SCHOLARLY PAPER: RISK FACTORS AND NAUSEA PROPHYLAXIS IN THE GYNECOLOGICAL (GYN), UROLOGICAL, AND EAR, NOSE AND THROAT (ENT) SURGICAL POPULATION AT AN AMBULATORY SURGERY CENTER

by

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A doctoral scholarly project submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctorate in Nursing Practice

2023

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ABSTRACT

REBEKAH P. ROSS. Risk Factors and Nausea Prophylaxis in the Gynecological (GYN), Urological, and Ear, Nose and Throat (ENT) Surgical Population at an Ambulatory Surgery Center

(Under the Direction of DR. STEPHANIE WOODS)

This is a quality improvement (QI) project that examines post-operative nausea and vomiting prophylaxis (PONV) and PONV in the Post Anesthesia Care Unit (PACU) in an ambulatory surgery center of a large hospital system. PONV causes negative health sequelae, increases the financial burden, and decreases patient satisfaction. The clinical question for this QI project is: In the population of Gynecological (GYN), Urological, and Ear, Nose, and Throat (ENT) surgical patients 18 years and older, undergoing surgery at an ambulatory surgery center, how does patient, anesthetic, and surgical risk factors for PONV and the delivery of antiemetics affect the incidence of PONV? Data related to patient, anesthetic, and surgical risk factors, and PONV in the PACU was collected via chart review. Data analyses were conducted to determine patient, anesthetic, and surgical risk factors, and PONV prophylaxis administration. Apfel score was positively associated with an increase in actual antiemetics given. Patient risk factors (Apfel score), anesthesia risk factors, and surgical risk factors did not predict PONV. A little over half of the patients received PONV prophylaxis consistent with the Fourth Consensus Guidelines. Lastly, over 80% of high-risk patients (Apfel > 2) are receiving an inadequate amount of antiemetics. Education to improve anesthesia providers knowledge on the Apfel scoring system and Fourth Consensus Guidelines is recommended to improve adherence.

Keywords: PONV, gynecologic, ENT, urologic, surgery, ambulatory surgery centers, anesthesia, PACU

ACKNOWLEDGMENTS

First and foremost, I would like to acknowledge Dr. Stephanie Woods, my doctoral quality improvement project chair. Without her extensive time, effort, patience, and assistance, this project would not have been possible. Next, I would like to thank my nurse anesthesia program faculty member, Dr. Karen Lucisano. I appreciate your feedback and advice for the direction of this project. Your deep knowledge of the practice of anesthesia was invaluable. Thank you to my clinical expert, Dr. Jenny Dhingra, who was always available to give her valued input. Thank you to Dr. Shanti Kulkarni who served as my graduate faculty representative. Thank you, Dr. Katie Shue-McGuffin, for your help in facilitating the completion of the logistics for this project. Additionally, I would like to thank Dr. Zhuo Chen who assisted with analyzing the data in a meaningful way. I extend a warm thank you to my Electronic Health Record Champion, Dr. Sherry Bernardo. Without your prompt assistance in gathering the data, this project would not have been completed on time. The completion of this individual quality improvement project was only possible with the support, guidance, and backing from my brilliant doctoral project group members, Abby Sanders, and Meghan Sullivan. Thank you both for never wavering in confidence for the successful completion of this project. Lastly, I would be remiss for not mentioning my family for their continued support and motivation in getting me to the finish line of this doctoral quality improvement project.

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CHAPTER 1: INTRODUCTION

While antiemetic therapy has evolved over the past decade, those with the following risk factors: female gender and undergoing breast, middle ear, gynecological or obstetrical surgery, still experience a 70% incidence of postoperative nausea and vomiting (PONV) (Ugochukwu, 2010). Additionally, according to Smith et al. (2012), PONV is "one of the most commonly reported adverse effects of anesthesia" (p. 94). Excessive PONV leads to deleterious health effects such as electrolyte imbalance, dehydration, hypotension, and other systemic complications (Bhakta et al., 2016). The economic implication of PONV is also significant. In ambulatory centers, a delay in surgical turnover due to PONV can lead to substantial financial losses (Girotto et al., 2010). In a study at the University of Rochester Medical Center, it was found that each hour of unused operative time costs $3,600 (Girotto et al., 2010).

Many risk factors can contribute to the development of PONV. These include patient, anesthetic, and surgical risk factors. Combining multiple risk factors can increase the potential risk for PONV development. Patient risk factors that contribute to PONV in the adult patient include female gender, younger age, nonsmoker, history of PONV and/or motion sickness, and receiving opioid analgesia (Murphy et al., 2006).

PROBLEM STATEMENT

Prevention of PONV requires assessing patient risk factors and treating the likelihood of PONV with antiemetics. A nationally recognized scoring system has been created by Apfel and his colleagues based on the consensus guidelines. The Apfel score includes four associated risk factors for PONV: female gender, non-smoker, postoperative opioid use, and previous PONV or motion sickness (Weilbach et al., 2006). According to Apfel et al. (1999) if the patient has one risk factor, there is a 10-21% incidence of PONV. This percent risk increases to 29-78% in

patients who exhibit two or more risk factors. Each risk factor increases the percent chance of PONV by 20%, with the baseline risk never being less than 10% (Weilbach et al., 2006). Once the number of risk factors the patient presents with is identified, an estimation of how many antiemetics the patient needs is made based on the Apfel score. With a risk score of 0, no antiemetics are recommended, a score of 1-2 indicates 2 antiemetics should be given, and a score of 3-4 means 3 or more antiemetics should be administered (Moore et al., 2021). Additionally, it is important to utilize combination therapy in high-risk patients, by using antiemetic drugs of different classes to cover multiple physiologic receptors (Gan et al., 2020).

General anesthesia also increases the risk for PONV. Volatile anesthetics, the primary source of anesthesia for general anesthesia surgeries, independently increases PONV (Morino et al., 2012). While the exact etiology is unknown, volatile anesthetics are thought to stimulate several of the afferent pathways which stimulate vomiting (Horn et al., 2014). Nitrous Oxide is an inhalational anesthetic commonly used in the operating room. A significant decrease in PONV has been noted when nitrous oxide was avoided (Shaikh et al., 2016). Long-acting opioids, such as morphine, are used for pain management in the postoperative anesthesia care unit (PACU) and have an increased risk for respiratory depression, urinary retention, pruritus, and PONV (Lim et al., 2016). The use of postoperative opioids doubles the risk of PONV (Pierre et al., 2003). In addition to the use of long-acting postoperative opioids, short-acting opioids like fentanyl and remifentanil are commonly used to blunt surgical stimulation during the beginning of the case. Lim and colleagues (2016) reported that patients who received 2mcg/kg of fentanyl during induction of anesthesia had a higher incidence of PONV.

With an increased length of surgery comes an increased risk for PONV. There are multiple theories and potential hypotheses of why this occurs. Chatterjee et al. (2011) estimates that a surgery duration greater than 30 minutes increases the risk of PONV by up to 60%.

PURPOSE OF THE PROJECT

Negative Patient Health Sequela

Many patients undergoing surgery continue to have an unacceptably high level of PONV. PONV can cause adverse patient health sequelae, which can have detrimental consequences for the patient. In research from Bhakta et al. (2016), postoperative nausea may lead to persistent vomiting, which can cause pulmonary aspiration syndrome, electrolyte imbalances, and dehydration. Excessive retching can lead to even more severe effects such as wound closure, bleeding, tension on suture lines, and venous hypertension (Manahan et al., 2013). In non-ambulatory surgery, the negative health effects caused by PONV can lead to increased perioperative morbidity, increased length of stay, prolonged overall recovery, and thus increase overall costs (Smith et al., 2012).

