

THE PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING FOLLOWING
CARDIAC SURGERY AND EVIDENCE-BASED GUIDELINES TO PREVENT

by

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Dedication and Acknowledgement

We dedicate this project to our family and friends who have been a constant source of support and encouragement throughout the challenges of graduate school and life. The completion of this project would not have been possible without the participation and assistance of so many people whose names could not all be mentioned. Their contributions are sincerely appreciated and greatly acknowledged. We would like to express deep recognition and indebtedness particularly to the following:

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Abstract

Postoperative nausea and vomiting (PONV) continues to cause concern and side effects for patients following general anesthesia. Extensive research and recommendations exist guiding care for non-cardiac surgery patients. Evidence is, however, limited for cardiac surgery patients due to risks of QT prolongation, arrhythmias, and the use of fast-track anesthesia. Cardiac surgery patients present unique challenges due to their increased risk of arrhythmias and opioid requirements. Research supports utilizing the Apfel risk scoring system to determine which cardiac surgery patients should receive prophylactic medication. Routine antiemetics are not appropriate in the cardiac surgery population, but the developed *Apfel with cardiac indicators* tool can be utilized to treat patients based on their risk level. The study's purpose was twofold, first to determine the prevalence of PONV and assess for statistically significant relationships and second to develop a risk assessment tool. The following variables were examined for significant effects: opioid dosage, presence of arrhythmias, QT prolongation, and times between postoperative milestones.

A retrospective chart review of 100 patients was completed. In total, 46% (n = 46) of patients reported feeling nauseated after surgery, 11% (n = 11) reported to have vomited, and 49% (n = 49) received at least one dose of a rescue antiemetic. Gender was the only significant predictor of PONV (p=.021). Opioid dosage was not found to be associated with reports of nausea (p=.467). Study results coincide with previously published research and identifies a need for prophylactic treatment of PONV in the cardiac surgery population. The authors recommend utilization of the *Apfel with cardiac indicators* tool to guide risk factor assessment and prophylactic treatment.

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The Prevalence of Postoperative Nausea and Vomiting Following Cardiac Surgery and Evidence-Based Guidelines to Prevent

Postoperative nausea and vomiting (PONV) are common complications following anesthesia administration, involving approximately 30% of the general population and up to 80% in higher risk populations (Gan et al., 2020). Patient complaints of PONV are second only to complaints of pain after surgery (Shaikh et al., 2016), with many patients actually preferring pain over the sensations of nausea and vomiting. Poor pain control can lead to negative pulmonary effects, including inadequate deep breathing and coughing, atelectasis, and the potential for subsequent pneumonia (Choi et al., 2010). The necessity for adequate pain control, vital in this population, comes with the need for PONV prevention as well as treatment, when necessary. Negative effects of PONV include delayed recovery, wound dehiscence, dehydration, electrolyte imbalance, increased myocardial oxygen consumption and metabolic demands, and increased pain perception (Champion, Zieger, & Hemery, 2018; Choi et al., 2010). There is also potential for rarer, but serious complications including aspiration (pneumonia), Boerhaave syndrome (esophageal rupture), severe subcutaneous emphysema, pneumothorax, ruptured trachea, and vision loss (DynaMed, 2018; Weibel et al., 2017). Patients with PONV report feeling miserable. Left untreated, the negative effects have the potential to impact patient experiences as well as outcomes, as PONV is both common and distressing (Gan et al., 2020). Because there is a similar incidence of PONV in cardiac surgical patients versus the general population (Riha et al., 2009), the risk for the above-mentioned negative effects of PONV is similar.

Appropriate and routine use of antiemetics postoperatively may prevent the negative consequences of nausea and vomiting; this would allow patients greater comfort, the ability to ambulate earlier, and improve outcomes and experiences. PONV is one of the biggest concerns

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of patients undergoing anesthesia and has both direct and indirect costs. Some of the costs include nursing care and prolonged hospitalization; improvements in PONV prophylaxis ultimately result in improved outcomes and patient satisfaction (Tricco et al., 2015; Weibel et al., 2017). Better outcomes equate to shorter hospital stays, saving the facility money (Mishra et al., 2017). Improved patient experience equates to improved patient satisfaction scores, which will improve reimbursement dollars as well as guide the public to that hospital site.

Magnitude of Problem and Impact on Population

The literature search revealed very limited studies regarding PONV prophylaxis specific to the cardiac surgical population. Most studies conducted examined PONV in non-cardiac surgery patients. Due to the limited information specific to the desired population, this project reflects the culmination of information mainly from non-cardiac populations and incorporates monitors for the concerns cited specific to the cardiac surgical population. Several reasons are cited for the lack of literature on the cardiac surgical population specific to PONV prevention. One reason is the introduction of fast-track anesthesia, that, with the use of appropriate rescue antiemetics, has reduced the incidence of PONV. Fast-track anesthesia is a perioperative multidisciplinary anesthetic management approach aimed at early extubation, typically within six hours post operation (Hijazi et al., 2018).

Champion et al. (2018), cited that the reduction of PONV decreased the importance of prophylaxis in the post cardiac surgery population, however Wang and colleagues question the reported figures as being “implausibly low” (2020). Gan et al. (2020) discuss evidence-based guidelines for PONV management in enhanced recovery pathways. Methods for PONV reduction and prevention include the following: avoidance of volatile anesthetics and nitrous oxide, use of multimodal systemic analgesia, neuraxial anesthesia, regional anesthesia, propofol

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total intravenous anesthesia (TIVA), antiemetics, steroids, supplemental oxygen, and novel interventions, such as the use of sugammadex for reversal of neuromuscular blockade. Only some of these are suitable in the current context, and truly are not a part of the problem amenable in this project. Another reason is that anesthesia providers may be unaware of the PONV incidence following cardiac surgery and patients may be managed by different care teams (Wang et al., 2020).

Finally, the most common reason for the avoidance of PONV prophylaxis in the target population is the potential for arrhythmias and QT prolongation, as many medications used in PONV prophylaxis may cause QT prolongation and dysrhythmias (Champion et al., 2018; Choi et al., 2010 & Weibel et al., 2017). Postoperatively, cardiac patients are at a greater risk of dysrhythmias than the general surgical population (Chung, 2000). In addition to the potential for arrhythmias due to surgery, cardiac patients are often prescribed medications that have the potential to lengthen the QT interval, compelling the clinician to decide which risks are worth introducing (Champion et al., 2018; DynaMed, 2018; Gan et al., 2020; Veiga-Gil, Pueyo & López-Olaondo, 2017).

Problem Statement

There is a lack of evidence due to inherent risks of PONV prophylaxis specific to the cardiac surgical population; however, with specific cardiac indicators, prophylactic treatment has demonstrated safe, effective results. Based on the above, this project quantified the true prevalence of PONV in the cardiac surgical population at Beaumont Hospital, Royal Oak, Michigan. This project also developed a PONV protocol specific to cardiac surgical patients and disseminated it, along with the findings, to the cardiac surgery team, cardiac anesthesia providers, and nurses and mid-level providers caring for these patients.

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Purpose Statement and Project Objectives

The purpose of this project was to identify the prevalence of PONV in post-cardiac surgery patients at Beaumont Hospital, Royal Oak, Michigan and develop evidence-based guidelines to prevent PONV. The objectives for the project were to provide statistical data on the prevalence of PONV and establish evidence-based protocols, based on cardiac risk, for the anesthesia and intensive care unit (ICU) teams to utilize. Findings of true prevalence provided measurable outcomes that were analyzed and discussed, in addition to the research-supported treatments that were foundational in building the protocol. Ultimately, study findings support the need for a practice change to improve patient outcomes.

Literature Review

Evidence-based Literature Search and Appraisal

Articles were selected from but not limited to the following medical and nursing databases: Cochrane Library, Comprehensive Index of Nursing and Allied Health (CINAHL) database, PubMed, DynaMed Plus, and Medline Plus. Ninety-three articles met inclusion and exclusion criteria, with 13 articles selected for relevance to the research question. Inclusion criteria consisted of peer-reviewed articles examining the efficacy of PONV prevention measures in postoperative patients, preferentially for those who had undergone cardiac surgery. Further inclusion criteria were human subjects, English language, with studies aged 10 years or less. Exclusion criteria were articles specific to the pediatric population, unclear methodology, and irrelevance to the research question. To assure the most current and relevant research, four searches were conducted that ultimately resulted in the final selected articles. Keywords used to perform the search were the following: *antiemetics, nausea and vomiting, prevention, postoperative, and cardiac surgery*.

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Of the studies appraised specific to cardiac patients, two failed to find a statistically significant treatment modality worthy of practice change (Murphy et al., 2011; Riha et al., 2009), while one provided mixed findings (Champion et al., 2018). Riha et al. compared the preventative antiemetic effects of droperidol, thiethylperazine, and ondansetron with those of placebo in patients following cardiac surgery. The authors found a reduction in PONV, but results were not significant (droperidol 1.25 mg 18.5%, thiethylperazine 6.5 mg 18%, ondansetron 4 mg 18.0%, placebo 27.1%, $P > .05$). The authors also found limited differences among the medications' effects (Riha et al., 2009). Murphy et al. (2011) examined the effects of dexamethasone after cardiac surgery and discovered that the use of dexamethasone correlated with improvements in quality of recovery (QoR) scores (emotional state, physical comfort, pain). They also found reductions in PONV, however, results were insignificant (nausea 54.2% vs. 35.1%, $P > .01$; vomiting 27.1% vs. 8.8% $P > .01$) (Murphy et al., 2011).

Applying Apfel to Cardiac Patients

Champion et al. (2018) investigated prophylactic use of betamethasone with and without droperidol in high-risk cardiac surgery patients. The authors utilized the Apfel risk scoring system to determine which patients may benefit from prophylactic intervention. For patients with two or more risk factors treated with the prophylactic regimen, PONV was significantly reduced (67.8% to 46.8%, $P = .0061$). While overall PONV was reduced in the active arm, results were not significant (45.5% vs. 54%, $P = .063$), but the article authors concluded that the intervention was successful. Also of interest, the treatment group used nearly twice as much morphine, and still had significantly less PONV (Champion et al., 2018).

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Use of 5-HT₃ Antagonists

The study conducted by Choi et al. (2010) compared the use of ondansetron and romasetron following cardiac surgery when given via bolus, or mixed in a fentanyl patient-controlled analgesia (PCA) infusion, or both. The ondansetron group (O) received ondansetron at the end of surgery as well as mixed in the fentanyl PCA. The romasetron group 1 (R1) received romasetron at the end of surgery only. The romasetron group 2 (R2) received romasetron via bolus at the end of surgery as well as added to fentanyl PCA. The authors found reduced incidence of nausea for group O (46% vs. 71% in placebo group). The R1 group had reduced nausea (54% vs 71% in placebo group). Further, the R2 group also had statistically significant lower nausea symptoms than the control group (35% vs 71% in the placebo group). Of note, although nausea was lowered in these groups, vomiting remained similar (Choi et al., 2010).

Two of the studies investigated the efficacy of serotonin receptor antagonists (5-HT₃) on PONV (Chun et al., 2014; Tricco et al., 2015). Tricco et al. (2015) conducted a meta-analysis and found that all agents (ondansetron, granisetron, tropisetron, dolasetron, palonosetron, & ramosetron) studied were effective at reducing PONV when compared to placebo, which correlates with the findings of Chun et al. (2014). Wang et al. (2020) conducted a randomized controlled study to investigate the incidence of PONV after a one-time administration of ondansetron 4 mg following cessation of propofol infusion for cardiac surgery. The group found a statistically significant lower incidence of PONV in the study group versus the placebo group. While the group examined patients who were at lower risk of PONV, they found similar incidences of PONV as discussed by other authors and questioned whether cardiac surgery is itself an independent risk factor for PONV (Wang et al., 2020).

