Nurse Anesthetists' Perceptions of an Educational Intervention Regarding Postoperative Nausea and Vomiting: A Quality Improvement Project

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Abstract

Postoperative nausea and vomiting (PONV) is a preventable adverse event often occurring among surgical patients during the postoperative period that is associated with negative patient outcomes and increased healthcare costs. This quality improvement project aimed to produce a better understanding of this problem in order to inform future interventions designed to reduce the incidence of PONV. The methodology of this project included assessing the perceptions of nurse anesthetists at two partnering healthcare facilities regarding PONV management and prevention before and after receiving an educational resource and presentation on the topic. Data was collected using pre- and post-implementation surveys.

Review of the pre-implementation and post-implementation survey results suggests that following the intervention there was an increase in awareness of the national standards on PONV monitoring and prevention for nurse anesthetists, improvement in efficiency in accessing evidence-based guidelines and recommendations regarding PONV monitoring and management to support and help guide the CRNAs' clinical practice, and an increase in the reported confidence level of the CRNAs' perceived knowledge about PONV monitoring and management. As predicted by the literature, our findings suggest that providing an educational presentation and an accompanying evidence-based resource on the recommended practices for preventing PONV could be a cost-effective means to facilitate a decrease in its incidence. Findings from this project also suggest potential target areas for future interventions aimed at better understanding the phenomenon of PONV and ways it may be prevented.

Keywords: nurse anesthetist, postoperative, nausea and vomiting, education, guideline

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Section I. Introduction

Background

Postoperative nausea and vomiting (PONV) is one of the most common complications following procedures involving anesthesia. Affecting 30% of the general surgical population, PONV can be a highly distressing experience that can lead to longer stays in the post anesthesia care unit (PACU), unexpected hospital admissions, and increased health care costs (Gan et al., 2020). PONV is a multimodal phenomenon that must be addressed from various angles to decrease its incidence and provide optimal comfort for patients during post-anesthesia care. Certified Registered Nurse Anesthetists (CRNAs) and anesthesiologists play a key role in prevention and management of PONV as they are responsible for the stability and well-being of the patient during the surgical process.

Determining a patient's risk of developing PONV is an essential first step in preventing PONV. Using a risk assessment allows anesthesia providers to identify patients at higher risk of developing PONV and then prophylactically treating them, while not premedicating those at lower risk. Factors associated with increased risk of developing PONV include female gender, nonsmoking status, history of PONV, less than 50 years of age, and postoperative opioid administration (Thomas et al., 2019). The Apfel risk assessment tool first developed by Apfel et al. (2012), takes each of these factors into consideration and provides a score for the patient, which can then be used to guide appropriate interventions to prevent PONV.

The International Anesthesia Research Society evaluates many aspects of the anesthesia process and provides guidelines based on evidence-based research to support anesthesia providers in providing the best possible care. Current guidelines for the management of PONV include identifying reliable predictors of PONV and assessing the efficacy of individual or

combination therapy for PONV prophylaxis, among other actions (Gan et al., 2020). This institution publishes guidelines every five to six years based upon the most up-to-date literature and evidence-based practices with the goal of improving patient care and satisfaction. In addition, the American Society of Anesthesiologists (ASA) guideline states that routine assessment and monitoring of nausea and vomiting detects complications and reduces adverse outcomes (Apfelbaum et al., 2013). It is important to note that The American Association of Nurse Anesthetists (AANA), Anesthesia Patient Safety Foundation (APSF) and the ASA currently endorse the *Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting* published by Gan et al. (2020), which is referenced multiple times throughout this paper.

Organizational Needs Statement

Within the partnering medical center, CRNAs and anesthesiologists are responsible for administering anesthesia and providing patient care, including PONV monitoring and management during surgery and medical procedures. The risk of PONV is present whenever anesthesia is administered, and steps must be taken to ensure occurrence is decreased as much as possible. The prevention of PONV using combination therapy is part of the Merit-based Incentive Payment System (MIPS; https://qpp.cms.gov/mips/traditional-mips) established by the federal government. Although the provision of safe patient care is the number one priority, hospitals can also increase reimbursement from Medicare by ensuring PONV occurrences are kept at a minimum. The occurrence of PONV is not only distressing for patients, but it is also costly for hospitals and healthcare organizations. With the ultimate goal of reducing the incidence of PONV, providing ongoing education regarding current PONV guidelines and recommendations has the potential to help achieve this goal. Providing education to anesthesia-

administering providers (for this project, CRNAs) about strategies to prevent PONV, has been demonstrated to reduce hospital expenses by decreasing the incidence of PONV and associated treatment and admission costs (Dzwonczyk et al., 2012).

Problem Statement

Postoperative nausea and vomiting (PONV) is an adverse event affecting 30% of the general surgical population and up to 80% of high risk patients (Gan et al., 2020). In addition to being distressing to patients, PONV is also associated with longer stays in the postoperative anesthesia care unit (PACU) and increased hospital admissions/health care costs.

Purpose Statement

The purpose of this scholarly project was to assess the CRNAs' knowledge, preferences, and practices for managing PONV and whether or not they perceived a PONV Quick Reference Guideline is a useful tool for their practice to aid in identifying high-risk patients, managing baseline PONV risks, and selecting strategies for prophylaxis and rescue treatment.

Section II. Evidence

Description of Search Strategies

The purpose of this literature review was to examine current evidence and recommendations addressing CRNAs' perceptions of PONV and the current guidelines and recommendations that address this phenomenon. The PICOT question used to guide the search strategy was: In the prevention of postoperative nausea and vomiting, how does an educational resource on evidence-based nausea and vomiting risk factors and preventative measures affect the CRNA's perception of the effectiveness of their post-operative nausea and vomiting prevention practices in improving patient outcomes within the postoperative period in the PACU?

A search of current literature was conducted using the databases PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) as well as the search engine Google Scholar. Boolean operators were used to combine keywords and concepts. The search strategy used to query PubMed was (post-operative nausea and vomiting) AND (education OR guidelines). This search strategy pulled in the Medical Subject Heading (MeSH) terms postoperative period, nausea, vomiting, education, educational status, teaching, and guidelines. The limits applied to this search included publication in the most recent five years (2017-2022) and English language. CINAHL was searched using a combination of keywords and subject headings identified using these keywords. Google Scholar was searched using the same search strategy as PubMed. See Appendix A for a list of keywords, MeSH terms, and subject terms utilized in searches.

The first search strategy (PubMed) resulted in a total of 148 articles, and of those, four articles were kept. The second search strategy (CINAHL) resulted in a total of 106 articles and four articles were kept. The third search strategy (Google Scholar) resulted in a total of 17,200

articles, of which only the first three pages of articles were reviewed, with five articles kept. Articles were excluded if PONV was not the sole focus of the article, the parameters were so specific and the articles yielded little information in regard to PONV, and if the article focused on a specific surgery and PONV incidence rather than maintenance and prevention measures. See Appendix B for search strategies and numbers of articles found and kept using structured searching.

Additional evidence/information was identified by reviewing related and referenced articles as well as the websites and resources of anesthesia organizations. Along with endorsing the PONV guidelines published by Gan et al. (2020), the AANA and other professional organizations endorse specific journal articles pertaining to PONV. Although evidence in these guidelines is not necessarily specific to nurse anesthesia, it pertains to the perioperative and postoperative period when nurse anesthetists play a key role in PONV management and prevention and, as such, is highly applicable to this project.

Based on Melnyk and Fineout-Overholt's (2019) levels of evidence hierarchy, upon full-text review articles identified for inclusion in this literature synthesis included four Level I systematic reviews, two Level II randomized controlled trials, two Level IV controlled cohort studies, and one Level V uncontrolled cohort study. The systematic reviews provided the most comprehensive level of evidence, as multiple studies were examined and summarized in each. The focus of the articles varied, but included comparing treatment and prevention options for PONV, the use of a screening tool to determine the risk of developing PONV, implementing a protocol for PONV, and set guidelines for current evidence-based practice. See Appendix C for a more detailed breakdown of the articles and the details involved.

Selected Literature Synthesis

Implementing a Screening Tool

The use of a PONV risk assessment pre-screening technique has been shown to significantly reduce the incidence of PONV and provide an overall better experience for the patient as well as the anesthesia provider (Gan et al., 2020). Indicators that are known to increase a patient's risk of developing PONV include female gender, nonsmoking status, history of PONV, less than 50 years of age, and postoperative opioid administration (Dewinter et al., 2018; Thomas et al., 2019). The Apfel risk assessment tool takes each of these indicators into consideration and provides a score for the patient. This score is then translated into how likely the patient is to develop PONV.

One study by Dewinter et al. (2018) utilized a similar approach to the Apfel risk assessment tool, though taking a more objective and targeted approach to assess the risk of PONV. An additional study by Thomas et al. (2019) utilized an algorithm method to prevent PONV. Both studies were similar in their mutual goal of providing PONV prophylaxis. The Thomas et al., (2019) study took place over four months and compiled data both pre- and post-implementation of the modified risk assessment. The Apfel factors were taken into account with the addition of general anesthesia. This modified risk assessment tool indicated the patient's risk of developing PONV, the number of antiemetics to administer based on the score determined with the tool utilized, and a suggested medication strategy. As a result of implementing the modified risk assessment, there was a 3.4% reduction in the occurrence of PONV. The study by Dewinter et al. (2018) was similar in that it used the same indicators to determine the patient's risk of developing PONV. An algorithmic approach was utilized to guide providers in prescribing a single antiemetic or a combination of up to three drugs. The results of this study

were significant in that 33% of patients experienced PONV prior to algorithm implementation whereas only 22% experienced PONV post algorithm implementation (Dewinter et al., 2018). It is important to note that the study implemented by Thomas et al. (2019) included only female patients undergoing a gynecological procedure, while the study implemented by Dewinter et al. (2018) included all adult patients admitted to the PACU. Having noted these two studies, it is safe to conclude that the use of a risk assessment tool or algorithm has the potential to decrease the rate of PONV occurrence among patients.

Pharmaceutical Interventions

Several medications are known to be effective in the prevention and treatment of PONV, including ondansetron, haloperidol, and dexmedetomidine (Gan et al., 2018; Kamali et al., 2018). Studies have demonstrated that if a patient is high risk for developing PONV, as determined by a risk assessment, a combination of two or three drugs seems to provide better effects. In a study performed by Kamali et al. (2018), three drugs, including ondansetron (serotonin receptor antagonist), haloperidol (sedative), and dexmedetomidine (a-2 agonist), were examined in patients who underwent abdominal hysterectomy. Each drug has a different mechanism of action in relation to preventing PONV and the goal of the study was to determine which was most effective.

A literature search performed by Gan et al. (2020) examined multiple drugs used to treat and prevent PONV. Their finding supported the status of ondansetron as the "gold standard" in PONV management, and more effective than both haloperidol and dexmedetomidine. According to Gan et al. (2020), recommendations are being made to use a multimodal prophylaxis plan in patients with one or more risk factor. Adding this recommendation enhances the importance of

performing a thorough risk assessment to identify those patients at high risk of developing PONV.

Non-Pharmaceutical Interventions

The use of non-pharmaceutical options, such as crystalloid and colloid infusion, to treat/prevent PONV is an excellent alternative to drug therapy, as it is more cost-effective and lowers the risk of experiencing an adverse reaction (Jewer et al., 2019). Crystalloids and colloids are often administered before, during, and after a procedure requiring general anesthesia. One meta-analysis involving 41 randomized controlled trials concluded that the use of supplemental perioperative intravenous crystalloid likely reduces the risk of PONV, with little to no known adverse effects (Jewer et al., 2019).

Kim et al. (2019) performed a systematic review of multiple randomized controlled trials comparing the use of colloid versus crystalloid infusions to prevent PONV. The review concluded that colloid administration was generally found to be of no benefit over crystalloid administration for perioperative infusion to prevent PONV; however, colloid administration did have a greater preventative effect on PONV in patients undergoing abdominal surgery for more than three hours. It is important to note that in both Jewer et al. (2019) and Kim et al. (2019), crystalloid and colloid administration were studied as preventative rather than as treatment options. Overall, one can take from these works that there is some evidence that perioperative crystalloid administration can decrease PONV among patients in the perioperative period and colloid administration has no significant benefit when compared to crystalloid administration, except in those patients undergoing abdominal surgery that lasts longer than three hours.

Effectiveness of a PONV Educational Tool

Evidence-based practice, with regard to healthcare, is constantly changing and incorporating the most up-to-date research, with the aim of improving patient satisfaction and safety. It is important that current evidence and research be implemented in not only anesthesia practice but all healthcare practices. Guidelines are put into place when new research findings are evaluated, synthesized, and deemed trustworthy enough by topical experts to support a change in care delivering, with the goal of providing guidance to practice as a whole. Protocols are then established based on these guidelines. Guidelines approved by an international panel of experts and reported by Gan et al. (2020) recommend that PONV management protocols should be in place to determine if additional prophylaxis is needed.

