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Preoperative Fluid Therapy to Decrease Postoperative Nausea and Vomitting in High Risk Populations: Practice Change Outcomes

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PREOPERATIVE FLUID THERAPY TO DECREASE POSTOPERATIVE NAUSEA AND VOMITTING IN HIGH RISK POPULATIONS: PRACTICE CHANGE OUTCOMES

by

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ABSTRACT

PREOPERATIVE FLUID THERAPY TO DECREASE POSTOPERATIVE NAUSEA AND VOMITTING IN HIGH RISK POPULATIONS: PRACTICE CHANGE OUTCOMES

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Postoperative nausea and vomiting (PONV) continues to be a negative complication that impacts patient satisfaction and potentiates unfavorable patient outcomes. Certified Registered Nurse Anesthetists (CRNA) are in a unique position to help alleviate this problem. However, CRNAs must be vigilant in utilizing evidence-based practices that decrease PONV and identifying patients who have increased risk factors for developing PONV.

For this doctoral project, an educational in-service on the use of preoperative fluid therapy to decrease PONV in high risk populations was held with participating CRNAs. This doctoral project's main purpose was to evaluate CRNAs' willingness to make a practice change after participating in the educational in-service. Also, the in-service increased the CRNAs' knowledge on how to recognize patients that are at increased risk for developing PONV. Before the educational in-service was held, an informal needs assessment was conducted at the chosen facility. The needs assessment revealed that CRNAs as well as post-anesthesia care unit (PACU) nurses were still routinely treating PONV.

Participating CRNAs completed two questionnaires. The first questionnaire was administered before an educational in-service and the second questionnaire was

administered 2 weeks later. A total of 18 CRNAs participated in the educational in-service and completed both questionnaires. Descriptive statistics was utilized to analyze the data gathered from the questionnaires.

Before the educational in-service was held, only 5 out of 18 (27.8%) participants indicated they currently used preoperative fluid therapy to decrease PONV. Two weeks after the educational in-service was held, 18 out of 18 (100%) participants indicated the educational in-service influenced their decision to use preoperative fluid therapy in their plan of care. Although the amount of times preoperative fluid therapy was used varied among the CRNAs, all 18 participants utilized preoperative fluid therapy in the 2-week time frame.

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I would like to express my sincere gratitude to my chair, Dr. Janie Butts as well as my committee members, Dr. Lachel Story and Dr. Michong Rayborn for their encouragement and guidance throughout this process. I would like to give a special thanks to Dr. Joe Campbell for supporting this project and the CRNAs who participated in the project.

DEDICATION

I would like to thank my husband, Adam, for supporting me and always encouraging me throughout this process.

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LIST OF ABBREVIATIONS

AVP	Antidiuretic hormone
CRNA	Certified Registered Nurse Anesthetist
CTZ	Chemoreceptor Trigger Zone
IRB	Institutional Review Board
IV	Intravenous
PACU	Post-anesthesia care unit
PON	Postoperative nausea
PONV	Postoperative nausea and vomiting
POV	Postoperative vomiting
SRNA	Student Registered Nurse Anesthetist
VAS	Visual analogue scale

CHAPTER I – INTRODUCTION

Background and Significance

Postoperative nausea and vomiting (PONV) is a major concern for all providers caring for patients in the surgery setting. PONV has been linked to negative complications, such as extra time spent in the post-anesthesia care unit (PACU), extended patient stay, patient discontent, increased hospital expenses, and morbidity (Lambert, Wakim, & Lambert, 2009). Though considerable research has been done on evidence-based ways to eradicate this complication, it frequently occurs anyway. For instance, "the overall incidence of PONV for all surgeries has been estimated to be 25% to 30% and up to 70% in high-risk groups" (Lambert et al., 2009, p. 110). Patients at a higher risk for PONV include: nonsmokers, women, people who have had motion-sickness or PONV in the past, and opioids given postoperatively (Yavux et al., 2014).

The use of general anesthesia is constantly evolving and improving to achieve better anesthesia outcomes for patient populations. The use of multimodal drug approaches to prevent PONV has become a customary anesthesia practice. Examples include: (a) patient controlled antiemetics, (b) oxygen use, (c) pain management and prevention, and (d) antiemetic administration. Common antiemetic drugs used are sedatives, anxiolytics, antimuscarincis, corticosteroid, antagonists, and providing adequate hydration (Yavux et al., 2014).

Problem Statement/ Needs Assessment

Though some patients have no risk factors for PONV, they may experience PONV after surgery. While there are commonly used antiemetic medications, these drugs can have some safety concerns, particularly their "effect on the ECG with prolongation of

the QTc interval by butyrohenones and first-generation 5-HT3 receptor antagonist class of antiemetics" (Kovac, 2013, p. 1525). Studies have indicated that overnight fasting increases the likelihood for PONV (Apfel, Meyer, Organ-Sungur, Jalota, Whelan, & Jukar-Rao, 2012b). The frequent use of laparoscopic abdominal procedures poses another safety concern (Yavux et al., 2014). In fact, patients have an increased incidence of 50% to 80% for PONV after laparoscopic abdominal procedures because of Carbon Dioxide (CO2) insufflation, nasogastric tube placement, and CO_2 absorption (Blitz et al., 2012; Yavux et al., 2014). In addition, another group of researchers determined that laparoscopic procedures, gynecological surgery, and cholecystectomies are significant predictors of PONV in themselves (Apfel et al., 2012a).

Researchers have identified preoperative fluid therapy as an effective and efficient way to reduce the occurrence of PONV (Lambert et al., 2009). For example, one group of researchers concluded that using fluid bolus as a preventive therapy is useful and cost effective, and, in the future, could play a critical role in multimodal prevention (Magner, McCaul, Carton, Gardiner, & Buggy, 2004). PONV can be costly to healthcare organizations. Some of the increased cost of PONV involves more time spent in the PACU and extended hospital care (Rahman & Beattie, 2008). However, not all patients should receive preoperative fluid therapy. For instance, patients who have heart, kidney, liver, respiratory, or brain conditions could experience negative effects if given to much fluid (Adanir, Aksun, Ozgurbuz, Altin, & Sencan, 2008).

After speaking with seven CRNAs who are employed at the facility where this DNP project will be implemented, they voiced that one out of five postoperative assessments indicated patients suffered from PONV. They also voiced interest in learning

more ways to prevent this postoperative complication. Furthermore, 8 PACU (3 night shift and 5 day shift) nurses were asked about their experience with PONV. The night shift nurses reported having more patients with PONV than the day shift nurses. However, the day shift nurse stated they still routinely treat patients experiencing PONV.

