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The Effectiveness of a Preoperative Multimodal Antiemetic Regimen on Reducing Early Postoperative Nausea and Vomiting in Total Joint Arthroplasty Patients

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THE EFFECTIVENESS OF A PREOPERATIVE MULTIMODAL ANTIEMETIC REGIMEN ON REDUCING EARLY POSTOPERATIVE NAUSEA AND VOMITING IN TOTAL JOINT ARTHROPLASTY PATIENTS

by

Jerry Mosley Jr.

Abstract of a Capstone Project
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
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ABSTRACT

THE EFFECTIVENESS OF A PREOPERATIVE MULTIMODAL ANTIEMETIC REGIMEN ON REDUCING EARLY POSTOPERATIVE NAUSEA AND VOMITING IN TOTAL JOINT ARTHROPLASTY PATIENTS

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Postoperative nausea and vomiting (PONV) occurs frequently in all types of surgeries including after total joint orthopedic procedures. The resulting PONV can lead to many unwanted occurrences including immobilization, distress, and many serious adverse health complications. These unwanted occurrences may then lead to increased cost to the patient and healthcare facility. Administration of a preoperative multimodal regimen known to reduce PONV has the potential to reduce such unwanted anesthetic side effects influencing a reduction in overall healthcare cost. The purpose of this study is to determine the effectiveness of the preoperative kit which includes the administration of metoclopramide, famotidine, ondansetron, and levoduboisine on PONV in patients undergoing total knee arthroplasy (TKA) and total hip arthroplasty (THA). Inclusion criteria would be patients between the ages of 18 to 60, male and female, American Society of Anesthesiologists (ASA) I and II health score, undergoing TKA or THA, and receiving the standard preoperative kit. Exclusion criteria would be those patients less than 18 or older than 60 years of age, ASA III or greater, hip or knee revisions, having significant blood loss, or significant hypotension. A retrospective chart review will be completed and data collected with respect to this specific patient population and the presence of PONV and need for antiemetic use. The percentage of PONV will be

calculated for the specified patient population and compared to expected PONV percentage rates from evidence-based literature.

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A Capstone Project
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DEDICATION

I would like to thank my family, friends, peers, and professors for all the support and guidance towards earning my degree of Doctor of Nursing Practice, with a specialty in nurse anesthesia. “Here is to improving the lives of everyone around us.”

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I would like to extend a special thank you to Dr. Vickie Stuart, committee chair, and to the other members of my committee, Dr. Cathy Hughes and Dr. Michong Rayborn, for all of their continued assistance, guidance, and support throughout this process. I would also like to thank Mr. Terry Whittington for navigating me through this process and providing essential information towards completion of this project.

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LIST OF ABBREVIATIONS

ASA	American Society of Anesthesiologists
CDC	Centers of Disease Control and Prevention
CTZ	Chemoreceptor Trigger Zone
DCF	Data Collection Form
DCT	Data Collection Tool
DF	Degrees of Freedom
EC	Emetic Center
EPIC	Electronic Patient Integrated Care
IRB	Institutional Review Board
LMA	Laryngeal Mask Airway
PACU	Post Anesthesia Care Unit
PONV	Post-Operative Nausea and Vomiting
SPSS	Statistical Package for the Social Sciences
THA	Total Hip Arthroplasty
TKA	Total Knee Arthroplasty
US	United States

CHAPTER I

INTRODUCTION

Statement of the Problem

In the United States (US) over 50 million patients undergo surgery per year and more than 100 million patients worldwide (Centers of Disease Control and Prevention [CDC], 2014). The total amount of total hip and total joint arthroplasty surgeries encompass over one million alone in the US (CDC, 2014). Postoperative nausea and vomiting is one of the most commonly reported adverse effects of anesthesia and patients with no known risk factors still carry a 10% risk of PONV (Smith, Smith, & Smith, 2012). Postoperative nausea and vomiting is nausea and/or vomiting occurring within 24 hours after surgery (Kore, Wondwossen, & Amare, 2013). Early PONV is nausea and/or vomiting that occurs in the first 2 to 6 hours after surgery and usually occurs in the phase I post-anesthesia care unit. PONV is one of the most commonly reported adverse effects of anesthesia and affects between 20% and 30% of adult patients undergoing a surgical procedure and as many as 70% to 80% of high risk adult patients (Kore et al., 2013). Adverse effects of PONV can include aspiration, wound suture opening, prolonged hospital stays, increased patient discomfort and dissatisfaction, unanticipated admission after outpatient surgery, and delayed return of a patient's ability to function in daily activities (Ku & Ong, 2003). PONV can lead to inflated health care costs related to extended post anesthesia care unit (PACU) stays, prolonged nursing care, and over-night admissions (Ku & Ong, 2003). Research has shown that the use of several different antiemetic medications can reduce the occurrence of PONV from over 52% to less than 30% in certain populations (Chatterjee, Rudra, & Sengupta, 2011). The purpose of this

study is to determine the effectiveness of the preoperative administration of anti-nausea medications on early PONV in patients undergoing total hip arthroplasty and total knee arthroplasty. Realizing the potential monetary loss to healthcare facilities for extended care, the future loss in revenue due to patient dissatisfaction, and effect on patient health, one would appreciate the need to complete such a study to gain needed insight into reducing PONV.

Conceptual and Theoretical Framework

The development and use of nursing theory is geared towards the description, prediction, and explanation between two or more objects, properties, or events (Butts & Rich, 2011). Past benefits of nursing theory include the substitution of medical theory for a more appropriate nursing theory and the growth and increase of nursing knowledge (McKenna, 2005). Middle-range theory is a type of theory that is described as more concrete, narrower in scope, less abstract, and has fewer concepts than other theories (Butts, 2011; Fawcett, 2005). These reasons make middle-range theory more appropriate in a clinical setting (Lenz, 1998). Prescriptive theory is a type of middle-range theory that can be associated with a graduate level project related to a clinical setting.

