An analysis of these means revealed $p > 0.05$; therefore, a statistically significant difference in the total time under anesthesia for these groups did not exist. The mean total PACU time for the pre-capnography group was one hour and 26 minutes compared to the post-capnography group mean of one hour and 10 minutes. An analysis of these means revealed $p < 0.02$; therefore, a statistically significant difference existed in the total PACU time for the pre- and post-capnography groups.

SECTION FIVE: DISCUSSION

Data analysis demonstrated that capnography led to a statistically significant increase in appropriate respiratory-related nursing interventions and a statistically significant decrease in the amount of time between PACU admission and the first appropriate respiratory-related nursing intervention other than discontinuation of oxygen. Nursing interventions were provided faster to the post-capnography group. The post-capnography group experienced a statistically significant increase in appropriate respiratory-related nursing interventions that included head repositioning, verbal stimulation, and tactile stimulation. Capnography was not associated with a statistically

significant decrease in the total number of respiratory-related SAEs; however, capnography was associated with a statistically significant decrease in hypoxemic events. Studies conducted by Conway et al. (2016) and Saunders et al. (2017) reported similar findings.

Implications for Practice

The implementation of capnography contributed to the provision of higher quality care for pediatric PACU patients. This aligns with the organization's strategic nursing goal to increase the effectiveness of nursing care. Pediatric PACU nurses recognized changes in respiratory status earlier and responded sooner when using capnography than when using pulse oximetry alone, which reduced the prevalence of hypoxemia in the pediatric PACU. It is possible that the use of new technology contributed to the nurse's vigilance, which could inject bias into the project findings. Langhan et al. (2017) considered a similar confounding factor in their study. A two-week implementation and acclimation period preceded the post-capnography data collection period to minimize this impact.

Another possible limitation was that one group may have been more vulnerable. Additional analysis of explanatory variables allowed for an expanded understanding of sample factors that may have influenced the analysis for the measurable outcomes. A statistically significant difference existed in the ages of the pre- and post-capnography groups, which was 6.72 years old versus 8.63 years old. This age difference suggested that the pre-capnography group may have been more vulnerable and prone to poorer outcomes compared to the post-capnography group. Langhan et al. (2017) reported an increase in the age of their study's intervention group, which was attributed to intolerance of capnography-equipped nasal cannulas in younger patients. Comparison of means between the pre- and post-capnography groups for anesthesia risk level and time under anesthesia did not yield a statistically significant difference.

The pre-capnography group may have been younger, but the group's anesthesia risk level and time spent under anesthesia was not statistically significant. Finding no statistically significant difference between the pre- and post-capnography groups in anesthesia risk level or time spent under anesthesia bolstered confidence in the positive outcomes demonstrated by the post-capnography group.

Sustainability

Sustaining the use of capnography requires embedding its use in nursing practice and demonstrating capnography's value to the organization. As explained by Iyer et al. (2015) and Langhan et al. (2014), making nurses aware of positive outcomes associated with the use of capnography increases sustainability. The statistically significant differences in appropriate respiratory-related nursing care interventions provided and its impact will be shared with the nurses at the project site. Additionally, the nurse leader at the project site agreed to provide capnography updates on a weekly basis during daily huddle in an effort to sustain the use of and value for capnography in daily nursing practice.

Aligning capnography with an organizational priority is important to sustainability. Given that a statistically significant decrease did not exist in the total SAEs in the post-capnography group, evidence for the value of capnography was evaluated by comparing the cost of the capnography-equipped nasal cannulas to the amount saved related to the statistically significant difference between group means for time spent in pediatric PACU. The capnography-equipped nasal cannulas costs $9.41 compared to $1.14 for standard nasal cannulas, which is a difference of $8.27. The cost to apply capnography-equipped nasal cannulas to the 71 patients in the post-capnography group was $587.17. Analysis of total time spent in pediatric PACU was important to evaluate the cost to benefit ratio. On average, the

post-capnography group spent 16 minutes less in pediatric PACU than the pre-capnography group. The cost for pediatric PACU was $22.25 per minute. For the 71 patients observed in the post-capnography group, this time difference equals a $25,276 reduction in healthcare costs associated with a reduced length of pediatric PACU stay. After subtracting the cost for capnography-equipped nasal cannulas, the total healthcare cost savings during this two-week post-capnography data collection period was $24,688.83. This cost difference translated to an annual reduction in healthcare costs of $641,909.58. This cost reduction contributes to increasing the affordability of care, which is a current strategic nursing goal and organizational priority. It is in the organization's interest to sustain the use of capnography.

An important lesson was learned during implementation. Communicating the practice change to all stakeholders was important for sustainability. Although the CRNAs had no practice change, a couple were surprising upset with and verbal about being unaware of the nursing practice change in the pediatric PACU. The PACU nurses were well prepared and were able to explain the origin of and rationale for the practice change, which diffused the negativity. Advanced planning and careful consideration of interconnected aspects impacted and influenced by the new practice change was key to the project's success. Researching and planning the intervention required a great deal more time than actual implementation of capnography. The importance of allowing for advanced planning was another lesson learned.

Dissemination Plan

Results of this pilot study will be disseminated to the project site's nurse leader at the unit level first. After sharing the results with the nurse leader, the outcomes will be shared with the pediatric PACU nurses at the project site via email notification and included in the information provided at the next scheduled staff meeting. Next, the results will be shared with the

perioperative medical director. The project leader will collaborate with the unit nurse leader and the perioperative medical director to formalize and operationalize changes needed in practice standards, policies, procedures and physician order sets. Dissemination at the organizational level will be accomplished using a poster presentation. The project site's organization calls for abstracts for poster presentations two times each year. An abstract for this project will be submitted at the organization's next poster fair scheduled in October 2019. Lastly, a manuscript will be constructed for this project and submitted to the Journal of PeriAnesthesia Nursing. This publication is a peer-reviewed journal published by ASPAN, which is a national organization for perianesthesia nurses. This publication is the primary journal used by nurses in the pediatric PACU at the project site for journal clubs.

In conclusion, updated clinical guidelines and professional practice standards called for the use of capnography for pediatric PACU patients until awake. This project championed implementation of capnography in the pediatric PACU at the project site. Every pediatric PACU room was capnography equipped and capnography-equipped nasal cannulas were stocked daily in every bedside cart. Nurses in the pediatric PACU were trained in capnography and competency was verified. Capnography led to a statistically significant increase in the number of appropriate respiratory-related nursing interventions and a statistically significant decrease in the nurse's response time to changes in respiratory status. Capnography was associated with a statistically significant decrease in the pediatric PACU length of stay, which translated to a potential annual reduction in healthcare costs of $641,909.58. Capnography contributed to increasing the effectiveness of respiratory-related nursing care, which demonstrated a positive impact on the affordability of healthcare provided in the pediatric PACU. These were positive indicators for sustainability. Dissemination of results will begin at the unit level, move to the

organizational level using a poster presentation, and progress to the national level via manuscript submission to a peer-reviewed journal published by ASPAN. Participation in sharing the EBP pilot study results is a Doctor of Nursing Practice (DNP) essential, and it is foundational to the advancement of professional nursing practice.

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Saunders, R., Struys, M. M. R. F., Pollock, R. F, Mestek, M., & Lightdale, J. R. (2017). Patient safety during procedural sedation using capnography monitoring: A systematic review and meta-analysis. *British Medical Journal Open, 7*(6), e013404+. doi:10.1136/bmjopen-2016-013402

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Appendix A

Evidence Table

Name: Deborah Renee Whitley

Clinical Question: For PACU nurses who monitor respiratory status for pediatric patients, does capnography compared to pulse oximetry result in earlier recognition of respiratory depression and fewer respiratory-related adverse events?

Citation	Study Purpose	Sample	Methods	Study Results	Level of Evidence	Study Limitations	Useful as Evidence to Support a Change?
Cote, C. J., & Wilson, S. (2016). Guidelines for monitoring and management of pediatric patients before, during, and after sedation, for diagnostic and therapeutic procedures: Update 2016. *Pediatrics, 138*(1), e1-e31. doi:10.1542/peds.2016-1212	The purpose was to review current evidence and update the previous clinical guideline that expires automatically every five years. A primary purpose described in the introduction was to	The guidelines included synthesis of evidence from 496 sources.	The guideline was developed as a collaborative effort between the American Academy of Pediatrics and the American Academy of Pediatric Dentistry. There was no description of how	With regard to capnography following sedation of pediatric patients, the guideline lists capnography as a requirement following deep sedation and as a recommendation following	Clinical Guideline Level 1	The search strategy and critique of strength of evidence included was missing; however, the guideline does acknowledge the American Society of Anesthesiologists Task Force clinical guidelines as an included	This evidence does support change. The project site is a Level I Pediatric Trauma center and takes care of the most acute pediatric anesthesia patients in the region, but capnography is not

	update and clarify monitoring requirements, especially continuous capnography, and promote safe outcomes for pediatric patients being sedated in a variety of settings by medical and dental providers.		evidence included was located or chosen for inclusion. The previous 2011 guideline was a reaffirmation of the 2006 guideline, and it included 213 articles of evidence with the most current dated 2006. This 2016 updated guideline contained 496 articles of evidence with the most current dated 2016.	moderate sedation. For patients receiving supplemental oxygen, capnography is most helpful to detect apnea and obstruction of airway. The capnography value observed was reported as less important with using capnography to confirm air exchange and ventilation as the most important aspect. The guideline stated that heart rate, oxygen		resource. Although the method for obtaining and including evidence was not specifically provided, the credibility and authority of those responsible for the guideline is high. Of note, there was confirmation that no conflicts of interest were present.	monitored in the pediatric PACU. Most delivered to the pediatric PACU at the project site would be considered as having been deeply sedated by this guideline's definition; therefore, all deeply sedated patients should be on capnography in PACU until awake. An additional finding included that heart rate, pulse oximetry, and capnography

				saturation, and capnography should be monitored continuously following sedation and recorded every five minutes until the patient awakens.			should be recorded every five minutes until the patient is awake. After awake, the interval can be increased to every 15 minutes. Currently, the pediatric PACU records every 15 minutes from admission to discharge.
American Society of Anesthesiologists. (2018). Practice guidelines for moderate procedural sedation and analgesia 2018: A report by the American Society of Anesthesiologists Task Force on moderate procedural sedation	The purpose of this guideline is to clearly define and clarify margins that establish moderate sedation for adults and children. This update replaced the	The guidelines include synthesis of evidence from 187 sources with most current dated 2017.	An interdisciplinary team of 13 selected by the American Society of Anesthesiologists followed a seven-step process to identify, include, and	There were seven new recommendations discussed. Of relevance to this project, the second recommendation listed was continually capnography for all	Clinical Guideline Level 1	There were no identified limitations. This guideline detailed a strict methodology and defined procedures for evidence critique, categorization and	This evidence does support practice change. All patients, including adults and children, should have capnography monitoring and recording

and analgesia, the American Association of Oral and Maxillofacial Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology. (2018). *Anesthesiology: The Journal of the American Society of Anesthesiologists, Inc.*, *128*(3), 437–479. doi:10.1097/ALN.0000000000002043	previous guideline published in 2002. This update included a more comprehensive interdisciplinary collaboration than the previous guideline.		critique evidence. The evidence included represented scientific studies and expert opinion. Evidence was categorized and strength was rated. Only evidence appraised as high level as included in the guideline.	patients receiving moderate sedation. Capnography should be recorded every five minutes until the patient awakens.		inclusion.	every five minutes until awake. Patients having moderate sedation represent the least acute population in the pediatric PACU. Currently, capnography is not monitored in the pediatric PACU at the project site for patients being sedated at any level.
Conway, A., Douglas, C., & Sutherland, J. R. (2016). A systematic review of capnography for sedation. *Anaesthesia, 71*(4), 450-454. doi:10.1111/anae.1	The purpose was to determine if capnography decreased episodes of hypoxemia in sedated patients	n = 6 The six studies included represented 2534 patients that were pediatric and	The researchers used a systematic search approach and included studies conducted up	The study found that capnography decrease hypoxemia during sedation, but other outcomes	Systematic Review of Random Controlled Trials Level 1	The numbers of articles included was low, and the quality of the studies included was low. Also, the definition	This evidence does support practice change. Although the quality of this study could be