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Reported Secondary Outcomes

The propensity for arrhythmias, specifically QT prolongation, and its ability to lead to Torsades de Pointes and potentially ventricular fibrillation, appears to be the main reason for the avoidance of routine antiemetics in this population. Despite this, secondary outcomes reported in the cardiac surgery studies failed to correlate any increase in QT interval following antiemetic administration (Champion et al., 2018; Murphy et al., 2011, Wang et al., 2020). Choi et al. (2010) reported no difference in the incidence of arrhythmia with the administration of ondansetron and romasetron. While Champion et al. (2018) suggests that droperidol is safe and efficient for use in this population, Riha et al. (2009) argues that it is not worth the risk due to alternative antiemetics (thiethylperazine or ondansetron) having similar efficacies. Gan et al. (2014) state that all 5-HT₃ receptor antagonists, except palonosetron, affect the QT interval, although this was not reiterated in the updated 2020 PONV management consensus article.

The 2020 consensus article provides perioperative providers with comprehensive, evidence-based guidelines for risk stratification, prevention and treatment of PONV in both adults and children (Gan et al., 2020). Additionally, the article provides suggestions for institutional implementation of a PONV protocol that focus on multimodal PONV prophylaxis and management in conjunction with enhanced recovery pathways (Gan et al., 2020). Tricco et al. (2015) reported QT prolongation in only two out of 125 randomized controlled trials of 5-HT₃ antagonist medications. It is well-known that these medications have the potential to prolong the QT interval, but it has been difficult to ascertain the real risks of using these medications routinely in this group.

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Risk-based Treatment

Gan et al. (2020) in their *Fourth Consensus Guidelines for the Management of PONV*, updated their previous recommendations from 2014 in regards to the postoperative surgical patient. Evidence does not support prophylactic antiemetics for all surgical patients, but rather suggests identifying risk factors to determine which patients should be treated. The authors oppose treating patients that are not at high risk, as they may not benefit from antiemetics but may suffer undesired side effects; they suggest baseline risk reduction and use of Koivuranta and Apfel risk scales. The group now recommends the use of multimodal prophylaxis in patients who have one or more risk factors (Gan et al., 2020). The meta-analysis conducted by Veiga-Gil, Pueyo, and López-Olaondo (2017) also supports using the Apfel risk scale to determine prophylactic antiemetic use. Evidence-based practice guidelines (DynaMed, 2018) support the use of risk scoring in addition to multimodal prophylaxis for high risk patients. Limiting the dosage of the medications known to affect the QT interval is another strategy for risk mitigation (Gan et al., 2020; DynaMed, 2018). The study conducted by Wang et al., (2020) excluded high risk patients (having either a history of PONV or a prolonged QT interval, among others) from the study, further strengthening the argument that antiemetics would be best given under the guidance of a risk stratification tool. Synthesis and evaluation tables summarizing the cited literature can be seen in Table 1 and 2. Table 3 quantifies the effects of antiemetics in the general population while Table 4 outlines the effects of antiemetics specific to the cardiac surgery population.

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Framework

EBP Framework

The lack of research on the topic identifies the need for a preventative protocol that is inclusive of the cardiac surgical population. Advanced practice registered nurses (APRNs) are in a unique position to positively influence systemic change, through leadership and the application of informatics principles for data collection. As discussed by McBride and Tietze (2015), APRNs have important roles in developing information systems and evaluating their performance, while ensuring inclusion of patient perspectives. APRNs work as leaders to ensure thorough communication and collaboration among interdisciplinary teams; they also function as “superusers” to be both the expert of the system as well as facilitator for end-users (McBride & Tietze, 2015). Due to concerns about patient experiences and complications of PONV, this project investigated current practice and created protocols focused on PONV prevention in the cardiac surgical patient that could be implemented for future use. The framework for this project focused on a strong research question, relevant and critically-appraised literature, and development of a protocol that is applicable to this patient population.

Organizational Theory

The value of investigating the clinical question lies in the significance of helping to further distinguish nursing as a defined discipline. The focus of the clinical intervention was on the prevention of suffering, rather than the alleviation of symptoms, which has been the more-common modality of care for this patient population. According to Newman, Sime, and Corcoran-Perry (1991), a professional discipline requires “social relevance and value orientations” (p. 2). The act of caring has been frequently tied to the nursing profession and the

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clinical query here is a specific example. Prevention of suffering is an act of caring, and can be tied to the further development of the nursing profession's focus.

Rosemary Ellis' ideas on nursing's development recommended differentiating viewpoints of clinical practice, so that nursing's focus as a profession is clear. She also advocated for the extrication of themes that outline pressing clinical questions (Algase & Whall, 1993). Nursing's focus on health maintenance and lifestyle promotion is clearly advocated by the development of the modified risk assessment tool, *Apfel with cardiac indicators*. If the tool is successful in being utilized, it will direct others to utilize the same type of preventative measures within this patient population. No published studies of this type were found during the literature review. The tool stands to develop the nursing knowledge base and prevent suffering for the patient who is already enduring a highly stressful and possibly traumatic experience.

Plan for Implementation

The literature review suggested that the most applicable method to prevent PONV in cardiac surgical patients is by using standardized risk scoring instruments. The Apfel score is held in high regard among the medical community and could be utilized for this population. To implement such a change into current practice, the scoring instrument would be instituted for routine use with cardiac surgery patients. Champion et al. (2018) used the Apfel score to determine which cardiac surgery patients were at highest risk for PONV, and thus, which should receive prophylactic medication. The following domains were included in the measurement instrument: age, sex, smoking status, history of motion sickness or PONV, pre- and post-surgical QT interval, presence of arrhythmias, rescue antiemetics used, intraoperative opioids administered, time of first narcotic administration, use and dose of postoperative opioids, morphine milligram equivalents (MME), reported nausea or vomiting, history of cardiac surgery,

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surgery type, length of ventilation, and times between transport to ICU, extubation, narcotic and antiemetic administration.

Due to perceived changes in workflow and added responsibilities in multiple departments, readiness for change was assessed and additional education provided. Change is inevitably met with some degree of resistance, and acknowledgement of this barrier leads to a discussion on intervention facilitation (Jasinska, 2020). Compliance was improved by educating staff about the importance of PONV prevention, the reasoning for the intervention, and the evidence that supports it. The staff needed to know why the intervention was important and how it was measured. Barriers such as staff attitudes regarding change in protocol and reasons for why they feel this way could be surveyed anonymously to detect obstacles and construct solutions for future implementation.

All members of the care team received education regarding the intervention specific to their workflow; this may also help in improving compliance as well as detecting concerns prior to future intervention rollout. The direct care personnel received education regarding the scoring system, medications and contraindications to specific medications. This information is readily available on the scoring instrument. Indirect providers were given education about the intervention including feasibility, costs, and evaluation methods. The use of both formal and informal leaders at the unit level facilitated the intervention.

Methods and Procedures

Project Design

An integrative review with presentation of the PONV prophylaxis tool was the basis of this project's design. This project involved two tiers. The first tier consisted of data collection and analysis. A retrospective chart analysis was conducted using data obtained from patients

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who underwent open heart surgery at Beaumont Hospital, Royal Oak, Michigan. Open heart surgical cases were defined as coronary artery bypass grafts or valvular repairs in which a sternotomy incision is used. Data from the chart review was used to inform the staff of the need for a PONV prevention plan. The second tier consisted of the development of a protocol for PONV prevention and subsequent dissemination of the protocol.

Project Setting

An inpatient chart review from patients at Beaumont Hospital, Royal Oak campus, was conducted between December 1 and December 23, 2021. This campus is a level one trauma and urban teaching hospital in Royal Oak, Michigan.

Key Personnel/Stakeholders

Stakeholders for the intervention include patients, direct care providers (staff nurses, anesthesia providers, surgery team, and intensive care physicians), and indirect providers (nursing education department, pharmacy department, managers, and administrators). The preoperative screening team would use the tool for initial risk stratification for PONV. Anesthesia personnel would initiate the intervention, while staff nurses and the postoperative care team would continue to monitor and treat patients as clinically necessary.

Participants/Population

The intervention included a retrospective chart review on 100 patients who underwent open heart surgery between January 1 and December 31, 2019 at Beaumont Hospital, Royal Oak. All patients who underwent elective or urgent cardiac surgery procedures including coronary artery bypass graft (CABG), valvular replacement or repair including but not limited to: aortic valve (AVR), mitral valve (MVR), or tricuspid valve (TVR), or combination of those procedures

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were considered. Exclusion criteria included prolonged ventilatory requirement beyond 12 hours or hemodynamic instability requiring surgical re-exploration.

Recruitment Strategies

Data for this project's implementation was collected through a retrospective chart review. Based on this, no further recruitment of subjects was necessary in order to obtain data relevant to the proposed project. Approval from the Institutional Review Board (IRB) was obtained prior to data collection and analysis. See Appendix B for the approval letter.

Project Intervention Plan

The intervention plan for the project began with a retrospective chart review in order to obtain prevalence rates of PONV at the specified hospital. The next step was to develop the protocol that could be utilized in the future as a PONV prophylaxis guide that is unique to patients undergoing cardiac surgery. During this phase of the plan, communication with the cardiac anesthesia providers was crucial to gathering information regarding current PONV protocols for this population. In the final phase of the project, the project team met with cardiac surgeons, the ICU nurses, cardiac certified registered nurse anesthetists (CRNAs), the CRNA educator, and anesthesiologists to present data relevant to incidence rates of PONV. The dissemination of the protocol included the developed tool, *Apfel with cardiac indicators*, to aid in reduction of PONV in this patient population. Permission to use the Apfel Risk Scoring Scale was obtained via email communication with the American Society for Enhanced Recovery. Communication of approval is located in Appendix C.

Data Collection and Analysis Plan

No specific data collection instruments were required for the project. The retrospective chart review entailed manual entry of patient data including age, sex, smoking status, history of

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motion sickness or PONV, pre- and post surgical QT interval, presence of arrhythmias, rescue antiemetics used, intraoperative opioids administered, time of first narcotic administration, use and dose of postoperative opioids, morphine milligram equivalents (MME), reported nausea or vomiting (both subjective and objective reports), history of cardiac surgery, surgery type, length of ventilation, and times between transport to ICU, extubation, narcotic and antiemetic administration. Data obtained included medications administered during the perioperative period up to 24 hours after transport to the ICU. Table 5 in the appendices section contains the data collection tool that was utilized throughout the project.

Deidentified data was uploaded into an Excel (Microsoft Corporation, Redmond, WA) spreadsheet and analyzed using Statistical Package for the Social Sciences (SPSS) version 28. Descriptive statistics included frequency distributions, standard deviation, mean, median, mode, and chi square for significance. Accuracy of analyses were guided in collaboration with a statistician.

Procedures for Project Implementation

Tier 1 included data collection and statistical analysis for the prevalence of PONV and investigated the correlation between risk factors. Proper sample size of 100 patients was estimated to identify significant and generalizable findings. Collaboration with a statistician provided insight on the appropriate statistical analyses to execute based on collected data.

Tier 2 commenced with interviews from practicing cardiac ICU nurses, cardiac CRNAs and anesthesiologists to investigate the current protocol utilized for patients undergoing the specified cardiac surgeries. The information gathered contained goals for extubation time, how antiemetics were prescribed, and if rescue antiemetics varied between providers. Paralleling with the most recently published articles, a protocol was then developed to encompass PONV

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prophylaxis for this patient population. After the protocol's composition, an information session for cardiac surgeons, cardiac ICU nurses, cardiac CRNAs, anesthesiologists, and the CRNA educator at Beaumont Hospital, Royal Oak campus was scheduled and the project was disseminated.