McKenna and Slevin (2008) defined prescriptive theory as a scientific theory also known as "knowledge utilization." Other theorists label prescriptive theory as practice theory and even situation-producing theory (Butts, 2011). Prescriptive theory is a type of middle-range theory that encompasses descriptive, explanatory, and predictive theory (Butts, 2011). This theory is applicable to classify and describe events, explain the relationship between concepts, and to predict cause-and-effect relationships (Butts, 2011). Prescriptive theory, also known as practice theory, should prescribe the scientific

interventions of a clinical nurse (McKenna, 2005). Nursing theories are assumed to improve problem solving, increase patient satisfaction, guide and justify nursing actions, and direct research towards clinical nursing needs (McKenna, 2005). Practice theory should have a cause-effect relationship that can be empirically tested and replicated (McKenna, 2005). This theory is also based on causal agents that can be manipulated by the professional with relevance to achieving practice goals that are within the practice guidelines (McKenna, 2005).

The application of prescriptive theory to this project will hopefully demonstrate that the administration of a preoperative antiemetic regimen to total knee arthroplasy (TKA) and total hip arthorplasty (THA) patients will reduce the occurrence of PONV and the use of rescue emetics. Using prescriptive or practice theory will include the use of descriptive, explanatory, and predictive theories, since prescriptive theory is composed of such (Butts, 2011). Descriptive theory will be used to gain knowledge into the efficacy of the administration of a preoperative antiemetic regimen to surgical patients for PONV to reduce nausea and/or vomiting and its effect on the healthcare system; explanatory theory will help explain the relationship between the administration of a preoperative antiemetic regimen and the reduction of PONV; and predictive theory will be used to foresee cause-and-effect relationships. The use of a middle-ranged theory such as prescriptive theory will help classify, explain, and predict PONV. The application of prescriptive theory in combination with a retrospective chart review will hopefully show the benefits of the administration of a preoperative antiemetic regimen for PONV and lead to a better understanding and a decrease in such an unwanted occurrence. The overall goal would be a standard of care, or protocol, composed of the administration of a preoperative

prophylactic antiemetic regimen to a certain population undergoing a certain surgical procedure to reduce PONV.

Prescriptive theory is an appropriate theory to describe what PONV is, explain the relationship between a certain population at risk for PONV and some of the causes of PONV, the reasoning behind the administration of a multimodal preoperative antiemetic regimen for PONV, and identifying those at risk for PONV and predicting a positive outcome with proper treatment.

Needs Assessment

Postoperative nausea and vomiting (PONV) is still one of the most widely arising complications even with numerous advances in medicine. Postoperative nausea and vomiting in patients undergoing total hip and total knee surgery can lead to aspiration, electrolyte imbalances, immobility, thromboembolic disease, emotional distress, and discomfort (Peters, Brayton, & Erickson, 2006). With vast advances in surgical technique, surgical equipment, and pharmaceuticals, surgical patients recover in a shorter amount of time than in the past. Less time recovering in the post anesthesia care unit and in the hospital not only equates to less cost to the patient and healthcare facility but also to an increase in patient satisfaction.

In the past much of healthcare was based upon the treatment of those already infected and geared towards treating the sick. Healthcare has now shifted towards preventative treatment in the hopes of reducing the amount of unwanted occurrences and in turn reducing healthcare costs. Providing a prophylactic preoperative antiemetic regimen to surgical patients undergoing total hip and total knee arthroplasty surgeries can reduce undesirable outcomes as well as overall cost to the client and healthcare

establishment. Determining how proficient the use of an antiemetic regimen consisting of metoclopramide, famotidine, ondansetron, and levoduboisine leads to a decrease in early PONV in total knee and total hip arthroplasty patients will be extremely valuable. The results may lead to an increased use of such an antiemetic regimen for all total knee and total hip surgeries as well as other surgeries that involve high risk PONV patients. This in turn will lead to a decrease in patient and facility cost, a decrease in patient recovery time in the post anesthesia care unit and recovery time on the floor unit, as well as a decrease in the amount of time the patient can return to normal functioning in society or employment.

PONV Implications

It is estimated that an episode of PONV will increase a patient's stay in the post anesthesia care unit (PACU) by about 25 minutes to one hour. (Chatterje et al., 2011; Parra-Sanchez et al., 2012). Patient's polled before surgery were willing to pay approximately $56 in United States (US) currency for a medication that would completely prevent nausea, and were willing to pay approximately $100 in US currency once they developed PONV (Tong, Sloan, Dear, El-Moalem, & Lubarsy, 2000). Patient's polled at surgical centers also ranked vomiting as the most undesirable manifestation, even over pain, residual weakness, and recall (Smith et al., 2012). An incremental cost per patient of $75 in US currency accrued for those patients that experienced PONV in an ambulatory setting (Parra-Sanchez et al., 2012). Also of importance is the cost to an ambulatory surgery center for the treatment of acquired PONV which can be approximated to over $1000 US currency per patient (Sanchez, Hirsch, Carroll, & Miederhoff, 1994).