3378	when compared to pulse oximetry and if capnography had an impact on clinician interventions.	adult.	to 2015. Two authors reviewed the articles and used the Cochrane tool to assess bias. The authors did not detail the number of articles initially generated by the search, and they did not provide the key terms searched. Ultimately, six articles were included. Details that explained inclusion of these six articles are not given.	were unchanged, meaning clinician intervention did not change. The researchers could not explain how capnography decreased hypoxemia when management by the clinicians did not change in response to capnography reading. The researchers did acknowledge that the studies included were low quality.		of hypoxemia was not consistent from study to study.	improved, the results are corroborated by other higher quality studies. Capnography decreases the occurrence of hypoxemia during sedation when compared to the standard use of pulse oximetry only.
Saunders, R., Struys, M. M. R. F., Pollock, R. F, Mestek, M., &	The purpose of the study was to evaluate the	n=13 13 Random Controlled	A systematic search of PubMed, the Cochrane	The study found that the addition of	Systematic Review of Random Controlled	The largest limitation is that the studies	This evidence does support practice

Lightdale, J. R. (2017). Patient safety during procedural sedation using capnography monitoring: A systematic review and meta-analysis. *British Medical Journal Open, 7*(6), e013404+. doi:10.1136/bmjopen-2016-013402	impact capnography for sedated patients has on adverse events.	Trials were included. Outcomes for adult and pediatric patients were represented.	Library, and EMBASE was conducted and included publications from 1995 to 2017. The researchers independently reviewed articles meeting inclusion criteria. Afterward, independent reviews were collectively evaluated and agreement was established. The points of interest to assess impact of capnography were saturation less than 85%, "apnea,	capnography reduced mild desaturation by thirty-percent and severe desaturation by 40%. There was no significant impact on the reduction of bradycardia or apnea; however, there was significant reduction in the need to provide assisted ventilation when capnography was used. Overall, the study indicated that the use of capnography for sedated patients	Trials Level 1	included in the review had differing definitions for desaturation, severe desaturation, and apnea. Another limitation is that five of the 13 studies included were deemed to be of low quality.	change. This source did not focus exclusively on pediatrics, but it did include pediatric data. The article did not indicate that age was a factor impacting outcomes related to use of capnography; therefore, this is relevant and applicable to adult and pediatric patients. This article supports capnography as a tool to assist the healthcare team with earlier

			aspiration, bradycardia, hypotension, premature procedure termination, respiratory failure, use of assisted/bag-mask ventilation and death" (p. e013404). Quality of the articles was determined using Jadad scoring between zero and eight. Articles with score below 5.5 were deemed low quality, and those above 6 were deemed high quality.	would reduce adverse events by 50%.			recognition of and intervention for respiratory depression, which improves patient safety.

Langhan, M. L., Li, F.-Y., & Lichtor, J. L. (2017). The impact of capnography monitoring among children and adolescents in the postanesthesia care unit: a randomized controlled trial. *Paediatric Anaesthesia, 27*(4), 385–393. doi:10.1111/pan.13077	The purpose of the study was to determine if capnography increased the frequency of intervention in response to recognized respiratory depression and decreased the number of adverse respiratory events for pediatric patients in PACU compared to the use of pulse oximetry alone.	n=201 Control group = 98 Intervention group = 103 Average age = 10 years old	Participants between the age of 1 and 20 having elective surgery under general anesthesia being recovered in the pediatric PACU were recruited and consent obtained. A random number table was used for participant selection for consent. The following were excluded: emergent cases, intolerance of nasal cannula related to behavior or location of	Pediatric patients in the intervention group experienced lower rates of apnea and hypoventilation; however, there was no statistical difference between groups for the rates of desaturation measured by pulse oximetry. This supports evidence that hypoventilation measured by capnography is more sensitive than desaturation measured by pulse oximetry.	Randomized Controlled Trial Level 2	Given that capnography was not routinely monitored in the pediatric PACU research setting, adding this intervention may have heightened staff awareness and vigilance with respiratory monitoring. Most patients excluded for intolerance of capnography monitoring were younger, less cooperative patients. This increased the average age of the	Yes, this evidence supports practice change. The authors stated that capnography monitoring decreased adverse respiratory events in the OR by 50%. The effect anesthesia linger beyond the OR and children are at a higher risk for adverse respiratory events. Additionally, 29% of the sample in the study demonstrated apnea. This study provides

			surgery, and abnormal pulse oximetry baselines. Capnography cannulas were sent to the OR with the patient. Randomization to control and intervention group occurred on arrival to PACU using sealed envelopes randomized by a statistician uninvolved in sample recruitment. Healthcare personnel were not allowed to view the capnography monitor for			sample.	evidence that capnography is more sensitive than pulse oximetry, which led to quicker and more effective interventions to address respiratory depression.

			those in the control group.				
Coates, B. M., Chaize, R., Goodman, D. M., & Rozenfeld, R. A. (2014). Performance of capnometry in non-intubated infants in the pediatric intensive care unit. *BioMed Central*, *14*(1), 163-169. doi:10.1186/1471-2431-14-163	This purpose of this study was to evaluate the accuracy of sidestream carbon dioxide measurements in non-intubated, critically ill children age one year or less.	n=43 Sidestream readings = 43 Transcutaneous carbon dioxide comparison group = 29 Arterial carbon dioxide comparison group = 14	A sidestream cannula was placed and a capnography reading was recorded when two minutes of consistent reading was observed. At the time the sidestream reading was recorded, a transcutaneous carbon dioxide reading was recorded. If the patient had an arterial line, a carbon dioxide reading was obtained from a sample of arterial blood	The correlation between the sidestream reading and the arterial carbon dioxide was high at r2 0.907. Agreement between the sidestream reading and the transcutaneous reading was lower at r2 0.649. Additionally, the study found that neither the infant's weight nor respiratory rate impacted performance of sidestream capnography.	Single Descriptive Study Level 6	Convenience sampling was used. The sample size was also small.	This evidence supports practice change. This study provided evidence of effectiveness of capnography as an assessment of ventilation for pediatric patients one year old and under. This population is among the most vulnerable after anesthesia, and evidence of the accuracy of capnography in this population

			drawn at the time the sidestream reading was recorded.	The study concluded that sidestream monitoring of carbon dioxide provided an accurate estimation of arterial carbon dioxide levels and should be used when continuous assessment of ventilation is needed.			increases confidence in its use. This information will be helpful when educating the nurses and will assist with increasing the commitment of staff to use capnography.
Iyer, N. S., Koziel, J. R., & Langhan, M. L. (2015). A qualitative evaluation of capnography use in paediatric sedation: Perceptions, practice and barriers. *Journal of Clinical Nursing, 24*(15-16), 2231-2238.	The purpose was to evaluate perceptions of and barriers to capnography use for sedated pediatric patients.	n = 17 MD = 5 Nurse = 12	This study took place in a large level 1 trauma center. A randomized controlled trial (RCT) examining capnography had been previously conducted at	The study identified four themes. Personal experience was one theme. Knowledge of the function of capnography was another theme. Use	Qualitative Study Level 6	The study findings were based on the experiences of participants who had limited exposure to the use of capnography during a	This evidence does support practice change. This study provides important insight into the need for ongoing education and

doi:10.1111/jocn.12848			this site, and only participants involved in the previous study were considered for participation in this study. This study took place three months after the RCT. A four-person multidisciplinary team with qualitative research experience conducted the study. One-on-one 20-minute interviews by one researcher were conducted, and grounded	of capnography in other patient populations was another theme. Difficulty with capnography use was the final theme identified. In regard to personal experience, clinicians reported sedation as safe with rare adverse events and saw capnography as unnecessary until they were required to use it, which increased the value they had for		RCT. These experiences may be different with participants with more experience and frequent use of capnography.	remediation of education during capnography implementation. It also sheds light on the fact that sustaining use of capnography requires ongoing efforts beyond a pilot study. The researcher's pondered if capnography use would have been better sustained if it were introduced as change in practice and not has part of a temporary RCT. This

			theory was used to identify themes. Interviews were audio-recorded and transcribed. Data were manually reviewed and entered into a software used for qualitative analysis.	capnography. Regarding knowledge about the function of capnography, not all participants had a solid understanding of capnography despite being systematically educated for the RCT conducted three months earlier. Although participants had not retained previous education regarding capnography function, using capnography during the RCT increased			provides helpful information when implementing capnography for this project.