Financial Burden of PONV

The financial burden of PONV is estimated to be $1.5 million per year in lost surgical revenue (Masiongale et al., n.d.). When evaluating the overall cost of PONV, hospitals have looked at the financial benefit of prophylactic treatment versus rescue treatment once the patient developed symptoms. Preventative antiemetic treatment improved the patient experience and was more cost-effective than rescue treatment alone (Gress et al., 2020). An audit done in the post-anesthesia care unit (PACU) highlighted that most charges come from an increased length of stay (Gress et al., 2020).

Additionally, Gress and colleagues (2020) found that patients without PONV stayed in the PACU for 171 minutes. This duration increased to 234 minutes in patients with PONV (Gress et al., 2020). An additional study revealed that every vomiting event a patient experienced increased PACU time by 20 minutes (Gress et al., 2020). A longer PACU duration drives up the financial burden by increasing the supplies used, nursing staff needed, and backs up the surgical schedule (Parra-Sanchez et al., 2012).

PICO QUESTION

PICO: In the population of Gynecological (GYN), Urological, and Ear, Nose, and Throat (ENT) surgical patients 18 years and older, undergoing surgery at an ambulatory surgery center, how does patient, anesthetic, and surgical risk factors for PONV and the delivery of antiemetics affect the incidence of PONV?

Intra-operative processes that influence the risk for PONV include patient variables as measured by the Apfel score, anesthetic variables, surgical variables, and antiemetics administered. There were 4 specific aims derived from the PICOT for this project. For the first aim the patients were given an individual Apfel score based on their risk factors for PONV. The second aim determined the relationship between the Apfel score and the number of antiemetic medications administered during the intraoperative period. Aim three eassesds the prevalence of anesthetic and surgical risk factors including the use of Nitrous Oxide, volatile agents, intraoperative opioids, such as fentanyl and remifentanil, and surgery length greater than 30 min. Aim four assessed PACU charting to determine if the patient developed PONV.

LITERATURE REVIEW

A literature review was conducted between January 2022 and March 2022. Databases searched included PubMed, Cochrane Database of Systematic Reviews (CDSR), Google

Scholar, and ScienceDirect. The keywords used were PONV, gynecologic, surgery, ambulatory surgery centers, Fourth Consensus Guidelines, risk factors, nausea, PACU, volatile anesthetics, opioids, Nitrous Oxide, length of surgery, vomiting, antiemetics, negative health sequelae, and financial burden. The literature review included research studies and articles published from 1991 to 2022. Inclusion criteria were peer-reviewed articles beginning after 1991, written in the English language with full text availability. Exclusion criteria were articles that were published prior to 1991, were not in the English language, and were not peer-reviewed.

PATIENT RISK FACTORS

Female Gender

The female gender is an independent risk factor for PONV due to endocrine and hormonal differences after puberty (Golembiewski & O'Brien, 2002). Women experience PONV three times more often than males. When this risk factor is also combined with gynecological surgery, the incidence of PONV in this population is approximately 45%, significantly higher than the 30% average for other surgical populations (Apfel & Roewer, 2003). The overall incidence of PONV varied with the female population depending upon the current day of their menstrual cycle (Beattie et al., 1991). Beattie et al. discovered that the incidence of PONV was four times higher during menses than other times of the month in the female population (1991). Additionally, as women entered menopause, nausea and vomiting became closer to the incidence of the male gender (Beattie et al., 1991). It has been suggested that scheduling surgery based on the menstrual cycle may be beneficial to reducing overall PONV incidence in the female population due to hormonal differences between male and female genders (Beattie et al., 1991).

The risk of PONV between the genders is significant when determining the overall risk factors for PONV in the adult surgical patient. Pierre et al. (2002) found when examining the

incidence of PONV, males had a lower incidence of PONV when compared to females. Another difference regarding PONV is that females often already have the underlying risk factor of motion sickness or previous PONV, while males do not (Krieser et al., 2020). A study comparing the number of prophylactic agents given for PONV prevention showed that even with computer guidance, females received inappropriate PONV prophylaxis while undergoing general anesthesia when compared to their male counterparts (Krieser et al., 2020). For example, 96% of the time females received inappropriate prophylaxis, compared to males only receiving inappropriate prophylaxis 5% of the time (Krieser et al., 2020). This study supports that females are at a higher risk of developing PONV and are often given inadequate PONV prophylaxis, contributing to the overall increased incidence of PONV in the female patient (Krieser et al., 2020).

Age

Age also impacts the risk for PONV in the surgical patient. The highest incidence for PONV occurs in the adolescent population and has an inverse relationship with increasing age (Apfel & Roewer, 2003). The peak incidence of PONV is in school-age children, and it is not increased in females until after puberty (Rose & Watcha, 1999). As noted previously, the increase in PONV after puberty in females may be due to the menstrual cycle (Beattie et al., 1991).

Nonsmokers

Nonsmokers have an increased incidence of PONV when compared to smokers. Although the cause of a decreased incidence associated with PONV in smokers has not been determined, there are several potential reasons. Smokers are exposed to the chemicals in tobacco smoke which may desensitize them to volatile anesthetics or cause cytochrome p450

upregulation and an increased metabolism of volatile anesthetics (Werner et al., 2008). Because the use of volatile anesthetics significantly increases the risk for PONV, this may be a large factor for the decreased level of PONV found in smokers (Morino et al., 2012)

History of PONV/Motion Sickness

A history of PONV and/or motion sickness increases the risk for PONV due to the disturbance of the vestibular apparatus in the inner ear. The vestibular system senses body position and helps with balance (Hromatka et al., 2015). The vestibular system also aids in sensing toxins that may contribute to PONV and need to be excreted from the body (Hromatka et al., 2015). Consequently, a disturbance to the vestibular system (i.e., a history of PONV and/or motion sickness) increases the risk for PONV (Hromatka et al., 2015).

ANESTHETIC RISK FACTORS

Volatile agents

Using volatile agents to perform a balanced general anesthetic is standard practice. The three most common volatile anesthetics used today include Sevoflurane, Isoflurane, and Desflurane. These volatile agents are used to induce and maintain anesthesia throughout surgery. Volatile anesthetics are associated with a two-fold increase in the risk of PONV (Pierre & Whelan, 2012). The risk of PONV increases with increasing the dose of the volatile agent (Pierre & Whelan, 2012). It has been shown that the use of volatile anesthetics is the most important factor in predicting nausea and vomiting within the first two postoperative hours (Pierre & Whelan, 2012). Substituting propofol for a volatile anesthetic while performing total intravenous anesthesia (TIVA) reduces the risk of PONV by about 19% (Fernandez-Guisasola et al., 2020). However, no significant difference between these different volatile agents and their effect on PONV have been shown (Pierre & Whelan, 2012).

Nitrous Oxide

The emetogenic effects of Nitrous Oxide is a well discussed topic in the literature and within the hospital setting. Avoiding Nitrous Oxide can reduce the risk of PONV by 20% (Fernandez-Guisasola et al., 2020). Data shows that the increase in PONV that is seen with the administration of Nitrous Oxide is highly dependent on the duration of exposure (Peyton & Wu, 2014). The emetogenic effects of Nitrous Oxide are not typically significant until one hour of exposure (Peyton & Wu, 2014), offering the anesthesia provider some assurance that the use of short-term Nitrous Oxide will not increase the chances of PONV. Therefore, the use of Nitrous Oxide may be seen more in the ambulatory setting where surgeries have a shorter duration of time. A common practice for Nitrous Oxide also includes its use at the end of surgery to help decrease the amount of maintenance volatile anesthetic being used. This helps provide amnesia towards the end of the case while also supporting a rapid wake up. Nitrous Oxide when used for a rapid wakeup has not been found to cause PONV (Peyton & Wu, 2014).