CHAPTER II

REVIEW OF LITERATURE

Nausea and Vomiting

Nausea is an uncomfortable sensation of an approaching vomiting occurrence (Watcha & White, 1992). It is often associated with symptoms such as salivation, tachycardia, swallowing, burping, and sweating (Watcha & White, 1992). Vomiting is a complicated process, mediated by a central coordinating vomiting center, residing in the Emetic Center (EC) in the brainstem (Andrews, 1992). This area receives inputs from the pharynx, GI tract, mediastinum, higher cortical centers including the visual, olfactory, gustatory, vestibular centers, and the Chemoreceptor Trigger Zone (CTZ) (Andrews, 1992). CTZ activity is modified by a variety of receptors (Andrews, 1992). There are at least four major receptor areas that are believed to be involved in PONV and these areas are the cholinergic (muscarinic) receptors, dopaminergic (D2) receptors, histaminergic (H1) receptors, and serotonergic (5HT3) receptors (Chatterje et al., 2011). The cholinergic receptors are found in the vomiting center and vestibular nuclei, serotonergic and dopaminergic are found in the area postrema, and last the histaminergic are located in the nucleus tractus (Chatterje et al., 2011). The CTZ receives input from these receptors and the EC initiates vomiting (Andrews, 1992). Most anti-nausea treatments act by a direct or indirect antagonizing of chemicals on receptors in the CTZ, which reduce PONV (Chandrakantan & Glass, 2011).

Etiology of PONV

The etiology of PONV is multifactorial consisting of individual, anesthetic, and surgical risk factors (McCracken, Houston, & Lefebvre, 2008). Individual risk factors

include the female gender, positive history of PONV or motion sickness, nonsmoking status, and young age (McCracken et al., 2008). Anesthetic considerations include the use of inhalational agents, nitrous oxide, opioids, and neostigmine (McCracken et al., 2008). Surgical risk factors include gynecological procedures, laparoscopic procedures, orthopedic procedures, and duration of the surgery (McCracken et al., 2008). Other possible risk factors include obesity, dehydration, low blood pressure, and a history of migraine headaches (McCracken et al., 2008). Severe nausea and vomiting post total joint procedures are common due to the use of regional anesthetics, general anesthetics, and narcotics and have a reported incidence of 20% to 83% (Dilorio, Sharkey, Hewitt, & Parvizi, 2010). In spinal anesthesia there are several different mechanisms that can be attributed to PONV including hypotension (systolic blood pressure less than 80 mmHg), a block higher than the fifth thoracic segment, and the addition of a vasoconstrictor or narcotic to the local anesthetic (Borgeat, Ekatodramis, & Schenker, 2003). Hypotension is very common in neuraxial anesthesia and PONV may be attributed to the activation of the vomiting centers by brain ischemia (Borgeat et al., 2003). Gut ischemia may also lead to nausea and vomiting by the release of emetogenic substances like serotonin from the intestines (Borgeat et al., 2003). Neuraxial agents also cause sympathetic blockade which results in unopposed vagal action resulting in gastrointestinal hyperactivity which is believed to contribute to PONV (Borgeat et al., 2003). The addition of narcotics such as morphine and fentanyl to the local anesthetic used in regional anesthesia may lead to PONV by activating the chemoreceptive trigger zone (Borgeat et al., 2003). Opioids also decrease muscle tone and peristalsis, thereby reducing gastric emptying, and can lead to distention and vomiting (Whelan, 2012). General anesthesia and the use of volatile

anesthetics may increase PONV by two fold through decreasing serum levels of anandamide, which works on receptors that suppress nausea and vomiting (Whelan, 2012). Some studies have even shown up to a 27% occurrence in PONV with the use of inhalational agents (Kenny, 2004).

PONV Recognition Tools

The Apfel Score (Appendix A) is a useful tool in recognizing those at the highest risk for PONV (Apfel, Kranke, Eberhart, Roos, & Roewer, 2002). This scoring system is composed of a four point scale with one point given for each positive characteristic (Apfel et al., 2002). The four characteristics are female sex, history of motion sickness or post-operative nausea or vomiting, being a non-smoker, and the anticipated use of opioids (Apfel et al., 2002). The presence of 0, 1, 2, 3, or 4 risk factors equate to 10%, 20%, 40%, 60%, and 80% respectively (Apfel et al., 2002). Another tool in recognizing those at the highest risk for PONV is Koivuranta Score (Appendix B) which is composed of a five point scale with one point given for each positive characteristic (Koivuranta, Laara, Snare, & Alahuhta, 1997). The five characteristics are female sex, history of motion sickness, history of post-operative nausea or vomiting, duration of surgery longer than sixty minutes, and being a non-smoker (Koivuranta et al., 1997). The presence of 0, 1, 2, 3, 4, or 5 risk factors equate to a 17%, 18%, 42%, 54%, 74%, and 87% respectively (Koivuranta et al., 1997).

Multimodal Antiemetic Regimen

Metoclopramide (Reglan) is a benzamide that prevents PONV by increasing lower esophageal sphincter tone, which promotes gastric emptying by increasing small bowel and gastric motility (Nagelhout & Plaus, 2014). Metoclopramide is believed to

exert its effects on cholinergic, serotonergic, and dopaminergic receptors with more profound effects acting as a dopaminergic receptor antagonist (Nagelhout & Plaus, 2014). Through research it has been found to be insignificant in the prevention of PONV unless it is combined with other antinausea medications including Ondansetron or Dexamethasone (Nagelhout & Plaus, 2014). An extremely advantageous aspect of Reglan is the lack of sedative traits, while containing an unwanted side effect of extrapyramidal symptoms and dystonia (Nagelhout & Plaus, 2014). Famotidine (Pepcid) is a histamine 2 antagonist (H2 blocker) that provides the best duration of action versus side effect profile (Nagelhout & Plaus, 2014). Famotidine reduces gastric volume by reducing gastrin-induced acid production and raises the pH of gastric contents as well (Nagelhout & Plaus, 2014). Ondansetron (Zofran) is a selective serotonin type 3 receptor antagonist (5HT3) that is widely used as a lone antiemetic or in conjunction with other antiemetics (Nagelhout & Plaus, 2014). Ondansetron has the ability to reduce PONV and has been shown to have little effect on cardiovascular, extrapyramidal symptoms, or sedation (Kenny, 2004). Some minimal side effects common to the serotonin antagonists include headache, lightheadedness, dizziness, and constipation (Chatterje et al., 2011). Levoduboisine (Scopolamine) is an anticholinergic agent that acts on the muscarinic and histaminic receptors of the vestibular apparatus and the nucleus of the tractus solitarus to reduce the incidence of PONV (Chatterje et al., 2011). Levoduboisine has a high incidence of side effects causing sedation, dry mouth, drowsiness, contact dermatitis, and visual disturbances (Nagelhout & Plaus, 2014).