				their belief that it would be beneficial in other patient populations. Immediate availability of the equipment was found to be a reported barrier to use.			
Langhan, M. L., Kurtz, J. C., Schaeffer, P., Asnes, A. G., & Riera, A. (2014). Experiences with capnography in acute care settings: A mixed-methods analysis of clinical staff. *Journal of Critical Care, 29*(6), 1035-1040. doi:10.1016/j.jcre.2014.06.021	The purpose was to identify barriers to and facilitators for capnography use in acute care settings.	n = 19 MD = 10 RN = 9 ED = 9 ICU = 10 Average years of experience = 9.5	Clinicians were recruited by purposeful sampling from five different hospitals. Three of the five sites were children's hospitals. A five-person interdisciplinary research team was formed. Four of the five	The study found that doctors and nurses from the same unit shared similar perceptions about capnography use. Three of the nine units reported rare or no capnography use, and the others reported	Mixed-Methods Study Level 6	The results cannot be generalized because the themes are directly related to those interviewed and their unique experiences. The sample size was small, but the researchers did achieve the saturation of themes	This evidence does support practice change. This study provides valuable information to consider when planning implementation of this evidence-base practice initiative. This study specifically

			members of the team had experience with qualitative research methods and interviewing. The researchers attempted to recruit one nurse and one doctor from the ED and the ICU from each site. One unit refused to participate, which made the sample 19 instead of the desired 20. One researcher interviewed participants individually. The interviews lasted 30	some capnography use. No statistically significance difference in responses related to type of unit, age of participant, or years of experience was found. Six themes regarding capnography were found. Inconsistency of use was one theme. Timely access to equipment was another theme. Different interpretations of evidence for capnography were another theme.		they needed.	explored the challenges of capnography use and provided information to facilitate uptake of the new technology. Making the equipment readily available, ensuring staff is aware of positive outcomes associated with capnography, and planning education purposely prior to implementation will help to support use of capnography.

			minutes, were audio recorded and transcribed. Grounded theory was used to analyze the data. Software for qualitative analysis was used. Cohen's Kappa was used to evaluate provider agreement according to unit. Fisher's exact test and Student's T-test was used for demographic data and to evaluate difference between use of	Different beliefs about the benefit of capnography were another theme. Previous negative experience with capnography was another theme. Lack of capnography training was the last theme identified. Environmental, experiential, and knowledge translational approaches were recommended to support implementation. To overcome environment			

			capnography.	al barriers, equipment must be readily accessible, preferably in all acute care patient rooms. To address experiential barriers, share information where capnography made a difference and recruit staff champions to encourage use. To overcome barriers related to knowledge translation, plan education carefully prior to implementati			

				on of capnography.			
Langhan, M. L., Li, F. –Y., & Lichtor, J. L. (2016). Respiratory depression detected by capnography among children in the photometers care unit: a cross-sectional study. *Pediatric Anesthesia, 26*(10), 1010–1017. doi:10.1111/pan.12965	The purpose of the study was to describe how often hypoventilation and apnea was detected by capnography in a pediatric PACU. A secondary focus was to capture the frequency of oxygen desaturations using pulse oximetry and record the associated staff interventions.	n = 194 Average age = 9 Male = 53% White = 55% Hispanic = 26% ASA I or II = 74%	The study site was a 12-bed PACU that care for approximately 25 patients per day, and two hours is the typically length of stay. A convenience sample was used, but the patients chosen to approach for consent was randomized. Patient was fitted for appropriate sized capnography equipped cannula, and the cannula was sent with the	The study found that capnography measurements indicated the presence of hypoventilation or apnea in 56% of the participants; however, pulse oximetry measurements demonstrated oxygen desaturation in 19% of participants. Respiratory-related staff interventions occurred in 9% of the participants.	Prospective Cross-sectional Study Level 6	The researchers defined hypoventilation according to parameters normally used for moderate sedation, but the patients in this study had general anesthesia, which may account for the low staff intervention levels. The number of very young children under two was limited, and this is the e most vulnerable population.	This evidence does support practice change. The proposed project site is a 15 bed pediatric PACU that cares for approximately 30 cases per day, which is nearly identical to this study's setting. This study provided a clear indication that capnography captures evidence of respiratory depression more often

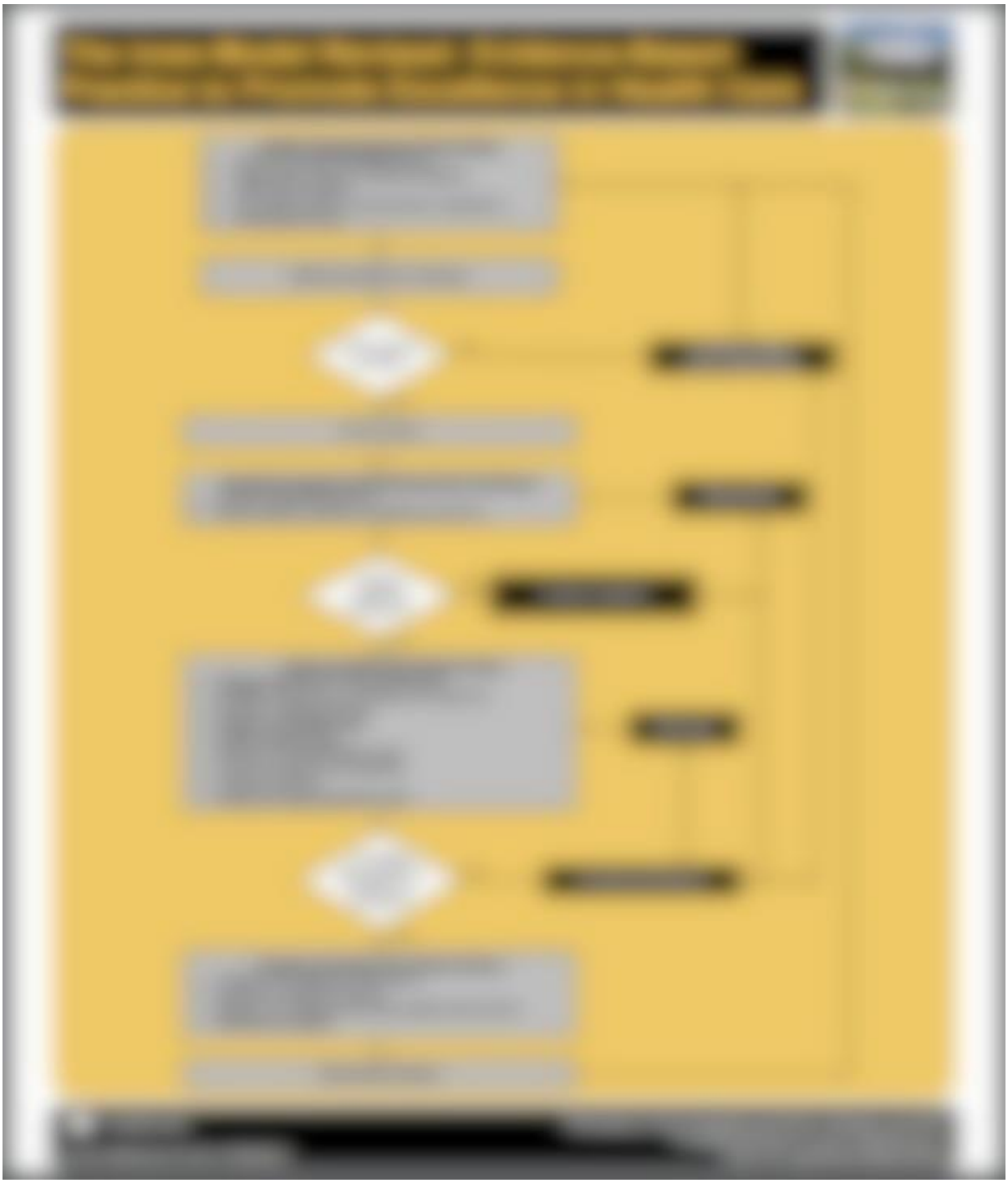
			patient to the OR. Upon arrival to PACU, capnography was initiated. Nurses caring for the patient were not permitted to see the capnography reading, and alarms were silenced. Staff provided routine care. A researcher was at the bedside and recorded study measures every 30 seconds until monitors were removed. Vital sign readings, including capnography,				and faster than pulse oximetry.

			were recorded, and the researcher documented all respiratory-related staff interventions.				
American Society of Anesthesiologists. (2014). *Standards for postanesthesia care* [PDF document]. Retrieved from https://www.asahq.org/standards-and-guidelines/standards-for-postanesthesia-care	The purpose of this document is to define the professional practice standard for post anesthesia care from the anesthesia provider's perspective.	Not Applicable	The standard was developed by professional consensus of members of the American Society of Anesthesiologists and approved by the Committee on Standards and Practice Parameters (CSPP).	Five standards were defined for postanesthesia care for patients of all ages receiving anesthesia. The fourth defined standard stated that patients should be continuously monitored in PACU with specific emphasis on monitoring in several	Professional Practice Standard Document Level 7	The method by which emphasized areas should be monitored was not specifically stated. The standard indicated that an appropriate quantitative method should be used.	This evidence supports practice change. The proposed project site uses pulse oximetry, but this is not a quantifiable measure of ventilation. No quantifiable measure of ventilation is used. Capnography provides a quantifiable measure of ventilation.

				areas. Ventilation was included as an emphasized area in which continuous monitoring must occur.			
American Society of PeriAnesthesia Nurses. (2016). *2017-2018 perianesthesia nursing standards, practice recommendations and interpretative statements*. Cherry Hill, NJ: American Society of PeriAnesthesia Nurses.	The purpose of this document is to define the professional practice standards, recommendations and interpretative statements for perianesthesia care from the perianesthesia nurse's perspective.	Not Applicable	This document was developed with the consensus of Clinical practice experts from the American Society of PeriAnesthesia Nurses. This document is reviewed, updated, and approved every other year.	Practice recommendation two indicated that capnography should be monitored if was available, but it was not listed as a requirement.	Professional Practice Standard Document Level 7	The practice recommendation specified that respiratory status should be monitored, but specific aspects of respiratory status, such as ventilation and oxygenation, were not included.	This evidence supports practice change. All 15 PACU rooms at the proposed project site are equipped to monitor capnography. This practice recommendation indicated that capnography should be monitored if it is available.