Two identified studies (Aubrun et al., 2019; Pym & Ben-Menachem, 2018) were implemented to determine the impact of practicing with versus without a PONV protocol in place and the impact of a PONV reduction strategy/tool for PONV prophylaxis. According to Aubrun et al. (2019), only 12% of the 221 healthcare institutions studied followed a PONV protocol. This is a concerning number because this study took place within a limited area in France and only reflects a small percentage of global healthcare institutions. Pym and Ben-Menachem (2018) studied the impact of a local PONV guideline implemented at a hospital in Sydney, Australia. The study found that those patients (approximately 300) who received PONV prophylaxis in accordance with a newly formulated, evidence-based guideline had significantly less PONV. This speaks volumes on the importance of implementing guidelines and protocols in a healthcare institution to reduce the amount of PONV.

Applying Evidence-Based Research in Practice

Research and evidence-based practice are essential in the development of new practice standards and protocols that are put in place to improve the safety and overall satisfaction of the patient. This is especially important in the perioperative period, as there are multiple factors and personnel that can drastically change the perioperative course. Williams et al. (2021) performed a study in which a newly developed PONV risk factor tool, based on the Apfel scoring system, was introduced into practice. It was noted that following the risk factor screening tool for PONV preoperatively and providing adequate prophylaxes to patients resulted in the reduction of PONV to about 2% versus 3% prior to implementing the tool.

In addition, Thomas et al. (2019) performed a study in which guidelines, established by Gan et al. (2020), were implemented in the perioperative setting with the goal of determining if PONV prevalence was affected. It is important to note that antiemetic administration compliance among anesthesia providers increased from 37% to 61% post guideline. This statistic is noteworthy, as it shows a substantial change in practice with the implementation of strong evidence-based guidelines and the ability of anesthesia providers to adapt.

Project Framework

The Institute for Healthcare Improvement's (2021) model for improvement was the framework used in this quality improvement (QI) project. Included in this framework is the plan-do-study-act (PDSA) cycle, a four-stage problem-solving tool that was used to guide the process of creating the project. First, a *plan* was developed to set the goals and direction of the project. This included deciding what was going to be done, when it was going to be done, and with what target population. In coordination with other members of the project team, an educational intervention was developed and approvals to perform the project were obtained. After providing

the educational intervention to the target population, CRNAs, and having participants complete both pre- and post-implementation surveys (*do*), the results of these surveys were reviewed and analyzed (*study*). Finally, conclusions from these results were drawn and recommendations for the next cycle were made and shared (*act*).

The goal of this project was to enhance the understanding of CRNAs' perceptions and understanding of a quick reference guide pertaining to PONV management and prevention. The steps of the PDSA model appropriately guided the design and involved use of a cycle of providing a small change, surveying CRNAs to test the outcomes of the change, acquiring insight into their perceptions on the issue, and summarizing what was learned so that findings could be applied in additional cycles.

Ethical Considerations and Protection of Human Subjects

Ethical considerations were addressed in this project inclusively with target subjects (CRNAs). They were invited to take part in our QI project based on their role, location of employment, and willingness to participate, regardless of sex, race, ethnicity, or other criteria. Providing a quick reference guideline that incorporates the most up-to-date, evidence-based guidelines and recommendations to the CRNAs had potential to enhance their knowledge and provide more positive experiences for their patients. There was no known potential harm for CRNAs participating in the QI project, nor potential they could be taken advantage of through the process.

To better prepare for the ethical and moral aspects of the QI project, this investigator completed two Collaborative Institutional Training Initiative (CITI) Program (https://about.citiprogram.org/) modules, *All Biomedical Investigators and Key Personnel* and *Responsible Conduct of Research*. Upon completion of an internal review process for student

projects with the investigator's College of Nursing and University and Medical Center Institutional Review Board (UMCIRB), this project was deemed QI and thus exempt from full IRB review. This project also received complete facility approval through the research office of the partnering facility in conjunction with the UMCIRB. Approval from the partnering facility to collect data was granted and documented. See Appendix D for documentation of this formal approval process.

Section III. Project Design

Project Setting

The partnering facilities for this project were two small critical access hospitals in eastern North Carolina. The two hospitals are part of a larger health system that includes nine hospitals. The hospitals have fewer than 50 inpatient beds each, with surgical services supported by less than five inpatient/ambulatory surgery operating rooms. A wide range of inpatient and outpatient surgical procedures is performed at these facilities, including neurological, endoscopic, gastrointestinal, general surgical, gynecologic, ophthalmologic, orthopedic, podiatric, and urologic. An anesthesia care team comprised of CRNAs and anesthesiologists provides anesthetic services and patient care during procedures requiring anesthesia. An existing relationship between this facility and the university facilitated the implementation of this project.

Project Population

The population of focus for this quality improvement project included the CRNAs practicing in the partnering community hospitals. All anesthesia providers practicing in the facility are proficient in the management of anesthesia, patient monitoring, and ventilatory and hemodynamic management of patients undergoing a variety of medical and surgical procedures requiring anesthesia. The anesthesia providers vary in experience and age and work autonomously. Within this group of providers, experienced leaders familiar with the facility's perioperative practices and workflow helped facilitate the onboarding of this QI project.

CRNAs work in a fast paced, high acuity, and stressful environment. Their work is physically and mentally demanding; therefore, reluctance to spend extra time participating in this project was a potential barrier to successful implementation. On the other hand, because these CRNAs work in a teaching hospital and are accustomed to working relationships with students, it

was reasonable to anticipate that some might be inclined to help support the success of a student-led quality improvement project. That proved to be the case.

Project Team

The QI project team consisted of a nurse anesthesia student team lead, three additional nurse anesthesia students, a project chair, a site contact, a CRNA faculty clinical contact, the course director, and the nurse anesthesia program director. Together, the author and three other student registered nurse anesthetists (SRNAs) developed the project, though each student implemented using a different setting and population.

The primary SRNA, the author of this paper, led the implementation of this project at these two small rural hospitals that are part of a larger hospital organization. The project chair, a doctorly prepared practicing CRNA and faculty member in the program, met regularly with the students to support and guide the development of the project. A team member from each hospital provided a letter of acknowledgement of data collection being performed at the sites. The clinical contact member was a CRNA faculty member who led student clinical learning experiences and provided mentoring and clinical expertise during this project. The DNP project course director was a doctorly prepared registered nurse faculty member who provided direction and feedback on each step of this project's development and completion. The program director facilitated coordination between the team and the partnering facility and provided leadership and oversight to all project team members and for all aspects of the project.

Methods and Measurement

The purpose of this project was to better understand CRNAs' PONV knowledge and practices and to assess their perceptions of a newly created PONV management and prevention quick reference guide (see Appendix E). This data was collected using a pre-test/post-test

methodology. Their changes in perceptions served as outcome measures, with the results considered valuable for informing future studies and initiatives aimed at promoting optimal PONV management and prevention. The quick reference resource and an educational PowerPoint with voice over recording (Appendix E) as well as the links to the pre- and post-intervention Qualtrics surveys (Appendix F) were delivered to participating CRNAs via email (Appendix G). This project completed a single PDSA cycle.

Plan

After identifying PONV as a relevant problem deserving further exploration, a literature search and a subsequent review were performed. Nurse anesthetists and their PONV prevention and management practices were identified as having a significant role in the management of PONV. Being involved in all phases and settings of perioperative care, the perceptions of CRNAs are valuable in providing insight into current perioperative practices about PONV prevention and management. The project team determined a goal was to provide a better understanding of CRNAs' perceptions of a quick reference guide to prevent and manage PONV. It was determined that this data would be gathered by having the participating CRNAs complete a survey before and after receiving an evidence-based quick reference guide developed by the project team.

The SRNAs and project chair developed these surveys in the planning phase. The pre-intervention questions inquired about the CRNAs' current PONV management and prevention strategies, their perception about their available PONV resources, and confidence level in their knowledge of current national PONV guidelines (see Appendix F). Many post-intervention questions were intentionally aligned with the pre-intervention questions in order to compare if and how certain perceptions changed after receiving the educational intervention. The

questionnaire primarily included Likert-type questions, but with several open-ended ones. The data collected from these survey responses included nominal and ordinal levels of measurement.

The SRNAs, with feedback from the project chair, developed an evidence-based quick reference guideline to be provided to CRNAs at the partnering facilities. The quick reference guideline, created as a single page handout to be shared electronically, provided the Apfel risk assessment scoring system, along with risk factors that predispose patients to development of PONV. It provided examples of single or combination agents that can be administered depending upon patients' Apfel risk assessments. Currently accepted national standards and guidelines, as well as recommendations made in current literature regarding best practices for PONV management and prevention, were reviewed by the SRNAs and summarized in the quick reference guideline. The quick reference guideline was designed to be an evidence-based resource to support practice. Using PowerPoint and the voiceover tool, the SRNAs recorded an educational presentation in which the content of the quick reference guideline was presented in detail. The plan was for participating CRNAs to watch the presentation and download the quick reference guideline so that it could be quickly accessed in their practice.

Based on the goals of this project, the team identified change in CRNAs' perceptions after receiving the educational intervention as one outcome measure. An outcome the project team had hoped to see was an enhanced understanding of current PONV management practices, perceptions of these practices, baseline knowledge on this topic, and how these are affected by incorporating an educational presentation and accessible resource into CRNAs' practice.

Before the implementation phase, this project was granted approval by the university and the partnering facility. Upon providing a description of the purpose and process of this project and answering a series of questions, the university determined this project to be QI and therefore

exempt from full IRB approval. The partnering facility also provided permission to implement this project and presented a letter of acknowledgement of data collection at that site (see Appendix D). The recruitment of participants was accomplished through communication between the clinical contact team member and CRNAs working in the partnering facility.

Do

Upon launch of the "*do*" phase of the PDSA cycle, the project team lead sent an email to all CRNAs potentially participating in the project that included a link to a confidential Qualtrics pre-intervention survey. They were asked to complete the survey, view a PowerPoint presentation with narration (also provided in the email), and then download the quick reference guideline, to have as a reference for use in practice. After reviewing these educational resources, the CRNAs were asked to resume their practice using the quick reference guideline as a resource. Two weeks later, they received an email requesting they complete the post-intervention survey via a provided Qualtrics link. Responses to the Qualtrics questionnaires remained confidential, with results gathered electronically then analyzed and reported in a confidential manner.

Study

All survey responses were collected from Qualtrics and analyzed using Excel. Pre-survey responses were analyzed to assess baseline PONV management practices through the perspective of the participating CRNAs. These were also reviewed to understand how the CRNAs perceived the effectiveness of current practice and confidence in their knowledge of effective PONV management. Pre-survey results were compared to post-survey responses to determine if the quick reference guideline had any impact on their perceived knowledge, confidence in the efficacy of their practices, and efficiency in accessing evidence-based resources on this topic. Acquiring these data satisfied the study portion of this project.

Act

After analyzing the results, the project team discussed what was learned and what could be concluded from this cycle. Ways the processes and results of this project might be applied to subsequent cycles and future endeavors to better manage PONV were considered. These conclusions and recommendations were presented to the faculty and students of the nurse anesthesia program through an electronic poster presentation. Project participants were invited to attend this presentation virtually. Finally, the project paper and poster were uploaded to The Scholarship, the ECU digital repository.

Section IV. Results and Findings

Results

The purpose of this scholarly project was to assess the CRNAs' knowledge, preferences, and practices for managing PONV and whether they perceived a PONV Quick Reference Guideline to be useful in their practice to aid in identifying high-risk patients, manage baseline PONV risks, and select strategies for prophylaxis and rescue treatment. A PONV Quick Reference Guideline and PowerPoint presentation were developed and sent via email to six CRNAs at two rural community hospitals. The email also contained a pre-project protocol implementation (PPI) survey that was created with Qualtrics technology. The expectation was that the CRNAs would take this pre-PPI survey before using the PONV Quick Reference Guideline for two weeks. Four CRNAs responded to the pre-PPI survey. A post-PPI survey was sent after two weeks of implementation; four CRNAs responded. The data collected was analyzed using Excel.

Data Presentation

When asked in the pre-PPI survey what percentage of adult anesthesia patients experience PONV, the average was 10% out of four responses. When this same question was asked in a post-intervention survey, the average was 8% out of four responses. Prior to the implementation of this quality improvement project, one CRNA responded that they "sometimes" consider prophylaxis and treatment of PONV when planning for a case and three CRNAs responded that they "often" consider prophylaxis and treatment. Following the implementation of the QI project, two CRNAs responded that they "often" consider prophylaxis and treatment of PONV when planning for a case and two CRNAs responded that they "always" consider prophylaxis and treatment.