Potential Barriers to Implementation and Sustainability

The biggest identifiable obstacle to implementation was hesitancy or resistance to change current practice from cardiac surgeons; this same principle carried over to the anesthesia team. To combat this, the impetus for change was supplied by providing significant evidence of the true prevalence of PONV along with a sustainable protocol that is evidence-based.

Ethical Considerations and Risks

There was minimal risk in conducting the retrospective chart review and the need for significant consideration regarding ethical data collection methods was also minimal. Beaumont Hospital IRB approval was obtained prior to commencement of the project. With respect to the chart review, it was assumed and carried forward that all participants were protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The protection of privacy of patients' health information was supported through HIPAA standards. The student researchers and project chair carefully conducted chart reviews with consideration to the protection and standards of care that are encompassed under these rules. Collected data did not include any potential patient identifiers. Participants were assigned unique identification numbers and any hard copies of information that paired this data were locked in the graduate office of nurse anesthesia, only accessible to the project chair. Any electronic files that obtained data specific to this project were password protected and only available through SharePoint

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access. Chart review to obtain data was only completed on the secured networks of Beaumont Hospital, Royal Oak campus.

Potential Benefits & Outcomes

The interventional tool would aid in the reduction of PONV. Ultimately, this would improve patient experiences, satisfaction, and outcomes by eliminating distressing and painful episodes of emesis, maintaining hydration and electrolyte balance, preventing wound dehiscence, and reducing the risk of other more serious complications like aspiration or esophageal rupture. The outcomes align with shorter hospital stays, lower direct and indirect costs, and improved patient satisfaction and healing.

Timeline

Upon gaining IRB approval for the project, the time from chart review until dissemination was six months. Completing the chart review and statistical analyses of gathered data was finished in three months. The second tier of the project required another three months and encompassed connecting with cardiac CRNAs, anesthesiologists, and other team members at Beaumont Hospital, Royal Oak to understand and obtain current protocols for their cardiac surgery program. The project team completed additional literature reviews throughout the stated timeline to incorporate the most current evidence-based data regarding PONV and cardiac surgery. The project team developed a tool, *Apfel with cardiac indicators*, that entails guidelines specific to the cardiac patient population. The tool is attached in Appendix A. The final step was organizing a meeting with the cardiac surgeons, ICU nurses, and anesthesia providers to disseminate project information and highlight the risk stratification tool, *Apfel with cardiac indicators*.

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Resources, Budget and Funding Plan

Resources for the project were the anesthesia providers and ICU nurses that are familiar with the protocols for cardiac surgery at Beaumont Hospital, Royal Oak. Utilizing our project chair, DNP project team member, and the CRNA educator, an inclusive list of anesthesia resources were procured. A total of 350 dollars was used to obtain light refreshments that were offered during the dissemination and payment of services to the hired statistician. The sum of money was funded by the DNP chair and two DNP student researchers.

Evaluation Plan

Evaluation of Objectives

Obtained statistical data evaluated the prevalence of PONV at Beaumont Hospital, Royal Oak, Michigan. Utilization of data analysis after completion of chart review determined there to be statistically significant relationships between the variables in this study. Collaboration with a statistician and use of SPSS version 28 provided metrics for evaluating the objectives.

Establishment of an evidence-based protocol, based on cardiac risk, was created and presented for possible use by the cardiac surgery and anesthesia team.

Project Implementation

Utilizing the assistance of a member of the cardiac research team at Beaumont Hospital, billing codes denoting the included cardiac surgeries were used to capture the initial population of interest. This included coronary artery bypass grafts (CABG), aortic valve replacements (AVR), mitral valve replacements or repairs (MVR), tricuspid valve replacement or repairs (TVR), or a combination of any of those. The initial data set was then filtered for the patients using the following inclusion criteria: male or female aged 18 years or older who had open heart surgery requiring a sternotomy during the time period of January 1, 2019 to December 31, 2019.

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The final number of that search criteria was 506 patients. Patients were selected by computerized randomization. Data was manually extracted via chart review over two sessions completed at Beaumont Hospital, Royal Oak, MI in December of 2021. Patients' medical record numbers were immediately reassigned to a patient identification number. A SharePoint folder was created and used to store data collected; further protecting patient records and confidentiality. During the chart review, patients were excluded from the study if they required prolonged ventilation via endotracheal tube or hemodynamic instability requiring surgical re-exploration, both within 12 hours of leaving the operating room. The authors hand-searched electronic charts and ultimately reviewed 176 charts before the 100 patient data set was completed. Seventy-six charts were excluded due to meeting above stated criteria. The analyses were then conducted using SPSS version 28. Information was kept confidential during data collection and throughout the course of the project using SharePoint.

Results

Demographics

Of the 100 patients sampled, 76 were male and 24 were female. Ages ranged from 27-86 years ($M = 67$, $SD = 10.3$). Forty-five were lifetime non-smokers, 37 were former smokers, and 18 were current smokers. Only three had a documented history of motion sickness. None had documentation of a history of PONV. Twenty-three had documented arrhythmias after surgery. Ninety-eight patients received intraoperative opioids. All 100 patients received postoperative opioids. Nausea and/or vomiting was present in 46 patients. Rescue antiemetics were administered to 49 patients, with three of these receiving antiemetics prior to extubation. See Table 6 for patient demographics.

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Types of Cardiac Surgery

The coronary artery bypass graft with three vessels bypassed (CABG x 3) was the dominant surgery performed on the patients for this study (33.0%) followed by the CABG x 4 (20.0%) and the MVR (11.0%). Additional surgeries included CABG with less or more bypass grafts, aortic valve replacements, combination of procedures and redo surgical approaches. See Table 7 for a complete breakdown of surgery types.

Prevalence of Nausea and Administration of Antiemetics

Forty-six of the 100 (46.0%) patients indicated feeling nauseated after surgery. Eleven of the patients (11%) were reported as having vomited. Forty-nine (49.0%) received at least one dose of a rescue antiemetic.

Variables Tested

The following variables were tested with nausea as the dependent variable: age, gender, smoking status and opioid dosage. Motion sickness was not tested given that the majority of participants (97.0%) had no documentation of its presence. Of the independent variables listed, only gender was significantly associated with the presence of nausea and/or vomiting following surgery ($X^2 = 5.430$, $p = 0.02$). See Table 8 for results of variables tested. A binomial logistic regression was performed to ascertain the effects of age, gender, smoking status, and opioid dosage on the reporting of nausea. The overall model was not significant, and the only significant predictor was gender ($p = .02$). Because all patients received opioids after surgery, this variable was not tested for significance at the same level.

MME

The study team utilized morphine milligram (mg) equivalents to standardize the amount of narcotic(s) administered in the postoperative period ("*Opioid conversion*", 2019). There was

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a good deal of variance for the MME with a minimum of 8 and a maximum of 327. Both were analyzed as a point biserial correlation ($r = .006$, $p = .952$) and as an aggregated crosstabulation, X^2 ($p = .467$), and opioid dosage was not associated with reports of nausea. See Table 9 for MME aggregated crosstabulation results.

Times Between Transport, Extubation, and Narcotic to First Antiemetic

The time between transport, extubation, and narcotic administration to antiemetic was recorded in minutes for the patients who received antiemetics ($n = 49$). The mean time, recorded in minutes, for patient transport to antiemetic was 691.3 ($SD = 366.2$). The mean time from extubation to antiemetic was 382.2 ($SD = 352.1$), and the mean time from the first narcotic dose to antiemetic was 642.2 ($SD = 381.8$). A correlation of the data revealed a significant relationship with a very strong positive correlation between the transport and the extubation to the antiemetic ($r = +.922$, $n = 49$, $p < .01$, two-tails). Data suggests a strong, positive significant relationship between the extubation time to the antiemetic and first narcotic dose to the antiemetic ($r = +.772$, $n = 49$, $p < .01$, two-tails).

Electrocardiogram Availability for QT Analysis

To the surprise of the authors, most charts reviewed did not contain a postoperative electrocardiogram (ECG). Of the 100 patients studied, only 25 had both preoperative and postoperative ECGs for review. All patients had preoperative ECGs. This was an unfortunate finding, as the authors would have analyzed the preoperative and postoperative QT intervals for signs of increase following antiemetic administration, a common reason for routine avoidance in the target population. The definition for QT prolongation used for this study was based on the standard at Beaumont Hospital. It is defined as a corrected QT interval (QTc) of greater than 500 milliseconds (ms) in both males and females. Of the 25 patients with complete ECG records,

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four (16%) developed QT prolongation following the administration of either ondansetron (n = 3) or metoclopramide (n = 1). None of these patients developed a life-threatening arrhythmia. One (4%) patient had a prolonged QTc on their preoperative ECG only, which was resolved on their postoperative ECG, even with the administration of both ondansetron and prochlorperazine in the postoperative timeframe. One (4%) patient had a prolonged QTc on preoperative and postoperative ECGs without any antiemetic administration. Eight (32%) patients had normal QTc on preoperative and postoperative ECGs with administration of either ondansetron and/or metoclopramide. Eleven (44%) had normal QTc without administration of any antiemetics. Despite the most commonly cited reason for avoidance of routine antiemetic administration in the cardiac surgery population being QTc prolongation, the current study failed to find a correlation between QT interval prolongation and antiemetic administration, this also correlates with findings observed by Champion et al (2018), Murphy et al (2011), and Wang et al (2020).

Discussion

The overall aim of this study was to determine the prevalence of PONV in cardiac surgery patients as research is limited regarding this population. Because the incidence of PONV following general surgery ranges from 30-80% (Gan et al., 2020), it is not surprising to have found the PONV prevalence to be 49% in this study's population. This finding emphasizes the importance of prophylactic antiemetic administration and a measured need for practice change. Support for this finding has also been reported in similar cardiac patient populations (Riha et al., 2009). Changing practice to implement ondansetron administration at completion of the propofol drip after ICU arrival was suggested by Wang and colleagues (2020). The *Apfel with cardiac indicators* tool was developed to preemptively treat cardiac surgery patients with

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well-known risk factors and may prove beneficial in reducing PONV incidence in the cardiac surgical population.

Factors increasing likelihood for PONV are well-known throughout the literature. Risk increases for patients with the following characteristics: young, female, non-smoker, history of PONV/motion sickness, and use of opioids (Weibel et al., 2020). Further investigation of the data revealed female gender as the only significant predictor of PONV in the studied surgical population, with 18 (75%) of the 24 female patients being treated for PONV within the first 24 hours. This finding suggests that female patients should be considered at higher risk for PONV after cardiac surgery, which correlates with research on patients having non-cardiac surgery. Implementing prophylactic measures could greatly benefit their outcomes. Other well-known risk factors failed to produce statistically significant results, this may have been due to inadequate sample size or documentation.

There was no significant relationship revealed between opioid dosage and antiemetic use, which coincides with the known effects of opioid administration. Higher and repeat doses of opioids depress the vomiting center in the brain, reducing nausea and vomiting. This effect is variable (Nagelhout & Elisha, 2018). This finding suggests that other factors could be responsible for PONV in this population and escalating opioid doses do not equate to PONV symptoms requiring rescue antiemetics.

Mean times in minutes for patient transport to antiemetic administration ($M = 691.3$, $SD = 366.2$), resembled the average times for first narcotic dose to antiemetic ($M = 642.2$, $SD = 381.8$). Data collection revealed that narcotic administration always preceded antiemetic administration in all patients who required antiemetics, as all, except two patients, received narcotics prior to extubation. Extubation times, in comparison to antiemetic administration,

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further show that most patients received antiemetics following extubation ($M = 382.2$, $SD = 352.1$). When looking at the measured times for transport, extubation, narcotic and antiemetic administrations, a six hour window for each parameter that coincided with the highest number of antiemetics for the time evaluated was noted. Transport to antiemetic was most frequent between six and 12 hours (41%), narcotic to antiemetic was most frequent between three and nine hours (49%), and extubation to antiemetic was most common between one and seven hours (53%). Most patients who were administered antiemetics received them within seven hours after extubation ($n = 26$). See Tables 10, 11, 12, and 13 for graphical representation of these time frames.