Opioids

Another anesthetic agent contributing to PONV includes opioids (Shaikh et al., 2016). Opioid receptors are found in the Chemoreceptor Trigger Zone (CTZ). The CTZ is located outside of the blood-brain barrier and allows substances in the blood and cerebrospinal fluid (CSF) to interact. Toxins or drugs, such as opioids traveling in the blood stimulate the CTZ. This stimulation sends triggers to the vomiting center of the brain, causing nausea and vomiting (Shaikh et al., 2016).

SURGICAL RISK FACTORS

Surgery Duration

Surgery duration is a strong predictor of PONV. If operating time is increased by 30 minutes, the risk for PONV may be increased by as much as 60% (Shaikh et al., 2016). It is

hypothesized this is because surgery duration is directly linked to increased exposure to volatile anesthetics and potentially additional intraoperative opioid administration, both of which are emetogenic substances (Pierre, S. & Whelan, R., 2013). With increased surgical duration and an increase in delivery of volatile anesthetics, there is an increased risk of PONV. There is a gap in the literature regarding whether the surgery duration reaches a peak emetogenic effect.

Type of Surgery

Patients undergoing some types of surgeries are more at risk for PONV than others. There is an increased risk of PONV in gynecological surgery compared to other surgical populations. According to Shaikh et al. (2016), this increased risk may be due to the location of the surgery and the potential for delays in gastric emptying, which also increases the risk of PONV. Additionally, the afferent vagal pathways are in the gastrointestinal system, which when stimulated, can activate the sensation of vomiting (Shaikh et al., 2016).

The risk of PONV following ENT surgery can be as high as 70% (Erkalp et al., 2014). One potential cause is the flow of blood entering the stomach during the procedure. The literature is undecided on whether gastric decompression following the procedure will improve the incidence of PONV or not. Other potential causes of PONV stemming from ENT surgery are stimulation of the chemoreceptor trigger zone, and stimulation of the trigeminal nerve which causes an activation of chemoreceptors and mechanoreceptors in the stomach and oropharynx (Erkalp et al., 2014).

Urologic Surgery

There is currently insufficient data establishing the incidence of PONV following urologic surgery (Vukovic & Dinic, 2018). One study by Stadler et al. (2003) found that patients undergoing urology surgery have an increased risk of developing PONV compared

to vascular and orthopedic surgery and less of an incidence when compared to GYN and maxillofacial surgery. Urologic surgery was included in this QI project to gather a larger percentage of men in the sample.

FOURTH CONSENSUS GUIDELINES

The risk factors for PONV, as noted above, can be patient-specific, anesthetic-specific, and surgery-specific. Assessing each patient's risk factors to determine their total number of risk factors is recommended in Guideline 1 of the Fourth Consensus Guidelines. Prevention of PONV is essential in the surgical patient. Giving appropriate PONV prophylaxis medications reduces the rate of PONV (Gan et al., 2020).

Per the Fourth Consensus Guidelines, the number of risk factors that a patient has determines the number of PONV prophylaxis medications to be given. According to Gillman et al. (2019) “Adherence to PONV prophylaxis guidelines … is still remarkably low" (p. 408). Additionally, "Less than half of medium to high-risk patients receive the appropriate PONV prophylaxis" (Kumar et al., 2012, p. 58). If a patient has one to two risk factors, they should receive two prophylactic agents, and if they have greater than two risk factors, they should receive three to four prophylactic agents (Gan et al., 2020).

The Consensus Guideline also decreased the threshold for administering PONV prophylaxis to make multimodal PONV prophylaxis a common practice. The Fourth Consensus Guideline now recommends that adults with one or more risk factors receive multimodal PONV prophylaxis due to concerns that these patients were not receiving adequate prophylaxis. In support of compliance with the Consensus Guidelines, the Centers for Medicare and Medicaid Services has established a "merit-based incentive payment system (MIPS)" for those who follow the PONV prophylaxis protocol (Gan et al., 2020).

ANTIEMETICS

Many antiemetic medications can be utilized for the prevention of PONV. Antiemetic classes are 5HT3 receptor antagonists, NK-1 receptor antagonists, corticosteroids, antidopaminergics, antihistamines, anticholinergics, and additionally other antiemetics such as gabapentin and midazolam. These drugs can be used in combination therapy for the prevention of PONV. It was found that the combination of two or more antiemetics for prophylaxis for adults is superior to only utilizing one agent for prophylaxis (Gan et al., 2020). Dexamethasone, a corticosteroid, ondansetron, a 5HT3 receptor antagonist, and droperidol, a dopamine antagonist, show equal efficacy in preventing PONV (Apfel et al., 2004). However, the low cost and high safety profile of dexamethasone make it an attractive first line agent for PONV (Apfel et al., 2004). Dexamethasone shows greatest efficacy when used at the beginning of surgery to decrease surgery related inflammation and is not effective as a rescue agent. Saving 5HT3 receptor antagonists to utilize as rescue treatments may be the best course of action in the management of PONV (Apfel et al., 2004). Droperidol has fallen out of favor due to causing dysphoria, as well as for the black box warning for its potential to cause torsade's de pointes, a lethal heart rhythm. Droperidol, while effectively decreasing PONV in females, shows no risk reduction for men (Apfel et al., 2004).

Additional antiemetics such as scopolamine, a centrally acting anticholinergic and aprepitant, which is a NK-1 receptor antagonist is also effective in preventing PONV. Although a scopolamine patch is a cheap, highly effective drug for preventing PONV, it should be avoided in pediatric and elderly patients, as it does have negative side effects such as dry mouth, drowsiness, and visual disturbances (Elvir- Lazo et al., 2020; Kassel et al., 2018; White et al., 2007). A study by Gan et al. (2007) shows that aprepitant is superior to preventing vomiting

when compared to ondansetron. However, because of its high cost, it should be reserved for extremely high-risk patients (Elvir-Lazo et al., 2020).

PONV PREVENTION

Prior research has established that adherence to the guidelines results in a significant decrease in PONV (Stephenson et al., 2021). However, minimal research has been conducted to determine facility compliance with the Fourth Consensus Guidelines. Current research has found a knowledge gap between understanding of the Apfel scoring system and the consistent application of its antiemetic interventions into practice (Devarakonda et al., 2022). Routine education on utilizing the Apfel score as well as staff reminders to administer the proper prophylactic agents aids in significantly decreasing the percent of patients who develop PONV (Devarakonda et al., 2022). Even when antiemetics are administered, if they are not administered appropriately according to the protocol, they will not assist in preventing PONV (Gillman et al., 2019).

Research from Öbrink et al. (2015) shows preventing PONV has a four-tiered pyramid approach. The foundation begins with assessing and scoring patients PONV risk factors utilizing the Apfel scoring system. This is used in combination with providing a multi-modal opioid sparing anesthetic. The next level emphasizes the use of multi-modal PONV prophylactic medications. A step up provides a tailored anesthetic plan specific for each patient and their risk factors. Finally, if these three steps fail, rescue therapy in the form of a different class of antiemetics is the final step in the escalating pyramid (Öbrink et al., 2015).

Inappropriate PONV prophylaxis was associated with an 11% incidence of PONV compared to a 4% incidence with appropriate PONV prophylaxis according to the protocol (Gillman et al., 2019). Additionally, Gillman et al. (2019) found that compliance to the PONV

prophylaxis protocol varied between surgical populations, with gynecological surgical patients only having adherence 41% of the time while urological surgical patients had a 72% adherence rate. It was also discovered that the rates of insufficient PONV prophylaxis were more significant than both overshooting and correct PONV prophylaxis combined (Gillman et al., 2019). Gillman et al. (2019) discovered that patients with an Apfel score of 3 or greater received insufficient PONV prophylaxis in more than 50% of the cases. The study supports the need for further research on patient, anesthetic, and surgical risk factors for PONV as well as determining the compliance with the PONV prophylaxis guidelines in gynecologic, ENT, and urologic surgical patients.