When asked in the pre-PPI survey how familiar they were with using the Apfel risk assessment for PONV risk screening, one participant responded with "not familiar" and three participants responded with "somewhat familiar." Following project protocol implementation, one participant responded with "somewhat familiar," and three participants responded with "very familiar" on the post-PPI survey. In the pre-PPI survey, when asked how often they used the Apfel risk assessment to screen for PONV, one participant responded with "rarely," two with "sometimes," and one with "often." Following project protocol implementation this same question was asked in the post-PPI survey with two participants responding "often" and two responding "always."

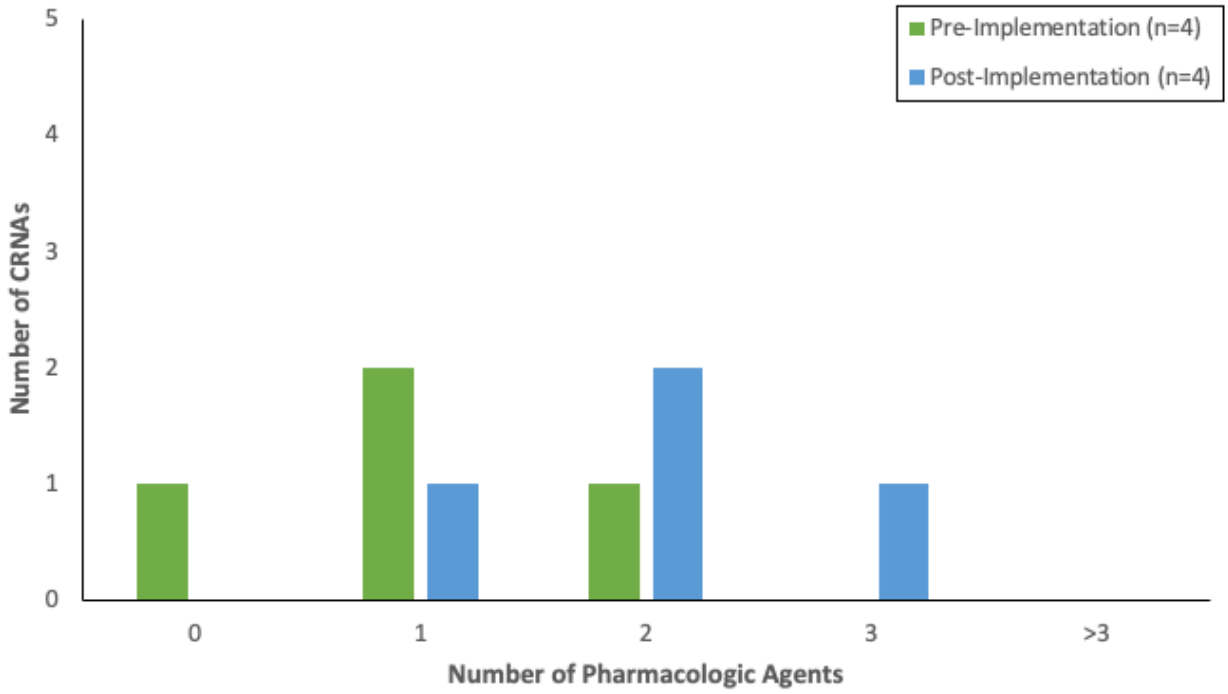
Prior to project protocol implementation, when asked "How often do you tailor PONV prophylaxis based on Apfel risk factors?" Two participants responded with "never," one with "rarely," and one with "sometimes." Following project protocol implementation this same question was asked in the post-PPI survey with three participants responding with "often" and one responding with "always." In both pre- and post-PPI surveys, participants were asked how often they use ondansetron, droperidol, dexamethasone, and scopolamine for preventing PONV during routine general anesthesia cases. The following responses were noted in the pre-survey: for ondansetron, one participant responded with "sometimes" and three participants responded with "often"; for droperidol, two participants responded with "never" and two participants responded with "rarely"; for dexamethasone, three participants responded with "sometimes" and one participant responded with "often"; for scopolamine, one participant responded with "rarely" and three participants responded with "sometimes." Following project protocol implementation, the following responses were recorded; for ondansetron four participants responded with "always"; for droperidol one participant responded with "rarely" and three participants

responded with "sometimes"; for dexamethasone four participants responded with "often"; for scopolamine three participants responded with "sometimes" and one participant responded with "often."

Prior to project protocol implementation, on the pre-survey, participants were asked how many pharmacologic agents they used in patients at low risk for developing PONV. Risk factors were also included in the question. After project protocol implementation, a post-survey was sent with the same question. See Figure 1 with results.

Figure 1

Number of Pharmacologic Agents Used for Low-Risk Patients

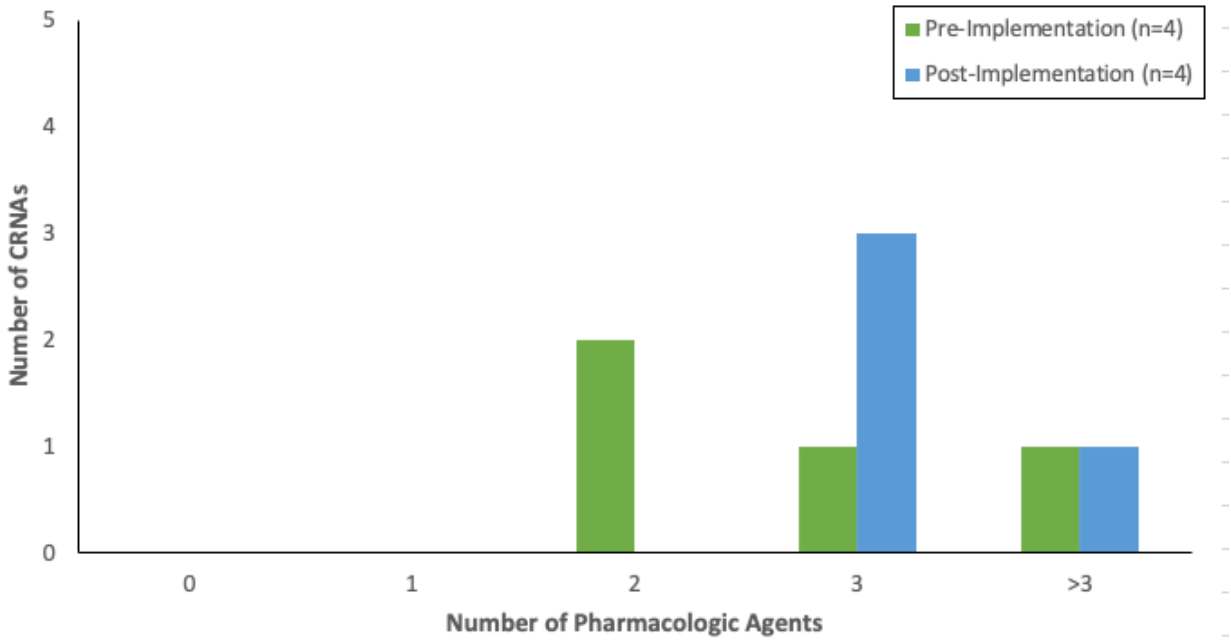


Prior to project protocol implementation, on the pre-survey, participants were asked how many pharmacologic agents they typically used in patients at high risk for developing PONV.

Risk factors were also included in the question. After project protocol implementation, the post-survey was sent with the same question. See Figure 2.

Figure 2

Number of Pharmacologic Agents Used for High-Risk Patients



Prior to project protocol implementation, participants were asked in the pre-survey "What is the average cost of PONV prophylaxis per case?" One participant responded with "less than $50" and three participants responded with "between $50-$100." This same question was asked in the post-PPI survey with four participants responding with "less than $50." Prior to project protocol implementation, participants were asked in the pre-survey if their department had an implemented PONV management protocol. Two participants responded with "not sure," and two participants responded with "yes." Following the project protocol implementation, the post-

survey question asked the participants if they would recommend that their department implement a PONV management protocol. All four participants responded with "yes."

Before project protocol implementation, participants were asked "How useful would you perceive a quick reference guide for managing PONV to be?" One participant responded with "somewhat useful," and three participants responded with "very useful." This same question was asked in the post-PPI survey and four participants responded with "very useful." In the post-PPI survey, participants were asked "How would you improve the PONV quick reference guide?" None responded to this question.

Analysis

From the data gathered, several inferences may be made. First the PONV quick reference guideline may have enhanced the participants' practice. Upon analysis of the first question from the pre- and post-PPI surveys, there was a perceived decrease in the percentage of patients who experienced PONV, from 10% to 8%. When analyzing the responses to the question addressing consideration of PONV prophylaxis and treatment when planning for an anesthesia case, one could conclude that the information and guideline may have made an impact on the participants' practice as two participants answered that they "always" consider PONV prophylaxis when planning for a case in the post-PPI survey while no participants chose this answer in the pre-PPI survey. This positive trend is seen in comparing each of the pre- and post-PPI survey responses. The overall trend was that the PONV Quick Reference Guideline may have had a positive impact on the participants' PONV prophylaxis and treatment perceptions.

Section V. Implications

Financial and Nonfinancial Analysis

According to Gan et al. (2020), the average cost of a PONV occurrence is about $75. When compared to the cost of the antiemetic, which is between $0.30 cents and $3, one can assume that prophylactically preventing a PONV occurrence would have a significant positive financial impact on the healthcare institution. The actual costs and processes of giving antiemetic medications are not expensive or complex. Anesthesia providers are not paid extra to administer a medication and the supplies needed include a syringe, a needle to draw up the medication, and an alcohol swab. These supplies cost about $0.75 cents. In theory, if a patient having surgery is at high risk for developing PONV based on Apfel risk factors, they should receive three or more prophylactic antiemetic medications. Since each medication costs about $3 and supplies used would cost $1, this would total about $10. If PONV is prevented, the healthcare institution has saved $65 or more.

Implementing an institutional PONV prophylaxis and treatment guideline would have little impact in terms of cost for the institution. Anesthesia providers should already be well educated on the various types of antiemetics and their mechanisms of action, so little education would have to be provided pertaining to those aspects. A simple tool or handout with information about the Apfel risk assessment placed in the electronic health record, or a paper copy placed in each operating room, would suffice to remind anesthesia providers about the risk factors of PONV and when patients should be prophylactically treated based on current guidelines. This would be an estimated cost of about $300-$400. The potential benefits include improved patient outcomes and more efficient use of operative rooms and post-anesthesia care units.

Patient satisfaction is an important factor in terms of preventing PONV. After surgery most patients are going to have some degree of pain. This, most of the time, cannot be prevented

and is often expected by the patient. Most patients, however, do not expect to have PONV. This can be a very uncomfortable and miserable experience for the patient, while increasing PACU times and slowing down the operating room.

Implications of Project

The AANA, which is in support of the *Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting,* sets practice standards for CRNAs (Gan, et al, 2020). These guidelines were summarized in the quick reference tool made accessible for CRNAs participating in the project. After using the quick reference tool all, of the CRNAs reported they were more familiar with the risk factors of PONV, various treatment options, and how the impact of preventing PONV not only improves patient satisfaction but also makes a positive financial impact on the healthcare institution.

Multiple studies cited in the literature suggest that using continuing education on the topic of PONV will result in improved patient outcomes and overall satisfaction (Aubrun et al., 2019; Gan et al., 2020; Pym & Ben-Menachem, 2018). In this project the perceptions of the participating CRNAs were overwhelmingly positive.

Sustainability

This project could be easily duplicated on a larger scale if there are people willing to provide the education and maintain the most up to date information on PONV management and prophylaxis. In some institutions, this project would need to be implemented on a larger scale and require more personnel. This education would also need to be provided to those anesthesia providers who work evening and night shift. The cost of implementing this project would be very small compared to the potential savings for the healthcare institution as a whole.

To monitor impact, survey data would need to be collected with Qualtrics, or a program that is similar. Healthcare institutions usually have access to this type of software so this could be easily implemented. Excel software would also need to be used to sort and analyze the responses received from the pre- and post-project implementation surveys. A dedicated team would need to be established to organize and create a timeline for the duration of the project. Emails would need to be sent out in advance. Depending on how large the institution is, a staff meeting might be beneficial in ensuring everyone understands all aspects of the educational offering. The Quick Reference Guide could also be shared with all new CRNA employees.

Dissemination Plan

The design, results and findings, and implications of this quality improvement project were summarized in a poster and presented to the students and faculty of the East Carolina University Nurse Anesthesia Program. Additionally, the project participants were invited to attend. The final version of this paper and poster were posted in The Scholarship, the East Carolina University digital repository.