Timing of antiemetic administration following extubation suggests PONV may have been present prior to extubation and that assessment was either difficult or inadequate. This also suggests that prophylaxis in this patient group would have been beneficial to prevent PONV. Despite the high numbers of patients treated for PONV within the seven hour window from extubation, patients continued to develop PONV throughout the observed 24-hour period. Both subjective and objective reports were acquired during chart review. Patients had documented nausea and vomiting, which reduced their motivation to ambulate and participate in their activities of daily living. Evidence-based prophylaxis in high-risk populations is necessary to reduce the incidence of PONV and improve patient outcomes, which will ultimately improve recovery.

Dexamethasone Considerations

Research supports the use of dexamethasone as a primary prophylaxis approach. Gan and colleagues (2020) recommend administering dexamethasone early during the surgical case for best efficacy and found no difference in 4-5 mg versus 8-10 mg dosing in PONV prevention.

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Dexamethasone reduced the need for pain medications in many studies, providing an opioid-sparing effect (Singh et al., 2018; Liu et al., 2017), and there is conflicting evidence on whether this effect is dose-dependent. Dexamethasone has few adverse effects, and in a Cochrane Database analysis of 37 trials, there was no evidence of increased risk of wound infections. An additional review of 56 trials indicated that dexamethasone (along with other corticosteroids) did not increase wound infection rates, bleeding, or clinically significant hyperglycemia (Gan et al., 2020).

Dexamethasone has been found to mildly elevate the blood glucose, this effect can be more dramatic in patients with diabetes mellitus (DM). But even in patients with DM, there is minimal evidence that dexamethasone causes a clinically significant increase in blood glucose and less elevations are reported when using the 4 mg dose of dexamethasone versus a higher dose (Gan et al., 2020). A Cochrane Library systematic review found a mild increase in blood glucose levels in nondiabetic patients in the first 12 hours after surgery and limited evidence suggested a more pronounced increase in blood glucose in patients with DM (Polderman et al., 2018).

Aside from PONV prevention and the potential adverse effects worthy of consideration, dexamethasone has other beneficial aspects for the cardiac surgery patient. These aspects include improved respiratory parameters, reduced fatigue, better quality of recovery, and reduced lengths of stay in the hospital (Gan et al., 2020). As this paper highlights PONV prevention and the use of risk factors to guide decision-making, the use of dexamethasone should be no different. The authors believe that the use of dexamethasone in this population should be considered for appropriate surgical candidates with elevated risk levels for PONV.

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Limitations

While this study allowed the researchers to obtain research evidence in which there is a gap in the literature, it is not without limitations. The sample size of 100 patients was sufficient to collect meaningful data, however, expanding the sample size to evaluate all the patients that underwent cardiac surgery that year would improve the generalizability of the study. Another limitation was the reliability and validity of subjective narratives within the charting. The retrospective nature of this review forced the authors to rely on the nurses or physicians to chart a thorough narrative of any subjective patient experiences. The authors question the low number of patients with documented history of PONV and motion sickness. Lastly, there are many confounding variables that could not be accounted for that may have heavily influenced outcomes.

While the team examined the direct effect of ondansetron and metoclopramide on QTc intervals, it is impossible to remove the potential confounders that may have affected the development of prolonged QTc. Confounders include patient demographics, electrolyte levels, and the use of additional medications known to increase the QT interval including, but not limited to antiarrhythmics and antihistamines. There is also the potential effect that cardiac surgery itself has on QT intervals, as CABG was shown to have a non-significant increase in the QT interval in a small prospective audit (Pasley & Gillham, 2014).

Another confounding variable noted was the use of the orogastric tube. Patients are transported to the ICU with an orogastric tube in place. Practices may vary regarding verifying placement and connecting to suction to ensure that the stomach is empty prior to extubation. The retrospective nature of this review made it impossible to assess how the orogastric tube was managed upon arrival to the ICU.

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Recommendations

For future research, a standardized system for each patient would reduce the number of confounding variables that were experienced in this study. Adding into the postoperative order set that all open heart patients receive an ECG on postoperative day one or following antiemetic administration, would allow researchers to determine if QT prolongation is medication related or as result of recent cardiac surgery. Modifying ICU standards of care for patient arrival to include ensuring the orogastric tube is placed on suction would assist in making sure patients are extubated with an empty stomach. Lastly, by having a structure for which rescue antiemetics would be prescribed would allow for greater evaluation of any correlation.

Project Sustainment

This project has uncovered a need for changes in current practice and protocol at Beaumont Hospital, Royal Oak. By disseminating project findings to critical stakeholders, the authors hope that small changes to routine care and protocols based on evidence-based findings will be implemented. One limitation to this project is the retrospective nature of the study and obtaining data based on information compiled in the medication administration record and provider notes. Future studies should focus on the enrollment and follow up of patients during their perioperative stay. Another limitation to this project was the inability to pilot the *Apfel with cardiac indicators* tool that was developed. The tool sets a foundation to assess risk factors, navigate care, and provide appropriate prophylactic PONV treatment. There are many aspects of this project that could continue to be advanced with other APRN students, ICU nurses, and cardiac surgery team members. Sustainability could also be maintained by implementing data collection at another facility where these surgeries are also performed. This would allow for a larger sample size to be obtained and standardize care throughout the hospital system. Overall,

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addition of the small changes to risk assessment preoperatively or management strategies postoperatively has the potential to improve outcomes in patients having cardiac surgery.

Implications for Career Practice and Development

With the complexity of the healthcare system continually rising, APRNs must have clinically-capable skill sets as well as leadership experience. The doctorally-prepared nurse has the ability to build upon foundations set forth in previous degrees while generating new knowledge and practice innovations through the translation of research into practice. These evidence-based strategies, aimed at improving clinical decision-making, will equate to health outcome optimization. Nurse development into advanced practice should focus on leadership and executive positions in healthcare organizations. Utilizing interprofessional relations to coordinate care and quality improvement initiatives, influencing health policies, and analyzing cost effective protocols are all important aspects of the APRN. Healthcare systems stand to gain innumerable benefits from developing projects set forth by APRNs. As clinical practice experts, APRNs possess skills that allow for continual assessment, innovative change, improved outcomes and care teams collaborators. With the potential to build upon this project for future research, the findings confirmed in this study will be instrumental in the practice of APRNs and CRNAs who treat cardiac patients.

Achieving DNP Essentials and Personal Goals

The development, implementation, and dissemination of this project has created paths to meet all eight of the DNP Essentials. With the structure of the DNP Essentials integrated in the curriculum, the authors developed core, foundational competencies that support the transition into the role of advanced practice nurses. Essentials I and II have established the ability to determine an area of need for change, strongly present supportive evidence to show its necessity,

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and develop and evaluate new practice approaches based on nursing theories. The ability to translate research into practice, utilizing the application of clinical scholarship, employing analytical methods for evidence-based practice combined with the overarching goals of this project to represent the foundations of Essential III. With assistance from the cardiac research team member and statistician, the authors were able to achieve the importance of Essentials IV and VI. These interactions were evident on how technology provides enhancement of obtaining and evaluating data that ultimately affects overall care systems. Throughout this project, the team has become more-established advocates for patients and advanced practice nurses by understanding the framework that incorporates Essential V. The identification of key stakeholders and their engagement in strong political activism to facilitate change, allows the authors to be at the forefront of addressing health care needs as an APRN. With the knowledge that the cardiac surgery patient population requires protocol adaptation to prevent PONV and improve outcomes, the authors were able to more deeply understand the concepts surrounding Essential VII. Lastly, Essential VIII contains the continuum that the advanced practice nurse moves along in their career. This project, in its entirety, has highlighted the importance of an APRN and equipped us with the skills to support and improve patient care for the duration of the authors' careers.

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Appendices

Table 1: Evaluation Table

Citation: Author, Date of Publication & Title	Purpose of Study	Design/Meth od	Sample/Setti ng	Major Variables Studied and Their Definitions	Measurement of Major Variables	Study Findings	Strengths/We aknesses LOE Feasibility/C onclusion
1. Gan T. J. et al., 2014 “Consensus guidelines for the management of postoperative nausea and vomiting.”	Risk analysis for PONV; recommendat ions on new antiemetics, changes in recommendat ions from previous guidelines; implementati on of PONV prevention & treatment strategies	SR of literature concerning PONV management in adult and pediatric patients undergoing surgery	335 articles from MedLine, Cochrane Controlled Trials Register, Cochrane Library, EMBASE 1/2007-10/20 11; studies for children reported separately	IV: antiemetics DV: PONV	Antiemetic: use risk analysis to devise treatment plan Risk reduction P<0.01	-Evidence does not support prophylactic antiemetics for all surgical pts -5HT3 antagonists work best when given at end of surgery -risk analysis and baseline risk reduction when possible -multimodal prophylaxis for high risk pts (80% complete response vs. 43% (inhaled drug) to 63% (TIVA) -if PONV occurs after surgery, give medication different than prophylactic -if none given, use low dose 5HT3 blocker -repeating dose of antiemetic <6 hours after initial found no benefit; use of protocol for PONV decreases PONV incidences	<u>Weaknesses:</u> not enough information to fully answer PICOT <u>Strengths:</u> well-construc ted search of recent articles and recommendat ions <u>LOE 1</u> <u>Feasibility/c onclusion:</u> useful, informative; applicable; simple to apply to clinical situation with appropriate tools for risk/treatmen t

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						-no	
2. Weibel, S. et al., 2017 “Drugs for preventing postoperative nausea and vomiting in adults after general anaesthesia: a network meta-analysis (Protocol)”	To generate a clinically useful rating of antiemetic drugs (mono- and combination prophylaxis); to enhance efficacy and reduce side effects	RCT and trials in which allocation to treatment may not have been adequately concealed but considers trial methodological quality in analyses and interpretation	Adult pts undergoing general anesthesia, full text, peer-reviewed; antiemetics vs each other vs no treatment or placebo	IV: 6 drug classes of antiemetics DV: PONV	Random effects NMAs, between trial variance τ^2 , Q-test, and I^2 statistic	-Table provided with acceptable dosages and drugs from 6 classes alphabetized -prophylaxis can reduce incidence by 25%	<u>Weaknesses:</u> relative ranking information not presented <u>Strengths:</u> antiemetics given prior to PONV symptoms (preoperatively or during anesthesia) <u>LOE 1</u> <u>Feasibility/conclusion:</u> useful in the context of formulary building for pharmacy; clinically, providers only have access to medications available from pharmacy, so applicability is significantly limited

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3. DynaMed “Postoperative Nausea and Vomiting (PONV) in Adults” (2018)	Overview of PONV and recommendations for treating (DynaMed)	Evidence-based guidelines	737 randomized trials of drugs for preventing postoperative nausea or vomiting in 103,237 patients	IV: antiemetic DV: PONV	N/A	-Identify at-risk pts; use multimodal prophylaxis when possible -8 medications shown to reduce risk, significance cannot be determined due to publication bias: cyclizine, dexamethasone, dolasetron, droperidol, granisetron, metoclopramide, ondansetron, tropisetron	<u>Weaknesses:</u> publication biases present in individual studies, so significance undetermined; not specific to cardiac pts <u>Strengths:</u> large-scale systematic review <u>LOE:</u> 1 <u>Feasibility/conclusion:</u> evidence can be extrapolated, but significance still undetermined
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4. Tricco, A. C. et al., 2015 “Comparative efficacy of serotonin (5-HT3) receptor antagonists in patients undergoing surgery: a systematic review and network meta-analyses.”	Comparative efficacy of 5HT3 antagonists	Systematic review & network meta-analyses	450 studies and 80,410 patients were included after the screening of 7,608 citations and 1,014 full-text articles.	IV: 5HT3 drug DV: PONV	Random effects pairwise meta-analyses and network meta-analyses; network geometry; Chi-square	-Significantly fewer pts experienced nausea than placebo group, except ondansetron + metoclopramide (NMA). -Significantly fewer pts had vomiting than placebo group, except for palonosetron + dexamethasone (NMA). -All agents resulted in fewer PONV episodes vs. placebo (NMA). Granisetron + -dexamethasone best combination across age groups (86% probability) -Ondansetron + droperidol 78% probability -Only two studies reported QT prolongation	<u>Weaknesses:</u> population included children; unclear or high risk of bias on important items, slight changes to original protocol, effects of different dosages were assumed identical across treatments <u>Strengths:</u> large body of evidence and broad eligibility criteria (for feasibility) <u>LOE:</u> 1 <u>Feasibility/conclusion:</u> useful along with other current research
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