Multimodal Drug Therapy

The use of a multimodal drug therapy was initiated due to the limiting effects of single drug therapy and the overall reduction of PONV with more than one medication (Chandrakantan & Glass, 2011). There are several receptor systems involved in the initiation and treatment of PONV, and a combination of those drugs acting at the different receptors would have greater efficacy than a single drug (Chandrakantan & Glass, 2011). The use of more than one anti-emetic that works on the same receptor does not decrease the rate of PONV but the incidence of side-effects does increase (Chandrakantan & Glass, 2011). Therefore, the multimodal technique offers the benefits of enhanced PONV reduction with a lower incidence of side-effects (Chandrakantan & Glass, 2011). There is also a correlation between the number of different antiemetics used, assuming they each work on the different receptors, and the reduction of PONV. For each antiemetic used up to a total of four, there is a 10% decrease for each after the first administered antiemetic medication up to a total of 30% (Chandrakantan & Glass, 2011).

CHAPTER III

METHODOLOGY

Setting

The setting for this retrospective chart analysis will be at a specialty facility in the Southeastern United States. This facility encompasses a 10-bed preoperative area, six operating rooms, a 10-bed postoperative recovery room, and a 30-bed orthopedic patient care floor. Patient information and record-keeping is accomplished by using Electronic Patient Integrated Care (EPIC) software.

Target Outcome

Based upon the Apfel and Koivuranta Postoperative Nausea and Vomiting (PONV) Scoring Systems, if no antiemetics are administered, all patients undergoing a surgical procedure will have between a 10% and 80% risk for PONV and between a 17% and 87% risk for PONV respectively (Apfel, 2002; Koivuranta, 1997). Postoperative nausea and vomiting in patients undergoing total hip and total knee surgery can lead to aspiration, electrolyte imbalances, immobility, thromboembolic disease, emotional distress, and discomfort (Peters, Brayton, & Erickson, 2006). An incremental cost per patient of $75 in United States (US) currency accrued for those patients that experienced PONV in an ambulatory setting (Parra-Sanchez et al., 2012). Also of importance is the cost to an ambulatory surgery center for the treatment of acquired PONV which can be approximated to over $1000 US currency per patient (Sanchez, Hirsch, Carroll, & Miederhoff, 1994). Today these costs would be more accurately listed as an incremental cost per patient of $77.30 in US currency and to over $1600 US currency to an ambulatory surgery center for treatment of PONV (Measuring Worth, 2015).

The desired goal of this capstone study is to determine the effectiveness of a preoperative prophylactic multimodal regimen on reducing early PONV in TKA and THA patients. If results are favorable, the desired outcome of the project is to provide information for the future development of a policy change in healthcare facilities and/or to provide a documented and researched source for verification. Results in a lower rate of PONV with this predetermined regimen can lead to a protocol for other institutions to incorporate into practice. Use of such an antiemetic regimen to prevent PONV can reduce healthcare costs to facilities and patients as well as decrease deteriorative incidents and increase patient comfort, safety, and satisfaction.

Limitations

The following are limitations to the accuracy of this capstone project. Individuals have been shown to exhibit different levels of PONV tolerance. While some are able to tolerate the feeling others are not. Those able to tolerate differing levels of PONV might request not to receive any antiemetic medications in the post anesthesia care unit (PACU). Completing a retrospective chart review does not allow direct observation of the patients. If no anti-emetics are given there will be no identification of early PONV, even if this transpires, unless the PACU nurse documents such. Also there are many different ways to treat PONV besides anti-emetic medications and if those non- medicinal therapies are administered, such therapies will not be identified as PONV treatments. The recognition of PONV may also be blunted by the administration of narcotics and the triggering of a sleep state. This patient may not exhibit signs and symptoms of PONV until becoming more alert on the recovery floor past the early PONV timeframe. Last, human administration and recording of the type and amount of all medications to patients

are provided by human caregivers into computer systems. There is always a chance of human error in documentation, administration, and the quantity of administration.

Population

The setting for this retrospective chart analysis will be at a specialty facility in the Southeast region of the United States. A retrospective chart analysis shall be conducted on a range of between 50 to 60 patients undergoing total knee arthroplasty (TKA) or total hip arthroplasty (THA) surgery of which are proficient with the English language, any race, and are not legally blind or deaf. Inclusion criteria will be those undergoing TKA or THA surgery, between the ages of 18 and 60, an American Society of Anesthesiologists (ASA) physical status score of I or II (Appendix C), and that have received the standard preoperative kit. The standard preoperative prophylactic multimodel regimen will include oral metoclopramide (Reglan) 10 milligrams (mg) and oral famotidine (Pepcid) 20 mg the night before surgery and the morning of surgery, levoduboisine (Scopolamine) 1.5 mg transdermal patch the morning of surgery and ondansetron (Zofran) 4 mg intravenously the morning of surgery. The standard anesthetic plan at the clinical institution shall include the use of a 0.75% bupivicaine (Marcaine) 7.5mg to 15mg with morphine (Duramorph) 100 micrograms (mcg) to 300 mcg spinal, intravenous induction with isopropylphenol (Propofol) 50mg to 200mg with lidocaine (Xylocaine) 20mg to 100mg for Laryngeal Mask Airway (LMA) insertion, and the use of sevoflurane (Ultane) or desflurane (Suprane) inhalational agent. Exclusion criteria would be those patients less than 18 or older than 60 years of age, ASA III or greater, hip or knee revisions, having blood loss greater than 500 milliliters (mls), or hypotension requiring the use of more than 1000 micrograms (mcg) of neosynephrine (Phenylephrine) intravenously or more