Section VI. Conclusion

Limitations

Two limitations that were encountered when implementing this project were the small sample size of four CRNAs and the short implementation period of just two weeks. The small sample size resulted in limited data and the short implementation period possibly limited the number of responses that could have been collected. In addition, the small sample size consisted of CRNAs who travel. There was only one CRNA who was full time at one of the facilities, which could have been data limiting. An additional limitation is that this project was implemented in small rural hospitals. A larger institution with an increased number of anesthesia providers may have yielded more impactful results.

Recommendations for Future Implementation and/or Additional Study

One future recommendation would be to incorporate a larger sample size to further determine if providing a PONV quick reference guide is of benefit to not only the anesthesia provider but to the healthcare institution as a whole. In addition, it is recommended that software such as Qualtrics and Excel be used to track and analyze the data in a consistent manner. Forming a strong bond with the anesthesia providers potentially participating in the project is encouraged to ensure a greater number of responses are received.

Upon seeing the positive impact this QI project made at these small healthcare facilities in just two weeks, one can only imagine the impact it could have at a larger facility where more time may be allotted. If implemented at a larger healthcare institution, it may be beneficial to incorporate a team leader for both day and night shift. These individuals would be responsible for ensuring that the quick reference guideline is made available to all anesthesia providers,

check Qualtrics or other survey software daily to ensure progress, and provide encouragement to those who have not yet completed the survey.

References

Apfel, C. C., Heidrich, F. M., Jukar-Rao, S., Jalota, L., Hornuss, C., Whelan, R. P., Zhang, K., & Cakmakkaya, O. S. (2012). Evidence-based analysis of risk factors for postoperative nausea and vomiting. *British Journal of Anaesthesia*, *109*(5), 742–753. https://doi.org/10.1093/bja/aes276

Apfelbaum, J. L., Silverstein, J. H., Chung, F. F., Connis, R. T., Fillmore, R. B., Hunt, S. E., Nickinovich, D. G., Schreiner, M. S., Silverstein, J. H., Apfelbaum, J. L., Barlow, J. C., Chung, F. F., Connis, R. T., Fillmore, R. B., Hunt, S. E., Joas, T. A., Nickinovich, D. G., & Schreiner, M. S. (2013). Practice guidelines for postanesthetic care. *Anesthesiology*, *118*(2), 291–307. https://doi.org/10.1097/aln.0b013e31827773e9

Aubrun, F., Ecoffey, C., Benhamou, D., Jouffroy, L., Diemunsch, P., Skaare, K., Bosson, J. L., & Albaladejo, P. (2019). Perioperative pain and post-operative nausea and vomiting (PONV) management after day-case surgery: The Sfar-Opera national study. *Anaesthesia Critical Care & Pain Medicine*, *38*(3), 223–229. https://doi.org/10.1016/j.accpm.2018.08.004

Dewinter, G., Staelens, W., Veef, E., Teunkens, A., Van de Velde, M., & Rex, S. (2018). Simplified algorithm for the prevention of postoperative nausea and vomiting: A before-and-after study. *British Journal of Anaesthesia*, *120*(1), 156–163. https://doi.org/10.1016/j.bja.2017.08.003

Dzwonczyk, R., Weaver, T. E., Puente, E. G., & Bergese, S. D. (2012). Postoperative nausea and vomiting prophylaxis from an economic point of view. *American Journal of Therapeutics*, *19*(1), 11–15. https://doi.org/10.1097/mjt.0b013e3181e7a512

Gan, T. J., Belani, K. G., Bergese, S., Chung, F., Diemunsch, P., Habib, A. S., Jin, Z., Kovac, A. L., Meyer, T. A., Urman, R. D., Apfel, C. C., Ayad, S., Beagley, L., Candiotti, K., Englesakis, M., Hedrick, T. L., Kranke, P., Lee, S., Lipman, D., … Philip, B. K. (2020). Fourth consensus guidelines for the management of postoperative nausea and vomiting. *Anesthesia & Analgesia*, *131*(2), 411–448. https://doi.org/10.1213/ane.0000000000004833

Institute for Healthcare Improvement. (2021). *How to improve.* http://www.ihi.org/resources/Pages/HowtoImprove/default.aspx

Jewer, J. K., Wong, M. J., Bird, S. J., Habib, A. S., Parker, R., & George, R. B. (2019). Supplemental perioperative intravenous crystalloids for postoperative nausea and vomiting. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.cd012212.pub2

Kamali, A., Ahmadi, L., Shokrpour, M., & Pazuki, S. (2018). Investigation of ondansetron, haloperidol, and dexmedetomidine efficacy for prevention of postoperative nausea and vomiting in patients with abdominal hysterectomy. *Open Access Macedonian Journal of Medical Sciences*, *6*(9), 1659–1663. https://doi.org/10.3889/oamjms.2018.366

Kim, H. J., Choi, S. H., Eum, D., & Kim, S. H. (2019). Is perioperative colloid infusion more effective than crystalloid in preventing postoperative nausea and vomiting? *Medicine*, *98*(7), e14339. https://doi.org/10.1097/md.0000000000014339

Melnyk, B. M., & Fineout-Overholt, E. (2019). *Evidence-based practice in nursing and healthcare: A guide to best practice.* Wolters Kluwer, (4th ed.)

Pym, A., & Ben-Menachem, E. (2018). The effect of a multifaceted postoperative nausea and vomiting reduction strategy on prophylaxis administration amongst higher-risk adult

surgical patients. *Anaesthesia and Intensive Care*, *46*(2), 185–189. https://doi.org/10.1177/0310057x1804600207

Thomas, J., Maple, I., Norcross, W., & Muckler, V. (2019). Preoperative risk assessment to guide prophylaxis and reduce the incidence of postoperative nausea and vomiting. *Journal of PeriAnesthesia Nursing*, *34*(1), 74–85. https://doi.org/10.1016/j.jopan.2018.02.007

Williams, A., Stephenson, S. J., Jiwanmall, M., Cherian, N. E., & Kamakshi, S. (2021). Reduction in post-operative nausea and vomiting (PONV) by preoperative risk stratification and adherence to a standardized anti emetic prophylaxis protocol in the day-care surgical population. *Journal of Family Medicine and Primary Care*, *10*(2), 865. https://doi.org/10.4103/jfmpc.jfmpc_1692_20

Appendix A

Concept Table

	Concept 1 Post-operative Nausea and Vomiting	Concept 2 Nurse Anesthetist	Concept 3 Education
Keywords	Post-operative nausea and vomiting	Nurse Anesthetist Anesthesia CRNA	Education guidelines
PubMed MeSH	Postoperative period, nausea, vomiting	Nurse anesthetist, anesthesia	Education, teaching, educational status
CINAHL	Anticipatory nausea and vomiting, nausea and vomiting	Nurse anesthetists, anesthetists, anesthesia	Education, guidelines
Google Scholar	Post-operative nausea and vomiting	Nurse anesthetist, CRNA	Education, guidelines

Appendix B

Literature Search Log

Search date	Database or search engine	Search strategy	Limits applied	Number of citations found/kept	Rationale for inclusion/exclusion of items
10/23/2022	PubMed	(Post-operative nausea and vomiting) AND (education OR guidelines)	2017-2022	**Found:** 148 **Kept:** 4	**Inclusion:** Great articles on PONV risk factors and tools that help with evaluating the risk. **Exclusion:** Like with any search there were quite a few articles that are useless.
10/23/2022	CINAHL	((MH "Nausea and Vomiting")) AND ((MH "Nurse Anesthetists") OR (MH "Anesthesia") OR (MH "Anesthesia Recovery") OR (MH "Anesthesia, General"))	English 2017-2022 Peer reviewed	**Found:** 106 **Kept**: 4	**Inclusion:** Some good articles on PONV prevention in specific surgeries. **Exclusion:** A lot of very specific articles not pertaining to the project
10/23/2022	Google Scholar	(Post-operative nausea and vomiting) AND (education OR guidelines)	2017-2022	**Found:** 17,200 (reviewed the first 3 pages) **Kept:** 5	**Inclusion:** A lot of great articles on the implementation and evaluation of the PONV screening tool. **Exclusion:** Many articles pertaining to specific curative treatments for PONV that are too specific.

Appendix C

Literature Matrix

Year	Author, Title, Journal	Purpose & Conceptual Framework or Model	Design and Level of Evidence	Setting	Sample	Tool/s and/or Interventio n/s	Results
2019	Apfel, C. C., Heidrich, F. M., Jukar-Rao, S., Jalota, L., Hornuss, C., Whelan, R. P., Zhang, K., & Cakmakkaya, O. S. (2012). Evidence-based analysis of risk factors for postoperative nausea and vomiting. *British Journal of Anaesthesia*, *109*(5), 742–753. https://doi.org/10.1093/bja/aes276	The main objective of the study was to assess pain and PONV management after outpatient surgery using a prospective survey carried out on given days, in a large sample of French healthcare institutions and to compare results to guidelines previously published by the SFAR. No conceptual framework or model noted	Random Controlled Trials (RCTs) Level II No specific design noted	French healthcare institutions	221 healthcare institutions and 7,382 patients	N/A	There was no standardized take-home analgesic and PONV strategies for selected surgical procedures at risk of moderate to severe pain. PONV management guidance after discharge was included in only 12 % of healthcare institutions.
2018	Dewinter, G., Staelens, W., Veef, E., Teunkens, A., Van de Velde, M., & Rex, S. (2018).	In a before-and-after study, the effectiveness of a simplified algorithm for	Uncontrolled Cohort Study Level V	Hospital	First Audit: 211 patients	N/A	A simplified algorithm for PONV prophylaxis resulted in a significant reduction in the PONV incidence and better

	Simplified algorithm for the prevention of postoperative nausea and vomiting: A before-and-after study. *British Journal of Anaesthesia*, *120*(1), 156–163. https://doi.org/10.1016/j.bja.2017.08.003	PONV prophylaxis on the incidence of PONV was tested. No conceptual framework or model noted	Quasi-experimental design		Second Audit: 211 patients Adults (> or = 18) admitted to PACU post general anesthesia		compliance with the PONV algorithm.
2020	Gan, T. J., Belani, K. G., Bergese, S., Chung, F., Diemunsch, P., Habib, A. S., Jin, Z., Kovac, A. L., Meyer, T. A., Urman, R. D., Apfel, C. C., Ayad, S., Beagley, L., Candiotti, K., Englesakis, M., Hedrick, T. L., Kranke, P., Lee, S., Lipman, D., … Philip, B. K. (2020). Fourth Consensus Guidelines for the management of postoperative nausea	The goals of the current guidelines were established by the panels as follows: (1) establish interventions which reduce the baseline risk for PONV; (2) assess the efficacy of individual antiemetic and combination therapies for PONV prophylaxis including nonpharmacologic al interventions; (3) create an	Systematic Review Level I Grading of evidence is achieved using a grading system reported by the American Society of Anesthesiologists	Various settings	Number of articles reviewed is not provided. Studies in adults > or = 18 and published in the English language	Preliminary searches were conducted, and produced articles that contained the chosen keywords, mesh terms, and EMTREE descriptors. Specific search strategies are provided in the article.	The current guideline was developed to provide perioperative practitioners with a comprehensive and up-to-date, evidence-based guidance on the risk stratification, prevention, and treatment of PONV in both adults and children. The guideline also provides guidance on the management of PONV within enhanced recovery pathways.

	and vomiting. *Anesthesia & Analgesia*, *131*(2), 411–448. https://doi.org/10.1213/ane.0000000000004833	algorithm to summarize the risk stratification, risk reduction, prophylaxis, and treatment of PONV. No conceptual framework or model noted					
2019	Jewer, J. K., Wong, M. J., Bird, S. J., Habib, A. S., Parker, R., & George, R. B. (2019). Supplemental perioperative intravenous crystalloids for postoperative nausea and vomiting. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.cd012212.pub2	To assess whether supplemental intravenous crystalloid administration prevents PONV in patients undergoing surgical procedures under general anesthesia. No conceptual framework or model noted	Systematic Review Level I Standard methodological procedures	Hospital	41 Studies 4224 Participants Predominantly ASA class I or II All studies took place in surgery centers	N/A	Supplemental intravenous crystalloid administration probably reduces the risk of postoperative vomiting

2018	Kamali, A., Ahmadi, L., Shokrpour, M., & Pazuki, S. (2018). Investigation of ondansetron, haloperidol, and dexmedetomidine efficacy for prevention of postoperative nausea and vomiting in patients with abdominal hysterectomy. *Open Access Macedonian Journal of Medical Sciences*, *6*(9), 1659–1663. https://doi.org/10.3889/oamjms.2018.366	To compare the effects of ondansetron, haloperidol, and dexmedetomidine for reducing postoperative nausea and vomiting (PONV) after laparoscopic cholecystectomy. No conceptual framework or model noted	RCTs Level II No specific design noted	Hospital	114 Patients undergoing abdominal hysterectomy	N/A	These three drugs are effective in reducing PONV in patients undergoing a hysterectomy. However, the effect of ondansetron was found to be more than the other two drugs in reducing PONV.
2019	Kim, H. J., Choi, S. H., Eum, D., & Kim, S. H. (2019). Is perioperative colloid infusion more effective than crystalloid in preventing postoperative nausea and vomiting?	Aimed to evaluate the effect of hydration, according to the type of fluid, on PONV. No conceptual framework or model noted	Systemic review/meta-analysis of RCTs Level I No specific design noted	Healthcare institutions where general anesthesia is administered	8 RCTs	N/A	Compared with the crystalloid infusion, perioperative colloid infusion did not reduce PONV incidence overall. However, In the subgroup that underwent anesthesia for more than 3 hours, in which the patients had mostly undergone