Clinical Question

The clinical question for this doctoral project is: Will CRNAs who have received evidence-based information regarding preoperative fluid therapy as a method for decreasing PONV make a practice change to incorporate it in their plan of care for patients at high risk for developing PONV 2 weeks after receiving the information? Preoperative fluid therapy before anesthesia generally will prevent a volume deficit, therefore, facilitating a state of normovolemia (Yavux et al., 2014). The amount of preoperative fluid therapy has varied among researchers. The most effective preoperative fluid therapy ranges from crystalloids 5-30 ml/kg up to 1000 ml 1 hour prior to the induction of anesthesia or some researchers replaced fluids using the 4-2-1 rule up to 1000 ml (Adanir et al., 2008; Ali et al., 2003; Apfel et al.,2012b; Chaudhary et al., 2008; Ghafourifard et al., 2015; Lambert et al, 2009; Magner et al., 2004; Turkistani et al, 2009; Yavux et al., 2014). Research findings have strongly supported the use of one to two liters of crystalloids as a method to decrease drowsiness, dizziness, and PONV (Holte, 2010). Two other researchers found that patients who received 1000 ml crystalloids preoperatively had less incidences of PONV than those patients who received less fluid (2-3 ml/kg) (Monti & Porkorny, 1999). In CRNAs (P), will presenting an educational in-service (I) on the use of preoperative fluid therapy to decrease PONV in high risk

populations effect their willingness to change practice (O) compared to CRNAs who do not participate in the educational in-service (C) over the course of 2 weeks (T)?

Purpose of the Project

The primary purpose of this project was to create a practice change among CRNAs in which they will incorporate preoperative fluid therapy to prevent PONV in at risk patients for PONV. Providing information to CRNAs regarding the positive effects of preoperative fluid therapy will heighten awareness of the need to incorporate this therapy into their practice. By providing evidence-based information gained from the literature review, CRNAs will be able to make an informed decision to use preoperative fluid therapy in their plan of care.

Theoretical Framework

Since the primary purpose of this project is to create a practice change, the model for evidence-based practice change will be used, which is a revised model from Melynk and Fineout-Overholt (2015) model for evidence-based practice. The revised model could serve as a foundation for many practice change projects. The revised model was based on Rosswurm and Larrabee's (1999) original model titled model for change to evidence-based practice.

The revised model consists of 6 steps. Step 1, evaluate if a change in practice is warranted , involves as its name implies: (a) recognizing a practice problem; (b) seeking ways to repair it; (c) gathering information that will improve possible interventions and desired outcomes, such as comparing existing internal facts and statistics to present-day practices to decipher if there is a problem; and (d) offering ways to repair problem and goals that are to be achieved (Rosswurm & Larrabee, 1999; Melnyk & Fineout-Overholt,

2015). Step 2, locate the best evidence, involves several actions: (a) reviewing the evidence to reveal the types and sources, (b) formulating a plan for the evidence search, and (c) performing the search for the most accurate evidence (Larrabee, 2009). Step 3, critically analyze the evidence, includes: (a) reviewing the evidence and concluding if the evidence is strong or weak and (b) combining the chief evidence and discerning the attainability, advantages, and negative outcomes of the new practice. Step 4, design the practice change involves: (a) explaining the suggested practice change, (b) pinpointing the resources that will be needed, (c) strategizing the appraisal of the pilot, and (d) putting together the implementation plan. Step 5, implement and evaluate change in practice, includes: (a) putting the pilot study into action; (b) accessing the process, results, and expenses; and (c) formulating conclusions and suggestions for the future. Step 6, integrate and maintain change in practice, involves: (a) disseminating the information gathered about the new practice change with those persons it directly effects, (b) include the new practice change as part of the standards of care, (c) tracking the process and outcome indicators, and (d) sharing the outcomes of the project.

DNP Essentials

The DNP essentials (AACN, 2006) directly related to this doctoral project are Essentials I, II, and VI (see Appendix A). DNP Essential I: Scientific Underpinnings for Practice relates to this doctoral project in terms of the development of nursing science through researching and adding to knowledge of preoperative fluid therapy use. DNP II Essential: Clinical Scholarship and Analytical Methods for Evidence-Based Practice relates to this doctoral project in terms of the use of clinical scholarship and evidence-based research that will enhance CRNA knowledge. DNP VI Essential: Interprofessional

Collaboration for Improving Patient and Population Health Outcomes relates to this doctoral project by a collaboration with CRNAs to discuss the benefits of preoperative fluid therapy use to decrease PONV to promote better patients' post-anesthetic outcomes.

Summary of the Evidence

A literature review was conducted for this paper by initially accessing The University of Southern Mississippi's library website and utilizing the articles and databases function. The selected databases included CINAHL, MEDLINE, and Health Source: Nursing/Academic Edition. The phrase preoperative fluid therapy was entered in the search field. There were 27 results, and 2 articles were relevant to the research topic. Next, an advanced search was performed by using the advanced search option to look for all search terms and not just phrases, including the terms PONV or postoperative nausea and vomiting. The time frame was set for the last 10 to 20 years. This search yielded 10 articles; of the 10 articles, 2 were duplicates, 2 were irrelevant, and 6 articles were relevant and, therefore, used. The other articles included in this paper were found by citation tracking of the articles found in the previous mentioned search.

Postoperative Nausea and Vomiting

Nausea and vomiting are serious postoperative complications that significantly decrease patients' sense of well-being and are considered the most distressing byproduct of general anesthesia and surgery (Chatterjee, Rudra, & Sengupta, 2011). Research has revealed that 70% of patients experience PONV (Adanir, Aksun, Ozgurbuz, Altin, & Sencan, 2008). Some patients even report worrying more about PONV than postoperative pain (Rahman & Beattie, 2008). Negative effects associated with PONV

include healthcare cost surge upward due to lengthened recovery room stays and extended hospital care.

Many modalities have been implemented to help prevent these unfortunate complications. For instance, many factors play into the cause of PONV. A variety of anti-nausea medications that work at different receptor sites should be used along with utilizing a multimodal approach (Chatterjee et al., 2011). Ignoffo (2009) further reported that using medications from various classes could be beneficial in treating those patients at moderate risk for developing PONV. Adequate hydration is an essential part of a multimodal approach (Adanir et al., 2008), especially since patients who have fasted after midnight develop hypovolemia that can worsen PONV (Apfel et al., 2012a).