OUTCOME VARIABLE

PONV in the PACU

The outcome variable that was assessed was postoperative nausea and/or vomiting in the PACU. It is well established that PONV increases the PACU stay and increases resources utilized (Habib et al., 2006). Vomiting is especially detrimental, as it costs nearly 1.5 times more than an episode of nausea in the PACU costs (Habib et al., 2006).

PONV in an Ambulatory Surgery Center

According to the Centers for Medicare and Medicaid Services (2022, para. 2), an Ambulatory Surgery Center (ASC) is a "distinct entity that operates exclusively for the purpose of providing surgical services to patients not requiring hospitalization and in which the expected duration of services would not exceed 24 hours following an admission." Traditionally, ASCs have several benefits over the traditional hospital surgery setting, with the most apparent benefit being higher efficiency with comparable patient outcomes (Hollenbeck et al., 2014). ASCs are growing rapidly, with a 60% increase in the number of ASC operating rooms from 2004 to 2014

(Hollenbeck et al., 2014). According to Rascol et al. (2006), the advantages of having surgery at an ambulatory surgery center are faster recovery, earlier ambulation, and a quicker return to everyday life.

Although there are no clear criteria for which patients qualify to have ambulatory surgery, Rascol et al. (2006) argues that patients' comorbid diseases should be relatively well controlled to be a candidate. Seven risk factors have been noted to contribute to poor postoperative outcomes including hypertension, an overweight or obese BMI, chronic obstructive pulmonary disease (COPD), previous transient ischemic attack or stroke, prior cardiac surgery, and an extensive operating time (Mathis et al., 2013).

PONV can increase recovery time in the PACU, cause unplanned hospital admission, and decrease the efficiency of the ASC. In a study of 100 patients, over one-third of the ASC patients experienced PONV which created a financial burden (Parra-Sanchez et al., 2012). The incidence of PONV increased the cost per patient, by increasing the direct nursing care by 14 minutes, and by prolonging the PACU stay by one hour (Parra-Sanchez et al., 2012).

Parra-Sanchez et al. (2012) also found that PONV “is one of the leading causes for delayed discharge and unplanned hospital admission following outpatient surgery" (p. 367). Research from Smith et al. (2012) found that .1 to .2% of unplanned hospital admissions from ambulatory surgery centers are due to PONV (Parra-Sanchez et al., 2012). Additionally, patients having surgery at ambulatory surgery centers lack access to intravenous antiemetic rescue therapy at home after discharge, which further illustrates the necessity of preventing PONV (Gan et al., 2014).

OVERALL SUMMARY

The Fourth Consensus Guideline for the Prevention of PONV is a valuable tool for guiding the management of PONV in the perioperative setting. There is a gap in the literature in determining whether anesthesia providers administer additional antiemetics based on patient, anesthetic, and surgical risk factors. Patients undergoing general anesthesia still experience a 30% incidence of PONV (Pierre, S. & Whelan, R., 2013). Patient risk factors that contribute to PONV in the adult population include female gender, younger age, nonsmoker, surgery type, history of PONV and/or motion sickness, and receiving postoperative opioid analgesia (Murphy et al., 2006). Anesthetic risk factors include Nitrous Oxide, volatile anesthetics, and opioids. Surgical risk factors include length of surgery greater than 30 minutes. The unique characteristics in each of these sites will play a role in determining which factors increase the rate of PONV in the PACU. The outcome variable that will be assessed is PONV in the PACU. Understanding how risk factors for PONV influence the patient's anesthetic will ultimately help mitigate adverse patient health sequelae and decrease the financial burden caused by PONV.

CONCEPTUAL FRAMEWORK

The Plan-Do-Study-Act conceptual framework was utilized for this quality improvement project. According to Hall (2016) the PDSA is utilized to continuously improve a process with a four-stage model. Establishing a plan and writing down the steps promoted clarity while conducting this QI project. Based off the PDSA, four aims for this QI project were created.

Plan/Do: This project lays a foundation for a quality improvement project on PONV following GYN, Urology, and ENT procedures. A literature review on patient, anesthetic, and surgical risk factors for PONV was conducted. Additionally, the review of literature included PONV prophylaxis, negative health sequelae related to PONV, and the financial burden of PONV.

Next, chart reviews were performed at an ambulatory surgery center to determine patient, anesthetic, and surgical risk factors, and PONV prophylaxis administration.

Study: After the data was collected, the results were analyzed. The incidence of PONV was determined based on postoperative anesthetic chart review. Next, the incidence of PONV was compared with the number and class of antiemetic drugs administered.

Act: Future Quality Improvement projects can utilize this data to determine the barriers of appropriate PONV prophylaxis administration in accordance with the Fourth Consensus Guidelines. Additionally, a plan can be recommended to improve PONV prophylaxis and minimize the number of modifiable risk factors. Education can be performed to improve providers' knowledge of the patient, anesthetic, and surgical risk factors for PONV, and the recommended prophylactic treatment.

CHAPTER II: METHODOLOGY

Project design, Timing, and Data Collection Methods

The project design for this quality improvement project on risk factors and nausea prophylaxis in the Gynecological (GYN), Urologic, and Ear, Nose and Throat (ENT) surgical population is a descriptive design. A descriptive design places emphasis on objective measurements and statistical, mathematical, or numerical analysis of data collected without changing the current environment (Babbie, 2010; Nebeker, n.d.). This project consisted of data collection from an ambulatory hospital. Data was collected on the number of GYN, urologic, and ENT patients who received nausea prophylaxis based on the Apfel score for PONV as well as their anesthetic and surgical risk factors.

SETTING

Ambulatory Hospital

This Quality Improvement project was conducted in the ambulatory surgery center (One Day Surgery [ODS]) of a major urban trauma center. It has 11 total operating rooms, not including their one NORA site. It is estimated ODS performs around 37 surgeries per day in the main operating rooms. Per day, there are on average 15 GYN surgeries, 3-4 ENT surgeries, and 3-4 urology procedures. Over a third of surgeries at ODS are OB/GYN related. There is approximately 1 CRNA per OR and 1 anesthesiologist per 4 ORs in use. There are an additional 2-3 CRNAs not assigned to a particular OR, available to give breaks, and provide additional assistance (Atrium Health, personal communication, February 25th, 2022).

The ambulatory surgery center resides directly next to a major urban trauma center that serves a major Southern metropolitan area. The ambulatory surgery center offers a same day surgery experience for patients. Patients having surgery at ODS are intended to be discharged the same day and not be admitted to the hospital post-operatively. The patients at the ambulatory surgery center are typically healthier with less comorbidities and are having a simpler procedure performed compared to patients who have surgery at the major medical center.

Sample/Participants

Determining the sample size and composition was a crucial step to the continued implementation of the DNP project. To have a diverse sample of men and women this scholarly project included patients undergoing a variety of procedures: GYN, ENT, and urologic surgeries. Data was collected from chart reviews of patients who meet the inclusion criteria of patients over the age of 18 receiving general anesthesia for GYN, ENT, and urologic surgeries and were cared for by certified registered nurse anesthetists (CRNAs) that maintain employment at ODS. Convenience sampling was used for this project and is often used based on the accessibility in obtaining the data (Lavrakas, 2008). The convenience sample for this project consisted of the

first 35 people who underwent gynecological surgery, urological surgery and ear, nose, and throat surgery at ODS during the month of August 2022. A fairly equal number of patients from each surgical population were chosen.