	Medicine, *98*(7), e14339. https://doi.org/10.1097/md.0000000000014339						abdominal surgeries, colloid infusion significantly reduced the incidence of PONV compared with crystalloid infusion.
2018	Pym, A., & Ben-Menachem, E. (2018). The effect of a multifaceted postoperative nausea and vomiting reduction strategy on prophylaxis administration amongst higher-risk adult surgical patients. *Anaesthesia and Intensive Care*, *46*(2), 185–189. https://doi.org/10.1177/0310057x1804600207	To further elucidate current PONV prophylaxis practice a prospective observational study was conducted investigating antiemetic prophylaxis benchmarked against an evidence based, locally developed PONV prophylaxis guideline, with a second observational phase after a targeted intervention to improve appropriate prophylaxis rates.	Controlled Cohort Study Level IV Pre- and post-intervention survey design	St. Vincent's hospital, Sidney, Australia	581 patients in the pre-survey group 521 patients in the post-survey group All patients who underwent general anesthesia	N/A	Patients receiving PONV prophylaxis in accordance with the intervention algorithm had significantly less early PONV

		No conceptual framework or model noted					
2019	Thomas, J. S., Maple, I. K., Norcross, W., & Muckler, V. C. (2019). Preoperative risk assessment to guide prophylaxis and reduce the incidence of postoperative nausea and vomiting. *Journal of PeriAnesthesia Nursing*, *34*(1), 74–85. https://doi.org/10.1016/j.jopan.2018.02.007	This article describes the implementation of a postoperative nausea and vomiting (PONV) risk prediction and prophylaxis protocol. No conceptual framework or model noted	Systematic Review Level I Retrospective chart review, pre/post-test design.	Hospital	316 Females (risk factor for PONV) who underwent gynecologic surgeries	N/A	The results of this project suggest that a risk-tailored approach to PONV prophylaxis using a risk assessment tool along with treatment recommendations is effective at reducing the incidence of PONV in an adult female population undergoing gynecologic surgeries.
2021	Williams, A., Stephenson, S. J., Jiwanmall, M., Cherian, N. E., & Kamakshi, S. (2021). Reduction in post-operative nausea and vomiting	The goal of this study was to determine the prevalence of PONV, associated risk factors, and the effect of following	Controlled cohort study Level IV No specific design noted	Tertiary Care Teaching Institute	500 patients undergoing day care surgery over a period of 12 months were analyzed	Data analysis was done using the Mann-Whitney U test, the Chi-square, and the	The prevalence of PONV in each risk category was lower than that predicted by the Apfel score due to utilization of a standard anti-emetic prophylactic protocol. We found younger age, previous

	(PONV) by preoperative risk stratification and adherence to a standardized anti emetic prophylaxis protocol in the day-care surgical population. *Journal of Family Medicine and Primary Care*, *10*(2), 865. https://doi.org/10.4103/jfmpc.jfmpc_1692_20	standardized risk stratification and prophylaxis protocols No conceptual framework or model noted			Apfel scoring system for PONV risk was used on each participant	Fisher's exact test	history of nausea, previous history of vomiting, urological surgeries and alcohol consumption as significant risk factors for postoperative nausea. Longer duration of surgery, previous history of nausea, alcohol consumption and higher BMI were the significant risk factors for postoperative vomiting.

Note: Key to abbreviations: N/A = Not Applicable, RCT = Randomized Control Trial, BMI = Body Mass Index, ASA = American Society of Anesthesiologist. Key to Levels of Evidence: I: Systematic review/meta-analysis of randomized controlled trials (RCTs); II: RCTs; III: Nonrandomized controlled trials; IV: Controlled cohort studies; V: Uncontrolled cohort studies; VI: Descriptive or qualitative study, case studies, EBP implementation and QI; VII: Expert opinion from individuals or groups. Adapted from *Evidence-based practice in nursing and healthcare: A guide to best practice* (4th ed.), by B. M. Melnyk and E. Fineout-Overholt, 2019, p. 131.

Appendix D

Approval Forms

Quality Improvement/Program Evaluation Self-Certification Tool

Purpose:
Projects that do not meet the federal definition of human research pursuant to 45 CFR 46 do not require IRB review. This tool was developed to assist in the determination of when a project falls outside of the IRB's purview.

Instructions:
Please complete the requested project information, as this document may be used for documentation that IRB review is not required. Select the appropriate answers to each question in the order they appear below. Additional questions may appear based on your answers. If you do not receive a STOP HERE message, the form may be printed as certification that the project is "not research", and does not require IRB review. The IRB will not review your responses as part of the self-certification process. For projects being done at Vidant Health, site support will be required. Please email crg.quality@vidanthealth.com to obtain site support from Vidant Health.

Name of Project Leader:

Caleb Woolard

Project Title:

Nurse Anesthetists' Perceptions of an Educational Intervention in Regards to Post-Operative Nausea and Vomiting: A Quality Improvement Project

Brief description of Project/Goals:

The purpose of this quality improvement project is to assess anesthesia providers' perceptions of adequacy of a newly developed PONV management quick reference handout.

Process: A quick-reference perioperative PONV management handout , based upon accepted national guidelines, will be developed. Anesthesia providers at [redacted] will be asked several questions (through Qualtrics) about their perceptions of the adequacy of their currently used PONV management and their current practice. An educational video about the use of a newly developed

Will the project involve testing an experimental drug, device (including medical software or assays), or biologic?

- ○ Yes
- ● No

Has the project received funding (e.g. federal, industry) to be conducted as a human subject research study?

- ○ Yes
- ● No

Is this a multi-site project (e.g. there is a coordinating or lead center, more than one site participating, and/or a study-wide protocol)?

- ○ Yes
- ● No

Is this a systematic investigation designed with the intent to contribute to generalizable knowledge (e.g. testing a hypothesis; randomization of subjects; comparison of case vs. control; observational research; comparative effectiveness research; or comparable criteria in alternative research paradigms)?

- ○ Yes
- ● No

Will the results of the project be published, presented or disseminated outside of the institution or program conducting it?

- ● Yes
- ○ No

Would the project occur regardless of whether individuals conducting it may benefit professionally from it?

- ● Yes
- ○ No

Does the project involve "no more than minimal risk" procedures (meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests)?

- (●) Yes
- ( ) No

Is the project intended to improve or evaluate the practice or process within a particular institution or a specific program, and falls under well-accepted care practices/guidelines?

- (●) Yes
- ( ) No

Based on your responses, the project appears to constitute QI and/or Program Evaluation and IRB review is not required because, in accordance with federal regulations, your project does not constitute research as defined under 45 CFR 46.102(d). If the project results are disseminated, they should be characterized as QI and/or Program Evaluation findings. Finally, if the project changes in any way that might affect the intent or design, please complete this self-certification again to ensure that IRB review is still not required. Click the button below to view a printable version of this form to save with your files, as it serves as documentation that IRB review is not required for this project. 11/14/2022

Center for Research and Grants

[redacted]

Quality Improvement Project vs. Human Research Study Determination Form

This worksheet is a guide to help the submitter to determine if a project or study is a quality improvement (QI) project or research study, is involving human subjects or their individually identifiable information, and if IRB approval as defined by the Health and Human Services (HHS) or Food and Drug Administration (FDA) is required. (For more guidance about whether the activity meets the definition of Human Subjects Research see the IRB FAQs or the Human Subject Research Decision Chart)

Please use Microsoft Word to complete this form providing answers below. For signatures, please hand sign or convert into a PDF file and electronically sign. Once completed and signed please email the form to the [redacted] Center for Research and Grants [redacted] A CRG team member will contact you with the results of their review and may request additional information to assist with their determination. The determination will be made in conjunction with the UMCIRB office.

Project Title: Nurse Anesthetists' Perceptions of an Educational Intervention Regarding Postoperative Nausea and Vomiting		
Funding Source: None		
Project Leader Name: Caleb Woolard, BSN, SRNA/ Maura McAuliffe, PhD, CRNA ☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ☒ R.N. ☐ Other(specify):		
Job Title: ECU SRNA/ECU CRNA Faculty	**Phone:** [redacted]	**Email:** mcauliffem@ecu.edu
	Primary Contact (If different from Project Leader): Caleb Woolard, SRNA	
	Phone: [redacted]	**Email:** woolardca12@students.ecu.edu

Key Personnel/ Project Team members:

Name and Degree:	**Department:** (Affiliation if other than ECU Health)	**Email:**
Caleb Woolard, SRNA	ECU Nurse Anesthesia Program	woolardca12@students.ecu.edu
Maura McAuliffe, PhD, CRNA, FAAN	ECU Nurse Anesthesia Program	mcauliffem@ecu.edu
Travis Chabo, PhD, CRNA	ECU Nurse Anesthesia Program	chabot14@ecu.edu

QI/QA Assessment Checklist:

Consideration	Question	Yes	No
PURPOSE	Is the PRIMARY purpose of the project/study to: • IMPROVE care right now for the next patient? OR • IMPROVE operations outcomes, efficiency, cost, patient/staff satisfaction, etc.?	☒	☐
RATIONALE 1	The project/study falls under well-accepted care practices/guidelines or is there sufficient evidence for this mode or approach to support implementing this activity or to create practice change, based on: • literature • consensus statements, or consensus among clinician team	☒	☐
RATIONALE 2	The project/study would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "Yes" to this statement does not preclude publication of a quality activity.) **Of note, quality must not be published as if it is research!**	☒	☐
METHODS 1	Are the proposed methods flexible and customizable, and do they incorporate rapid evaluation, feedback and incremental changes?	☒	☐
METHODS 2	Are patients/subjects randomized into different intervention groups in order to enhance confidence in differences that might be obscured by nonrandom selection? (Control group, Randomization, Fixed protocol Methods)	☐	☒
METHODS 3	Will there be delayed or ineffective feedback of data from monitoring the implementation of changes? (For example to avoid biasing the interpretation of data)	☐	☒
METHODS 4	Is the Protocol fixed with fixed goal, methodology, population, and time period?	☐	☒
RISK	The project/study involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	☒	☐
PARTICIPANTS	Will the project/study only involve patients/subjects who are ordinarily seen, cared for, or work in the setting where the activity will take place?	☒	☐
FUNDING	Is the project/study funded by any of the following? • An outside organization with an interest in the results • A manufacturer with an interest in the outcome of the project relevant to its products • A non-profit foundation that typically funds research, or by internal research accounts	☐	☒

If all of the check marks are inside the shaded gray boxes, then the project/study is very likely QI and not human subject research. Projects that are not human subject research do not need review by the IRB.