Several factors can lead to PONV, including the individual, specific medical history, type of operation, and type of anesthetic used (Adanir et al., 2008). The Society for Ambulatory Anesthesia (2014) listed adequate hydration as one of the strategies to reduce PONV and include it in their consensus guidelines for the management of PONV (Gan et al., 2014). PONV can be identified in high risk populations by using a widespread PONV risk assessment tool known as the Simplified Apfel score (1999; see Appendix B). The type of surgery is another documented contributing factor to the development of PONV. For instance, the most notable post-surgery complication of laparoscopic operations is PONV, which occurs in approximately 70% of patients (Adanir et al., 2008). Laparoscopic surgery is believed to cause PONV due to pressure exerted on the vagus nerve from insufflation of the abdomen (Chatterjee et al., 2011).

Preoperative Fluid Therapy Mechanism of Action

The exact way in which preoperative fluid therapy decreases PONV remains unclear (Adanir et al., 2008), but there are some reoccurring theories. Adanir et. al. (2008) and Ali, Taguchi, Holtman, and Kurz (2003) discussed how patients fasting overnight leads to hypovolemia, and if adequate fluid is not replaced, can cause PONV. Lambert et. al. (2009) stated that every patient on the day of surgery is dehydrated from fasting overnight. Another possible cause of PONV is serotonin release from gut mucosa ischemia in response to perioperative hypo-perfusion; serotonin release is a powerful stimulate of nausea and vomiting (Adanir et al., 2008).

Chaudhary, Sethi, Montiani, and Adatia (2008) also stated that temporary intestinal ischemia can occur because of decreased perfusion to the mesentery caused by fasting throughout the night coupled with the effects of anesthesia and fluids lost from surgery. Giving patients' fluids in advance improves perfusion to the mesentery thus decreasing the chance of PONV. Adanir et al. (2008) emphasized that giving extra fluids prior to inducing the patient can reduce the volume deficiency and improve splanchnic perfusion; decreased perfusion to the intestines could be improved by adequate splanchnic perfusion. Supplemental fluids given prior to inducing general anesthesia also may cause the fluid volume status to normalize (Yavux et al., 2014).

Preoperative fluid therapy could also affect PONV through peripheral and central mechanisms (Adanir et al., 2008). Dehydration most likely affects the chemoreceptor trigger zone (CTZ). The CTZ is an area in the brain that has a vast amount of dopamine and serotonin receptors. When these receptors are stimulated by endogenous

catecholamines released due to anesthetics and surgery, PONV can occur (Rahman & Beattie, 2008).

In a quantitative review, Apfel et. al. (2012b) suspected that antidiuretic hormone (AVP) could increase the effect of additional fluids' ability to decrease PONV. Their belief stems from anesthesia causing arteries to dilate, creating a hypovolemic state. The hypovolemic state causes a "reduced central venous pressure with reduced negative feedback of the right atrial stretch receptors, leading to increased AVP release from the posterior pituitary" (Apfel et al., 2012b, p. 4). AVP has been known to cause nausea and vomiting (Apfel et. al., 2012b). For example, one group of researchers reported patients who developed PONV had increased levels of AVP throughout surgery leading to increased levels of AVP when brought to the recovery room; patients without PONV did not have increased levels of AVP (Oddby-Muhrbeck et al., 2005).

Preoperative Fluid Therapy

A group of researchers conducted a prospective randomized control study on three groups of 60 participants: Group A-- control group with a conservative amount of Ringer's lactate at 2 ml/kg Group B--Ringer's lactate at 12 ml/kg; and (c) Group C--4.5% hydroxyethlstarch at 12 ml/kg (Chaudhary et al., 2008). These researchers used a visual analogue scale (VAS) to assess PONV. The results were as follows: Group A mean VAS ranged from 0.45 to 4.30, Group B ranged from 0.25 to 3.90, and Group C ranged from 0.40 to 3.65. These researchers reported that the participants in Groups B and C experienced lower mean VAS scores ($p < 0.001$) than the participants in the Group A, who received conservative fluid therapy.

Another group of researchers tested the benefit of preoperative fluid therapy in female patients undergoing elective laparoscopic cholecystectomy. Group 1 received Ringer's lactate 15 ml/kg preoperatively, and Group 2 received Ringer's lactate 2 ml/kg preoperatively (Yavuz et. al., 2014). Total nausea VAS scores in Group 1 had a significantly lower incidence of nausea at the 8^{th} and 12^{th} ($p=0.001$, $p=0.041$). Within the range of 1 to 24 hours, Group 1 experienced less nausea and vomiting. They concluded the patients in Group 1, who received a larger amount of fluid preoperatively, experienced less PONV than the conservative fluid Group 2.

In a similar study, researchers tested two groups of patients undergoing laparoscopic cholecystectomy and gynecological procedures (Ali et al., 2003). The conservative fluid group received 2 ml/kg preoperatively and the supplemental fluid group received 15 ml/kg preoperatively. The supplemental fluid group's median (interquartile range [range]) VAS for nausea was lower than the conservative fluid group. The results were as follows: at 0 to 1 hour (16 (0-32[0-82]) vs. 0(0-10[0-70]), respectively; $p=0.013$) and over the 1 to 24-hour study period (55(30-70[0-100] vs. 15(0-55[0-100]), respectively; $p= 0.00$).

A group of researchers conducted a prospective, double-blind, randomized, control trial consisting of 210 patients and compared findings of two groups of patients having laparoscopic cholecystectomies (Adanir et al., 2008). Group 1 received a calculated volume deficit from overnight fasting along with a maintenance infusion of 0.9% normal saline at a rate of 1.5 ml/kg/hr intraoperatively. Group 2 received a calculated volume deficit plus the same maintenance infusion preoperatively. The findings demonstrated that in Group 1 64.42% of patients experienced nausea or

vomiting and retching. In Group 2, only 48.11% of patients experienced nausea or vomiting and retching. When the two groups were compared in regards to patients that received an antiemetic of nausea and vomiting, Groups 1 and 2 showed a statistically significant difference ($p=0.019$).

In another study with similar results, researchers conducted a prospective, randomized, control trail with 80 participants to compare four groups of patients undergoing laparoscopic cholecystectomy (Turkistani et. al., 2009). Each group received different fluids preoperatively. Group 1 received 10 ml/kg dose of low-MW tetrasrarch in saline; Group 2 received 10 ml/kg of medium-MW penstarch in saline; Group 3 received 10 ml/kg of high-MW heta-starch; and Group 4 received 10ml/kg lactated ringers. Out of the 4 groups, Group 4 experienced the least amount of PONV (30%). Thirty percent was significantly less compared to the other groups ($p < 0.05$). At 24 hours, the incidence of PONV was 5% in Group 1, 20% in Group 2, 20% in Group 3, and 15% in Group 4. The incidence of PONV 2 hours after surgery was 5% in Group 4 compared to 35% in Group 1, 45% in Group 2, and 60% in Group 3 ($p< 0.05$).