Appendix B

Iowa Model



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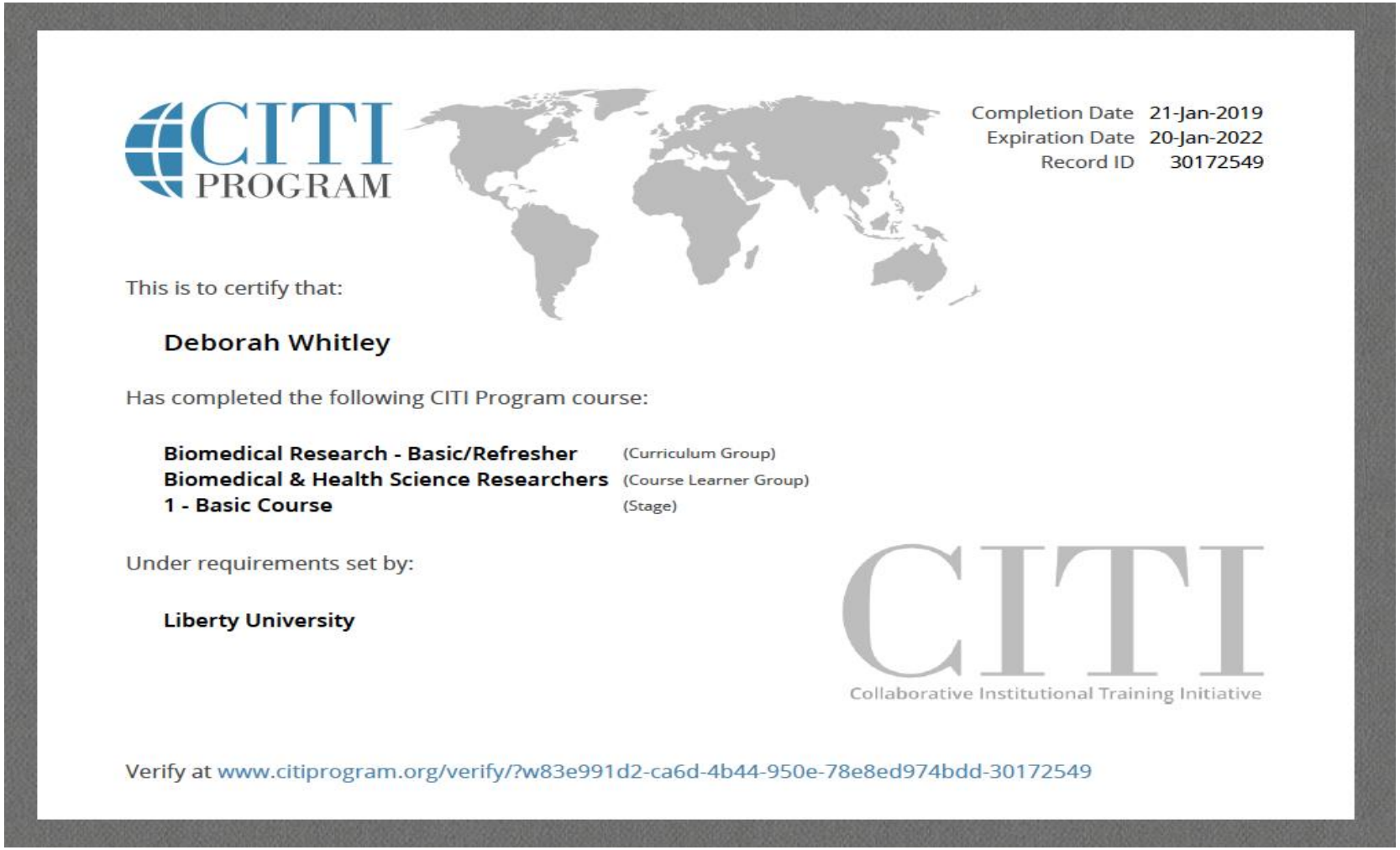
Appendix C

Collaborative Institution Training Initiative (CITI) Certificate



Appendix D

Letter of Support – Nursing Leadership

[redacted]

2/12/2019

Attention: IRB
Liberty University
Lynchburg, Virginia

IRB Members:

Mrs. Deborah Whitley, MSN, RN, CNE, Liberty University Doctor of Nursing Practice Student, has proposed to conduct Mrs. Whitley's Doctor of Nursing Practice Scholarly Project: The effectiveness of capnography in the pediatric post anesthesia care unit to promote early recognition of respiratory depression and reduce the number of reported respiratory care events in [redacted]

[redacted] is committed to providing the most advanced, comprehensive care for our patients, facilitated by the pursuit of quality improvement. Mrs. Whitley's Scholarly Project aligns with our commitment that every patient receives the ultimate quality health care.

[redacted] is pleased to support Mrs. Whitley's Scholarly Project Proposal: The effectiveness of capnography in the pediatric post anesthesia care unit to promote early recognition of respiratory depression and reduce the number of reported respiratory care events.

Please feel free to contact me if I can be of further assistance.

Respectfully,

[redacted] MHA, BSN, RN, NE-BC
Nurse Manager
[redacted]

Appendix E

Letter of Support – Perioperative Medical Director

3/11/2019

Attention: IRB
Liberty University
Lynchburg, Virginia

IRB Members:

Mrs. Deborah Whitley, MSN, RN, CNE, Liberty University Doctor of Nursing Practice Student, has proposed to conduct the Doctor of Nursing Practice Scholarly Project: Significance of Capnography in Pediatric Post Anesthesia Care. The use of capnography in the pediatric post anesthesia care unit to promote early recognition of respiratory depression and reduce the number of reported respiratory care events is consistent with the current clinical guidelines published by the American Society of Anesthesiologists. Implementation of capnography in pediatric PACU will align current practice with the current best evidence.

This organization is committed to providing the most advanced, comprehensive care for our patients, facilitated by the pursuit of quality improvement. Mrs. Whitley's Scholarly Project aligns with our commitment that every patient receives the ultimate quality health care.

This organization is pleased to support Mrs. Whitley's Scholarly Project Proposal: Significance of Capnography in Pediatric Post Anesthesia Care. Capnography is noninvasive and will be used in conjunction with pulse oximetry as an additional measure to promote safe and quality care.

Please feel free to contact me if I can be of further assistance.

Respectfully,

Appendix F

Institutional Review Board Approval – Liberty University

LIBERTY UNIVERSITY
INSTITUTIONAL REVIEW BOARD

April 25, 2019

Deborah Whitley
IRB Application 3771: Significance of Capnography in Pediatric Post Anesthesia Care

Dear Deborah Whitley,

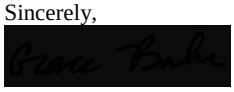
The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Your study does not classify as human subjects research because evidence-based practice projects are considered quality improvement activities, which are not considered "research" according to 45 CFR 46.102(d).

Please note that this decision only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued non-human subjects research status. You may report these changes by submitting a new application to the IRB and referencing the above IRB Application number.

If you have any questions about this determination or need assistance in identifying whether possible changes to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,



Administrative Chair of Institutional Research
Research Ethics Office

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Appendix G

Institutional Review Board Approval – Project Site

RECEIVED
APR 29 2019
IRB

[redacted]
Institutional Review Board / Patient Privacy Board

IRB Review & Determination of QI vs. Research Projects

This form must be completed in entirety Submission Date:4/27/2019	IRB Tracking #: (To be supplied by the IRB)
Project Lead: Deborah Renee Whitley	Dept.:LCH Post Anesthesia Care Unit 5th Floor
Phone: 704-807-8555	E-mail:renee.whitley@atriumhealth.org

Project Title: Significance of Capnography in Pediatric Post Anesthesia Care

Is the project supported by funding?

- ☐ Yes – Federal or Foundational funding, please provide copy of grant proposal with this form
- ☐ Yes – Industry sponsored
- ☐ Yes – CHS internal funding
- ☒ No

Purpose of the project: *Provide a 2-3 sentence description*
The purpose of this evidence-based practice project is to align nursing care in the pediatric post anesthesia care unit (PACU) with the current clinical guidelines, evidence from research, and professional practice standard recommendations. A review of current literature revealed that nurses in pediatric PACU should monitor capnography until the patient awakens.

Briefly describe project details, including how patients and/or providers will be involved:
Once all project approvals are obtained, a recruitment email will be sent to all pediatric perianesthesia nurses at the proposed project site. Pediatric perianesthesia nurses at the proposed project site will be taught the principles of capnography using face-to-face education and simulation. Return demonstration will be used for skill assessment. Nurses signing consent for nursing care to be observed for this project will be assigned a code, and a master list of the assigned codes will be kept separately in a password protected electronic file accessible only by this student. Over a two-week period, observations of routine nursing care provided in the pediatric PACU prior to capnography implementation will be recorded on a baseline data collection tool. During baseline data collection period, the nurse's code and the following patient sample characteristics will be collected: Age, ASA (airway) risk classification, anesthesia start time, anesthesia stop time, if anesthesia was received in the operating room or out of department, the type of airway management used while under anesthesia, times that respiratory related nursing interventions occur, times that respiratory related adverse events occur, and the times admitted and discharged from Phase I and/or Phase II recovery. Following baseline data collection, capnography modules will be installed in all pediatric PACU rooms, and current nasal cannulas will be replaced

*Adapted from the Stanford University Research Compliance Office Determination of Human Subject Research screening form

QI vs. Research Screening Form
v. 1.0
3.20.15

[redacted]

Institutional Review Board / Patient Privacy Board

IRB Review & Determination of QI vs. Research Projects

with nasal cannulas equipped to monitor capnography. Capnography modules and cannulas are already available. After a two-week implementation and acclimation period, observations of routine nursing care provided in the pediatric PACU post capnography implementation over a two-period will be recorded on a capnography data collection tool. The same information collected for baseline will be collected post capnography implementation plus the time capnography began and ended will be recorded. The pre and post intervention observations will represent independent groups. A histogram of data will determine if the data are normally distributed. If normally, distributed, independent t-tests will be used to determine if capnography significantly increased the number of respiratory related nursing interventions observed, decreased the number of respiratory related adverse events, and contributed to earlier recognition to respiratory depression. If data are not normally distributed, the non-parametric equivalent Mann-Whitney test will be used to evaluate the outcome measures. Additionally, descriptive statistical analysis will be conducted for each group on sample characteristics, nursing interventions, occurrence of adverse events, and intervention response time.