In order to assess whether your project meets the definition of human subject research requiring IRB review or may qualify as a quality improvement/assurance activity, please provide the following information:

1. Project or Study Summary:

Please provide a **summary of the purpose and procedures** as well address all of the following:

The purpose of this quality improvement project is to assess anesthesia providers' perceptions of adequacy of a newly developed postoperative nausea and vomiting (PONV) management guide. A quick-reference PONV guide, based upon accepted national guidelines, will be developed. Anesthesia providers at [redacted] will be asked several questions (through Qualtrics) about their perceptions of the adequacy of their currently used PONV guidance and preparedness for PONV management. An educational PowerPoint about the use of the newly developed quick-reference PONV guide will be made available to them, and they will be asked to use the guide for two weeks. Upon completion of the two-week utilization period, they will be asked to complete a questionnaire (via Qualtrics) about their perceptions of the adequacy of the guide. Qualtrics survey software will be used to gather participant perceptions of the acceptability and adequacy of the intervention (guide and educational PowerPoint presentation) prior to and post implementation of the project. No patient information will be recorded or maintained during this project.

a) **The project's primary purpose:** The purpose of this scholarly project is to assess the CRNAs' knowledge, preferences, and practices for managing PONV and whether or not they perceive a PONV quick reference guide is a useful tool for their practice to aid in identifying high-risk patients, managing baseline PONV risks, and selecting strategies for prophylaxis and rescue treatment.
b) **The project design:** The project will consist of a single Plan, Do, Study, Act cycle using a pre- and post-intervention survey design.
c) **Any interaction or intervention with humans:** CRNA participants will be contacted via email and asked to complete a pre-survey and then utilize an informational tool (the guide), developed based on current evidence that aligns with practices currently accepted within the facility, to support their practice regarding PONV management. After two weeks they will be asked to complete a post survey addressing their perceptions of the intervention and their own practice. The primary researcher will be available electronically, by phone, or in person to consult with participants as needed.
d) **A description of the methods that will be used and if they are standard or untested:** The intervention for this project will be a newly created informational guide focused on PONV management, with content based on current evidence and adhering to current accepted practice standards within the facility.
e) **Specify where the data will come from and your methods for obtaining this data -please specify who/where (i.e. CRG will provide you with the data, or someone from a specific department will provide you with the data, or you will pull it yourself):** Data will be gathered directly from participants through completion of Qualtrics pre- and post-surveys delivered and completed electronically.
f) **Specify what data will be used and any dates associated with when that data was originally collected (i.e Patient Name, Diagnosis, Age, Sex):** Aside from participant email and IP addresses, no identifiable data will be gathered. Data of interest is participant opinions and perceptions of practice and the newly developed PONV management guide.
g) **Where will the data (paper and electronic) for your project be stored? Please specify how it will be secured to protect privacy and maintain confidentiality. For paper data, please provide physical location such as building name and room number and that it will be kept behind double lock and key. For electronic data, please provide the file path and folder name network drive where data will be stored and specify that it is secure/encrypted/password protected. If using other storage location, please provide specific details:** All data will be gathered using Qualtrics survey software then transferred to Excel for analysis. The only identifying

information will be email and IP addresses of participants. Qualtrics survey software is accessed through ECU and involves multifactorial password protection. Excel files will be on a password protected personal laptop. Email and IP addresses will be deleted from Excel files after both surveys are completed and analysis of results begins.

h) **Please specify how long data will be stored after the study is complete? (Keep in mind that data collected/generated during the course of the project that includes protected health information (PHI) should have identifiers removed at the earliest opportunity.):** No PHI will be collected for this project. Data will be stored in Qualtrics and in Excel files (deidentified) until student graduation, anticipated to be spring of 2024.

i) **Please specify how the collected data will be used (internal/external reports, publishing, posters, etc.) and list name(s) of person responsible for de-identification of data before dissemination:** The deidentified data will be analyzed and results shared via a poster presentation to the ECU Nurse Anesthesia Program students and faculty, with participants invited to view the presentation remotely. If requested, a presentation of results to the participating department will be provided. Additionally, analysis of results will be addressed in a DNP Project Paper, completion of which is required for program graduation. This paper will be posted in the ECU digital repository, The Scholarship. Caleb Woolard will be responsible for de-identification of all data prior to dissemination.

Please use this space above or **attach a** separate **summary and/or any other additional documentation describing your project.**

2. **If the Primary purpose of your project is for QI, have you obtained approval from the [redacted] operational leader within your department or health system:**

☐ **No** [**STOP. Please contact the appropriate operational leader for approval before proceeding.**]

☒ **Yes** [Please specify here whom and obtain their signature in the signature section below]

[redacted] **Operational Mgr/Leader Name:** [redacted] [redacted]

Brandon Elvis

[redacted] 3/1/2023 | 9:43 AM EST 2/21/2023 | 1:26 PM EST

[redacted] **Operational Mgr/Leader Signature** **Date**

(Part 11 Compliant Electronic Signatures Acceptable-i.e. AdobeSign or DocuSign)

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Please note:

- By submitting your proposed project/study for QI determination you are certifying that if the project/study is established to qualify as QI project, you and your Department would be comfortable with the following statement in any publications regarding this project: "This project was reviewed and determined to qualify as quality improvement by the [redacted] Center for Research and Grants."
- If you are submitting a Poster to Media Services, you will also need to submit this Quality Determination Form or IRB Approval to Media Services for printing.
- If the [redacted] CRG determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research," "exempt research," or "expedited research."

Attestation of Understanding

My signature below indicates that I fully understand that HIPAA Privacy standards as they apply to Quality Projects involving Protected Health Information and patient medical records as outlined below.

Under HIPAA's minimum necessary provisions, [redacted] must make reasonable efforts to limit PHI to the minimum necessary to accomplish the purpose of the use, disclosure or request.

Under HIPAA, a Covered Entity (i.e. [redacted]) can disclose PHI to another CE (i.e. BSOM) for the following subset of health care operations activities of the recipient CE without needing patient consent:

- Conducting quality assessment and improvement activities
- Developing clinical guidelines
- Conducting patient safety activities as defined in applicable regulations
- Conducting population-based activities relating to improving health or reducing health care cost

Identified [redacted] healthcare data utilized in this project should not be shared outside of the CE without a fully executed data use/sharing agreement. [redacted] leadership reserves the opportunity to review all articles for dissemination/ publication for which [redacted] healthcare data has been utilized and that the content is being disseminated in the appropriate manner as a quality initiative, not resembling research in any context.

Caleb Woolard — 02/11/2023

Project Leader Signature — **Date**

(Part 11 Compliant Electronic Signatures Acceptable-i.e. AdobeSign or DocuSign)

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----------for [redacted] CRG Use Only----------

NHSR vs. HSR Determination:

☑ **Not Human Subject Research:** The [redacted] CRG has determined that based on the description of the project/study, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the [redacted] CRG at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ **Human Subject Research:** This project/study requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

Approval Signatures:

[redacted] CRG Reviewer: [redacted] Date: 3/7/2023

UMCIRB Office Staff Reviewer: [redacted] Date: 3/8/23

Appendix E

PONV Quick Reference Guideline and PowerPoint Presentation

ECU

Postoperative Nausea and Vomiting Prevention

Kristin Beute, BSN, SRNA
Greg Cornish, BSN, SRNA
Jared Galbreath, BSN, SRNA
Caleb Woolard, BSN, SRNA
Dr. Maura McAuliffe, CRNA, PhD, FAAN, Project Chair

Fourth Consensus Guidelines [2]

1. Identify Patients' Risk for PONV
2. Reduce Baseline Risk for PONV
3. Administer PONV Prophylaxis Using 2 Interventions in Adults at Risk for PONV
4. Administer Prophylactic Antiemetic Therapy to Children at Increased Risk for POV/PONV; As in Adults, Use of Combination Therapy is Most Effective
5. Provide Antiemetic Treatment to Patients With PONV Who Did Not Receive Prophylaxis or When Prophylaxis Failed
6. Ensure General Multimodal PONV Prevention and Timely Rescue Treatment Is Implemented in the Clinical Setting
7. Administer Multimodal Prophylactic Antiemetics in Enhanced Recovery Pathways

[1]

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV and/or Motion Sickness	1
Postoperative Opioids	1
Sum of points	0-4

Simplified Apfel Risk Score

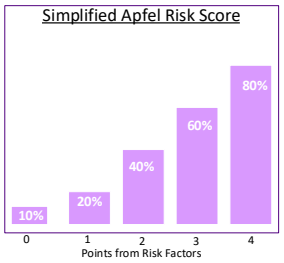


Table 3. Strategies to Reduce Baseline Risk From 2 (p414)

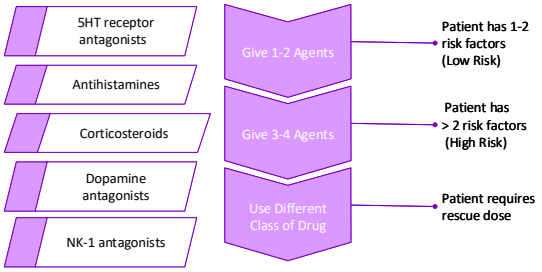
Avoidance of GA by the use of regional anesthesia[31,65] (A1)
Use of propofol for induction and maintenance of anesthesia[70] (A1)
Avoidance of nitrous oxide in surgeries lasting over 1 h (A1)
Avoidance of volatile anesthetics[26,61] (A2)
Minimization of intraoperative (A2) and postoperative opioids[26,47,49,72] (A1)
Adequate hydration[73,74] (A1)
Using sugammadex instead of neostigmine for the reversal of neuromuscular blockade[75] (A1)

Table 2. Risk Factors for PONV in Adults From 2 (p414)

Evidence	Risk Factors
Positive overall	Female sex (B1)
	History of PONV or motion sickness (B1)
	Nonsmoking (B1)
	Younger age (B1)
	General versus regional anesthesia (A1)
	Use of volatile anesthetics and nitrous oxide[a] (A1)
	Postoperative opioids (A1)
	Duration of anesthesia (B1)
	Type of surgery (cholecystectomy, laparoscopic, gynecological) (B1)
Conflicting	ASA physical status (B1)
	Menstrual cycle (B1)
	Level of anesthesiologist's experience (B1)
	Perioperative fasting (A2)
Disproven or of limited clinical relevance	BMI (B1)
	Anxiety (B1)
	Nasogastric tube (A1)
	Migraine (B1)
	Supplemental oxygen (A1)

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; PONV, postoperative nausea and vomiting.
[a]Use of nitrous oxide over 1 h duration.

Pharmacological Interventions [2]



Strength of Supporting Evidence

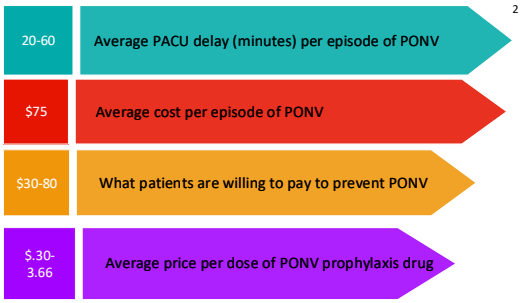
A1 — Multiple RCTs + meta analyses
A2 — Multiple RCTs. No meta analyses.
A3 — Single RCT.
B1 — Cohort, Case control designs

[2]

Drug	Dose	Evidence	Timing	Evidence	Class
Aprepitant	40mg PO	A1	At induction	A2	NK1 antagonist
Dexamethasone	4-8mg IV	A1	At induction	A1	Corticosteroid
Diphenhydramine	25-50mg IV	A3			Antihistamine
Droperidol	.625mg IV	A1	End of case	A1	DA antagonist
Methylprednisolone	40mg IV	A2			Corticosteroid
Metoclopramide	10mg	A1			DA/5HT antagonist
Ondansetron	4mg IV	A1	End of case	A1	5HT antagonist
Scopolamine	Transdermal	A1	24-2 h prior to case	A1	Antimuscarinic

Cost/Benefit Analysis

[2]



References
1. Apfel, C. C., Läärä, E., Koivuranta, M., Greim, C., & Roewer, N. (1999). A simplified risk score for predicting postoperative nausea and vomiting: Conclusions from cross-validations between two centers. *Anesthesiology (Philadelphia), 91*(3), 693-700. https://doi.org/10.1097/00000542-199909000-00022
2. Gan, T. J., Belani, K. G., Bergese, S., Chung, F., Diemunsch, P., Habib, A. S., Jin, Z., Kovac, A. L., Meyer, T. A., Urman, R. D., Apfel, C. C., Ayad, S., Beagley, L., Candiotti, K., Englesakis, M., Hedrick, T. L., Kranke, P., Lee, S., Lipman, D., . . . Philip, B. K. (2020). Fourth consensus guidelines for the management of postoperative nausea and vomiting. *Anesthesia and Analgesia, 131*(2), 411-448. https://doi.org/10.1213/ANE.0000000000004833

Postoperative Nausea and Vomiting

Kristin Beute, BSN, SRNA
Greg Cornish, BSN, SRNA
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Maura McAuliffe, CRNA, PhD, FAAN, Project Chair

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PONV Facts and Associated Complications

- 30% of adult, general surgical population experiences postoperative nausea and/or vomiting (PONV)
- 80% in high risk cohorts
- PONV is associated with significant patient dissatisfaction
- PONV is often rated as worse than having pain after surgery
- **An episode of PONV may cost $75 avg**
- There is generalized poor adherence to perioperative PONV management protocols- mainly due to lack of education
- Anesthesia providers are mainly responsible for PONV management
- Vomiting can cause wound dehiscence, hernia protrusion, aspiration, increased bleeding from surgical site, and electrolyte imbalance
- PONV increases length of stay in the PACU by an average of 20-60 minutes

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Risk Factors

- All increase the risk for PONV:
  - **Female Gender**
  - **Non-Smoking Status**
  - Younger Age
  - Normal BMI
  - **History of PONV or Motion Sickness**
  - General Anesthesia
    - Use of Volatile Anesthetics and/or Nitrous increase risk further
  - Long Duration of Anesthesia
  - Abdominal, Laparoscopic, Middle Ear, and Gynecological Surgeries
  - **Postoperative Opioid Administration**

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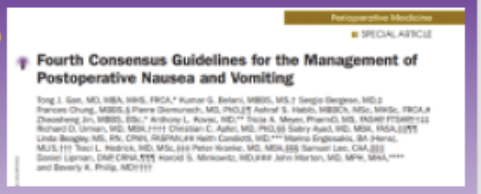
Risk Assessment

- Focused on four primary risk factors:
  - Gender
  - Smoking Status
  - History of PONV
  - Postoperative opioid administration
- Cumulative Score offers a relative risk based on the number of points the patient scores

Simplified Apfel Risk Score

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV and/or Motion Sickness	1
Postoperative Opiods	1
Sum of points	0-4

Guidelines


Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting

Fourth Consensus Guidelines:

- Identify Patients' Risk
- Reduce Baseline Risk
- Administer PONV Prophylaxis Using Combination Therapy in Adults at Risk
- Administer PONV Prophylaxis Using Combination Therapy in Children at Risk
- Provide Antiemetic Treatment to Patients with PONV
- Ensure General Multimodal PONV Prevention and Timely Rescue Treatment
- Administer Multimodal Prophylactic Antiemetics in Enhanced Recovery Pathways

These guidelines have been endorsed by the American Society of Anesthesiologists (ASA) and the American Association of Nurse Anesthesiology (AANA) along with twenty-five other organizations from across the world

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Pharmacology

Serotonin 5HT3 Receptor Antagonist

- **Ondansetron (Zofran) -** 4 mg IV commonly given 30 minutes before extubation
  - **MOA:** Blocks serotonin peripherally on vagal nerve terminals and centrally in the chemoreceptor trigger zone (PONV prevention part).