Ghafourifard, Zirack, Broojerdi, Bayendor, and Moradi (2015) performed a double-blinded, clinical trial involving 2 groups of 46 participants: (a) Group 1—the crystalloid group received a 7 ml/kg preoperative bolus of Ringers solution and (b) Group 2—the colloid group received a 7 ml/kg preoperative bolus of 3% Haemaccel. They concluded that both crystalloids and colloids help reduce the incidence of PONV. At 1 hour in the Ringer's lactate group, the incidence of PONV was 18.52% and 14.82% in the Haemeccel group.

In another study, the researchers conducted a literature review on the incidence of PONV (Apfel et al., 2012b). Fifteen trials were identified (N= 787 crystalloids; N= 783 conservative). They reported that "compared with conservative fluids, intravenous (IV) crystalloids reduced the risk of early postoperative nausea (PON) (relative risk 0.73, 95% confidence interval 0.59–0.89; p=0.003), late PON (0.41, 0.22–0.76; p=0.004), and overall PON (0.66, 0.46–0.95; p=0.02). IV crystalloids did not reduce the risk of early postoperative vomiting (POV) (0.66, 0.37–1.16; p=0.16) or late POV (0.52, 0.25–1.11; p=0.09), but did reduce overall POV (0.48, 0.29–0.79; p=0.004). IV crystalloids did not reduce the risk of early PONV (0.74, 0.49–1.12; p=0.16), but did reduce the risk of late PONV (0.27, 0.13–0.54; p<0.001) and overall PONV (0.59, 0.42–0.84; p=0.003). IV crystalloids reduced the need for antiemetic rescue treatment (0.56, 0.45–0.68; p<0.001)" (Apfel et al., 2012b, p.1). Although IV crystalloids did not show to decrease early PONV, they did decrease the risk of late PONV and overall PONV.

The next four studies reflected similar findings as the previously mentioned studies. All four studies included women undergoing laparoscopic gynecological procedures. Lambert et. al.'s (2009) controlled, prospective blinded study of 46 participants consisted of 2 groups: (a) Group 1, whom received up to 1 liter of lactated ringers preoperatively using the 4-2-1 rule as a guide and (b) Group 2, whose fluids were replaced at the time decided by the provider. Of the 16 patients in this study who experienced PONV, 5 patients from Group 1 experienced episodes of nausea. Eleven patients from Group 2 experienced episodes of nausea and 1 vomiting episode. Therefore, Group 1 had a 22% occurrence of PONV compared to Group 2's 52% occurrence of PONV.

Magner et al. (2004) conducted a prospective, randomized, double-blinded trial consisting of 141 female participants that produced similar findings to Lambert et. al.'s study. This study also consisted of 2 groups: (a) Group 1, who received compound sodium lactate at a rate of 10 ml/kg starting in the preoperative period and (b) Group 2, who received compound sodium lactate at a rate of 30 ml/kg starting in the preoperative period. They noted that Group 1 had a lower incidence of vomiting in the first 48 hours compared to Group 2 (8.6% vs. 25.7%, p=0.01). Also, Group 1 required less anti-emetic administration than Group 2 at 0.5 hours (2.9% vs. 14.3%, p=0.04). Group 1 experienced significantly less severe nausea than Group 2 upon awakening (2.9% vs. 15.7%, p=0.02), 2 hours (0.0% vs. 8.6%, p=0.04) and cumulatively (5.7% vs. 27.1%, p=0.001).

Maharaj et. al. (2005) tested 2 groups consisting of 80 women presenting for laparoscopic gynecological surgery: (a) the large volume group, who received compound sodium lactate at 2 ml/kg per hour of fasting and (b) the control group, who received the same fluid at 3 ml/kg (not per hour of fasting). In the first 72 hours postoperatively, the overall occurrence of PONV was significantly less in Group 1 (59%) versus Group 2 (87%) ($p < 0.05$). Also, mean postoperative VAS scores were significantly less in Group 1 ($p < 0.05$) in the PACU, and at 1, 4, 24, and 72 hours postoperatively. The large volume group experienced less incidence of PONV.

Monti and Pokorny (1999) studied 2 groups of patients consisting of 90 women undergoing laparoscopic gynecological surgery: (a) the experimental group, who received a 1 liter fluid bolus preoperatively and (b) the control group, who received fluids based on provider discretion. In the control group, 30% of patients experienced nausea and 5% experienced vomiting. Regarding nausea and vomiting, a significant difference was noted

between the 2 groups (p= .001). A total of 51% of the patients in the control group experienced nausea and vomiting compared to only 17% experiencing nausea and vomiting in the experimental group. The findings were consistent with the previous three studies that preoperative fluid therapy decreases PONV in gynecological laparoscopic procedures.

Conclusion

Evidence suggest that preoperative fluid therapy is an effective way to reduce PONV and, therefore, should be considered in the treatment plan of those individuals who are at increased risk for developing PONV. Patients at increased risk of developing PONV need to first be identified by way of an assessment. The Simplified Apfel score (1999) is a useful tool in identifying those patients at increased risk of developing PONV. This score lists four characteristics: (a) female gender, (b) non-smoker, (c) history of PONV, and (d) postoperative opioids. Even if no risk characteristics are present, the patient is still at a 10% risk of developing PONV; the chance that a patient will develop PONV rises to 20%, 40%, 60%, and 80% for each added risk factor (Apfel et al., 1999; Gan et al., 2014).

CHAPTER II - METHODOLOGY

Evidence indicated that preoperative fluid therapy is an effective part of a multimodal approach to decrease postoperative nausea and vomiting (PONV). Furthermore, the use of preoperative fluid therapy can easily be incorporated into the anesthesia plan. The aim of this project was to create a practice change in which Certified Registered Nurse Anesthetists (CRNAs) incorporate preoperative fluid therapy into their plan of care in those patients who are at increased risk of developing PONV.

Setting and Target Population

The target population for this project consisted of fully licensed CRNAs at a 512-bed hospital in South Mississippi. There was a total of 40 CRNAs at this facility. Therefore, there could have been up to 40 participants. These CRNAs were chosen as a convenience sample because of their location and their rapport with this student registered nurse anesthetist (SRNA) Also, the informal needs assessment revealed that CRNAs and post-anesthesia care unit (PACU) nurses were still treating patients for PONV.

Design

An educational in-service for the CRNAs was held at the chosen facility. The educational in-service was related to incorporating preoperative fluid therapy into their plan of care to decrease PONV and consisted of knowledge gathered from information in the literature review. After the in-service, the CRNAs will be asked to incorporate preoperative fluid therapy in their plan of care over the next 2 weeks. During those 2 weeks, the CRNAs were asked to document how many times they used preoperative fluid therapy. They were asked to document the number of times in their cellular device.