5. Gan T. J. et al., 2020 "Fourth Consensus guidelines for the management of postoperative nausea and vomiting."	Provide perioperative practitioners with comprehensive, up-to-date, evidence-based guidance on risk stratification, prevention, and treatment of PONV in both adults and children. Also provides guidance on management of PONV within enhanced recovery pathways	SR of literature concerning PONV management in adult and pediatric patients undergoing surgery	Lit from Jan 2011-Sept 2019; followed Cochrane (MECIR) for conducting the search, & PRISMA for reporting the search & PRESS for peer-reviewing the search strategies from databases. Ovid MEDLINE; Epub Ahead of Print & in-Process & other non-indexed citations, Embase classic + Embase; Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews. Adult studies >=18 y/o	IV: antiemetics DV: PONV	Antiemetic: use risk analysis to devise treatment plan Risk reduction P<0.05	-risk assessment, baseline risk prevention, pharmacoprophyl axis recommended -implement multimodal PONV prophylaxis in pts w/1+ risk factor (2 agents) -combination therapy = drugs from different classes at minimum effective doses -if PONV develops, admin rescue therapy from different class, or if >6 h from initial treatment, can use 1 st agent again -limited evidence on rescue therapy available -multimodal prophylaxis for all adult surgical pts w/any risk factors -institutions should provide antiemetics from at least 4 drug classes -multimodal prophylaxis from at least 2 classes w/addition of another agent in higher risk groups, compliance monitoring	<u>Weaknesses:</u> not enough information to fully answer PICOT <u>Strengths:</u> well-constructed search of recent articles and recommendations <u>LOE 1</u> Feasibility/concl usion: useful, informative; applicable; simple to apply to clinical situation with appropriate tools for risk/treatment
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

6. Riha, H., Drabek, T., Polisenska, J., & Brezina, A., 2009 “Postoperative nausea and vomiting in cardiac surgery.”	To identify effect of droperidol vs. other antiemetics; To identify which antiemetic medications are effective in preventing PONV after CABG surgery and whether length of CPB affects PONV	randomized trial, double-blind prospective	142 CABG pts with >45% EF undergoing CABG with CPB	IV1: droperidol 1.25 mg IV2: thiethylperaz ine 6.5 mg IV3: ondansetron 4 mg IV4: placebo DV: PONV up to 12 hours postoperative ly	Correlation coefficient (r) and Chi-square test (P); P<.05 statistically significant	-Metoclopra mide for rescue not effective for PONV prevention; CPB duration no influence on PONV -incidence of PONV insignificant lower than placebo group; number of pts in groups 1-3 with PONV not less than placebo group -droperidol not worth black box risk, as it's comparable with other medications for antiemetic effects (IV1) 18.5%, (IV2) 18%, (IV3) 18.0%, (IV4) 27.1% P>.05	<u>Weaknesses:</u> short article, little description about methods of data collection and selection of pts. Low number of total pts studied. Risk assessment not discussed. Older article <u>Strengths:</u> applicable toward PICOT question, but article insufficiently describes phenomenon – it states that prophylactic measures were not significant (P>.05) <u>LOE 2</u> <u>Feasibility/c</u> <u>onclusion:</u> need to further evaluate literature, but findings not correlating with most other research available
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

7. Choi, D. K. et al., 2010 “Prophylactic control of post-operative nausea and vomiting using ondansetron and ramosetron after cardiac surgery”	Evaluate the efficacy of ondansetron and ramosetron in the reduction of PONV associated with PCA after cardiac surgery	Prospective, randomized double-blind placebo-controlled study	279 adult pts undergoing elective cardiac surgery from 9/08-2/09	IV1(P): no prophylactic medications (only saline used) IV2(O): ondansetron at end of surgery and added to PCA IV3(R1): ramosetron at end of surgery and none added to PCA IV4(R2): ramosetron at end of surgery and added to PCA DV: PONV up to 48 hours postoperatively	Chi-square test, Fisher’s exact test, Kruskal-Wallis test, & analysis of variance with Tukey’s post hoc test; $P < .005$ statistically significant	-Incidence of nausea significantly lower in groups O (46%), R1 (54%), R2 (35%) than in group P (71%) -incidence of vomiting similar among groups -fewer pts received rescue meds in groups O, R2, than P, but similar between P and R2 $P < .001$ -no change in incidence of arrhythmia	<u>Weaknesses:</u> ondansetron and ramosetron doses unequal at time of study; differences in timing of antiemetic administration; addresses use of antiemetics with PCA only <u>Strengths:</u> well-controlled study with limitations discussed; applicable in use of antiemetics use postoperatively <u>LOE 2</u> <u>Feasibility/conclusion:</u> clinically useful in practice; antiemetics work; use of PCA different than original PICOT question
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

8. Champion, S., Zieger, L., & Hemery, C., 2018 “Prophylaxis of postoperative nausea and vomiting after cardiac surgery in high-risk patients: A randomized controlled study.”	To study the risk factors for PONV after cardiac surgery and the role of betamethasone with and without droperidol for its prevention	Randomized open-label controlled study	502 pts with planned nonemergent cardiac surgery; Feb-Nov 2016	IV1: risk factors not used; routine hospital care IV2: risk factors collected and available. Prophylaxis with betamethasone if 2+ risk factors; 3 risk factors received betamethasone and droperidol DV: PONV up to 48 hours postoperatively	Chi-square test; Mann-Whitney U-test; logistic regression with $P < .01$ in univariate analysis, then multivariate analysis; $P < .05$ statistically significant	-pts with 2+ risk factors; prophylaxis significantly reduced PONV (intention to treat 46.8% vs 67.8%, $P = 0.0061$) (per protocol 39.2% vs 69%, $P = .0002$) -independently associated risk factors included: female sex, past history PONV, and migraines; did not find correlations between PONV and volatile anesthetics, motion sickness, smoking status -PONV reduced in active arm, but not significant (45.5% vs 54%, $P = 0.063$) -VAS reduced in active arm (10.9 vs. 15.3 mm, $P = 0.043$) -Vomiting events: (IV1) 1.1+/-1.2% vs (IV2) 0.8+/-1% -Mean VAS: (IV1) 15.3+/-22.6 vs (IV2) 10.9+/-19.1% -betamethasone with droperidol safe and effective for use after cardiac surgery -QT not affected	<u>Weaknesses:</u> protocol violations in postop period; QTc defined retrospectively; fails to answer PICOT, lacks information regarding antiemetics as schedule prophylactics <u>Strengths:</u> provides validity in using risk scoring to determine prophylaxis <u>LOE 2 Feasibility/conclusion:</u> clinically useful; risk factors, QTc information useful; active group used nearly twice the morphine, PONV still lower in this group; betamethasone first line agent, cost effective, other physiological benefits
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

9. Murphy G. S. et al., 2011 “Small-dose dexamethasone improves quality of recovery scores after elective cardiac surgery: A randomized, double-blind, placebo-controlled study”	To determine the effect of small dose dexamethasone on QoR in elective cardiac surgery patients; assess effect of dexamethasone on common adverse events after CPB	Prospective, randomized, double-blind, placebo-controlled	117 patients undergoing CABG with CPB University hospitals	IV1: dexamethasone given at induction and at initiation of CPB IV2: control group; NS given DV: QoR Secondary measures of interest: nausea, vomiting, fatigue, febrile responses, shivering, pulmonary gas exchange, and analgesic requirements	QoR assessed preoperatively and at days 1 and 2 postoperatively Fisher Exact test, 95% CI 2 sample, 2-sided <i>t</i> -test Mann Whitney U test 99% CI Dunnett 2-sided multiple comparisons with control within groups Tukey-Kramer multiple comparison test between groups at the same time	-QoR scores enhanced significantly POD 1 and POD 2 -QoR improved in emotional state, physical comfort, and pain. -Incidences of postoperative fatigue, febrile responses, and shivering reduced -results not significant postop nausea: POD1 (IV2) 54.2% vs. (IV1) 35.1%; POD2 (IV2) 42.6% vs. (IV1) 26.3%; P>.01 -results not significant postop vomiting: POD1 (IV2) 27.1% vs. (IV1) 8.8%; POD2 (IV2) 10.6% vs. (IV1) 0%; P>0.01 -QT not affected	<u>Weaknesses:</u> 8 patients removed because medications not ready at induction; doses of dexamethasone not adjusted for body size; only low-risk pts enrolled in trial; study underpowered to study larger differences (ie MI) <u>Strengths:</u> effects of intervention on PICOT target population <u>LOE 2</u> <u>Feasibility/conclusion:</u> intervention feasible and contributes to body of knowledge; nausea not significantly decreased, but vomiting and other QoR measures improved
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

10. Kranke, P. 2015 “Randomise d, double-blind, placebo-cont rolled phase III study of APD421 (Amisulpride for IV Injection) as combination prophylaxis against post-operativ e nausea and vomiting in high-risk patients (Clinical Trials.gov).	Amisulpride as combination prophylaxis against PONV in high-risk patients	Randomized double-blind placebo-cont rolled clinical trial	1,111 high risk male/female elective surgery <1 hour from induction to wound closure in France, Germany, USA High risk = <3 Apfel risk factors	IV1: APD421 + “standard antiemetic” IV2: placebo + “standard antiemetic” DV: PONV up to 24 hours postop	Pearson’s Chi-square test	-Total response (absence of PONV) 57.7% (IV1) vs. 46.6% (IV2)	<u>Weaknesses:</u> sponsored by Acacia Pharma, unclear what “standard antiemetic”; groups unevenly distributed among sexes (F-97%, M-3%) <u>Strengths:</u> newer medication type for treatment of PONV <u>LOE:</u> 2 <u>Feasibility/c onclusion:</u> cost is an issue as well as not FDA approved until potentially February 2020; but not knowing “standard antiemetic” makes difficult for comparison
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

11. Chun, H.R. et al., 2014 “Efficacy of palonosetron for the prevention of postoperative nausea and vomiting: a randomized, double-blind ed, placebo-cont rolled trial”	Use of palonosetron for PONV prevention	Randomized double-blind placebo-cont rolled	189 pts undergoing elective surgery, ages 20-70 Korea	IV1: palonosetron IV2: placebo DV: PONV up to 72 hours postoperative ly	Chi square or Fisher’s exact $P < 0.05$ statistically significant	-PONV significantly lower in IV1 than IV2 group 0–24 h (33% vs 47%) and the 0–72 h postoperative period (33% vs 52%) ($P < 0.05$), but not during the 24–72 h postoperative period (6% vs 11%)	<u>Weaknesses:</u> noncardiac surgical pts; low incidence of PONV during 48-72 hours, even in IV2; fails to answer PICOT question <u>Strengths:</u> good study design with consistent findings <u>LOE:</u> 2 <u>Feasibility/c</u> <u>onclusion:</u> clinically applicable in addition to body of knowledge
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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