Is this project Quality Improvement (QI)?		
Quality Improvement includes activities that have purposes limited to: (a) implementing a practice to improve the quality of patient care, and (b) collecting patient or provider data regarding the implementation of the practice for clinical, practical, or administrative purposes. Improvement projects are limited to a setting of care and do not seek to make universal changes to evidence-based care. See [redacted] Policy http://documents.carolinas.org/Research/QI_vs_Research_Definition.pdf.	**Yes**	**No**
Do you consider this project to meet the definition of QI as noted above?	☒	☐
Is the activity primarily designed to:		
1. Improve clinical care at [redacted]?	☒	☐
2. Apply to patients or populations beyond your specific study population?	☐	☒

Is this project Research?		
Research is "a systematic investigation, including research development, testing and evaluation that is designed to develop or contribute to generalizable knowledge". [45CFR46.102 and 45 CFR 164.501] See [redacted] Policy http://documents.carolinas.org/Research/QI_vs_Research_Definition.pdf.	**Yes**	**No**
Do you consider this project to meet the definition of research as noted above?	☐	☒
Does the project involve a systematic investigation that may include a hypothesis, testing and evaluation?	☐	☒

*Adapted from the Stanford University Research Compliance Office Determination of Human Subject Research screening form

[redacted]

Institutional Review Board / Patient Privacy Board

IRB Review & Determination of QI vs. Research Projects

Is the activity primarily designed to:		
1. Develop new knowledge?	☐	☒
2. Apply to patients of populations beyond your specific study population?	☐	☒

Activity Involves Human Subjects?		
Does your project involve:	**Yes**	**No**
Interventions or interactions with patients, including manipulation of a person, or a person's environment through surveys, interviews, tests or observations? If yes, attach the document.	☒	☐

Does your project involve:	**Yes**	**No**
Obtaining identifiable private information about living people?	☐	☒
If this project uses existing data, please answer the following: *No use of existing data*		
What is the source of the data (i.e., from whom/where):		
Are the data publicly available?	☐	☐
Can the individual associated with the data be identified?	☐	☐
Are the data de-identified? If yes, who did (or will) de-identify the data?	☐	☐
Were the data collected specifically for this project?	☐	☐
Were the data collected as part of clinical care?	☐	☐

Clinical Investigation?	**Yes**	**No**
Does your project include testing the safety and efficacy of a drug or device in a human subject, including analysis or comparison of outcome data about a drug or device?	☐	☒
Does your project include a non-FDA-approved assay or In Vitro Diagnostic device?	☐	☒
Will any data resulting from this activity be submitted to the FDA?	☐	☒

Other Considerations	**Yes**	**No**

*Adapted from the Stanford University Research Compliance Office Determination of Human Subject Research screening form

QI vs Research Screening Form
v 1.0
3.25.15

[redacted]

Institutional Review Board / Patient Privacy Board

IRB Review & Determination of QI vs. Research Projects

Does your project involve a vulnerable population, e.g. children, impaired adults with special consent issues, [redacted] employees? See: http://documents.cancercare.org/Research/OCTR%20Research%20SOPs.pdf	☒	☐
Are there plans to publish information gained from this project?	☒	☐
Will patients be consented for entry into this project?	☐	☒

What are the potential risks to participants? *There are no identified or anticipated risks to participating in this project.*

What are the potential benefits to participants? *This project champions implementation of advanced patient care technology and elevates nursing care, which contributes to safer healthcare, promotes positive patient outcomes, and decreases the cost of healthcare over time.*

CERTIFICATION OF PROJECT LEAD:
I certify that the information provided in this IRB Review of QI and Research Projects screening form is complete and accurate. The above titled project has been/will be conducted in full compliance with the HHS/FDA Regulations and IRB requirements/policies governing human subject research. IRB review is required for projects meeting the criteria of, "Research" as noted above.

[redacted] 4-22-2019

Signature of Project Lead (only) **Date**

CERTIFICATION OF DEPARTMENT CHAIR (if a resident or student)
I certify that I have read the attached IRB Review of QI and Research Projects screening form and the project has been reviewed.

[redacted] 24 April 2019

Signature of Department Chair **Date**

IRB Use Only

The IRB has determined this project is: ☐ **Research** ☒ **Quality Improvement**

[redacted] 8 MAY 19

Completed by (Name) **Date**

[redacted]

*Adapted from the Stanford University Research Compliance Office Determination of Human Subject Research screening form

QI vs Research Screening Form
v 1.0
12.5.15

Appendix H

Recruitment Email

Dear Pediatric Perioperative Nursing Staff at [redacted] Children's:

As a graduate student in the School of Nursing at Liberty University, I am conducting an evidence-based practice project as part of the requirements for a Doctor of Nursing Practice degree. The purpose of my project is to implement capnography monitoring in the pediatric post anesthesia care unit (PACU), and I am writing to invite you to participate in my project.

If you are a pediatric perioperative nurse and are willing to participate, you will be asked to attend a 20-minute capnography training session and complete a capnography competency assessment. Capnography education will be provided in the form of simulation and demonstration. You will be trained to use the capnography module, place the nasal cannula properly, and interpret the capnography waveform. A capnography resource guide will be provided. This will be face-to-face and hands on learning. Competency validation will be accomplished by observing your return demonstration and identification of correct capnography interpretation.

Following competency validation, you will be asked to allow observations of the nursing care you provide in pediatric PACU pre and post capnography implementation. If you are providing nursing care to a patient that has an abnormal oxygen saturation baseline, your nursing care will not be observed. If you are providing nursing care to a patient that is older than 18 years old, awake on arrival to pediatric PACU, or intolerant of nasal cannula placement, your nursing care will not be observed. There will be a two-week baseline data collection period followed by a two-week capnography implementation and acclimation period. A two-week post intervention data collection period will follow the two-week capnography implementation and acclimation period. Participating nurses will be assigned a code, and a master list of the codes assigned will be maintained in a password protected file known only to the principle investigator. Your name and/or other identifying information will be collected as part of your participation, but this information will remain confidential. Human Resources has been made aware of this project, and your nursing leadership has provided a statement affirming that data collected while observing the nursing care you provide will not impact your performance appraisal.

To participate, you will attend a session to receive face-to-face capnography training and simulation. For competency validation, you will be asked to correctly return demonstration of capnography initiation and accurately identify the capnography measurement from the waveform.

The consent form is attached to this email. This document contains additional information about my project. Following capnography training and competency assessment, you will be asked to sign the consent document if you wish to participate.

Sincerely,

Deborah Renee Whitley, MSN, RN, CNE
Doctor of Nursing Practice Student
Liberty University

Appendix I

Participant Consent Form

CONSENT FORM

Significance of Capnography in Pediatric Post Anesthesia Care
Deborah Renee Whitley
Liberty University
School of Nursing

You are invited to participate in an evidence based practice project for capnography implementation in the pediatric post anesthesia care unit (PACU). Current clinical guidelines, best evidence and professional practice standard updates indicated that capnography in the pediatric PACU is needed to ensure patient safety and promote positive patient outcomes. You were selected as a possible participant because you are a pediatric perioperative nurse and provide nursing care in pediatric PACU. Please read this form and ask any questions you may have before agreeing to be in the study.

Deborah Renee Whitley, a doctoral candidate in the School of Nursing at Liberty University, is conducting this study.

Background Information: The purpose of this EBP project is to champion implementation of capnography in pediatric PACU. The impact of capnography on PACU nurses' recognition of respiratory depression compared to pulse oximetry and the effect on the number of respiratory related adverse events will be measured. The clinical question to be evaluated by this project is as follows: "In PACU nurses who monitor respiratory status for pediatric patients, does capnography compared to pulse oximetry result in earlier recognition of respiratory depression and fewer respiratory related adverse events?"

Procedures: If you agree to be in this project, I would ask you to do the following things:

1. Complete a 20-minute capnography training and competency validation by May 17, 2019.
2. Allow observations of nursing care provided during the two-week baseline data collection period.
3. Follow the Capnography Resource Guide for all patients to whom you provide care during the two-week implementation and acclimation period. No observations will be recorded during this period.
4. Continue capnography monitoring according to the Capnography Resource Guide and allow observations of nursing care provided during the two-week post intervention data collection period.

Risks: The risks involved in this project are minimal, which means they are equal to risks you would encounter in everyday life.

Benefits: The direct benefit participants should expect to receive from taking part in this project is the alignment of nursing care with current clinical guidelines, best evidence, and professional practice standards. Additionally, this project will enhance your ability to detect respiratory depression in pediatric PACU, which will elevate your nursing care and promote positive outcomes for patient to whom you provide care. Benefits to society include the delivery of safer healthcare for pediatric patients receiving anesthesia, which will lower the cost of healthcare in the long term.

Compensation: Participants will not be compensated for participating in this study.

Confidentiality: The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a participant. Project records will be stored securely, and only the investigator will have access to the records. I may share the data I collect from you for use in future research studies and projects or with other researchers and investigators; if I share the data that I collect about you, I will remove any information that could identify you, if applicable, before I share the data.

- Participants will be assigned a code. Only the participant's code will appear on the data collection tool.
- A master list of the assigned codes will be secured in a password protected electronic file known only to me. This master list will be kept separate from the data collected. Paper consents and data collection tools will be secured in a locked drawer in my office and will only be accessible by the investigator. Data may be used in future presentations. In accordance with Federal regulations, all electronic records will be deleted after three years. After three years, all paper documents will be disposed of in a locked bin for confidential paper waste.

Voluntary Nature of the Project: Participation in this project is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University or Atrium Health. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

How to Withdraw from the Project: If you choose to withdraw from the project, please contact the principle investigator at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, will be destroyed immediately and will not be included in this project.

Contacts and Questions: The principle investigator conducting this project is Deborah Renee Whitley. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at dwhitley@liberty.edu. You may also contact the principle investigator's faculty chair, Dorothy Murphy, at dlmurphy1@liberty.edu.

If you have any questions or concerns regarding this project and would like to talk to someone other than the principle investigator, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the investigator if you would like a copy of this information for your records.

Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the project.

_____ _____

Signature of Participant Date

_____

Signature of Investigator Date

Appendix J

Master List of Assigned Codes

Master List of Assigned Codes

Code Assigned	Last Name	First Name	Training Complete	Competency Verified	Consent Signed	Degree Earned	Certification	Years Experience
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Appendix K

Human Resource Notification and Management Affirmation of Participant Protection

Subject: Re: [redacted] PrePost Project Notification
Date: March 23, 2019 at 6:48 PM
To: [redacted].org

[redacted],

This comes on the cusp of our new anesthesia team being very interested in providing this much needed service to our pediatric patients in the pediatric recovery room. This is very exciting for our team and patients.
As the nurse manager who completes performance appraisals for all nurses in our pediatric PACU, I affirm that data collected for his evidence-based practice project will not impact the performance appraisals for nurses being observed.

Thank for you timely response in this manner.

Respectfully

[redacted] BSN,MHA,RN,NE-BC
Nurse Manager [redacted] Pre-op and PACU.
[redacted]

Get Ou look for iOS

From: Whitley, Renee R
Sent: Friday, March 22, 2019 2:33:48 PM
To: [redacted]
Cc: [redacted]
Subject: [redacted] PrePost Project Notification

Hello [redacted],

I am a student earning my doctorate in nursing practice. My scholarly project will focus on observations of nursing care provided in the pediatric PACU on [redacted] pre and post implementation of capnography monitoring. An overall analysis of data will be provided to the nurse leader, but the individual data collected for this project will not be used to impact leadership evaluations of nursing performance. Nurses will be coded, and a matching master list that is password protected will remain in my custody. Only the nurse's code will appear on the data collection tool. My university is requesting that I inform human resources of this project and obtain permission to observe nursing care provided in pediatric PACU on [redacted] An email reply confirming approval will satisfying this requirement. Thank you for your consideration.