The CRNAs were presented with two questionnaires (see Appendix C). They completed the first questionnaire on the day of the in-service education. This first questionnaire consisted of five items, three of which related to demographic data (age, years of experience, and gender), one related to their knowledge of the Simplified Apfel score, and one related to their use of preoperative fluid therapy. The second questionnaire was presented at the end of the 2 weeks and asked if the CRNAs did or would make a practice change based on their implementation of preoperative fluid therapy the last 2 weeks and based on evidence-based information presented to them in the educational in-service. The second questionnaire inquired about any barriers the CRNAs experienced when utilizing preoperative fluid therapy in their plan of care, if the in-service influenced their decision to use preoperative fluid therapy in their plan of care, and if they have any additional comments.

Procedures

Approval was secured from the Institutional Review Board (IRB) of The University of Southern Mississippi (Protocol number 17080701) (see Appendix D) and approval from the facility was obtained before any data collection or implementation of the project (see Appendix E). Descriptive statistics determined the percentage of CRNAs who have changed their practice to incorporate preoperative fluid therapy in their plan of care. The Simplified Apfel score was utilized in the in-service to facilitate the CRNAs' ability to recognize those patients at increased risk of developing PONV.

Ethical Protection of Human Subjects (IRB)

This project was submitted for approval to The University of Southern Mississippi. Approval for the doctoral project was obtained from the facility. All

information in terms of the educational in-service, discussions within the in-service, and data collected was kept confidential and secure. This SRNA assured confidentiality to the participants before they signed the consent form. Anonymity was maintained and assured regarding the information collected on the questionnaires. Data will be disseminated in a collective manner so as not to point out or identify any person. All data collected related to this project was securely maintained and then will be destroyed 6 months after graduation. Although anonymity was maintained in terms of the questionnaires and data collected from them, anonymity was not completely possible for the in-service participation because of the nature of the in-service. This SRNA asked the participants to maintain confidentiality and anonymity when they leave the in-service. There were no anticipated risks to the CRNAs for participation.

Resource Requirements

The resources required to fulfill this research project was the CRNA staff, questionnaires for the CRNAs, and time needed for the in-service. Also, the CRNAs needed easy access to the crystalloids. The in-service took approximately 10 to 15 minutes. Administering fluids preoperatively also took additional time from the CRNAs. The time needed to administer the fluids was approximately 15 minutes. Because of the busy schedule of the CRNAs, the in-services were conducted in small groups. An area conducive to learning was designated at the facility for the in-service.

CHAPTER III – RESULTS

Data Analysis

Descriptive statistics was utilized for data analysis. The independent variables for this study included the educational in-service, and demographic information which included: gender, age, and years of experience. The dependent variable was the mean score of the use of preoperative fluid therapy from questionnaire II collected 2 weeks after the educational in-service.

Results

A total of 18 Certified Registered Nurse Anesthetists (CRNAs) consented to participate in this study. Before the educational in-service was given, each CRNA completed questionnaire I. Next, the CRNAs were presented the educational in-service and given an opportunity to ask questions. Questionnaire I was used to obtain demographic information, assess the CRNAs knowledge on how to recognize high risk patients, and assess if they currently used preoperative fluid therapy to decrease postoperative nausea and vomiting (PONV). The following information was obtained from questionnaire I. The majority of participants in this project were males (83%, n=15). There were four age groups: (a) 25-35 years old (33.3%, n=6), (b) 35-45 years old (33.3%, n=6), (c) 45-55 years old (22.2%, n=4), and (d) 55 or older (11.1%, n=2) (see Figure 1). Years of experience was divided into 4 categories: (a) 0-5 years (33.3%, n=6), (b) 6-10 years (16.7%, n=3), (c) 11-15 years (11.1%, n=2), and (d) 15 years or more experience (38.9%, n=7) (see Figure 2). For the question, "are you familiar with the Simplified Apfel score?", 94.4% (n=17) said no and only 5.6% (n=1) said yes. For the question, "do you currently use preoperative fluid therapy in your plan of care to decrease

PONV?", 72.2% (n=13) said no and 27.8% (n=5) said yes. The mean value of CRNAs who currently use preoperative fluid therapy in there plan of care was 0.28.