Sampling

Chart review and data collection occurred for those participants meeting the project inclusion criteria and who had surgery between the dates of August 1, 2022, and September 1, 2022. The inclusion criteria were individuals over the age of 18 years old, who had GYN, ENT, or Urological procedures performed under general anesthesia at ODS. The exclusion criteria were individuals under the age of 18 years old, who did not have general anesthesia, or who did not undergo GYN, Urology, or ENT procedures at ODS.

Measurements/Instruments/Tools

An excel spreadsheet was created with a list of patient, anesthetic, and surgical risk factors for PONV, as well as the prophylactic antiemetics that are outlined in the Fourth Consensus Guidelines (1999). Patient risk factors for PONV as outlined by Apfel et al. include female gender, nonsmoker, history of PONV or motion sickness, and receiving opioid analgesia post-operatively (Murphy et al., 2006). Anesthetic risk factors assessed include the use of Nitrous Oxide, volatile anesthetics, and intraoperative opioids such as remifentanil and fentanyl. Finally, the surgical risk factor assessed is the length of surgery being greater than 30 minutes. This served as the data collection sheet for performing chart reviews. The antiemetic drugs for the prevention of PONV that are outlined in the Fourth Consensus Guidelines, and that are listed on the data collection sheet include 5-hydroxytryptamine (5-HT 3) receptor antagonists, neurokinin-1 (NK-1) receptor antagonists, corticosteroids, antidopaminergics, antihistamines,

anticholinergics, gabapentin, intramuscular Ephedrine, and Midazolam given at the end of the case (Gan et al., 2020).

Analysis Description

The sample population is limited to 35 patients aged 18 years or older undergoing GYN, urologic, and ENT procedures between August 1, 2022, to September 1, 2022. 35 patients' information was collected from ODS. This included the first 35 patients which meet the inclusion criteria from each surgery type: GYN, urologic and ENT. The sample was collected from the electronic health record (EHR). Data collection remained consistent by setting limitations on the sample population. The data collection sheet outlined above was utilized to organize the data.

Once a thorough and well-planned data collection sheet was created, an EHR champion was recruited to decode the EHR. The EHR champion was educated on the risk factors and prophylactic medications for PONV before they collected the data from the EHR charts. The EHR champion provided education on how data on PONV risk factors and prophylactic medications are recorded in the chart. This gave confidence that the information needed was accurately conveyed on the data collection sheet.

Once the data was collected, each patient encounter was assessed on four variables. First, the patient received an Apfel score of 0-4 based on patient risk factors for PONV as outlined above. Second, additional anesthetic and surgical risk factors were tallied. Third, the amount and type of antiemetics the patient received during the intraoperative period was counted. Finally, an assessment of compliance with the Fourth Consensus Guidelines was determined based on the number of antiemetics given compared to the number of patient risk factors. Compliance was determined by comparing this data to the recommended number of prophylactic agents as

outlined by the Apfel score. After these four variables were assessed and counted, a tally of each individual risk factor was counted for the 35 patients.

Accuracy of data retrieved from the chart was ensured by limiting the sample to patients aged greater than 18 and undergoing GYN, Urologic, or ENT procedures, as well as by reviewing the same patient, anesthetic, and surgical risk factors, and prophylactic medications for each patient. The data collector thoroughly reviewed the input placed in the excel sheet to ensure accuracy. There was close communication with the data collector to answer and clarify any questions that came up.

Intervention/Project Protocol

The data collection protocol consisted of a predetermined set of data that was collected from the patient charts. Data collection occurred from charts over a month-long period to reach a sample size of 35 from ODS. Once data was collected, the statistical analysis was completed, and a conclusion was formed based on the statistical significance of the data results.

Data Management Strategies & Confidentiality of Data

The EHR used was Epic. To protect patient privacy, only the data collector had access to identifying patient data. The sample population was de-identified before other group members had access to this patient data. The patient names were only available to the data collector and not listed in the data collection sheet. The data management program used was Excel.

Timeline

The first step to obtaining IRB approval was completing the Quality Improvement template and sending it to the Atrium Health DNP council. Once approved, the project was submitted to Atrium Health IRB and UNC Charlotte IRB. During this time recruitment of an EHR champion to assist with chart reviews began. Chart reviews began August 1, 2022.

Analysis of the data occurred between September and October of 2022. At this time the final draft of the final project defense has begun. The final written project defense is being submitted in November 2022. The oral defense of the project will be presented in the beginning of December 2022.

Data Analysis & Evaluation

Data analysis was completed with basic descriptive statistics. After data was collected and compiled, identifying missing data was performed. There was no data missing. Identifying and managing any potential missing information is an essential step in evaluating the data that was collected.

The statistical analysis was conducted based on the DNP project clinical question "In the population of Gynecological (GYN), Urological, and Ear, Nose, and Throat (ENT) surgical patients 18 years and older, undergoing surgery at an ambulatory surgery center, how does patient, anesthetic, and surgical risk factors for PONV and the delivery of antiemetics affect the incidence of PONV?" Descriptive analysis of the sample characteristics was conducted on data gathered from the ambulatory surgery center. Descriptive analysis included a description of the sample, risk factor, and PONV prophylactic medications. The mean Apfel score, the percentage of anesthetic risk factors, the percentage of surgical risk factors, as well as the percentage of antiemetics given was determined. Multiple linear regressions then tested associations of Apfel, anesthesia risk, and surgical risk with actual antiemetics given. Additionally, descriptive analysis of the data collected and the Apfel scores were completed and summed. Next, the aggregate mean Apfel score was calculated and compared with the aggregate mean number of prophylactic antiemetic medications given to determine facility compliance with the Fourth Consensus Guidelines. All data was analyzed used descriptive statistics initially including means and

standard deviations or frequencies. Logistic regression was used to test associations between patient risk factors, anesthesia risk factors and surgical risk factors on post-op nausea and vomiting. Regression analysis was used to test associations of the Apfel score, anesthesia risk factors, and surgical risk factors on antiemetics given. T-test analysis was conducted comparing actual antiemetics given with expected antiemetics to be administered.

Correlation

Correlational analysis depended on the level of data (interval v. nominal) collected. The data-collection correlation was done utilizing multiple linear regressions. The number of patient risk factors was correlated to the number of prophylactic medications given. The number of patient risk factors was also correlated to whether the patient experienced PONV. This test determined whether more risk factors correlate to more prophylactic agents being given, and if more risk factors equate to a higher incidence of PONV. This also allowed it to be determined if there is statistically significant data between what is expected to happen and what occurred. It was expected that with increased patient risk factors, there should be an increase in the number of PONV prophylactic medications given. On the contrary, it was also expected that more risk factors will show a higher incidence of PONV.

Needed Resources, Supports, and Challenges to Success of Project Implementation

This QI project was not seeking to implement a change into the operating room, therefore there is not a need for staff buy-in. The biggest point of emphasis was on data collection. The most difficult challenge was finding an EHR champion to assist with chart reviews who understood Epic, the new EHR. Because the member of the QI projects school is affiliated with a large area hospital, there was no cost for IRB approval or costs associated with accessing data. Supply needs were limited to computers with Microsoft Excel, who could securely store the data.

Challenges to successful project implementation included delays with receiving data from the chart reviews. The hospital system was in the process of transitioning EHR platforms, which caused a delay in receiving the data from the EHR champion. This was rectified by beginning the process early, being well educated on the Epic EHR system, and keeping constant communication with the EHR champion to receive the data as swiftly as possible.