Respectfully,

Renee Whitley, MSN, RN, CNE, CNIII
[redacted]

Appendix L

General Consent for Treatment Form

REQUEST FOR TREATMENT AND AUTHORIZATION FORM

REQUEST FOR TREATMENT. The undersigned hereby applies for outpatient treatment and/or admission of the patient to Carolinas HealthCare System Northeast and grants permission to the health care provider in charge of the patient's care to administer treatment deemed necessary or advisable in the diagnosis and treatment of this patient. I understand that I have the right to be informed by my providers of the nature and purpose of any proposed operation or procedure and any available alternative methods of treatment, together with an explanation of the risks associated with each of them. This form is not a guarantee for cardiopulmonary, which are the responsibility of my providers to provide according to recognized standards of medical practice, and I acknowledge that the Hospital and its personnel are not responsible for providing me this information. I understand that students or residents in various health related training programs may participate in my care or observe special procedures. I consent to receive services by telemedicine (using interactive audio, video, or data communications) to carry out consultations, evaluations, prescriptions, diagnosis, treatment, monitoring, or other communications benefiting a patient) if appropriate for my condition, and I understand the risks, benefits, and alternatives of this service. I am aware that the practice of medicine and surgery is not an exact science, and I acknowledge that no guarantees have been made to me as to the result of treatment or examination by this hospital. I choose to receive the services even if my insurance plan may not cover or continue to cover specific services, including the specific services rendered during this admission. No individual shall be subject to discrimination or denied the benefits of any of the services, programs, or activities at any facility of Carolinas HealthCare System-Northeast on the basis of race, color, religion, national origin, age, sex, disability or source of payment.

ASSIGNMENT OF INSURANCE BENEFITS. I hereby authorize payment directly to Carolinas HealthCare System Northeast and all health care providers involved in my treatment or diagnosis at Carolinas HealthCare System Northeast by the group insurance, major medical insurance, hospital, surgical, medical, and any other insurance payable to or on behalf of the undersigned, by virtue of hospitalization or Outpatient Services of the below named patient. I unconditionally assign any insurance benefits to Carolinas HealthCare System-NorthEast and all health care providers involved in my treatment and further authorize both to apply any surplus insurance benefits or any other payments received from any source, to the payment of other unpaid bills of the below named patient or of the undersigned or any individual who is financially responsible for the patient or premium. I understand that I am financially responsible to the Hospital and health care providers for charges not paid by insurance. I (patient and/or responsible party/ies) agree to pay all charges for services rendered by the Hospital and my providers or other providers during my hospitalization or treatment. This guaranty includes charges for services not covered by my insurance, regardless of the reason that insurance coverage is denied. If I fail to pay all charges and the Hospital or my physicians use an attorney to collect unpaid charges, I agree to pay the reasonable cost of the attorney's services in addition to the unpaid charges. I consent and authorize Carolinas HealthCare System Northeast and its agents and subcontractors to contact outside data sources of its choosing, including credit reporting agencies, for purposes related to my account, including evaluating and assessing my credit worthiness, my identity eligibility, and the viability of collecting any amounts due for the treatment I receive, whether at this time or subsequent visits. I understand and agree that Carolinas HealthCare System Northeast may assign my account as it deems necessary for purposes of collecting any amounts I owe, including to collection agencies and attorneys. I consent and authorize Hospital and third party agents of Hospital to contact me by telephone at any number associated with me, including a wireless number, and to use prerecorded and/or an automatic dialing service in connection with any communication made to me or related to my account.

NOTICE OF INDEPENDENT CONTRACTORS. I understand that many health care providers (and their assistants) providing care at Carolinas HealthCare System Northeast are independent contractors and NOT Carolinas HealthCare System Northeast employees. I consent to care by these non-employees. I understand that I will receive a separate bill for all health care providers (and assistants) services provided to me.

AUTHORIZATION FOR RELEASE OF MEDICAL INFORMATION. I understand that the Hospital and my providers may use my information for treatment, payment, and health care operations, as further outlined in the CHS Notice of Privacy Practices. As clarification, I understand the Hospital and my providers may furnish any medical information relating to my hospitalization or treatment to my insurance company, governmental or charitable agencies and their agents, and professional review organizations with whom I may have insurance coverage or who may be assisting in payment of my hospital and medical care. I also understand the Hospital and my providers may release any medical information to any licensed provider or medical facility to which I may be referred or transferred for further medical care. I authorize the Hospital and my providers to take and produce pictures, recordings, and/or videos of me for treatment and health care operation purposes. I can object to, or revoke, any permissions for pictures, recordings, and video being taken or produced for reasons other than treatment and health care operations at any time. In addition, I authorize the Hospital and my providers to release any medical information necessary to prove the Hospital's charges in any legal proceeding brought to collect any unpaid balances on any of my accounts.

[redacted]

REQUEST FOR TREATMENT
AND AUTHORIZATION FORM
Page 1 of 2
GEN0103 Rev. 4/16 Request for Treatment

901

DOS: DOB: // Sex:
Age: Race: Serv.Type: Visit Type: Loc: Rm:
Attend. Phy:

AUTHORIZATION TO RELEASE MEDICARE AND MEDICAID INFORMATION. I certify that the information I have given in applying for payment under Title V, XVII, and XIX of the Social Security Act is complete and correct. I authorize any holder of medical or other information about me to release to the Social Security Administration or its intermediaries any information needed for this or any related Medicare/Medicaid claim. I understand that the health care services paid for under Medicare, Medicaid and Maternal and Child Health Programs are subject to review by professional organizations, which may recommend denial of payment if my medical condition does not warrant continued hospital care. I authorize CarolinaEast HealthCare System-Pettigrew and the applicable County Department of Social Services (e.g., Cabarrus, Mecklenburg, Rowan, etc.) to discuss information about me in the event I apply for financial assistance, including Medicaid. This information may include the following: date of application, application status, the reason my application remains pending, any verification required to complete my application, the date and reason of denial (if applicable). I have received the document titled "An Important Message from CarolinaEast" or "Disclosure" at the time of my admission. My signature only acknowledges my receipt of this message from CarolinaEast HealthCare System-Pettigrew and does not waive any of my rights to request a review or make me liable for any payment.

RELEASE OF INFORMATION FOR FINANCIAL PURPOSES. I authorize the Financial Counseling staff of the Hospital to use the information I provide for the processing of any benefits application, including Medical Assistance. And to Families with Dependent Children, or Special Assistance, initiated for the Patient within six months of the date of this authorization. The Financial Counselor may have access to and copy any records or information to which I would be entitled. I authorize and direct the County Department of Social Services to provide such information to the Financial Counselor orally via telephone. I authorize and consent to referral to the County for benefits by use of an appropriate referral form. I request that if my benefits are approved or denied, a copy of the approval or denial be collected by and released only to the referral form. The disclosure of information may have been explained to me. I acknowledge that this consent is voluntary and that it may be revoked by me at any time except to the extent that action has already been taken in reliance on it. Unless otherwise revoked, this consent shall be valid for one (1) year from the date of authorization, or until final determination of any benefits application as described above, whichever is later.

I have read the foregoing request and authorization and agree to be bound by all its terms and conditions as an
Witness my (our) hand(s) and seal(s) below.

Patient (Seal) Responsible Party/Ins (Seal)

Witness Relation to Patient

Date Time

Husband
Wife
Parent(s)
Other (Specify)

Policyholder (if other than patient)

I have been provided a copy of CHS' Notice of Privacy Practices.

Signature: Date Time
(Patient or Authorized Representative)

Relationship to Patient_____

Reason Patient Unable/Unwilling to sign_____

TELEPHONE CONSENT FOR TREATMENT

Name/Title of 2 Persons Witnessing Consent:

_____

Consent Granted: Yes No

Date: Person Called:

Time: Relationship to patient:

Remarks:

[redacted]

REQUEST FOR TREATMENT AND AUTHORIZATION FORM
Page 2 of 2
GEN0103 Rev. 4/16 Request for Treatment

901

DOS: DOB: // Sex:
Age: Race: Serv.Type: Visit Type: Loc: Rm:
Attend. Phy:

Appendix M

Privacy Practices

Treatment for Drug and Alcohol Use If you receive treatment for drug or alcohol use in a federally funded rehabilitation center, federal laws prevent us from releasing that information, except in certain situations. For example, if there is an emergency or if you threaten to hurt someone, we can disclose the information appropriately.

Unemancipated Minors In North Carolina, if you are under the age of 18, are not married and have not been legally emancipated, you can consent to treatment for pregnancy, drug and/or alcohol abuse, venereal disease or emotional disturbances without an adult. This information will remain confidential, unless your doctor determines your parents or guardian need to know this information because there is a serious threat to your life or health, or your parents or guardian have specifically asked about your treatment. Note that minors are still required to get parental or court consent for an abortion.

Inspections and Surveys One or more of our facilities and services are subject to inspection by state and federal agency and accreditation representatives who may review patient health information, which we are required to provide. For example, the state may ask to review records as part of their review of our hospital license or review of a complaint (you may have certain rights to object to these disclosures). A licensing board may review records when evaluating a provider's qualifications.

OTHER USES OF HEALTH INFORMATION

Uses and disclosures of your health information not covered by this Notice or by applicable laws not necessarily listed here will be made only with your written permission.

YOUR RIGHTS REGARDING YOUR HEALTH INFORMATION

You have the following rights regarding the health information we maintain about you:

1. Access A Copy Of Your Health Records

You can ask to see and get a copy of your health record and other health information. You may not be able to get all of your information in a few special cases. For example, if your doctor decides something in your file might endanger you or someone else, your request for access may be denied.

- In most cases, copies of your health record will be given to you within 30 days, but this time frame can be extended for another 30 days.
- You may have to pay for the cost of copying and mailing if you request copies and mailing.

To request a copy of your health record, you must submit your request in writing to the Medical Records Custodian at the facility or practice where you were treated. You can find the form to request your records on the Carolinas HealthCare System website – [redacted]

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2. Revoke An Authorization

If you have provided us permission to use or disclose your health information, you may revoke that permission at any time by giving written notice to the Chief Privacy Officer, [redacted] If you revoke your permission, we will no longer use or disclose your health information for the reasons covered by your written authorization. You understand that we are unable to take back any disclosures we have already made before you notify us of your revocation.

3. Request Changes To Your Health Information

You can ask to change or add information to your health record that you think is wrong or incomplete. A request to change your health information is also known as a "request for amendment." The provider has the right to decide whether to grant the request for amendment. For example, if you and your provider agree that your file has the wrong result for a test, the provider will change it. However, if the provider believes the test result is correct, your disagreement will be noted in your file.

- A request for amendment must be made in writing to the Medical Records Custodian at the facility or practice where you were treated. You must describe the amendment and provide a reason for why it should be made.
- We will usually respond to your request for amendment within 60 days, but it may take an extra 30 days in some cases and if it does, we will provide you with the reason.