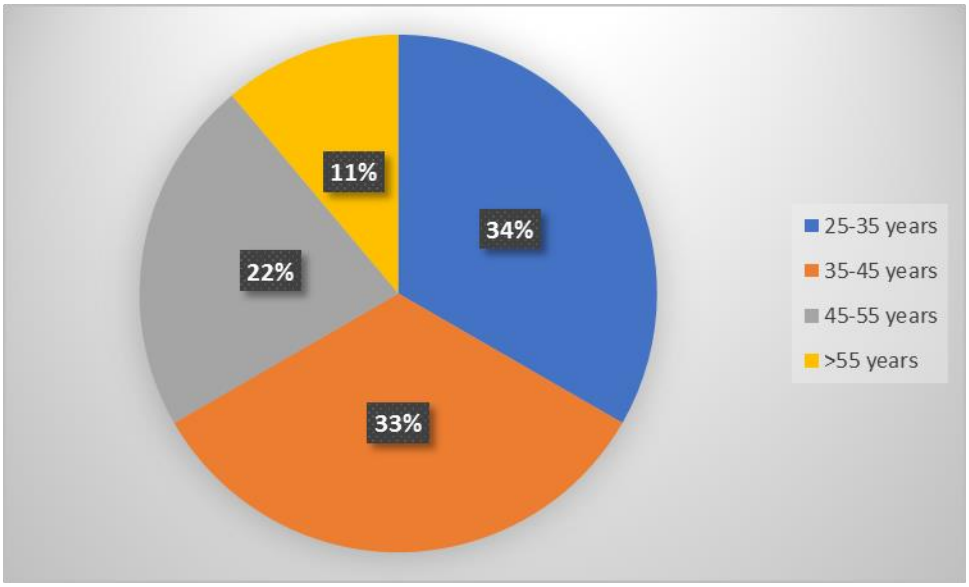


Figure 1. Participants age category

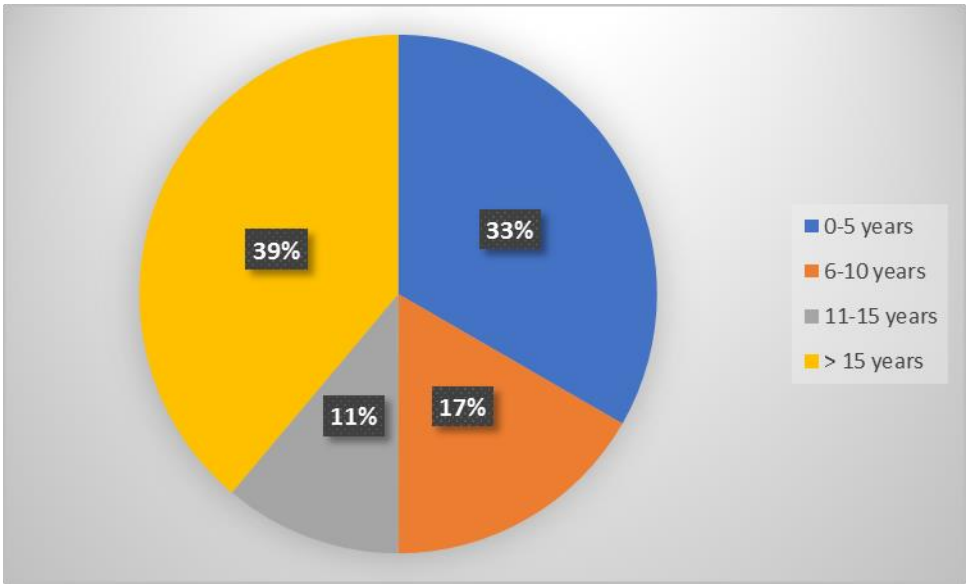


Figure 2. Participants years of experience

Two weeks after the educational in-service and questionnaire I, the CRNAs were asked to answer questionnaire II. The following information was obtained from

questionnaire II. For the question, “how many times did you use preoperative fluid therapy as part of your plan of care?”, participants could choose 3 different options: (a) 1-5 times (38.9%, n=7), (b) 6-10 times (50%, n=9), and (c) 10 or more times (11.1%, n=2). On the second question on questionnaire II, “were there any barriers that prevented them from using preoperative fluid therapy?”, the majority (66.7%, n=12) said no. Three CRNAs (16.6%) listed time constraints as being a barrier. Three CRNAs (16.6%) said patients’ comorbidities interfered with their ability to include preoperative fluid therapy in their plan of care for all patients. On the last question of questionnaire II, “did the educational in-service influence your decision to use preoperative fluid therapy?”, 100% (n=18) of the participants answered yes. In the section for additional comments, one CRNA stated, “Very informative. Definitely will influence my anesthetic technique.” The mean value of CRNAs who used preoperative fluid therapy in their plan of care after the in-service was 1.

The project’s intervention was a 10- to 15-minute educational in-service on the use of preoperative fluid therapy to decrease PONV in high risk populations. The in-service consisted of an educational handout (see Appendix F) on how to recognize patients at increased risk of developing PONV (Simplified Apfel score) and preoperative fluid therapy mechanism of action as well as administration. There were 18 CRNAs who consented to participate in the educational in-service and questionnaires I and II were collected from all 18 participants. Questionnaire I was collected the day of the in-service and questionnaire II was collected 2 weeks later.

CHAPTER IV – DISCUSSION

Interpretation of Results

The information gained from questionnaire I revealed a knowledge deficit. Of the participants, 94.4% (n=17) were not familiar with the Simplified Apfel score. This score identifies people at increased risk of developing postoperative nausea and vomiting (PONV). Part of the in-service consisted of a detailed discussion on the score and how to use it. Questionnaire I revealed that only 27.8% (n=5) were currently using preoperative fluid therapy in their plan of care. The in-service provided information from the literature review regarding the use of preoperative fluid therapy to decrease PONV to the Certified Registered Nurse Anesthetists (CRNAs). Of the CRNAs' responses on questionnaire II, 100% reported they used preoperative fluid therapy to some extent in their plan of care over the 2-week time frame. This finding indicated a 72.2% increase in CRNAs use of preoperative fluid therapy in their plan of care. Furthermore, 100% of participants agreed the educational in-service did influence their decision to use preoperative fluid therapy. The mean value of CRNAs that utilized preoperative fluid therapy increased from 0.28 to 1 after participating in the in the educational in-service.

The primary purpose of this project was to create a practice change for CRNAs to incorporate preoperative fluid therapy to prevent PONV in at risk patients for PONV. The primary goal of this project was fulfilled; namely, a 72.2% increase in the use of preoperative fluid therapy and 100% of CRNAs selected yes to the question, "did the educational in-service influence your decision to use preoperative fluid therapy?"

Limitations

Limitations of this project included the inability to eliminate bias because of the nature of this project's convenience sample, which means that participants will meet the candidate requirements for the study (Melnyk & Fineout-Overholt, 2015). Another limitation was the small sample size. Only 18 of 40 CRNAs at this facility participated in the study because of variation in the daily CRNA scheduling at this facility.

Future Practice Implications

Continuing education on evidence-based practices is important in medical and nursing professions to provide the best care for patients. Offering educational in-services to CRNAs is one way to help them keep current on best practices and recognize knowledge deficits. Educational in-services are also a good way to refresh concepts and generate new practices. CRNA students are in a unique position to offer seasoned CRNAs the most current literature regarding best practices.

Conclusion

The 18 CRNA participants indicated on questionnaire II that the educational in-service influenced their decision to use preoperative fluid therapy in their plan of care. Furthermore, 100% of the CRNA participants used preoperative fluid therapy to some extent over the 2-week time frame after they participated in the educational in-service, as compared to only 27.8% before the in-service. The PICO question for this project is: In CRNAs (P), will presenting an educational in-service (I) on the use of preoperative fluid therapy to decrease PONV in high risk populations effect their willingness to change practice (O) compared to CRNAs who do not participate in the educational in-service (C) over the course of 2 weeks (T). The results of this study confirm that the answer to this

PICO question is yes. The results and knowledge gained from this project can be shared with other anesthesia providers through presentations and at related conferences.

APPENDIX A – DNP Essentials

Table A1.

DNP Essentials

I. Scientific Underpinnings for Practice	relates to this doctoral project in terms of the development of nursing science through researching and adding to knowledge of preoperative fluid therapy use
II. Organizational and Systems Leadership for Quality Improvement and System Thinking	relates to this doctoral project in terms of the use of clinical scholarship and evidence-based research that will enhance CRNA knowledge
III. Clinical Scholarship and Analytical Methods for Evidence-Based Practice	
IV. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	
V. Health Care Policy for Advocacy in Health Care	
VI. Interprofessional Collaboration for Improving Patient and Population Health Outcomes	relates to this doctoral project by a collaboration with CRNAs to discuss the benefits of preoperative fluid therapy use to decrease PONV to promote better patients' post-anesthetic outcomes.
VII. Clinical Prevention and Population Health for Improving the Nation's Health	
VIII. Advanced Nursing Practice	

(AACN, 2006)

APPENDIX B - Simplified Apfel Score

Table A2.