12. Wang, E. H. Z. et al., 2020. "A single prophylactic dose of ondansetron given at cessation of postoperative propofol sedation decreases postoperative nausea and vomiting in cardiac surgery patients: A randomized controlled trial."	Test the hypothesis of single prophylactic dose of ondansetron reduces the incidence of PONV following cardiac surgery in the first 24 hours postextubation compared to placebo	Single-center, randomized, quadruple blinded, parallel-group clinical trial in cardiac surgery patients	159 adult cardiac surgical patients, Vancouver, BC, Canada	IV1: Single dose of ondansetron 4 mg IV IV2: Placebo DV: PONV within the first 24 hours after extubation	Chi square, Fisher exact test, Cochran-Armitage method, Student t test, Mann-Whitney U test, Kaplan-Meier curves	-PONV in the first 24 hours occurred in (IV2) 61% compared to (IV1) 43% -No difference between variables of occurrences of ventricular arrhythmias	<u>Weaknesses:</u> no comparison of adverse events, identifying differences between men and women, results may have been affected by use of propofol and rescue medication, history of motion sickness was not an exclusion criterion, cannot rule out whether higher ondansetron doses are more effective <u>Strengths:</u> results reflect similar outcomes of previous studies using prophylactic ondansetron <u>LOE:</u> 1 <u>Feasibility/Conclusion:</u> -ondansetron dose given after cessation of propofol sedation decreased PONV -results reflect real – world practice and demonstrate an easy approach into standardized cardiac surgery protocols.
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13. Veiga-Gil, L., Pueyo, J., & López-Olaondo, L. 2017 “Postoperative nausea and vomiting: Physiopathology, risk factors, prophylaxis and treatment”	Extensive topic review due to changing information; risk factors; guidelines for practice	Systematic review/summary	Unclear	IV: measures to decrease PONV reviewed DV: PONV	Unclear	-Listed recommendations (risk factors, medications) as well as unverified medications/interventions	<u>Weaknesses:</u> failed to discuss method for data collection/analysis <u>Strengths:</u> findings correlate with other current literature <u>LOE: 7</u> <u>Feasibility/conclusion:</u> useful with limitations due to lack of clarity on construct
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CABG = coronary artery bypass grafting; CI = confidence interval; CPB = cardiopulmonary bypass; DV = dependant variable; EBP = evidence-based practice; EF = ejection fraction; IV= independent variable; MI = myocardial infarction; NMA = network meta-analysis; NS = normal saline; PCA = patient controlled analgesia; POD = postoperative day; PONV = postoperative nausea & vomiting; pt = patient; QoR = patient perceived quality of recovery scores; SR = systematic review; TIVA = total intravenous anesthesia; vs = versus; VAS = visual analog scale

[illegible]

	1	2	3	4	5	6	7	8	9	10	11	12	13
PONV			**	 				**		**			
1=Gan TJ, et al. (2014); 2=Wiebel S, et al. (2017); 3=DynaMed “Postoperative Nausea and Vomiting (PONV) in Adults” (2018); 4=Tricco AC, et al. (2015); 5=Gan TJ, et al. (2020); 6=Riha H, et al. (2009); 7=Choi DK, et al. (2010); 8=Champion S, et al. (2018); 9=Murphy GS, et al. (2011); 10=Kranke P (2015); 11=Chun HR, et al. (2014); 12=Wang, EHZ et al. (2020); 13=Veiga-Gil L, et al. (2017)													
**= bias or study design problem; = decrease; = mixed responses; = increase/no change; ----- = not measured;													
Adapted with permission from Melnyk, B. M., & Fineout-Overholt, E. (2019). Evidence-based practice in nursing & healthcare a guide to best practice. Philadelphia: Wolters Kluwer.													

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 4: Effect of Antiemetics on PONV in Cardiac Surgical Patients for 24 Hours Postoperative (vs. control group)

	5	6 (post op PCA)	7 (risk analysis)	8	12
Betamethasone 4 mg alone or + Droperidol 0.625 mg	-----	-----	↓	-----	-----
Dexamethasone 8 mg	-----	-----	-----	↓ **	-----
Droperidol 1.25 mg	↓ **	-----	-----	-----	-----
Thiethylperazine 6.5 mg	↓ **	-----	-----	-----	-----
Ondansetron 4 mg	↓ **	↓ at end of surgery and 12 mg added to PCA	-----	-----	↓ At time of propofol discontinuation
Romasetron 0.3 mg	-----	↓ ↓ at end of surgery only; at end of surgery and 0.6 mg added to PCA	-----	-----	-----
PCA = patient-controlled analgesia; VAS = visual analog scale					
**= finding insignificant for design; ↓ = decrease; ↑ ↓ = mixed responses; ↑ = increase/no change; ----- = not measured;					
5=Riha H, et al. (2009); 6=Choi DK, et al. (2010); 7=Champion S, et al. (2018); 8=Murphy GS, et al. (2011); 12=Wang, et al. (2020)					
Adapted with permission from Melnyk, B. M., & Fineout-Overholt, E. (2019). Evidence-based practice in nursing & healthcare a guide to best practice. Philadelphia: Wolters Kluwer.					

[illegible]

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 6: Demographics

Demographics

Category	N	%	M	SD
Age	100	100.0	67.0	10.30
Gender				
Female	24	24.0		
Male	76	76.0		
Smoking Status				
No/Never	45	45.0		
Current Smoker	18	18.0		
Former Smoker	37	37.0		
History of Motion Sickness				
Yes	3	3.0		
No	97	97.0		
Arrhythmias				
Yes	23	23.0		
No	77	77.0		
Opioid Dosage (MME)	100	100.0	40.20	36.14
Nausea				
Yes	46	46.0		
No	54	54.0		
Rescue Antiemetics				
Yes	49	49.0		
No	51	51.0		

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 7: Surgery Types

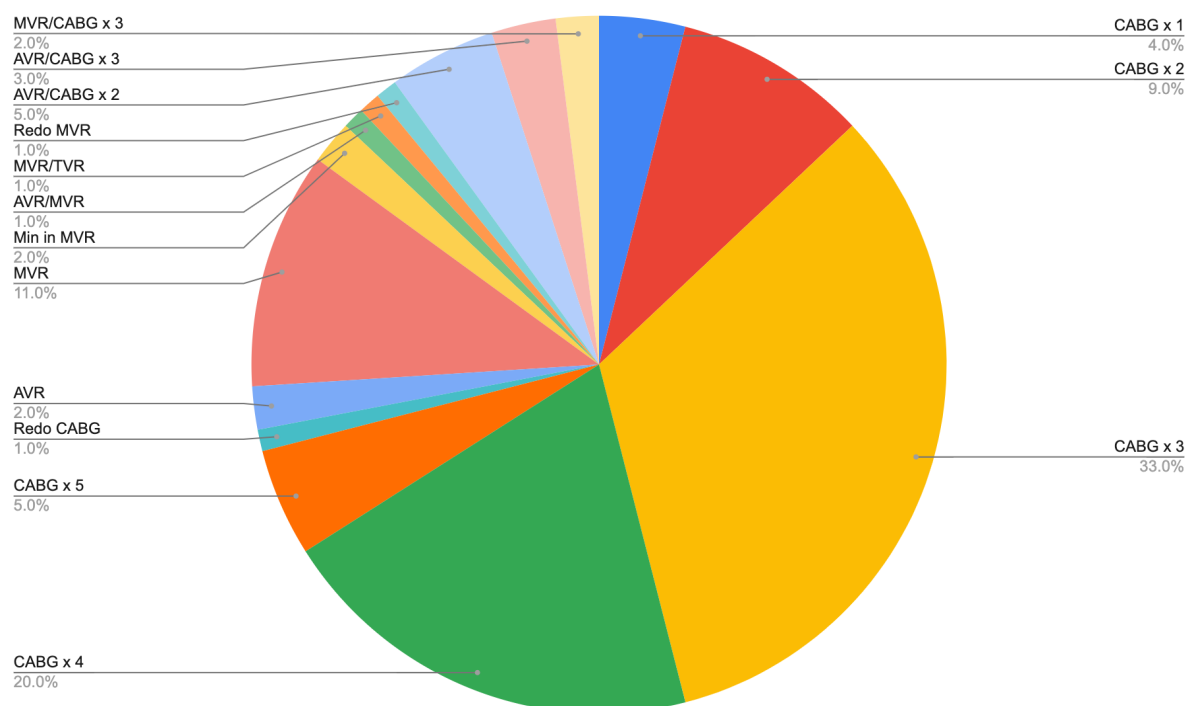


Table 8: Pearson Chi-Square Results for Gender and Smoking Status

Pearson Chi-Square Results for Gender and Smoking Status

Variable	X ²	df	p-value
Gender	5.430	1	0.02*
Smoking Status	.837	2	0.658

*Significant at an alpha level of .05 (two-sided).

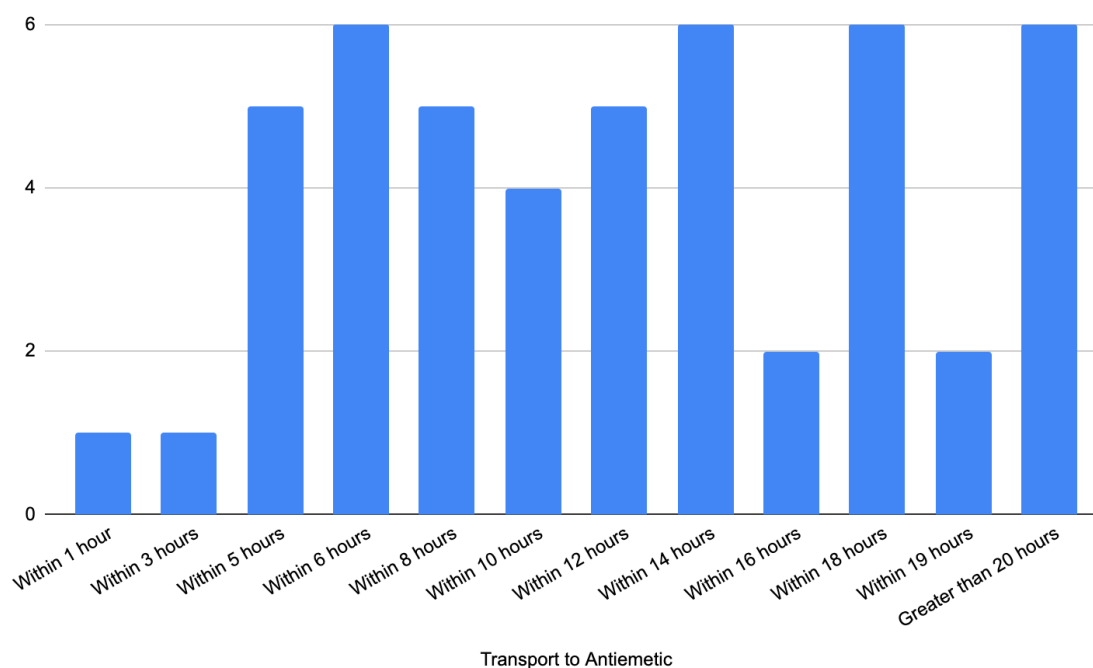
PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 9: MME Aggregated Crosstabulation

MME Aggregated Crosstabulation

	Nausea				Total	
	No		Yes			
	N	%	N	%	N	%
20 and Lower	8	14.8%	8	17.4%	16	16.0%
21 - 30	12	22.2%	13	28.3%	25	25.0%
31 - 40	12	22.2%	13	28.3%	25	25.0%
41 - 50	9	16.7%	8	17.4%	17	17.0%
51 - 60	7	13.0%	2	4.3%	9	9.0%
71 - 80	2	3.7%	0	0.0%	2	2.0%
81 - 90	2	3.7%	0	0.0%	2	2.0%
91 - 100	1	1.9%	0	0.0%	1	1.0%
101 and Over	1	1.9%	2	4.3%	3	3.0%
Total	54	100.0%	46	100.0%	100	100.0%