Dopamine D2 Receptor Antagonist

- **Metoclopramide (Reglan) -** 10 mg IV given 30-60 minutes prior to surgery
  - **MOA:** Blocks dopamine receptors and serotonin receptors in the chemoreceptor trigger zone. Also increases gastric emptying.
- **Droperidol -** 0.625-1.25 mg given at the end of surgery
  - **MOA:** Causes a blockade of dopamine stimulation in the chemoreceptor trigger zone.

Histamine Receptor Antagonist

- **Diphenhydramine (Benadryl)** - 25-50 mg IV
  - **MOA:** Competes with histamine for H1 receptors in GI, Respiratory tract, and blood vessels.

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Pharmacology

Anticholinergic

- **Scopolamine -** 1 patch applied behind the ear usually the night before surgery
  - **MOA:** Blocks the action of acetylcholine at parasympathetic sites and antagonizes histamine and serotonin.

Corticosteroid

- **Dexamethasone (Decadron) -** 4-8 mg given right after intubation or before the start of surgery
  - **MOA:** Antiemetic activity is unknown

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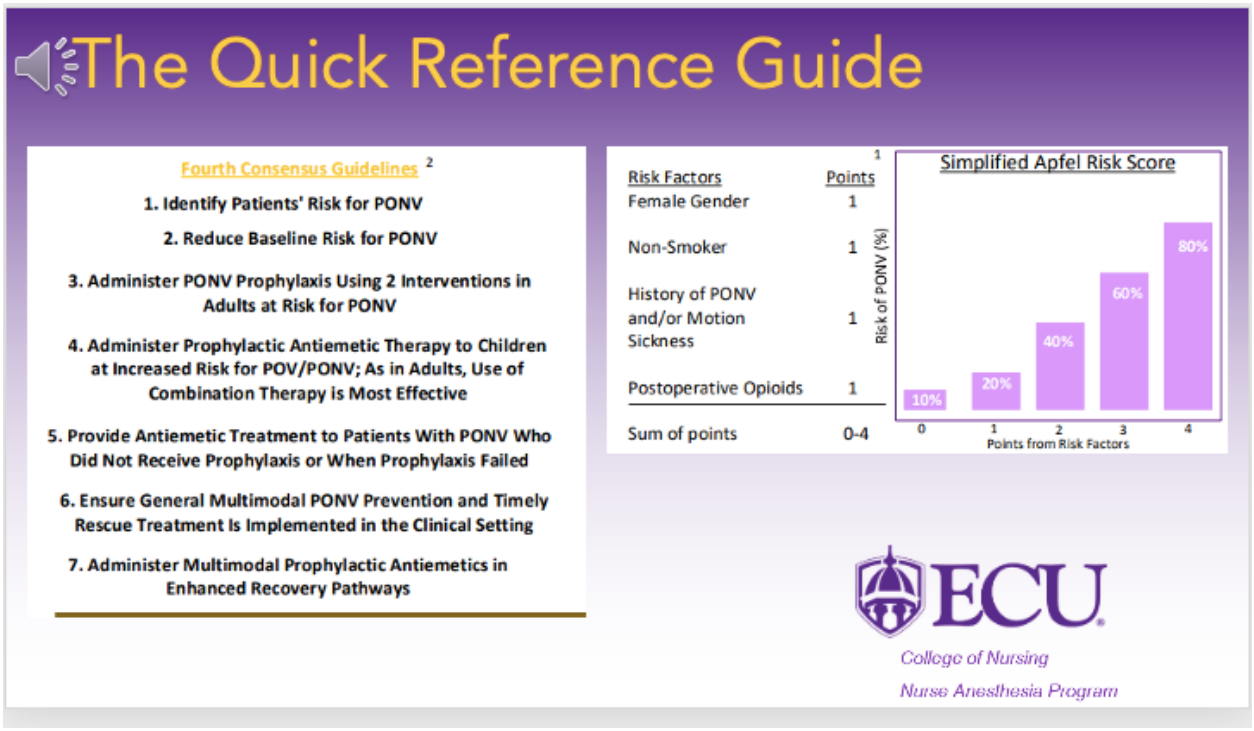
The Quick Reference Guide


The Quick Reference Guide
Fourth Consensus Guidelines 2
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Risk Factors Points
Female Gender 1
Non-Smoker 1
History of PONV and/or Motion Sickness 1
Postoperative Opioids 1
Sum of points 0-4
1
Simplified Apfel Risk Score
Risk of PONV (%)
10%
20%
40%
60%
80%
0 1 2 3 4
Points from Risk Factors
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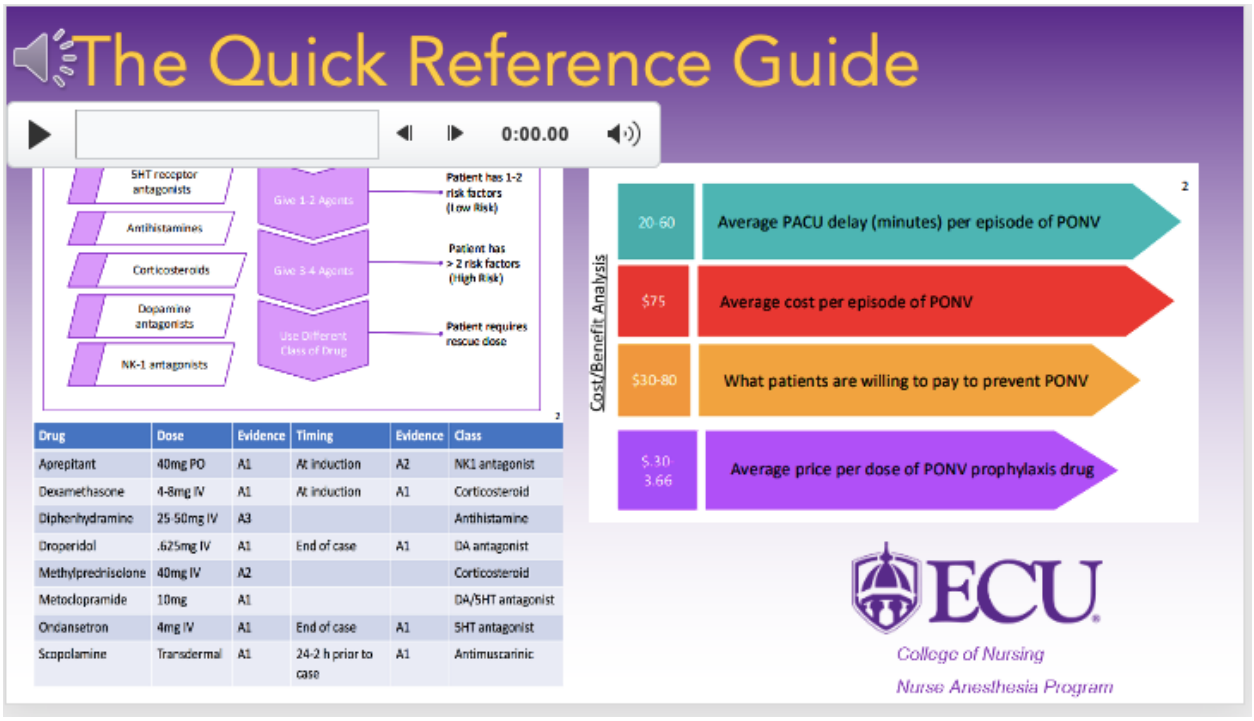
The Quick Reference Guide
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5HT receptor antagonists
Antihistamines
Corticosteroids
Dopamine antagonists
NK-1 antagonists
Give 1-2 Agents
Give 3-4 Agents
Use Different Class of Drug
Patient has 1-2 risk factors (Low Risk)
Patient has > 2 risk factors (High Risk)
Patient requires rescue dose
2
Drug Dose Evidence Timing Evidence Class
Aprepitant 40mg PO A1 At induction A2 NK1 antagonist
Dexamethasone 4-8mg IV A1 At induction A1 Corticosteroid
Diphenhydramine 25-50mg IV A3 Antihistamine
Droperidol .625mg IV A1 End of case A1 DA antagonist
Methylprednisolone 40mg IV A2 Corticosteroid
Metoclopramide 10mg A1 DA/5HT antagonist
Ondansetron 4mg IV A1 End of case A1 5HT antagonist
Scopolamine Transdermal A1 24-2 h prior to case A1 Antimuscarinic
Cost/Benefit Analysis
2
20-60 Average PACU delay (minutes) per episode of PONV
$75 Average cost per episode of PONV
$30-80 What patients are willing to pay to prevent PONV
$.30 3.66 Average price per dose of PONV prophylaxis drug
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The Quick Reference Guide

Table 3. Strategies to Reduce Baseline Risk From 2 (p414)

Avoidance of GA by the use of regional anesthesia[31,65] (A1)
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Avoidance of volatile anesthetics[26,61] (A2)
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Adequate hydration[73,74] (A1)
Using sugammadex instead of neostigmine for the reversal of neuromuscular blockade[75] (A1)

Strength of Supporting Evidence

A1	Multiple RCTs + meta analyses
A2	Multiple RCTs. No meta analyses.
A3	Single RCT.
B1	Cohort, Case control designs

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	Younger age (B1)
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	Postoperative opioids (A1)
	Duration of anesthesia (B1)
	Type of surgery (cholecystectomy, laparoscopic, gynecological) (B1)
Conflicting	ASA physical status (B1)
	Menstrual cycle (B1)
	Level of anesthesiologist's experience (B1)
	Perioperative fasting (A2)
Disproven or of limited clinical relevance	BMI (B1)
	Anxiety (B1)
	Nasogastric tube (A1)
	Migraine (B1)
	Supplemental oxygen (A1)

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; PONV, postoperative nausea and vomiting.
[a]Use of nitrous oxide over 1 h duration.