than 50 milligrams (mg) of Ephedrine intravenously. The addition of any other vasoactive medications would also exclude patients from this study as well as the patient not being able to communicate proficiently in the English language or being legally blind or deaf. The retrospective chart review will also make note of any anti-emetics and pain medications used preoperatively, intraoperatively and postoperatively and a positive indicator for early PONV is the administration of an antiemetic due to the complaint of nausea and/or vomiting while in the post anesthesia care unit from 0 to 6 hours after surgery. Information also included in the chart review shall include those items listed on the data collection tool in Appendix D.

Methods

After obtaining approval from the institutional review board (IRB) from the specialty facility IRB and the university IRB, the retrospective chart analysis will be initiated. A retrospective analysis of de-identified electronic health record data will be performed using medical record abstraction using a data collection form (DCF) during the time frame ranging from March 1, 2015 to August 31, 2015. Information obtained on patients treated at the specialty facility in the Southeastern United States include variables of age, gender, height, weight, ASA classification, comorbidities, type of surgery, length of surgery, type and administration amount of each medication used preoperatively, intraoperatively, and postoperatively, inhalation agent used, oral adjunct used, blood loss, and fluid administered. A positive indicator for early PONV is the administration of an antiemetic due to the complaint of nausea and/or vomiting while in the post anesthesia care unit from 0 to 6 hours after surgery.

Confidentiality of records will be maintained throughout the collection of data from the electronic health record, and the subjects will remain unidentifiable. Information obtained will be analyzed by using a standard statistical program and performing a one-sample t-test, a one-sided t- test. The percentage of patients experiencing PONV will be determined and compared to the expected incidence of PONV using the Apfel and Koivuranta PONV Scoring Systems. The occurrence of nausea in each age will then be calculated using chi-square test to determine if there is significance between age and prevention or occurrence of PONV. If there is a profound significance found between the ages, ages will be grouped and further testing will be completed to offer substantial data.

CHAPTER IV

ANALYSIS OF DATA

The intended purpose of this project was to determine the efficacy of a preoperative multimodal antiemetic regimen on reducing early postoperative nausea and vomiting (PONV) in total arthroplasty patients. This determination would be obtained performing a retrospective chart examination, collection of vital information related to PONV on a data collection tool, comparison of actual versus expected percentages of PONV, and statistical analysis of the information. The data analyzed is classified accordingly as follows: 1) Data Analysis, 2) Presentation of Findings.

Data Analysis

In order to determine the efficacy of a preoperative multimodal antiemetic regimen on early PONV, information obtained in relation to the Apfel and Koivuranta risk scores were categorized and given numeric values. Each patient was given a score according to the number of risk factors for PONV in relation to the Apfel and Koivuanta scales which correlated to a certain risk percentage. These patients were then identified as either having PONV or not having PONV. The total expected percentage of patients to exhibit PONV were then calculated as well as the actual total percentage of patients that exhibited PONV. These two numbers were then compared using a one sample t-test to determine if they were significantly different. The one sample t-test is used to determine the level of significance between a tested outcome of a group when compared to a known standard and can be used for a sample of 30 or less (Daniel, 2009). An actual percentage of patients that exhibited PONV were then found using a Statistical Package for the social sciences (SPSS). Use of a Pearson's chi-square test and a Fisher's exact test were then

used to determine the significance of the findings. A Pearson's chi-square test is the most frequently used statistical tool for analysis of frequency or to count data and can determine the relationship between two categories (Daniel, 2009). Pearson's chi-square tests are used when sample sizes are large while Fisher's exact tests are used when sample sizes are small (Daniel, 2009). The level of significance found by using the Pearson's chi-square test and the Fisher's exact test determined if the findings are significant or not. Level of significance, also known as alpha, is the probability of rejecting a true null hypothesis (Daniel, 2009). The alpha used in this study was equal to 0.05, which is the maximum level of significance used in scientific research (Daniel, 2009). Alpha was used to identify whether or not the multimodal preoperative kit is effective in treating early PONV in this surgical population. The population was also tested for significance in relation to age and PONV by using a cross tabulation Pearson's chi-square test as well as a Fisher's exact test. For this project a hypothesis and null hypothesis were formed. The hypothesis for this capstone was: there is no difference in the incidence of early postoperative nausea and vomiting in total knee arthroplasty (TKA) and total hip arthroplasty (THA) patients with the administration of a preoperative multimodal antiemetic kit when compared to no antiemetic use.

Presentation of Findings

The retrospective chart analysis was completed at a specialty facility in the Southeast region of the United States. It was conducted over a six month time frame on 50 patients between the ages of 24-60, undergoing total knee arthroplasty (TKA) or total hip arthroplasty (THA) surgery. All patients included in the study met previously stated inclusive criteria, including but not limited to, receiving the standardized preoperative

anti-emetic kit, acquiring the American Society of Anesthesiologists (ASA) physical health score of I or II, undergoing a spinal anesthetic as well as a laryngeal mask airway general anesthetic with medications associated with each, and not incurring overwhelming amounts of blood loss or hypotension.