CHAPTER III: FINDINGS

AIM ONE

The sample population consisted of 12 patients having GYN surgery, 10 patients having ENT surgery, and 13 patients having urological surgery at the ambulatory surgery center. The range of the patients age was from 19 to 90, with the mean being 60.83 years old, and a standard deviation of 15.56. The sample population consisted of 20 patients over the age of 60, 11 patients between age 40-60 and 4 patients younger than 40 years old. Aim one was to assign the patients an individual Apfel score based on their risk factors for PONV. Each component of the Apfel score added one point to their score. The Apfel score components were female gender, history of PONV/motion sickness, nonsmoker, and post op opioid administration. The majority, 57.14%, of patients were female, 5.71% had a history of PONV/motion sickness, 91.43% were nonsmokers and 20% had a post op opioid administered (Table 1, *Patient Risk Factors for Apfel Score*). The average Apfel score was 1.74, with a standard deviation of .78. The lowest score was 0 and the highest score was 3. The mode was 2 (Table 2, *Apfel Score Descriptive Statistics*).

Table 1.

Patient Risk Factors for Apfel Score (n = 35)

Patient Risk Factor	Frequencies
Female	57.14

History of PONV/motion sickness	5.71
Nonsmoker	91.43
Post op opioids	20.00

Note. All values are percentages.

Table 2.

Apfel Score Descriptive Statistics

Apfel score	
Mean	1.74
Mode	2
Standard Deviation	.78
Range	0 - 3

AIM TWO

Aim Two was to determine the relationship between the Apfel score and the number of antiemetic medications administered during the intraoperative period. Multiple linear regressions tested associations of Apfel, anesthesia risk, and surgical risk with actual antiemetics given. Apfel was positively associated with actual antiemetics, b = .33, p = .041, holding the other two risk factors equal. The result suggested that, holding anesthesia and surgical risk factors equal, one unit increase in the Apfel score was associated with 0.33 unit increase in actual antiemetics given. A paired-sample t-test showed that there was no significant difference between actual antiemetics given (M = 2.05, SD = 0.73) and expected antiemetics (M = 2.17, SD = 0.89), t = 0.68, p = .501.

Actual antiemetics administered versus recommended number is noted in Table 3, *Actual Antiemetics Administered v. Recommended Number,* and highlights several important factors. First, the patients with zero risk factors were still given 1 or 2 antiemetics, when the Fourth

Consensus Guidelines does not recommend the administration of any antiemetics for patients with zero risk factors. For patients with an Apfel score of 1, 30% did not receive enough prophylactic antiemetics. According to the Fourth Consensus Guidelines, patients with two risk factors should receive two antiemetics. However, based on the results of this QI project, 11.1% of patients with two risk factors received an inadequate amount, only 1 or 0 antiemetics. A third of the patients with two risk factors received 3 antiemetics, one over the recommended number of 2. Over half (55.5%) of the patients with an Apfel score of 2 received the correct number of antiemetics (2). Of the patients with an Apfel score of 3, 80% were under-dosed on antiemetic administration (only 2 antiemetics were administered). Only 20% of patients with an Apfel score of 3 received the correct number of 3-4 antiemetics. This result is consistent with Kumar et al. who found that a majority of the medium to high-risk patients did not receive the correct amount of antiemetic prophylaxis (2012). No patients had an Apfel score greater than 3.

Table 3.

Actual Antiemetics Administered v. Recommended Number

Apfel score (Patient risk factors)	Actual number of antiemetics administered	PONV Prophylaxis – number of antiemetics recommended per Apfel score based on Fourth Consensus guidelines
Less than 1	1 patient received 2 antiemetics 1 patient received 1 antiemetic	0
1	3 patients received 1 antiemetic 7 patients received 2 antiemetics	2
2	6 patients received 3 antiemetics 10 patients received 2 antiemetics 1 patient received 1 antiemetic	2

	1 patient received 0 antiemetics	
3	4 patients received 2 antiemetics 1 patient received 4 antiemetics	3-4
More than 4	-	3-4

AIM THREE

Aim three assessed the prevalence of anesthetic and surgical risk factors including the use of Nitrous Oxide, volatile anesthetic agents, intraoperative opioids, such as fentanyl and remifentanil, and surgery length greater than 30 minutes (see Table 4). All the patients underwent general anesthesia, with 94.29% having volatile anesthetics used. A little over half (54.29%) of the patients had Nitrous Oxide administered. All 35 patients in the sample received an intraoperative opioid. Almost all (97.14%) of the patients had a surgery length greater than 30 minutes, which is a PONV surgical risk factor. The number one antiemetic utilized was Zofran, a 5-HT3 receptor antagonist, with 94.29% of patients receiving it. The second most utilized antiemetic was a steroidal antiemetic, Decadron, at 85.71%. A small percentage, 8.57% of patients received a NK-1 receptor antagonist (aprepitant), and 17.1% of patients had an anticholinergic drug administered.

Table 4.

Surgical, Anesthetic, & Antiemetic Descriptive Statistics

Ambulatory surgery center (n = 35)	Frequencies
General anesthesia	100.00
Volatile Anesthetics	94.29
Nitrous Oxide Use	54.29
Intraoperative opioids	100.00

Surgery > 30 min	97.14
5-HT3 receptor antagonist	94.29
NK-1 receptor antagonist	8.57
Butyrophenones	0.00
Metoclopramide	0.00
Phenothiazine	0.00
Prochlorperazine	0.00
Antidopaminergics	0.00
Versed	0.00
Gabapentin	0.00
Anticholinergic	17.1
Antiemetic steroids	85.71

Note. All values are percentages.

AIM FOUR

Aim Four was to assess PACU charting to determine if the patient developed PONV. Of the 35 patients, 8.57% developed PONV. A logistic regression tested associations of risk factors with incidence of post-op nausea and vomiting (PONV). Patient risk factors (Apfel score), anesthesia risk factors, and surgical risk factors did not predict PONV. Actual antiemetics administered also did not predict PONV.

CHAPTER IV DISCUSSION

IMPLICATIONS FOR PRACTICE

Patients undergoing general anesthesia with anesthetic gas have an inherent risk of developing PONV. Aim one illustrates that the average Apfel score per patient in this sample was almost 2, and the most frequent Apfel score is 2. This piece of data illustrates that most patients would require administration of at least two antiemetics, per the Fourth Consensus Guideline recommendations.

The results for the second aim imply that when practitioners are administering antiemetics, they are taking into consideration the patient's Apfel score. There was a positive association between the Apfel score and the number of antiemetics given. The Apfel score consists of female gender, history of PONV/motion sickness, being a nonsmoker, and postoperative opioid use. The literature states that females have a higher incidence of PONV (Leslie et al., 2008). However, this risk is negligible over the age of 60, which is significant for this QI project, because 57% of patients were over the age of 60. Patients with a history of PONV/motion sickness are more susceptible to emetogenic stimuli. Being a nonsmoker nearly doubles the risk of developing PONV. Additionally, post op opioid use almost doubles the risk of PONV (Chatterjee et al., 2011). This is important for practice because it emphasizes the significance of education regarding the Apfel score. The number of antiemetics are not being administered appropriately in conjunction with the Apfel score and the Fourth Consensus Guidelines. Of a total sample of 35 patients, only 51.4% received sufficient PONV prophylaxis consistent with the Fourth Consensus Guidelines. Over 25% (25.7%) of patients in the sample were underdosed on their antiemetic prophylaxis. Additionally, 22.8% of patients received an excess amount of antiemetics. The over administration of antiemetics has the potential to pose a financial burden on the hospital system. Additionally, it is deleterious for the patient to receive unnecessary drugs. Many antiemetics are associated with unpleasant side effects, such as hypotension, sedation, dry mouth, or dysphoria (Tilahun Bantie et al., 2020). Conversely, patients that do not receive adequate prophylaxis are at an increased risk of PONV. The findings highlight that the most at-risk patients (Apfel score >2) are the most under-dosed population, with 80% not receiving the appropriate number of antiemetics (3), which is consistent with the literature. CRNAs should be aware of this fact and have a plan for which antiemetics they plan to

administer during the perioperative period to comply with the Fourth Consensus Guidelines recommendation.