Table 10: Transport to Antiemetic Times



PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 11: Extubation to Antiemetic Times

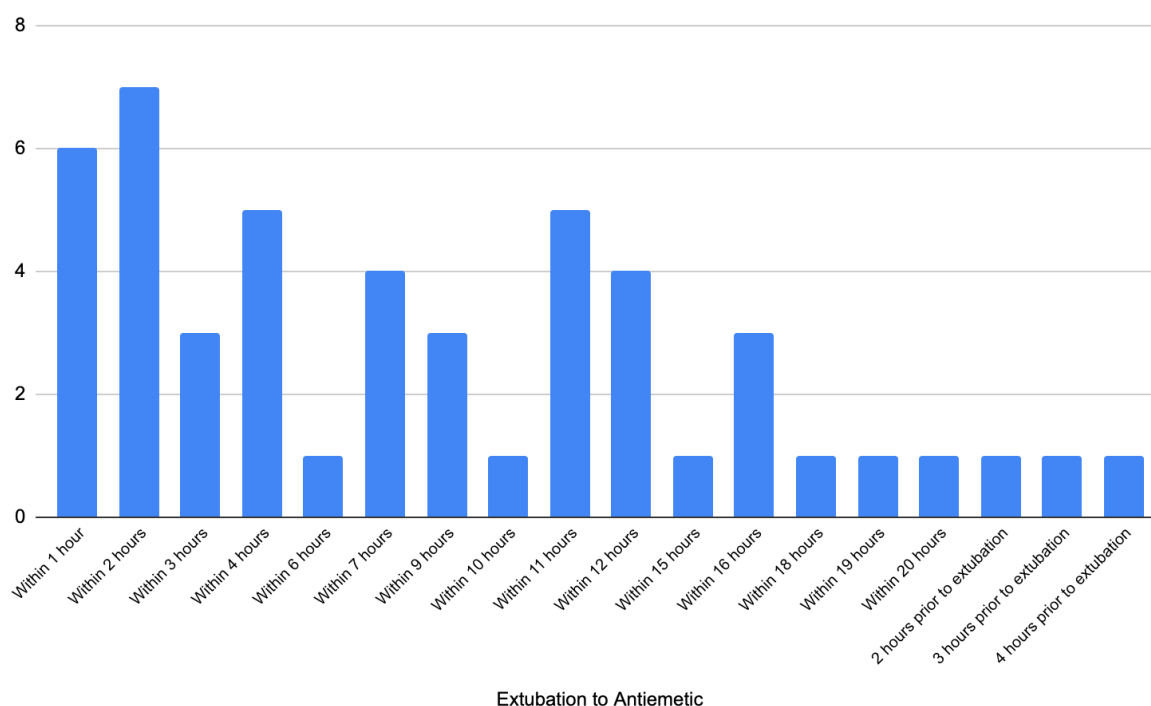
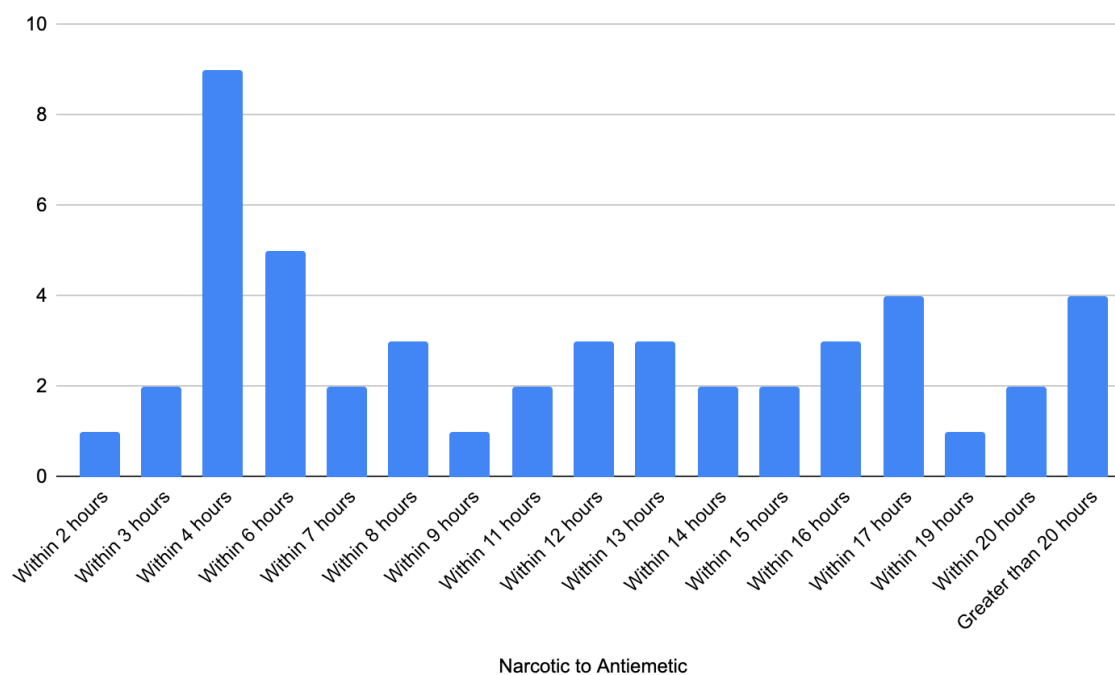
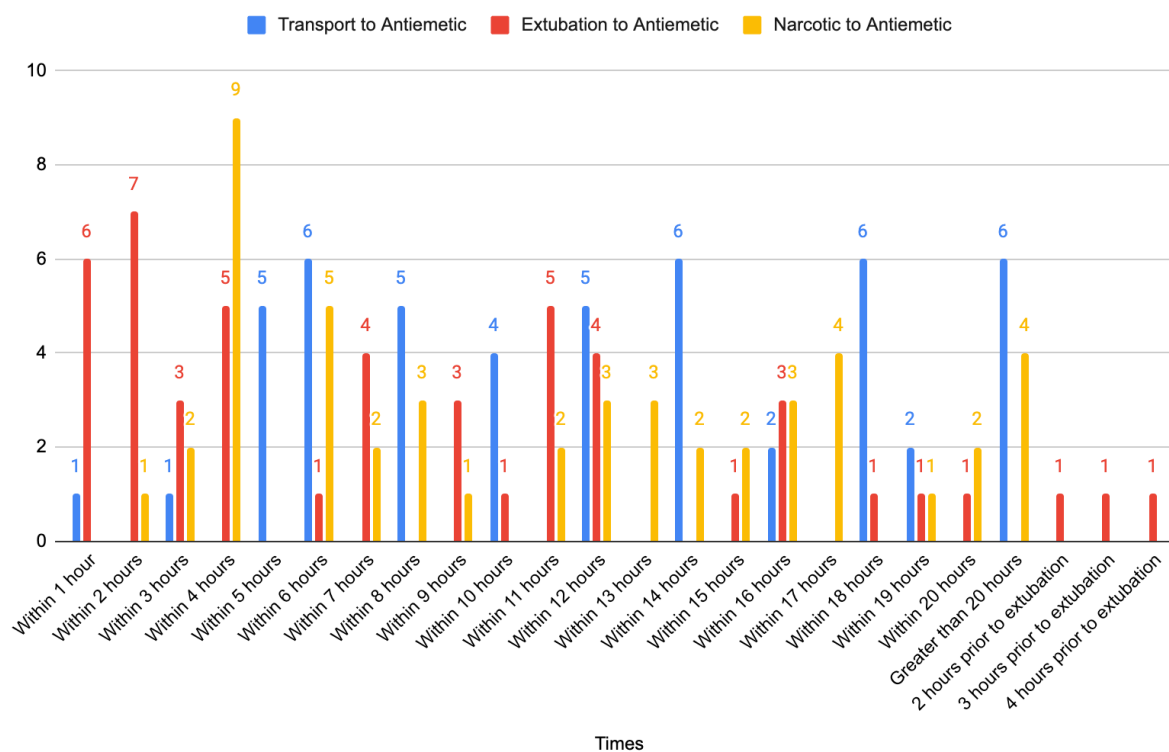


Table 12: Narcotic to Antiemetic Times



PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Table 13: Comparison of Various Antiemetic Administration Times



PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Appendix A: *Apfel with Cardiac Indicators Tool***Apfel with cardiac indicators Tool for PONV Prevention**

Risk Factors	Score (1 per item)
Age (<50)	
Sex (F)	
Smoking Status (N)	
History of Motion Sickness/PONV (Y)	
Opioid Use (Y)	

Prophylaxis Strategy*:

- If propofol infusion running, administer ondansetron at time of infusion discontinuation
- Daily monitoring of QTc-interval
- If administering ondansetron/droperidol, daily QTc required
 - If QTc prolonged, avoid ondansetron & droperidol - choose different agent
- Scoring:
 - 1 = give dexamethasone (1st agent)
 - 2 = dexamethasone + ondansetron (2nd agent)
 - 3 = scopolamine (3rd agent)+ dexamethasone + ondansetron
 - 4 = scopolamine + dexamethasone + ondansetron + droperidol (4th)
 - 5 = scopolamine + dexamethasone + ondansetron + droperidol + diphenhydramine (5th agent)

Pharmacologic Class	Medication	Order of Use Preference
Corticosteroid	dexamethasone 4 mg	1st
5 HT3-Antagonist	ondansetron 4 mg	2nd
Anticholinergic	scopolamine 1 mg	3rd
Antidopaminergic	droperidol 0.625 mg	4th
Antihistamine	diphenhydramine 50mg	5th
Benzodiazepine	midazolam 2mg	6th

*pt variables always dictate most beneficial agent at time of administration

Risk Factor Score (a)

0

10%

LOW

1

20%

LOW

2

40%

MEDIUM

3

60%

HIGH

4

80%

HIGH

a. Multimodal prophylaxis is recommended in patients with 1+ risk factor (Gan et al., 2020)

b. Risk factor scores quantify likelihood of PONV

Rescue Strategy:

- If no PONV prophylaxis, admin 5 HT3-antagonist (ondansetron) as first line therapy
- Administer antiemetic from a different drug class if already received dose within 6 hours
- If >6 h since initial dose, may repeat 5 HT3-antagonist or antidopaminergic (butyrophenone) (if no other alternatives available); evidence suggests use of medication from different class than first medication given

Other factors to consider:

- Is the patient well-hydrated?
 - Supplemental crystalloids (10-30 mg/kg) reduce risk of both early & late PONV as well as need for rescue antiemetics (Gan). Colloids are also beneficial for surgeries lasting longer than 3 hours. Dextrose infusions NOT effective at reducing PONV risk.
- Investigate reversible causes (bowel obstruction, blood in pharynx)
- Is the patient receiving multimodal analgesics to decrease opioid use?

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Appendix B: IRB Approval



**Research Institute
Institutional Review Board**

October 11, 2021

Andrea K Carr, DNP, MSN
Anesthesia & Perioperative Medicine, Nursing

IRB#: 2021-237
Protocol Title: THE INCIDENCE OF POSTOPERATIVE NAUSEA AND VOMITING FOLLOWING
CARDIAC SURGERY AND EVIDENCE-BASED GUIDELINES TO PREVENT
Sponsor: Investigator-Initiated Research (IIR)

Dear Andrea K Carr, DNP, MSN,

The Institutional Review Board has reviewed the above referenced research proposal and documents (if applicable) which were submitted for exemption consideration. A Research Waiver of Authorization is granted only for the stipulation of identification/data collection of the specific data variables for this study. The IRB determined:

Action: Acceptance of Exemption

Category: Exempt Review Category 4: Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met: iii. The research involves only information collection and analysis involving the investigator's use of identifiable health information when that use is regulated under 45 CFR parts 160 and 164, subparts A and E [HIPAA], for the purposes of "health care operations" or "research" as those terms are defined at 45 CFR 164.501 or for "public health activities and purposes" as described under 45 CFR 164.512(b).