The retrospective chart analysis was completed and pertinent information was transferred to a paper data collection tool (DCT). Confidentiality of patient information was maintained and all data was de-identified in the collection and transfer process. Once the information was categorized, given numeric values, and applied to statistics, the paper DCTs were then destroyed. Patient demographic characteristics related to this study can be found in Table 1.

Table 1

Demographic Characteristics of Patients

Characteristic	Number	Percentage
Gender		
Male	26	52
Female	24	48
Age (years)		
Mean	52.5	
Range	24 – 60	
Smoker	5	10
Non-Smoker	45	90

Table 1 (continued).

Characteristic	Number	Percentage
History of PONV	3	6
No History of PONV	47	94
No History of Motion Sickness	50	100
Postoperative Opioids	47	94
No Postoperative Opioids	3	6
Duration of Surgery > 1 hour	100	100

With the use of the Apfel PONV Risk Scoring System, patients were given a score related to the number of risk factors present, which in turn corresponded to the expected risk of experiencing PONV. The Apfel Risk Factor Score and corresponding percentage, as well as frequency and valid percentage numbers for patients in each category can be seen below in Table 2. Most of the patients fall in the risk factor score of 2 and 3 which equates to 20% and 40% corresponding risk.

Table 2

Apfel Risk Scoring System-Frequency of Patients

Apfel Risk Factor Score	Corresponding Risk %	Patient Frequency	Valid %
0	10%	0	0
1	20%	4	8
2	40%	25	50
3	60%	19	38
4	80%	2	4

With the use of the Koivurnata PONV Risk Scoring System, patients were given a score related to the number of risk factors present which in turn corresponded to the expected risk of experiencing PONV. The Koivuranta risk factor score and corresponding percentage, as well as frequency and valid percentage numbers for patients in each category can be seen below in Table 3. Most of the patients fall in the risk factor score of 2 and 3 which equals 42% and 54% corresponding risk.

Table 3

Koivuranta Risk Scoring System-Frequency of Patients

Koivuranta Risk Factor Score	Corresponding Risk %	Patient Frequency	Valid %
0	17%	0	0
1	18%	1	2
2	42%	28	56
3	54%	19	38
4	74%	2	4
5	87%	0	0

After the chart review, it was noted that only 8 of the 50 patients experienced early PONV. Of the 8 patients whom experienced early PONV, 6 were female and 2 were male. Ages ranged from 48 to 60, with all but one being a non-smoker, one having a history of PONV, and all receiving postoperative opioids. Demographics of these patients can be seen in Table 4. Table 5 is a representation of the frequency of those whom experienced PONV as an actual total percentage of the overall population.

Table 4

Demographic Characteristics of Patients Whom Experienced Early PONV

Gender	Age	Non-Smoker	History of PONV	Postoperative Opioids
Female	48	Yes	No	Yes
Female	50	Yes	No	Yes
Female	51	Yes	Yes	Yes
Female	52	No	No	Yes
Female	56	Yes	No	Yes
Female	59	Yes	No	Yes
Male	53	Yes	No	Yes
Male	60	Yes	No	Yes

Table 5

Frequency of PONV

PONV (Yes or No)	Patient Frequency	Actual Total %
Y	8	16
N	42	84

Note. Y=Yes, N=No

The expected total percentage was found for both the Apfel and Koivuranta PONV Scoring Systems. The results showed an expected total percentage of PONV to be 47.6% using the Apfel Score, and an expected total percentage of PONV was 47.4% using the Koivuranta Score. The actual total percentage was found to be 16%. The actual total percentage given in Table 5 was then placed with the expected total percentage for comparison in Table 6.

Table 6

Expected and Actual Total Percentage of PONV for Apfel and Koivuranta PONV Scoring System

Scoring System	Expected Total % of PONV	Actual Total % of PONV
Apfel	47.6	16
Koivuranta	47.4	16

A one-sided t-test was then used to determine if the actual total percentage of PONV was significantly different than the expected total percentage of PONV in both the Apfel and Koivuranta systems. The null hypothesis is that the difference between the expected total percentage of PONV and the actual total percentage of PONV is zero. The conclusion at the 0.05 critical alpha level is that the data revealed a significant difference between the actual total percentage of PONV and the expected total percentage of PONV for both scoring systems which can be seen in Table 7.

Table 7

One-Sided T-Test for Actual and Expected Total Percentage for PONV

Risk Scoring System	t-statistic	df	Two-tailed probability (p-value)
Apfel	3.052	49	.004
Koivuranta	3.034	49	.004

Note. df=degrees of freedom

The numbers of expected and actual patients with PONV for each risk factor were then found using a cross-tabulation in SPSS for both the Apfel and Koivuranta PONV Risk Scoring Systems. In the Apfel system the number of patients expected to experience PONV for risk factor scores of 0 through 4 were: 0, 1, 10, 11, and 2 respectively. The actual number of patients whom experienced PONV for each risk factor scores of 0 through 4 were: 0, 0, 3, 4, and 1 respectively. In the Koivuranta system the number of patients expected to experience PONV for risk factor scores 0 through 5 were: 0, 0, 12, 10, 1, and 0 respectively. The actual number of patients whom experienced PONV for

each risk factor scores of 0 through 4 were: 0, 0, 3, 4, 1, 0. Table 8 is a representation of such.