The improper dosing of antiemetics based on the Fourth Consensus Guidelines could be due to a variety of reasons, including the culture of the ambulatory surgery center, a shorter postoperative course, or the type of surgeries occurring there. Based on the findings of this QI project, the culture tends to be to administer two antiemetics, regardless of the number of patient risk factors (Apfel score). For instance, 22 out of 35 (62.9%) patients received two antiemetics, regardless of their unique Apfel score. Giving two antiemetics is common within anesthesia practice. The two most popular antiemetics given were one 5-HT3 receptor antagonist and one antiemetic steroid per patient. The ambulatory surgery center setting, which is a fast-paced environment, may influence the provider to give extra antiemetics to prevent an increased length of stay and delayed discharge for the patient. The type of surgery could also have influenced the provider to under-dose or over-dose antiemetics. Although specific surgeries increasing your risk for PONV varies among the literature, there is a consensus that laparoscopic and gynecological surgery increase the risk for PONV. In this quality improvement project, 12 patients underwent GYN surgery. Based on the knowledge from the literature that these patients may experience higher rates of PONV, anesthesia providers should take this into consideration when determining the amount of antiemetics to administer (Echeverria-Villalobos et al., 2022).

Assessing anesthesia providers willingness to change is the first step to increase compliance to the Fourth Consensus Guidelines. Gabutti et al. 2022, tells us that organizations which encourage bottom-up communication respond better to timely requests of change.

Communication must be had with the nurse anesthetist on the negative implications of PONV and the willingness to change their practice to follow the Fourth Consensus Guidelines.

As researched by Devarakonda et al. 2022, electronic medical record reminders have been shown to increase adherence to PONV prophylaxis guidelines. Additionally, Wax et al. states that implementation of a visual interactive electronic reminder regarding administration of medications is associated with increased compliance with guidelines (2007). According to Alidina et al. successful implementation of cognitive aids in the OR increases compliance with a multi-step implementation process (2018). A visual chart of the Apfel scoring system and its recommended antiemetics could be posted in each operating room to assist with successful prophylactic antiemetic administration.

Aim three examined anesthetic and surgical risk factors. The results for this aim are inconclusive, as no risk factors were predictive of PONV. These findings are contrary to what the literature shows, which is that surgical and anesthetic risk factors should predict PONV. Chatterjee et al. (2011) emphasizes that surgery duration longer than 30 minutes can increase PONV by as much as 60%. The ambulatory surgery center population had over 97% of patients with surgery length greater than 30 minutes. Because almost all the patients had this surgical risk factor, there was potentially not enough variety in the data to determine its influence. Additionally, the literature is conclusive that anesthetic risk factors such as volatile anesthetic use, Nitrous Oxide use, and postoperative opioid use increase the risk of PONV (Chatterjee et al., 2011).

There are many antiemetics that anesthesia providers can choose from to administer to their patients. However, it can be difficult to have them all memorized. Additionally, a barrier to

administration of the correct number of antiemetics could be related to patient specific allergies. If a patient is allergic to decadron or Zofran, this narrows the available options for which antiemetics to administer and the anesthesia provider may not know what other antiemetics are available to supplement with. A medication list could be posted in the operating room highlighting the different antiemetics that anesthesia providers can choose from in order to reach the correct number of antiemetics recommended based on the Apfel score and Fourth Consensus Guidelines.

The results for aim four illustrate that the PONV rate at the ambulatory surgery center is 8.57%. This is significantly lower than the statistical average of 27.7% (range 6.7 to 73.4%) according to a study of over 21,276 patients by Amirshahi et al. (2020). Therefore, because the ambulatory surgery center rate of PONV is lower than the average rate of PONV, current education to the CRNAs should continue to stay at a low incidence of PONV.

. As the Fourth Consensus Guidelines mentioned, treating PONV with appropriate rescue antiemetics is essential. For a patient suffering from PONV in the PACU, it is vital to treat them with an antiemetic from a different drug class than the one they previously received. There was no benefit shown in giving the same class of antiemetic as rescue therapy. Additionally, The Fourth Consensus Guidelines does not recommend a particular combination of antiemetics to treat established PONV. Still, it is recommended that practitioners make a clinical decision based on the antiemetics already administered and the guidelines stress the importance of treating established PONV with a different class of antiemetics than already administered (Gan et al., 2020). Healthcare providers assessing the patient for additional causes of PONV, such as bowel obstruction, is also essential (Gan et al., 2020).

LIMITATIONS AND STRENGTHS OF PROJECT

Limitations of this QI project were related to the transition of EHR platforms during this project. Due to CRNAs learning how to chart on the new EHR platform, EPIC, it must be considered that their charting on the patients was potentially missing information. This could have caused gaps in the data. Anesthetists administer many medications throughout all surgical cases and the majority of the time are not required or prompted to scan these medications. The Anesthesia Safety Foundation recommends using medication barcode scanning for all medications given by an anesthesia provider (Brown, 2014). Scanning the drugs, similar to the requirement for blood products to be scanned, would increase the patient's safety and ensure appropriate antiemetic prophylaxis was being administered versus hand charting the medications. Additionally, it was found that the barcode medication administration systems increased documentation capturing (Dunn & Anderson, 2019). If barcode scanning was in place there would be less of a chance of missing medications given.

Determining whether a patient experienced PONV in the PACU was difficult to assess. There was not a specific location in the patient's EHR that gave a numerical value for the patient’s nausea score. Therefore, extrapolation on whether the patient had an episode of PONV occurred based on whether they received an antiemetic in the PACU or if the anesthesiologist wrote the patient experienced PONV in their PACU discharge note. This left the opportunity for human error in accounting for the incidence of PONV in the PACU. Additionally, a limitation was the small sample size of only 35 patients during a one-month period. This QI project did not account for Post Discharge Nausea and Vomiting (PDNV), which continues to affect a large percentage of patients undergoing surgery at an ambulatory surgery center, due to the quick discharge from the ASC (Apfel et al., 2012). The final limitation of the QI project was the small

diversity in age. For instance, 57% of the sample patients were over the age of 60, who tend to have a lower incidence of PONV (Leslie et al., 2008).

One of the strengths of this QI project was the evenly distributed patient population. There was roughly an even number of patients undergoing GYN (12), urologic (10), and ENT (13) surgery. This allowed a diverse patient population to be examined. Additionally, there was almost an equal percentage of females (57%) vs. males (43%) in the sample population. Because females have an inherent risk of PONV, and a starting Apfel score of at least 1, this allowed the ability to include patients with a possible Apfel score of 0.

RECOMMENDATIONS

Data analysis conducted at the ASC found that patient, surgical, and anesthetic risk factors did not predict the rate of PONV in the PACU. Project findings did show that the Apfel score was positively associated with actual antiemetics administered. Therefore, it is recommended that CRNAs continue to be educated on the Apfel score to aid in guiding appropriate PONV prophylaxis administration. Utilizing the Electronic Health Record (EHR) to determine the patient's Apfel score and prompt the CRNA to administer the correct number of antiemetics would be beneficial to aid in following the Fourth Consensus Guidelines recommendations. Data analysis results highlight that the Apfel score, anesthetic risk factors, and surgical risk factors did not predict the number of antiemetics given. This exemplifies the need for education on what the anesthetic, surgical, and Apfel score risk factors are and how each of these risk factors affect the correct amount of antiemetics each patient should receive.