Summary

- 80% of high risk patients experience PONV
- Up to 30% of all patients may experience PONV
- Each PONV episode costs the facility an average $75
- PONV may cost <$5 to prevent

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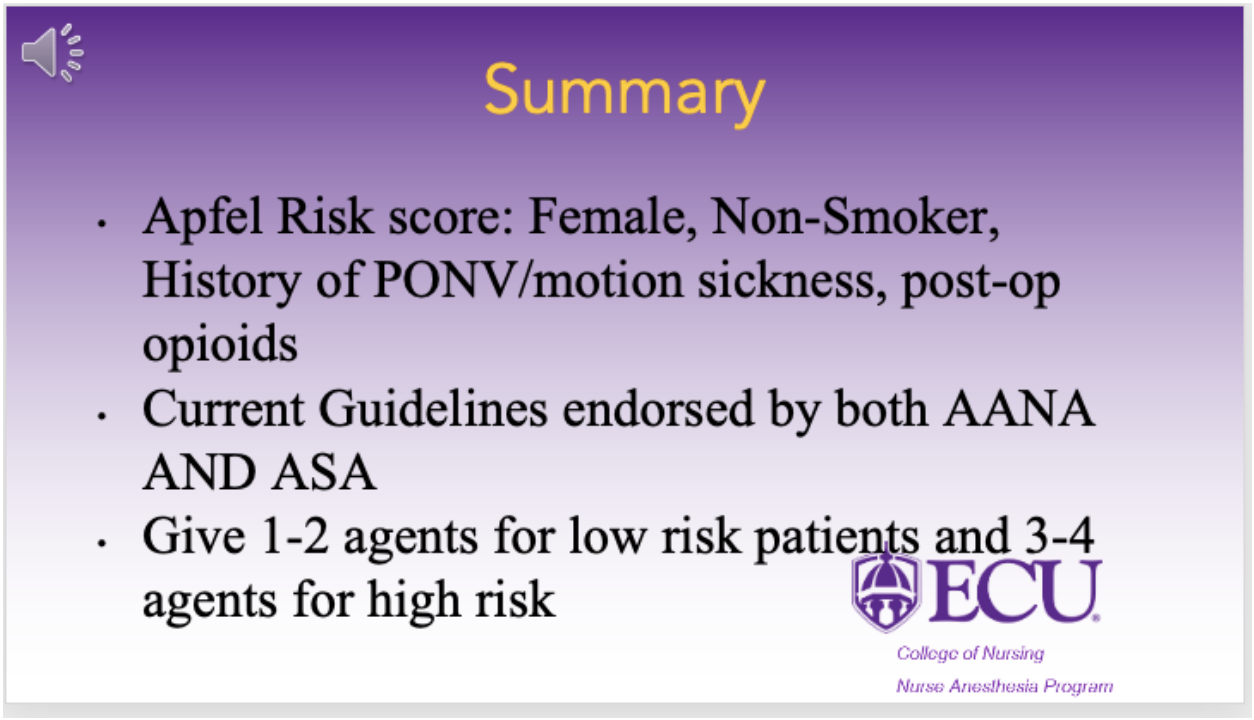
Summary
Apfel Risk score: Female, Non-Smoker, History of PONV/motion sickness, post-op opioids
Current Guidelines endorsed by both AANA AND ASA
Give 1-2 agents for low risk patients and 3-4 agents for high risk
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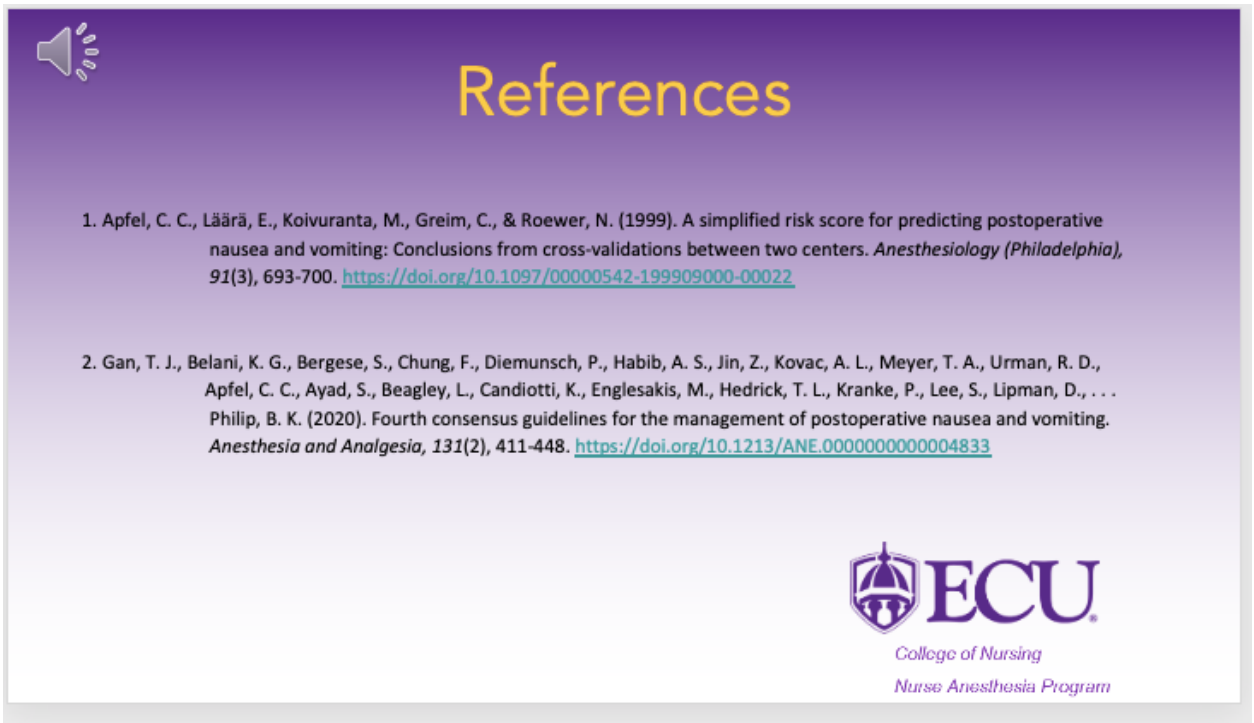
References
1. Apfel, C. C., Läärä, E., Koivuranta, M., Greim, C., & Roewer, N. (1999). A simplified risk score for predicting postoperative nausea and vomiting: Conclusions from cross-validations between two centers. Anesthesiology (Philadelphia), 91(3), 693-700. https://doi.org/10.1097/00000542-199909000-00022
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Appendix F

Pre- and Post-Survey Questions

Pre-Intervention

1: On average, what percentage of adult general anesthesia patients experience PONV?
(Free Response question)

2: On average, what percentage of **HIGH RISK** adult general anesthesia patients experience PONV?
(Free Response question)

3: How often do you consider prophylaxis and treatment of PONV when planning for a case?
(Likert Scale: never - rarely - sometimes - often - always)

4: How familiar are you with using the Apfel risk assessment for PONV risk screening?
(Likert Scale: not familiar – somewhat familiar – very familiar)

5: How often do you use the Apfel risk assessment to screen for PONV risk?
(Likert Scale: never - rarely - sometimes - often - always)

6: How often do you tailor PONV prophylaxis based on **Apfel risk factors**?
(Likert Scale: never - rarely - sometimes - often - always)

7: How often do you typically use the following agents for preventing PONV (in patients with no contraindications to use of these medications) during routing general anesthesia cases? List including ondansetron, droperidol, dexamethasone, and scopolamine. Likert scale options beside each medication.
(Likert Scale: never - rarely - sometimes - often - always)

8: How many pharmacologic agents do you usually employ for patients at **LOW RISK** (0-1 of the following risk factors: Female, Non-smoker, History of Motion Sickness, or Postoperative Opioid Administration) for PONV with no contraindications to use of these medications?
(Likert Scale: 0, 1, 2, 3, >3 agent(s))

9: How many pharmacologic agents do you usually employ for patients at **HIGH RISK** (3 or more of the following risk factors: Female, Non-smoker, History of Motion Sickness, or Postoperative Opioid Administration) for PONV with no contraindications to use of these medications?
(Likert Scale: 0, 1, 2, 3, >3 agent(s))

10: What is the average cost of PONV prophylaxis per case?
(Likert Scale: Less than $50, $50-$100, Greater than $100)

11: Does your department have an implemented PONV management protocol?
(Likert Scale, Yes, No, Not Sure)

12: How useful would you perceive a quick reference guide for managing **PONV** to be?
(Likert Scale: not useful – somewhat useful – very useful)

Post Intervention

1: On average, what percentage of adult general anesthesia patients experience PONV?
(Free Response question)

2: On average, what percentage of **HIGH RISK** adult general anesthesia patients experience PONV?
(Free Response question)

3: After participating in this quality improvement project, how often will you consider prophylaxis and treatment of PONV when planning for a case?
(Likert Scale: never - rarely - sometimes - often - always)

4: After participating in this quality improvement project, how familiar are you with using the Apfel risk assessment for PONV risk screening?
(Likert Scale: not familiar – somewhat familiar – very familiar)

5: After participating in this quality improvement project, how often will you use the Apfel risk assessment to screen for PONV risk?
(Likert Scale: never - rarely - sometimes - often - always)

6: After participating in this quality improvement project, how often will you tailor PONV prophylaxis based on **Apfel risk factors**?
(Likert Scale: never - rarely - sometimes - often - always)

7: After participating in this quality improvement project, how often will you typically use the following agents for preventing PONV in patients with no contraindications to use of these medications during routine general anesthesia cases? List including ondansetron, droperidol, dexamethasone, and scopolamine. Likert scale options beside each medication.
(Likert Scale: never - rarely - sometimes - often - always)

8: After participating in this quality improvement project, how many pharmacologic agents will you likely employ for patients at **LOW RISK** (0-1 of the following risk factors: Female, Non-smoker, History of Motion Sickness, or Postoperative Opioid Administration) for PONV with no contraindications to use of the medications?
(Likert Scale: 0, 1, 2, 3, >3 agent(s))

9: After participating in this quality improvement project, how many pharmacologic agents will you likely employ for patients at **HIGH RISK** (3 or more of the following risk factors: Female, Non-smoker, History of Motion Sickness, or Postoperative Opioid Administration) for PONV and with no contraindications to use of the medications?
(Likert Scale: 0, 1, 2, 3, >3 agent(s))

10: What is the average cost of PONV prophylaxis per case?
(Likert Scale: less than $50, $50-$100, greater than $100)

11: After participating in this quality improvement project, would you recommend your department have an implemented PONV management protocol?
(Likert Scale: No, Maybe, Yes)

12: After participating in this quality improvement projec, how useful do you perceive a quick reference guide for managing PONV to be?
(Likert Scale: not useful – somewhat useful – very useful)

13. How would you improve the PONV quick reference guide?
(Free Response question)

Appendix G

Emails to Participants

Initial Pre-Survey and PowerPoint Email to Participants

Dear [redacted] CRNAs,

Thank you for considering participating in a quality improvement project titled "Nurse Anesthetists' Perceptions of an Educational Intervention Regarding Postoperative Nausea and Vomiting." The purpose of this scholarly project is to assess the CRNAs' knowledge, preferences, and practices for managing PONV and whether or not they perceive a PONV Quick Reference Guideline as a useful tool for their practice to aid in identifying high-risk patients, managing baseline PONV risks, and selection of strategies for prophylaxis and rescue treatment at [redacted]

Participation is voluntary and will involve completing a short pre-intervention survey, viewing a brief PowerPoint, utilizing a Quick Reference PONV Guideline in your CRNA practice for two weeks (at your discretion), and completing a short post-intervention survey when the two-week implementation period is over.

Each survey should take less than 2-4 minutes to complete. The surveys were created and are completed using Qualtrics® survey software. The use of the Quick Reference PONV Guideline falls within currently accepted practice in your work area. Your participation is voluntary and confidential. We will share the results of this QI study with you upon completion.

First, complete the pre-intervention survey provided here.

Following completion of the survey, view the PONV Quick Reference Guideline and its accompanying PowerPoint presentation. These materials are attached in this email.

Again, thank you for your participation in our quality improvement project. I will be at [redacted] on June 18-22 and June 26-29 if you have any questions. You may also reach out to myself or Dr. Maura McAuliffe by email at any time.

Sincerely,

Caleb Woolard, SRNA
Woolardca12@students.ecu.edu

Maura McAuliffe CRNA, PhD, FAAN
Mcauliffem@ecu.edu

Pre-Survey and PowerPoint Reminder Email to Participants

Hello [redacted] CRNAs,

I just wanted to send a quick reminder about the ongoing DNP Project on PONV management and prevention (original email below). If you've already filled out the pre-survey and viewed the PowerPoint, thank you. If you haven't had a chance to do so yet, it's not too late and would be very helpful and much appreciated. I have attached the PONV Quick Reference Guideline and PowerPoint presentation, as well as the pre-survey link. You may use these at your discretion. After the end of next week, I will begin sending out the post-surveys.

Links:
Pre-survey
PowerPoint Presentation
PONV Quick Reference Guideline

Please let me know if you have any questions and thank you again for your participation.

Sincerely,
Caleb Woolard, SRNA
ECU Nurse Anesthesia Program
Class of 2024

Post-Survey Email to Participants

Dear [redacted] CRNAs,

Thank you to everyone who has already completed my pre-survey and viewed the video. It's now time to complete the brief post-survey.

If you have not filled out a pre-survey, I would really and truly appreciate your participation (it's just surveys and a video!). The link to the pre-survey is here, and you can follow it up by watching the PowerPoint Presentation and viewing the PONV Quick Reference Guideline.

If you've already completed the first survey, please complete the post-survey at by clicking here. It should take less than 2 minutes.

If anyone has questions or issues with any of these links, please let me know. Again, thank you to everyone for your help and for being excellent preceptors.

Sincerely,
Caleb Woolard, SRNA
ECU Nurse Anesthesia Program
Class of 2024

Final Thank You Email to Participants

Dear [redacted] CRNAs,

I just wanted to say thank you so much to everyone for helping me out with my DNP Project! I have collected all of the data I need to proceed with data analysis and will soon be finishing my paper. Once it's complete you all will be able to read it if you'd like.

Thank you again! I hope to work with you more in the future.

Take care,

Caleb Woolard, SRNA
ECU Nurse Anesthesia Program
Class of 2024