Table 8

Numbers of Expected and Actual Patients with PONV for each Risk Factor for Apfel and Koivuranta PONV Risk Scoring Systems

Risk Scoring System	Risk Factors	PONV Expected	PONV Actual
Apfel	0	0	0
	1	1	0
	2	10	3
	3	11	4
	4	2	1
Koivuranta	0	0	0
	1	0	0
	2	12	3
	3	10	4
	4	1	1
	5	0	0

The percentages of the expected and actual patients with PONV for each risk factor were then found using a cross-tabulation in SPSS for both the Apfel and Koivuranta PONV Risk Scoring Systems. These percentages can be seen in Table 9.

Table 9

Percent of Expected and Actual Patients with PONV for each Risk Factor for Apfel and Koivuranta PONV Risk Scoring Systems

Risk Scoring System	Risk Factors	PONV Expected Percent	PONV Actual Percent
Apfel	0	0%	0%
	1	20%	0%
	2	40%	12%
	3	60%	21%
	4	80%	50%
Koivuranta	0	0%	0%
	1	18%	0%
	2	42%	11%
	3	54%	21%
	4	74%	50%
	5	87%	0%

The results of the expected and actual patients with PONV for each risk factor were then compared for both the Apfel and Koivuranta PONV Scoring Systems to determine if the decrease in PONV were significant. In both the Apfel and Koivuranta PONV Scoring Systems, patients found to exhibit 2 or 3 risk factors were shown to have a significant decrease in PONV. The results can be visualized in Table 10.

Table 10

Significance of Expected and Actual Patients with PONV for each Risk Factor for Apfel and Koivuranta PONV Risk Scoring Systems

Risk System	Risk Factors	Value	df	p-value	Fisher's Test	Sig.
Apfel	0	0	0	0	0	N
	1	1.143	1	0.1425	0.5000	N
	2	5.094	1	0.0120	0.0253	Y
	3	5.397	1	0.0101	0.0224	Y
	4	1.333	1	0.1241	0.5000	N

Table 10 (continued).

Risk System	Risk Factors	Value	df	p-value	Fisher's Test	Sig.
Koivuranta	0	0	0	0	0	N
	1	2	1	0.0786	0.5000	N
	2	7.376	1	0.0033	0.0071	Y
	3	4.071	1	0.0218	0.0455	Y
	4	0	1	0.5000	0.8333	N
	5	0	0	0	0	N

Note. df=Degrees of Freedom, p-value=Pearson's one tailed Probability, Sig=Significance

The age groups of those who experienced PONV were then entered into SPSS to calculate if there was any relation between age and nausea, which was determined not to be significant with a p-value of 0.370. The numbers of individual risk factors were also compared to the incidence of PONV for both risk scoring systems which gave an Apfel p-value of 0.370 and a Koivuranta p-value of 0.415. Both of which are not significant. Therefore there was not a significant difference in PONV found between the patients with different numbers of characteristics for PONV.

CHAPTER V

SUMMARY

The purpose of this capstone project was to determine if there was a significant effectiveness of a preoperative multimodal antiemetic regimen on reducing early postoperative nausea and vomiting (PONV) in total hip arthroplasty (THA) and total knee arthroplasty (TKA) patients. Through the use of a retrospective chart analysis on 50 patients undergoing THA and TKA surgeries at a location in the Southeastern United States, information regarding this topic was concluded. Organization of this chapter is as follows: 1) Results, 2) Cost Implications, 3) Recommendations, and 4) Conclusions.

Results

After completing a statistical analysis on all the data gathered, with comparison to the expected Apfel and Koivuranta Risk Scale Scores for PONV, results showed a significant decrease in early PONV with the administration of a preoperative multimodal kit in THA and TKA patients who had 2 and 3 risk factors for PONV. There was no significant decrease found in early PONV with those patients with 1 and 4 risk factors for PONV. Results were not able to be determined for those patients with 0 and 5 risk factors since there were no patients available for study with 0 and 5 risk factors. Results also showed an overall total percentage decrease in early PONV from 47% to 16% for both scales with the administration of a preoperative multimodal kit in THA and TKA patients.

Cost Implications

The cost to an ambulatory surgery center for the treatment of acquired PONV can be approximated to over $1000 US currency per patient (Sanchez, Hirsch, Carroll, & Miederhoff, 1994). According to the specialty facility in the Southeastern United States, the cost of the preoperative multimodal kit is $21.60 per patient. The cost of the preoperative multimodal regimen to the surgical center is miniscule in relation to the potential cost of a patient acquiring PONV. Along with a potential savings in monetary cost, the overall health and mental wellbeing of the patient is also protected.

Recommendations

This capstone study has revealed a significant decrease in early PONV with the administration of a preoperative antiemetic multimodal regimen to patients with 2 or 3 risk factors for the development of PONV, undergoing THA and TKA surgery, and receiving both a spinal and general anesthetic. Recommendations would be for the continued use of such a preoperative antiemetic regimen specific for these types of surgeries, for American Society of Anesthesiologists (ASA) I and II health score patients with 2 or 3 risk factors for PONV, ranging from the ages of 24 to 60, and given both a spinal and general anesthetic with laryngeal mask airway use (LMA). Future research could include a larger sample size and include an equal distribution of patients in each group of risk factors to determine the significance. Additional research could include patients older than 60 years of age, ASA score greater than III, and having other types of surgeries.

Conclusion

The findings of this retrospective analysis has confirmed a significant decrease in postoperative nausea and vomiting (PONV) with the use of a multimodal antiemetic regimen on patients who exhibit 2 and 3 known risk factors for PONV. This study did also not establish a significant decrease in PONV on patients who exhibit 0, 1, 4, or 5 known risk factors for PONV. This may be attributed to either the small sample size of those patients, a decreased risk for developing PONV, or being at such a large risk for developing PONV. Overall this analysis should encourage stakeholders and anesthesia providers to support the use of preoperative antiemetic regimens not only for the purpose of controlling the establishment's monetary loss but to protect the patient from unnecessary risk, harm, and suffering.