Acceptance Date: October 11, 2021**IRB has acknowledged/approved the following documents:**

- IRB Study Application v1.1
- Waiver of Consent
- Approved number of participants/charts to be enrolled: 1000
- Age range of participants: 18 years of age and older
- Data Collection Tool, version date 09/21/2021
- Date range for data collection: 01/01/2019 to 12/31/2019
- The possible incidental inclusion of the following Vulnerable Participant Population(s) has been determined appropriate:
 - o Economically or Educationally Disadvantaged Individuals
 - o Students/Trainees/Staff
 - o Decisionally Impaired or Mentally Disabled Individuals

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Beaumont**Research Institute
Institutional Review Board**

You understand it is not permissible to print or download data to personal device(s) (i.e. personal laptops, personal computer, tablet, phone or any other personal device) from a research SharePoint folder. In the rare event you need to print the data for workflow purposes, you must shred the documents as soon as you have completed the project.

COVID 19 Requirements:

Beaumont Research Institute requires all key personnel **with face to face interaction with research participants** to follow Beaumont and department policies pertaining to COVID-19 safety measures e.g., PPE, hand washing, etc. This is essential to ensure safety of researcher staff and participants. Additional information is available on the Beaumont website at: <https://intranet.beaumont.org/departments-services/infection-prevention-and-epidemiology>. *Contact your clinical nurse manager for information and instructions.*

Changes to your original Exemption request must be submitted as an Amendment Request.

An Administrative Annual Report must be submitted to the IRB, and undergo review and approval prior to 11:59 PM on 10/10/2022. Failure to do so will result in an administrative withdrawal of the study. Research activity for this project may not continue after the expiration date.

If you have questions or concerns, please contact Cheryl J Wolfert, RN, BSN, CCRP at cheryl.wolfert@beaumont.org

Sincerely,

A handwritten signature in black ink, appearing to be "GK" or "Graham Krasan".

Graham Krasan, MD
Chairperson
Institutional Review Board

PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Appendix C: Approval to Use Risk Tool



Mara Trudgen <maratrudgen@oakland.edu>

Permission to use Risk Scoring Scale for DNP project

6 messages

Mara Trudgen <maratrudgen@oakland.edu>
 To: info@aserhq.org

Tue, Jul 6, 2021 at 4:20 PM

To whom it may concern:

Myself and Stephanie Takahashi are working on a doctoral project that evaluates postoperative nausea and vomiting in cardiac surgery patients. In order to do so, we would like to utilize the risk scoring system published in the "Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting by Gan et al., as the foundation of our tool that will also contain information specific for cardiac indicators. Please let us know if you can provide permission for us to include the information included with the risk scoring tool.

We would be happy to give you further information as needed.

Thank you,

Mara Trudgen
maratrudgen@oakland.edu
 Oakland University's Graduate Nurse Anesthesia Program

and

Stephanie Takahashi
stakahashi@oakland.edu
 Oakland University's Graduate Nurse Anesthesia Program

Lorena McMahon <loreana@aserhq.org>
 To: Mara Trudgen <maratrudgen@oakland.edu>
 Cc: info <info@aserhq.org>, Adam Kohm <adamk@spltrak.com>, Jamie Price <jamie@spltrak.com>

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Hello Mara,

Thank you for contacting ASER. As long as the source is properly referenced the figure may be republished. Please let us know if you have any other questions.

Best regards,

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PREVALENCE OF POSTOPERATIVE NAUSEA AND VOMITING

Appendix D: Dissemination PowerPoint Slides

The Prevalence of Postoperative Nausea and Vomiting Following Cardiac Surgery and Evidence-Based Guidelines to Prevent

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Oakland University
Class of 2022

Disclosure Statement

- We have no financial disclosures or conflicts of interest with the material in this presentation

Topics of Discussion

- Why PONV prevention is important for cardiac patients
- Current literature surrounding PONV protocols
- Development and implementation of our project
- Snapshot of patients at Beaumont Royal Oak
- Discussion of *Apfel with Cardiac Indicators Tool*
- Limitations and conclusions
- Future of the project

Background & Significance

- 30%-80% incidence cited
- Huge dissatisfier
- Negative postoperative effects
 - Delayed recovery → Longer hospital stays
 - Patient satisfaction scores
- Routine use of antiemetics avoided in this population
 - Studies conducted on non-cardiac surgery patients
- Reasons for avoidance
 - Fast-track anesthesia/enhanced recovery pathways
 - Providers unaware of true incidence
 - Arrhythmia concerns

Literature Review

- Similar PONV prevalence among surgery patients
 - Established risk scoring systems for non-cardiac surgery
 - Lack of protocol → *Apfel* for cardiac patients
- Secondary Outcomes
 - QT-Interval increased 2/125 RCTs (non-cardiac)
 - No correlation in QT interval increase (cardiac)
- PONV reduced using risk-based treatment
 - One-time dose of ondansetron at the end of cardiac surgery
 - Recommend multi-modal prophylaxis based on risk factors

Key Studies

- Champion et al. (2018)**
 - PONV reduced
 - 2+ risk factors
 - Betamethasone (4mg) with/without droperidol (0.625mg)
 - 2x morphine
- Gan et al. (2020)**
 - PONV consensus article
 - Risk stratification tool for multimodal PONV prevention
- Wang et al. (2020)**
 - 1x dose ondansetron (4 mg) at stop of propofol infusion
 - Significantly reduced PONV compared to placebo
 - Failed to correlate increase in QT interval
 - Choi et al. (2010) & Murphy et al. (2011)
 - Along with Champion et al. & Wang et al.

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Problem Statement

- Lack of evidence due to risks associated with PONV prophylaxis
- Incidence rates up to 80% in the cardiac patient population
- Prophylactic treatment with specific cardiac indicators has demonstrated safe, effective results

Research Objectives

1. Identify the prevalence of PONV in post-cardiac surgery patients at Beaumont Royal Oak Hospital
2. Design an evidence-based guideline to prevent PONV based on risk
3. Present the created *Apfel with cardiac indicators* tool to critical members of the cardiac surgery and anesthesia teams

Project Methodology

Project Design	Project Setting	Participants
- Integrative review - Tier 1: Data collection via retrospective chart review - Tier 2: Development & design of PONV prevention protocol for cardiac patients - Protocol dissemination	- Inpatient chart review - Patients at Beaumont Royal Oak Hospital - Level 1 trauma and urban teaching hospital	- Inclusion criteria: - Elective/urgent open heart surgery patients - CABG, valve replacement/repair, or combination - Patient of Beaumont Royal Oak Hospital

Project Implementation

- Pre-intervention**
 - Approval from Beaumont Hospital Nursing Research board
 - Thorough literature review for current PONV protocols
 - Development of *Apfel with cardiac indicators* tool
- Intervention**
 - Collect data on prevalence by retrospective chart review
 - Information session for cardiac surgeons, cardiac CRNAs, and anesthesiologists at Beaumont Royal Oak
- Post-intervention**
 - F/u to determine if *Apfel with cardiac indicators* tool has been considered for standard protocol

Retrospective Chart Review

- 100 patients who underwent elective or emergent:
 - CABG
 - Valvular replacement or repair
 - Combination
- January 1st - December 31st in 2019
- Reviewed medications administered:
 - Intraoperatively
 - Up to 24 hours post extubation
- Excluded patients:
 - Remained on ventilator >12 hours after arrival to ICU
 - Surgical re-exploration occurred within 24 hours

Results

Demographics

Demographics	N	%	M	SD
Category	100	100.0	67.9	18.20
Age				
Gender				
Female	24	24.0		
Male	76	76.0		
Smoking Status				
No/Nevar	45	45.0		
Current Smoker	18	18.0		
Former Smoker	37	37.0		
History of Motion Sickness				
Yes	3	3.0		
No	97	97.0		
Arrhythmias				
Yes	23	23.0		
No	77	77.0		
Opioid Dosage (MME)	100	100.0	40.20	36.14
None				
Yes	46	46.0		
No	54	54.0		
Rescue Antiemetics				
Yes	49	49.0		
No	51	51.0		

- 100 patients sampled
 - Males - 76
 - Females - 24
- Ages 27-86
- Smoking status:
 - 45 - lifetime non smokers
 - 37 - former smokers
 - 18 - current smokers
- Arrhythmias noted after surgery in 23 patients
- 98 patients received intraop opioids
- All 100 patients received postop opioids

Prevalence and Variables

- Age, gender, smoking status, & opioid dosage evaluated
- **Gender** was the only significant factor for nausea
 - Females - 75%
 - Males - 30%

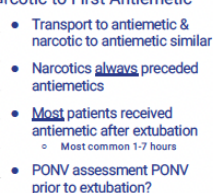
*Significant at an alpha level of .05 (two-sided).

Morphine Milligram Equivalents (MME)

- Postoperative opioids included:
 - IV: hydromorphone (IVP or PCA), fentanyl (IVP, PCA, & drips), and morphine (IVP or PCA)
 - Oral: hydrocodone, oxycodone, and tramadol
- Variance in MME:
 - Minimum - 8
 - Maximum - 327



Times Between Transport, Extubation, and Narcotic to First Antiemetic



Corrected QT (QTc) and QT prolongation

- Identified as QTc > 500 ms in males and females
- 25 postoperative ECGs available for analysis
 - 11 (44%) had normal QTc and received no antiemetics
 - 8 (32%) had normal QTc and received zofran, reglan, or both
 - 1 (4%) had prolonged QTc without any antiemetics given
 - 4 (16%) had prolonged QTc and received either zofran (3) or reglan (1)
 - 1 (4%) had a prolonged QTc on PreOperative ECG only and received zofran & compazine
- Limited postoperative ECG available hindered better analysis of correlation
- Other medications may cause QT prolongation & cardiac surgery itself
 - Antiarrhythmics or antiasthmatics

- Use of *Apfel with cardiac indicators* tool to determine patients at highest risk for PONV

- Score based system guides use of prophylactic medications
- Provide individualized care while minimizing cardiac risk
- Aids in identifying other factors that may contribute to PONV

*for variables always dictating most beneficial agent at time of administration

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Dexamethasone

- 4 mg enough to prevent PONV
- Reduce opioid requirements
- Does not increase:
 - Wound infection rates
 - Bleeding
 - Clinically significant hyperglycemia
- Glucose levels with 4 mg dose:
 - Non-diabetics: mild increase for first 12 hours postop
 - Diabetics: limited evidence to support more pronounced increase
- Improvements in:
 - Respiratory parameters
 - Reduced fatigue
 - Better quality of recovery
 - Reduced lengths of stay

Additional Recommendations

- Standardized use of antiemetics to identify any correlation
- Orogastric tube to suction upon arrival to ICU and remain until extubation
- Postoperative ECG at routine interval or after antiemetic administration to determine the causation of any QT prolongation

Limitations

- Smaller sample size
- Reliability and validity of retrospective view of narratives
- Various confounding variables
- Quantity of postoperative ECGs

Conclusions

- Need practice change in PONV prophylaxis for cardiac surgery patients
- Use of *Apfel with cardiac indicators* tool could prove valuable in guiding treatment approaches
- Dexamethasone should not be feared but instead, used with caution in conjunction with the tool
- Other post-surgical protocol standardizations would aid in eliminating other risks for PONV and identifying cause for its incidence

Future of the project

- Disseminated for CV surgery team at Beaumont Royal Oak
- Surgeons and anesthesia providers fully supportive of creating a policy that would implement tool use
- Future students of OUBGPNA carry on project and find effect on incidence rates after the implementation

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- Our friends and family

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Questions?

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