A way to translate this quality improvement project into practice would be to keep a visual copy of the Apfel scoring system and the list of recommended antiemetics in each operating room as a visual aid. Cognitive aids in the operating room have been shown to increase

compliance with multi-step implementation processes such as the Apfel scoring system and its antiemetic administration. Additionally, implementing a medication barcode scanning requirement for antiemetics in the EHR may be one step in helping adherence to the Fourth Consensus Guidelines and reducing the rate of PONV. Using a bar code medication administration charting would increase overall patient safety and more accuracy of documentation of antiemetic medications.

The literature is clear that using combination therapy is the best method for preventing PONV. However, after the two most common drugs, Zofran and Decadron are given, what should the third line antiemetic agent be? The Fourth Consensus Guidelines do not dictate which specific antiemetics to give, but rather provide a comprehensive list of potential options, including all those listed in Table 4. Some of the most common and readily available antiemetics that have a high efficacy for preventing PONV include Scopolamine, gabapentin, promethazine, haloperidol, droperidol, intramuscular Ephedrine, and Aprepitant (Gan et al., 2020). Anesthesia providers should receive education on the various types of antiemetics which can be administered if a third antiemetic is required.

To assess providers willingness to change, a survey can be administered which asks anesthesia providers how willing they would be to follow the Fourth Consensus Guidelines if a visual aid was implemented into the charting system. Assessing willingness to change in the ambulatory surgery center is the first step towards increasing compliance with the Fourth Consensus Guidelines. Additionally, the survey should include a spot for providers years of experience to determine if the amount of experience has any correlation to the anesthesia provider's antiemetic administration habits. It may be found that with more years of experience,

the providers are less likely to change personal practice based on evidence-based practice guidelines.

Educating the anesthesia and PACU staff on proper rescue antiemetic administration is crucial to treating PONV once it occurs. Equipping these providers with the knowledge of the different classes of antiemetics available to use can more effectively treat PONV in the PACU. Additionally, anesthesia providers should receive education on how different types of surgery have an increased risk for PONV. Because gynecologic and laparoscopic surgeries have a higher incidence of PONV, it should be recommended to anesthesia providers to administer an additional antiemetic to this patient population.

Future DNP quality improvement students can use this QI project data as a basis for providing education to the CRNAs at the ASC. Education should focus on the Fourth Consensus Guidelines and following the Apfel score to base antiemetic administration. While the ASCs PONV rate is lower than the statistical average across the country, there is still work to be done to improve the utilization of the Apfel score and Fourth Consensus Guidelines.

APPENDICES

Appendix A: Wake Forest IRB Approval Letter

MEMORANDUM

To: Karen Lucisano
Clinical and Translational Science Institute {CTSI}

From: Brian Moore, Director
Institutional Review Board

Date: 7/14/2022

Subject: Not Human Subjects Research: IRB00085740
Assessing Risk Factors and Nausea Prophylaxis in the Gynecologic, Urologic, and Ear, Nose and Throat Surgical Population

The Wake Forest University School of Medicine Institutional Review Board has reviewed your protocol and determined that it does not meet the federal definition of research involving human subject research as outlined in the federal regulations 45 CFR 46. 45 CFR 46.102(f) defines human subjects as "a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information."

The information you are receiving is not individually identifiable. In recent guidance published by the Office of Human Research Protections (OHRP) on the Guidance on Research Involving Coded Private Information or Biological Specimens, OHRP emphasizes the importance on what is being obtained by the investigator and states "if investigators are not obtaining either data through intervention or interaction with living individuals, or identifiable private information, then the research activity does not involve human subjects."

Note that only the Wake Forest University School of Medicine IRB can make the determination for its investigators that a research study does not meet the federal definition of human subject research. Investigators do not have the authority to make an independent determination that a study does not meet the federal requirements for human subject research. Each project requires a separate review and determination by the Board. The Board must be informed of any changes to this project, so that the Board can determine whether it continues to not meet the federal requirements for human subject research. If you have any questions or concerns about this information, please feel free to contact our office at 716-4542.

The Wake Forest School of Medicine IRB is duly constituted, has written procedures for initial and continuing review of clinical trials; prepares written minutes of convened meetings, and retains records pertaining to the review and approval process; all in compliance with requirements of FDA regulations 21 CFR Parts 50 and 56, HHS regulations 45 CFR 46, and

International Conference on Harmonisation (ICH) E6, Good Clinical Practice (GCP), as applicable. WFSM IRB is registered with OHRP/FDA; our IRB registration numbers are IRB00000212, IRB00002432, IRB00002433, IRB00002434, IRB00008492, IRB00008493, IRB00008494, and IRB00008495.

WFSM IRB has been continually fully accredited by the Association for the Accreditation of Human Research Protection Programs (AAHRPP) since 2011.

Appendix B: University of North Carolina at Charlotte IRB Approval

From: **Runden, Catherine Price** Received: **27-Jul-2022**

To: **Sanders, Abby Catherine** - *University of North Carolina at Charlotte*
Dr. Woods, Stephanie Joan - *School of Nursing*

CC: **Ross, Rebekah Caroline Peterson** - *University of North Carolina at Charlotte*
Sullivan, Meghan Marie - *University of North Carolina at Charlotte*
Dr. Woods, Stephanie Joan - *School of Nursing*

Subject: **IRB-23-0040 - NHSR Submission Acknowledged**

UNIVERSITY OF NORTH CAROLINA CHARLOTTE | RESEARCH AND ECONOMIC DEVELOPMENT

To:	Abby Sanders University of North Carolina at Charlotte
From:	Office of Research Protections and Integrity
Date:	27-Jul-2022
RE:	Determination that Research is not Human Subjects and does not require IRB Approval
Study #:	IRB-23-0040
Study Title:	Assessing Risk Factors and Nausea Prophylaxis in the Gynecologic, Urologic, and Ear, Nose and Throat Surgical Population

This submission was reviewed by the Office of Research Protections and Integrity, which has determined that this submission does not constitute human subjects as defined under federal regulations 45 CFR 46.102(e) and 21 CFR 56.102(e) and does not require IRB approval.

Study Description:
This is a quality improvement (QI) project chosen by the Safety and Quality Coordinator for Metro and Anesthesia Departments across multiple Atrium Health facilities. The project addresses practice, quality, and safety issues related to anesthesia providers. Participants of the QI project are Gynecologic, Ear Nose, and Throat, and Urologic surgery patients greater than 18 years old at Atrium Health Pineville, Atrium Health Carolinas Medical Center, and Atrium Health One Day Surgery Center. These individual hospitals are covered by one anesthesia team who provides care across multiple sites. PONV causes negative health sequelae, increases the financial burden, and decreases patient satisfaction. The purpose of this project is to compare anesthetic, surgical, and patient risk factors with the number of antiemetics given, in order to determine anesthesia providers compliance with the Fourth Consensus Guidelines, a guideline created for clinicians to utilize to prevent PONV. Our proposed instrument is an Excel spreadsheet with a list of risk factors for PONV, as well as the prophylactic antiemetics that are outlined in the Fourth Consensus Guidelines. Chart reviews and data analysis will be conducted to determine patient, anesthetic, and surgical risk factors, and PONV prophylaxis administration. A t-test will be used to calculate a statistically significant difference between the mean of each individual risk factor. The project design is a descriptive design; a comparative study design will also be implemented by comparing the data collected from the urban, suburban, and ambulatory hospitals utilizing a Chi-square test. Keywords: PONV, gynecologic, ENT, Urologic, surgery, ambulatory surgery centers, urban, suburban, anesthesia

Please be aware that approval may still be required from other relevant authorities or "gatekeepers" (e.g., school principals, facility directors, custodians of records), even though IRB approval is not required.

If your study protocol changes in such a way that this determination will no longer apply, you should contact the above IRB before making the changes.

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