CHAPTER VI

ESSENTIALS

The Essentials of Doctoral Education for Advanced Nursing Practice

I. Scientific Underpinnings for Practice

- The benefit to anesthesia will be improved patient outcomes by identifying those at risk for PONV, reducing the occurrence of PONV, and improving patient outcomes. The knowledge obtained from this study will help decrease cost related to adverse outcomes related to PONV.

II. Organizational and Systems Leadership for Quality Improvement and Systems

- Research supports that the use of preoperative antiemetic medications reduces the incidence on PONV. The administration of a multimodal regimen should improve the quality of care the patient receives, especially in those that are at a higher risk for PONV.

III. Clinical Scholarship and Analytical Methods for Evidence-Based Practice

- Research supports that preoperative prophylactic antiemetic use leads to a reduction in PONV. The results of this study can show a multimodal use for a particular surgical population that can be applied to other areas of surgery.

IV. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

- The use of a research database has led to a large source of knowledge that can be accessed easily and rapidly. SPSS can be used to assist in

quantifying data. The use of electronic records makes gathering of patient information easy. Use of electronic charting allows for the rapid categorizing of data as well as more legible information.

V. Health Care Policy for Advocacy in Health Care

- Evidence supports that a reduction of PONV leads to less occurrence of adverse outcomes. Standards of care exist for many areas of healthcare while standards for PONV do not seem to be present.

VI. Inter-professional Collaboration for Improving Patient and Population Health Outcomes

- Caring for a surgical patient requires collaboration and teamwork from many different individuals with many different job titles. It is vital that each individual perform according to their job description to provide the best care possible.

VII. Clinical Prevention and Population Health for Improving the Nation's Health

- A reduction of PONV will not only lead to an increase in patient satisfaction but also a decrease in cost to the patient and institution. A reduction in PONV will lead to shorter hospital stays, less readmits, less adverse outcomes in relation to PONV, and less morbidity and mortality.

APPENDIX A

APFEL RISK SCORE FOR PONV

Risk Factor	Points
Female Gender	1
Non-Smoker	1
History of PONV	1
Postoperative Opioids	1
----------	------
Sum	0-4
Sum of 0 points= 10% Risk for PONV Sum of 1 point = 20% Risk for PONV Sum of 2 points= 40% Risk for PONV Sum of 3 points= 60% Risk for PONV Sum of 4 points= 80% Risk for PONV	

(Apfel et al., 2002)

APPENDIX B

KOIVURANTA RISK SCORE FOR PONV

Risk Factor	Points
Female Gender	1
Non-Smoker	1
History of PONV	1
History of Motion Sickness	1
Duration of Surgery >60 minutes	1
----------	------
Sum	0-5
Sum of 0 point = 17% Risk for PONV Sum of 1 point = 18% Risk for PONV Sum of 2 points= 42% Risk for PONV Sum of 3 points= 54% Risk for PONV Sum of 4 points= 74% Risk for PONV Sum of 5 points= 87% Risk for PONV	

(Koivuranta et al., 1997)

APPENDIX C

AMERICAN SOCIETY OF ANESTHESIOLOGISTS PHYSICAL CLASSIFICATION

ASA PS Classification	Definition	Examples, including, but not limited to:
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30 < BM < 40), well controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA < 60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Examples include (but not limited to): recent (< 3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis
ASA V	A moribund patient who is not expected to survive without the operation	Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

(American Society of Anesthesiologists, 2015)

APPENDIX D

DATA COLLECTION FORM

Identification # _____ Procedure Date __/__/____
Age _____ Sex M / F Ht. _____ Wt. _____ BMI _____
Ethnicity _____ Smoker Y/N ASA _____
Current Medications _____
_____
Past Medical History_____
_____
Previous Surgeries _____
Past Anesthesia Complications _____
Preoperative medications_____
Anes Start _____ Anes End _____ Total Anes _____
Surgery Start _____ Surgery End _____ Total Surgery _____
Spinal:
Level _____ Local Anesthetic _____ Dose_____
Intraoperative:
Airway Type _____ Airway Size _____

Time	Medication	Dose	Vital Signs

IVF type: _____ Total IVF: _____ mL
EBL _____ml

PACU:
PACU Vital Signs:

BP _____ HR _____ Temp ____ SaO2 ____ RR ____ PACU in____ out_____

APPENDIX E

UNIVERSITY OF SOUTHERN MISSISSIPPI 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: 15081402
PROJECT TITLE: The Effectiveness of a Preoperative Multimodal Antiemetic Regimen on Reducing Early Postoperative Nausea and Vomiting in Total Joint Arthroplasty Patients
PROJECT TYPE: New Project
RESEARCHER(S): Jerry Mosley
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: Advanced Practice/Anesthesia
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 08/17/2015 to 08/16/2016
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX F

FORREST GENERAL HOSPITAL IRB EXEMPT STATUS

FORREST GENERAL HOSPITAL
Forrest Health®

DATE:	June 19, 2015
TO:	Jerry Mosley, SRNA, RN, BSN, BS
FROM:	Forrest General Hospital Institutional Review Board
STUDY TITLE:	[767943-1] The effectiveness of a preoperative multimodal antiemetic regimen on reducing early postoperative nausea and vomiting in total joint arthroplasty patients.
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	June 17, 2015
REVIEW CATEGORY:	Exemption category # *B4*

Thank you for your submission of New Project materials for this research study. Forrest General Hospital Institutional Review Board has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office.

If you have any questions, please contact Michele Stanley at 601-288-4324 or mstanley@forrestgeneral.com. Please include your study title and reference number in all correspondence with this office.

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