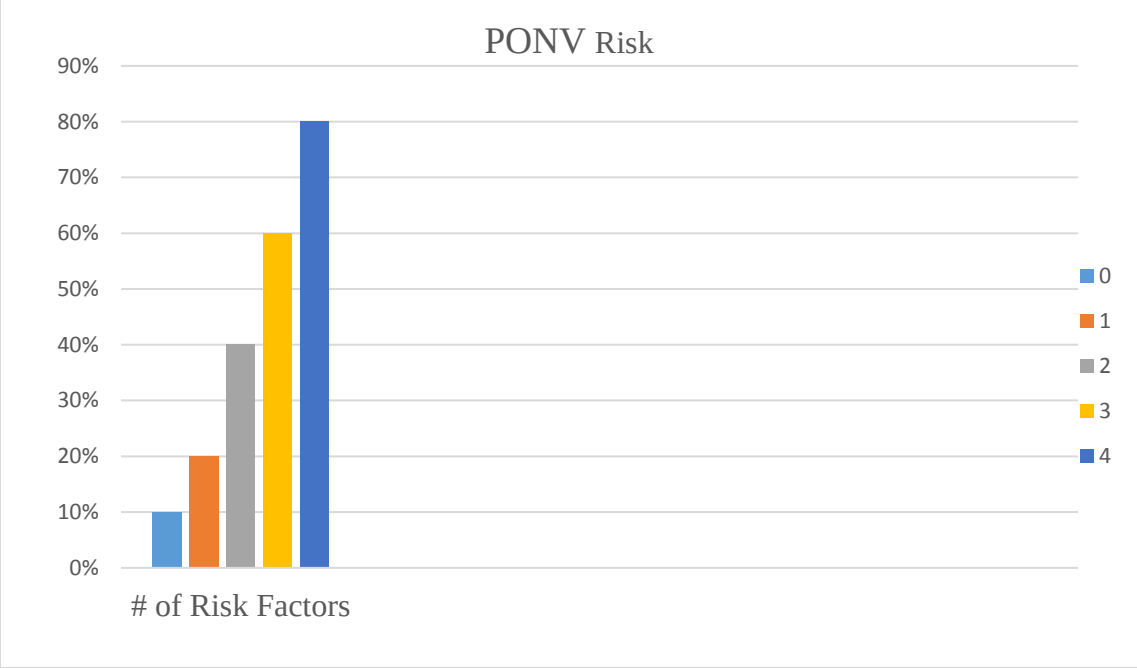
Simplified Apfel Score

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV	1
Postoperative Opioids	1
Sum =	0…4

(Apefel et al., 1999; Gan et al., 2014)

Table A3.

Simplified Apfel Score



(Apfel et al., 1999; Gan et al., 2014)

APPENDIX C - Questionnaires

Questionnaire I

1) How long have you been a Certified Registered Nurse Anesthetist?
    a) 0-5 years
    b) 6-10 years
    c) 11-15 years
    d) >15 years
2) What is your gender?
    a) Male
    b) Female
3) What is your age category?
    a) 25-35 years old
    b) 35-45 years old
    c) 45-55 years old
    d) >55 years old
4) Are you familiar with the Simplified Apfel score?
    a) Yes
    b) No
5) Do you currently use preoperative fluid therapy in your plan of care to decrease PONV?
    a) Yes
    b) No

Questionnaire II

1) How many times did you use preoperative fluid therapy as part of your plan of care?
    a) 1-5 times
    b) 6-10 times
    c) >10 times

2) Were there any barriers that prevented you from using preoperative fluid therapy?

3) Did the educational in-service influence your decision to use preoperative fluid therapy?
    a) Yes
    b) No

Additional Comments:

APPENDIX D - IRB Approval Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

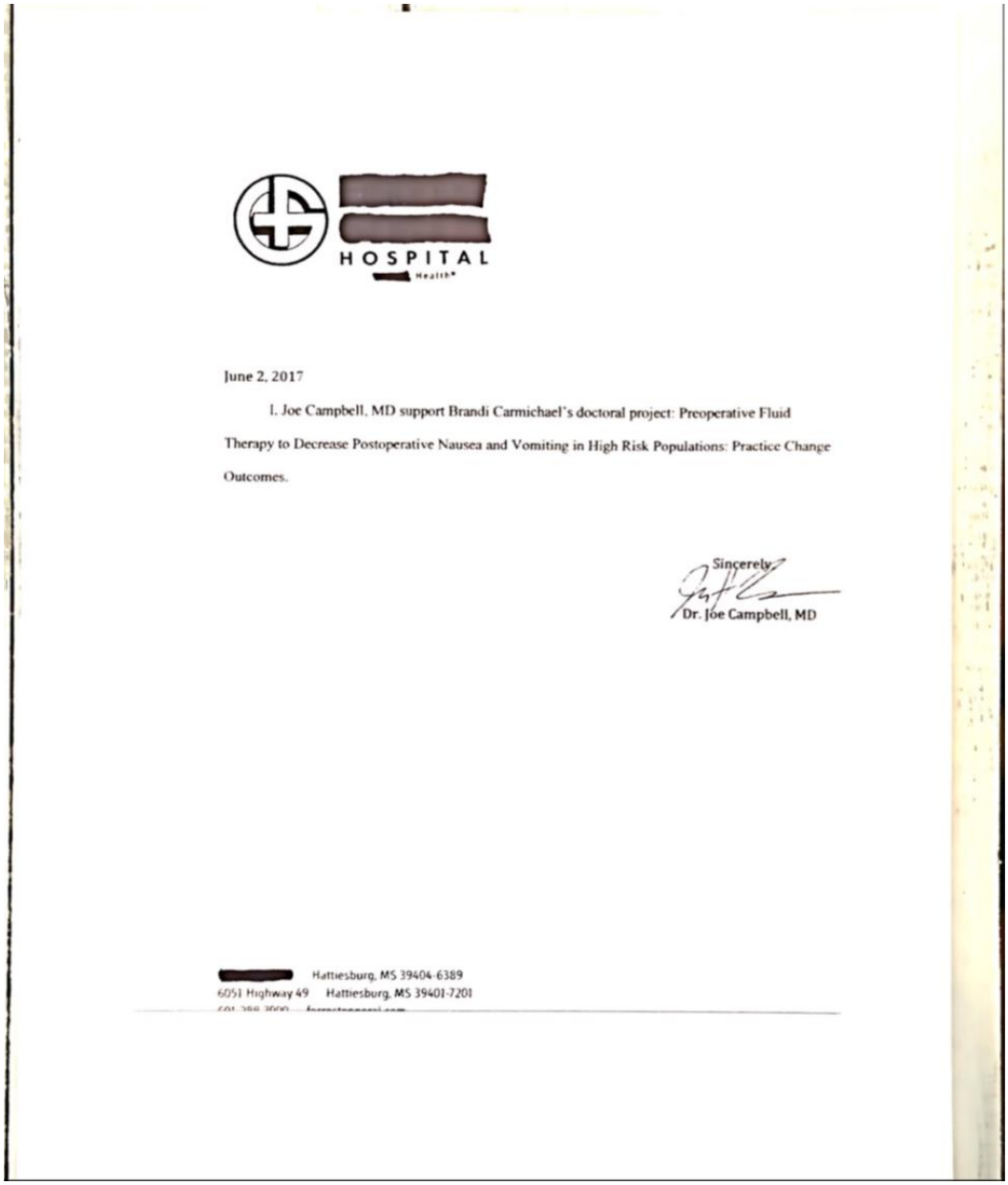
NOTICE OF COMMITTEE ACTION

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

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17080701
PROJECT TITLE: Preoperative Fluid Therapy to Decrease Postoperative Nausea and Vomiting in High Risk Populations: Practice Change Outcomes
PROJECT TYPE: Graduate Project
RESEARCHER(S): Brandi Carmichael
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: Advanced Practice
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 08/15/2017 to 08/14/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX E - Letter of Support



HOSPITAL
Health

June 2, 2017

I, Joe Campbell, MD support Brandi Carmichael's doctoral project: Preoperative Fluid Therapy to Decrease Postoperative Nausea and Vomiting in High Risk Populations: Practice Change Outcomes.

Sincerely,

Dr. Joe Campbell, MD

[redacted] Hattiesburg, MS 39404-6389
6051 Highway 49 Hattiesburg, MS 39401-7201

APPENDIX F – Educational In-service Handout

Use of Preoperative Fluid Therapy to Decrease Postoperative Nausea and Vomiting (PONV) in High Risk Populations

Educational In-service

Background and Significance

- PONV still occurs in up to 25%-30% of all surgeries and up to 70% in high risk populations.

(Lambert et al.,2009)

- PONV has been linked to negative complications such as extra time spent in the post-anesthesia care unit (PACU), extended patient stay, patient discontent, increased hospital expenses, and morbidity.

(Lambert et al., 2009)

- The Society for Ambulatory Anesthesia (2014) lists adequate hydration as one of the strategies to help reduce PONV, and, include it in their consensus guidelines for the management of PONV.

(Gan et al., 2014)

Recognizing High Risk Populations

- The Simplified Apfel Score (1999) is a useful tool in identifying those patients at increased risk of developing PONV.
- The score lists four characteristics: (a) female gender, (b) non-smoker, (c) history of PONV, and (d) postoperative opioids.

(Apfel et al., 1999)

- Even if no risk characteristics are present, the patient is still at a 10% chance of developing PONV; the possibility of developing PONV rises to 20%, 40%, 60%, and 80% for each added risk factor.

(Apfel et al., 1999; Gan et al., 2014)

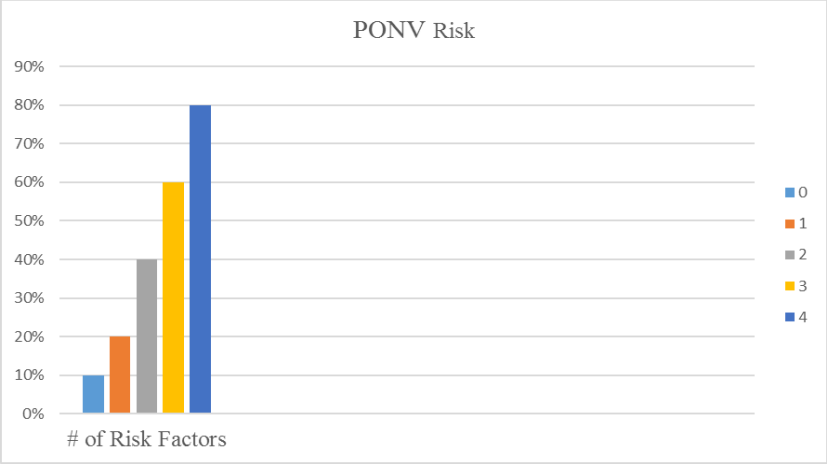
- The type of surgery has been shown to effect PONV; laparoscopic abdominal surgeries and gynecological procedures carry a greater risk of the patient developing PONV.

(Apfel et al., 2012a; Blitz et al., 2012; Yavux et al., 2014)

- The length of the procedure and the use of volatile anesthetics are significant indicators for the development of PONV.

(Apfel et al., 2012a; Chatterjee, 2011)

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV	1
Postoperative Opioids	1
Sum =	0…4



(Apfel et al., 1999; Gan et al., 2014)

Mechanism of Action

- The exact way in which preoperative fluid therapy decreases PONV remains unclear.

(Adanir et al., 2008; Yavux et al., 2014)

- Reoccurring theories suggest:
  - Anesthesia agents create a state of hypovolemia leading to hypoperfusion that causes the release of endogenous catecholamines such as dopamine and serotonin.
  - The hypovolemic state generated by anesthesia agents causes antidiuretic hormone (ADH) to be released from the posterior pituitary

gland; studies have shown that patients with increased levels of ADH experience more episodes of PONV.

(Adanir et al., 2008; Chaudhary et al., 2008; Yavux et al., 2014)

Fluid Therapy

- After reviewing the literature, the dosage ranged from 5-30ml/kg up to 1 liter of crystalloids approximately 1 hour before anesthesia induction.

  (Adanir et al., 2008; Ali et al., 2003; Apfel et al., 2012b; Chaudhary et al., 2008; Ghafourifard et al., 2015; Lambert et al., 2009; Magner et al., 2004; Turkistani et al., 2009; Yavux et al., 2014)
- In one study, the crystalloids were given using the 4-2-1 rule up to 1 liter of fluid while other studies gave 1-2 liters of crystalloids preoperatively at the discretion of the anesthesia provider.

  (Lambert et al., 2009)
- Not all patients are candidates for preoperative fluid therapy; patients with heart (CHF), Kidney (ESRD on dialysis), liver, respiratory, or neurologic conditions could experience adverse effects from excess fluids.

  (Adanir et al., 2008)

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