4. Obtain A List Of When And Why Your Health Information Was Shared

You have the right to request an "accounting of disclosures." This is a list of the disclosures of your health information (though it does not include disclosures made for treatment, payment, or for health care operations, or as authorized by you). This list is known as an "accounting of disclosures." To get this list, you must make your request in writing to the Chief Privacy Officer, [redacted] You must include the time frame for the request.

- You can get an accounting of disclosures for free every 12 months. There may be a charge for more than one report within a 12 month time frame.
- In most cases, we will get you the accounting of disclosures within 60 days, but it may take an extra 30 days in some cases and if it does, we will provide you with the reason.

5. Request Restrictions On Sharing Of Your Information

You have the right to request a restriction or limitation on the health information we use or disclose about you for treatment, payment or health care operations. You also have the right to request a limit on the health information we disclose about you to someone who is involved in your care, such as a family member or friend. For example, you could ask that we not use or disclose information about a surgery you had to your siblings. Note that if you ask us not to disclose health information to your health plan for items or services for which you paid in full and out of pocket, we will not disclose the information to the plan. To request a restriction, you must make your request in writing to the Chief Privacy Officer, [redacted] In your request, you must tell us (1) what information you want to limit; (2) whether you want to limit our use, disclosure or both; and (3) to whom you want the limits to apply (for example, disclosures to your spouse). ***We are not required to agree to your request.*** If we do agree, your restrictions may not be followed in some situations, such as emergencies or when required by law.

6. Request That We Change How We Contact You

You can make reasonable requests to be contacted at different places or in different ways. For example, you can have the nurse call you on your cell phone instead of your home number, or ask that your lab results be sent to your office, instead of to your home. If sending information to you at home might put you in danger, your health provider must talk, call, or write to you where you ask and in the way you ask, if the request is reasonable. To request confidential communications, you must make your request in writing to the Chief Privacy Officer, [redacted] You are not required to tell us the reason for your request. We will accommodate all reasonable requests, but your request must specify how or where you wish to be contacted. We may ask how you will handle payments as well.

7. Right to a Paper Copy of This Notice You have the right to a paper copy of this Notice upon request. You may also obtain a copy of this Notice at any time from our website, [redacted] or from the [redacted] facility where you obtained treatment.

CHANGES TO THIS NOTICE

We reserve the right to change this Notice. We reserve the right to make the revised Notice effective for health information we already have about you, as well as any health information we create or receive in the future. The Notice will contain the effective date on the first page. We will post a copy of the current Notice of Privacy Practices at each [redacted] treatment facility and on our website, [redacted]

COMPLAINTS

If you believe your information was used or shared in a way that is not allowed under the privacy law or if you believe your rights were denied you can file a complaint with [redacted] and with the Secretary of the Department of Health and Human Services.

MORE INFORMATION AND NOTICE

If you have any questions about this Notice or any complaints about our privacy practices, or would like to know how to file a complaint with the Secretary of the Department of Health and Human Services, please contact the Chief Privacy Officer at [redacted] ***You will not be penalized for filing a complaint.***

NOTICE OF

PRIVACY PRACTICES

[redacted]

For a list of the [redacted] facilities covered by this Notice of Privacy Practices, please see our website, [redacted] or call the Customer Care Line at [redacted]

Effective April 14, 2003
Modified December 15, 2012

A copy of this Notice is also available in Spanish.
Una copia de este anuncio esta disponible tambien en Espanol

THIS NOTICE DESCRIBES HOW MEDICAL INFORMATION ABOUT YOU MAY BE USED AND DISCLOSED AND HOW YOU CAN GET ACCESS TO THIS INFORMATION. PLEASE REVIEW IT CAREFULLY.

OUR PLEDGE REGARDING HEALTH INFORMATION

We understand that information about you and your health is personal. We are committed to protecting your health information. We will create a record of the care and services you receive at [redacted] its subsidiaries and other related entities. We use and disclose this record to provide you with quality care and to comply with certain legal requirements. This record will be available to all health care professionals who need access as described in this Notice, many of whom will be involved in your treatment at any [redacted] health care facility or practice. This Notice will apply to all of the records of your care generated by [redacted]

This Notice will tell you about the ways we may use and disclose your health information. It also describes your rights and certain obligations we have regarding the use and disclosure of health information.

We are required by law to:

- Make sure that health information that identifies you is kept private.
- Provide you notice of our legal duties and privacy practices with respect to your health information.
- Follow the terms of the Notice that is currently in effect.

WHO WILL FOLLOW THIS NOTICE?

- Any health care professional authorized to enter information into your [redacted] medical record, including doctors on the medical staff, while at a [redacted] health care facility or practice.
- All departments and units of [redacted] and practices owned by CHS and its subsidiaries.
- All employees, staff, volunteers and other [redacted] personnel.

In addition, these [redacted] facilities may share health information with each other for treatment, payment or health care operations purposes as described in this Notice.

HOW IS YOUR INFORMATION USED?

For Treatment We may use and disclose your health information to provide, coordinate, or manage your health care and related services, both among our own providers, and with others involved in your care. For example, a doctor treating you for a broken leg may need to know if you have diabetes because it affects the healing process. S/he may tell the dietitian, so you can have appropriate meals. S/he may tell a case manager so you can get proper resources at discharge. Different CHS departments also may share your health information in order to coordinate the different things you need, such as prescriptions, lab work and x-rays.

For Payment Generally, we may use and give your health information to others to bill and collect payment for the treatment and services we provide to you. Before you receive scheduled services, we may contact your health plan to ask for approval of payment before we provide the services, or we might contact Medicare or Medicaid to inquire as to whether you qualify for coverage. We may also share portions of your health information with billing departments, insurance companies, health plans and their agents which do or could provide you coverage; and consumer reporting agencies. For example, if you broke your leg, we may need to give your health plan information about your condition, the supplies used (such as plaster for your cast or crutches), and the services you received (such as X-rays or surgery).

For Health Care Operations We may use and disclose health information to conduct our business activities and health care operations, which assist us in improving the quality and cost of the care we provide to you and other patients. For example, we may look at patient records from the ICU to review our treatment and services and to evaluate the performance of our staff. We may also use patient health information to decide what new services we should offer, what services are not needed, and whether certain new treatments are effective. We may disclose information for education, licensing, legal and other purposes.

Appointment Reminders We may use and disclose health information to contact you as a reminder that you have an appointment for treatment or medical care.

Treatment Alternatives We may use and disclose health information to tell you about or recommend possible treatment options or alternatives that may be of interest to you.

Health-Related Benefits and Services We may use and disclose health information to tell you about health-related benefits or services that may be of interest to you, or to tell you about new facilities that we are opening.

Business Associates We sometimes hire other people to help us perform our services. We may disclose your health information to them so that they can perform the job we have asked them to do. We require them to protect your health information and keep it confidential. For example, we may hire a transcription service to transcribe parts of your medical record, or a billing and collections agency to bill you or your insurance company for the services rendered or collect payment.

USES OF HEALTH INFORMATION FROM WHICH YOU CAN OPT OUT

You can object to some uses and disclosures of your information.

Fundraising Activities We may use your health information to contact you in an effort to raise money for [redacted] and its operations. We may disclose health information to a [redacted] related foundation which may contact you regarding raising money for a treatment or service related cause. We would only release demographic information, such as your name, address and phone number and the dates you received treatment or services. If you do not want CHS to contact you for fundraising efforts, you must notify the Chief Privacy Officer in writing at [redacted]

Hospital Directory Unless you object, we may include your name, location in the hospital, and your general condition (e.g., good, fair, serious, etc.) in the [redacted] hospital directory while you are a patient at the hospital. The directory information may be released to people who ask for you by name. Unless you object, we can also share this information, as well as your religious affiliation, to clergy affiliated with your faith, regardless of whether they ask for you by name. To object to being included in the directory, notify the staff member registering you or providing your care.

Mental Health If you received treatment at a mental health facility, your information can be shared with other providers outside of the mental health facility for purposes of treatment, payment, and health care operations. For example, if you are having surgery at a hospital, your surgeon can review your mental health treatment information to make sure the plan of care is right for you. You have the right to opt out of the mental health facility information being available by submitting a written request to the staff member registering you or providing your care. Please allow five (5) business days for the opt out to take effect. Note that there are other situations in which we can disclose your mental health information, even if you opt out, such as in an emergency. You can opt back in by giving similar notice.

Individuals Involved in [redacted] or Payment for [redacted] Ve may share with a family member, personal representative, friend or other person you identify, your health information that is directly related to their involvement in your care or payment for your care. For example, if you are on a spouse's insurance plan, your spouse may have access to a bill explaining your treatment. We may share your health information when it is necessary to notify them of your location, general condition or death. In an emergency, or if you are incapacitated, we will use our professional judgment to decide if it is in your best interest to disclose your health information to a person involved in your care. If you bring family members or others to your appointments and do not tell us that you object to them hearing your medical information, then we are allowed to interpret that as your consent for them to do so.

HEALTH INFORMATION EXCHANGES

We may provide your health care information to a health information exchange (HIE) in which we participate. A HIE is a medical record database where other health care providers caring for you can access your medical information from wherever they are, assuming they are members of the HIE. These providers may include your doctors, nursing facilities, home health agencies or other providers who care for you outside of our hospitals or our practices. For example, you may be travelling and have an accident in another area of the state. If the doctor treating you is a member of the HIE in which we participate, s/he can access the information about you that other providers have contributed. Accessing this additional information can help your doctor provide you with well-informed care quickly because s/he will have learned a lot about your medical history or allergies or prescriptions from the HIE. If you do not want your medical information to be contributed to the HIE and shared with these member health care providers, you can opt out by visiting [redacted] and submitting the opt out form. It will take 5 business days for the opt out to go into effect. Note that if you opt out, your providers may not have the most recent information about you which may affect your care. You can always opt in at a later date by visiting [redacted]

SPECIAL SITUATIONS

In some situations, we may use or share your health information without your permission or allowing you an opportunity to object. Examples of these situations include:

When the disclosure is required by law
For Organ, Eye or Tissue Donation Purposes
For Public Health Activities (such as to prevent or control disease, injury, or disability; to report births or deaths; to report child or disabled adult abuse or neglect; to report reactions to medicine or problems with medical products, etc.)
For Health Oversight Activities
For a Legal Proceeding
To Law Enforcement
To Avoid a Serious Threat to Health or Safety
To Coroners, Medical Examiners and Funeral Directors
For Disaster Relief
For Research
For Specialized Government Functions
For Workers' Compensation

STATE AND FEDERAL LAWS

Sometimes, state or federal laws require us to protect or disclose your health information in keeping with or in addition to the ways stated in this Notice. For example, state law protects your health information under the doctor-patient privilege. There are also situations when we are required or permitted to disclose your information under the law, such as our obligation to report gun shot wounds. The following are just a few examples of some common situations where state or federal laws require us to protect or disclose your information:

Appendix N

Baseline Data Collection Form

Nurse Code: _____ Baseline Data Collection Form

Pilot Study Day:____ Age:_____ ASA:___ Anesthesia Start Time: _____ Stop time:_____

Circle: NORA or OR Circle: LMA/OETT/Shared Airway or General Mask/MAC

Nursing Intervention	Time	Time	Time	Time	Time	Time	Time	Time	Time
Oral airway removed									
Head position adjusted									
Jaw thrust/chin lift									
Oral airway placed									
Oxygen Up ↑									
Oxygen Down ↓									
Oxygen Off									
Verbal Stimulation									
Tactile Stimulation									
Event	Time	Time	Time	Time	Time	Time	Time	Time	Time
Pulse oximetry <92% (Phase I)									
Pulse oximetry <94% (Phase II)									
Call to Anesthesia									
Required bagging									
Bradycardia									
Intubation									
Code									

Phase I time in:_____ Phase I time out:_____ Phase II time in:_____ Phase II time out:_____

Appendix O

Capnography Data Collection Form

Nurse Code: _____ Capnography Data Collection Form

Pilot Study Day:____ Age:_____ ASA:___ Anesthesia Start Time: _____ Stop time:_____

Circle: NORA or OR Circle: LMA/OETT/Shared Airway or General Mask/MAC

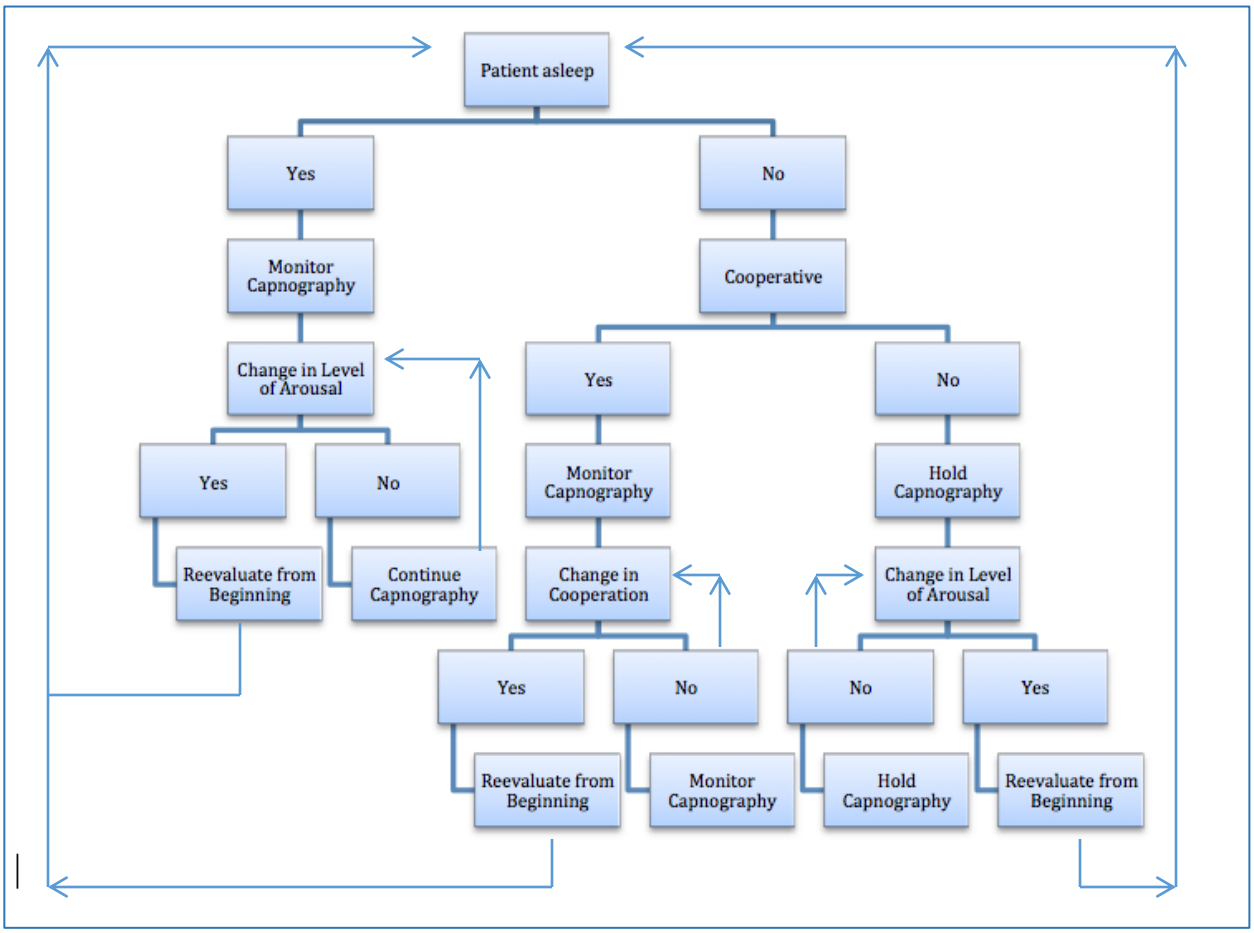
Nursing Intervention	Time	Time	Time	Time	Time	Time	Time	Time	Time
Oral airway removed									
Head position adjusted									
Jaw thrust/chin lift									
Oral airway placed									
Oxygen Up ↑									
Oxygen Down ↓									
Oxygen Off									
Verbal Stimulation									
Tactile Stimulation									
Event	Time	Time	Time	Time	Time	Time	Time	Time	Time
Pulse oximetry <92% (Phase I)									
Pulse oximetry <94% (Phase II)									
End Tidal CO2 <30									
End Tidal CO2 >50									
Call to Anesthesia									
Required bagging									
Bradycardia									
Intubation									
Code									

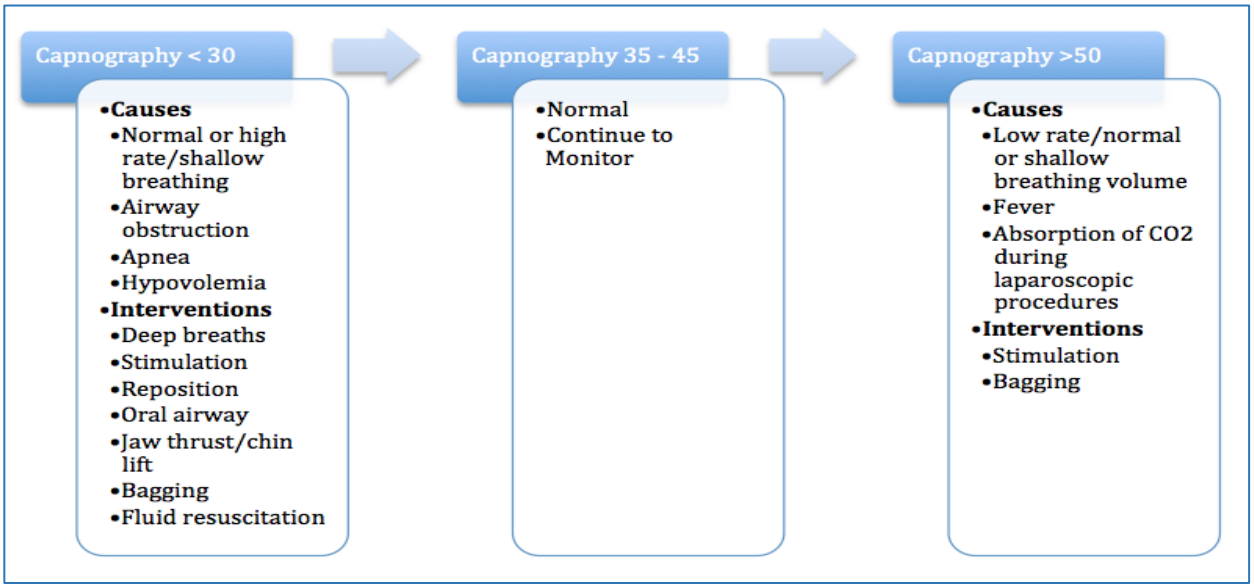
Phase I time in:_____ Phase I time out:_____ Phase II time in:_____ Phase II time out:_____

Capnography began:_____ Capnography discontinued:_____

Appendix P

Capnography Resource Guide





Note: Langhan, Li, & Lichtor, 2017

Appendix Q

Measurable Outcome Analysis

Table Q1
Comparisons of Means for Nursing Interventions

Test Statistics[a]

	Intervention #	Time Admit/1st Intervention x 02 OFF	Oral Airway Removed	Head Repositioned	Jaw Thrust/Chin Lift	Oxygen Up	Oxygen Down	Oxygen off	Verbal Stimulation	Tactile Stimulation
Mann-Whitney U	1621.000	280.000	2520.500	1970.000	2485.000	2477.500	2464.000	2483.500	1858.500	1934.000
Wilcoxon W	4177.000	1226.000	5076.500	4526.000	5041.000	5033.500	5020.000	5039.500	4414.500	4490.000
Z	-4.027	-2.460	.000	-3.077	-1.000	-.379	-.399	-.357	-3.892	-3.553
Asymp. Sig. (2-tailed)	.000	.014	1.000	.002	.317	.705	.690	.721	.000	.000

a. Grouping Variable: Group

Table Q2
Comparison of Means for Serious Adverse Events

Test Statistics[a]

	Event #	Pulse Ox < 92%	Pulse Ox < 94%	EtCO2 <30	EtCO2 > 50	Call Anesthesia	Bagging
Mann-Whitney U	2220.500	1726.500	2485.000	2414.000	2130.000	2306.500	2485.000
Wilcoxon W	4776.500	4282.500	5041.000	4970.000	4686.000	4862.500	5041.000
Z	-1.546	-4.808	-1.000	-1.744	-3.441	-2.186	-1.000
Asymp. Sig. (2-tailed)	.122	.000	.317	.081	.001	.029	.317

a. Grouping Variable: Group

Table Q3
Comparison of Means for Serious Adverse Event Related to EtCO2 > 50 mmHg

Test Statistics[a]

	Total Cap
Mann-Whitney U	237.000
Wilcoxon W	2067.000
Z	-1.478
Asymp. Sig. (2-tailed)	.139

a. Grouping Variable: EtCO2 >50

Table Q4
Comparison of Means for Explanatory Group Variables

Test Statistics[a]

	Age	Anesthesia Risk	Total Anes Time	Total PACU
Mann-Whitney U	1940.500	2398.000	2433.000	1952.500
Wilcoxon W	4496.500	4954.000	4989.000	4508.500
Z	-2.369	-.574	-.357	-2.318
Asymp. Sig. (2-tailed)	.018	.566	.721	.020

a. Grouping Variable: Group