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Post-operative Nausea and Vomiting Risk Assessment

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Post-Operative Nausea and Vomiting Risk Assessment and Prophylaxis

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Executive Summary

Post-Operative Nausea and Vomiting Risk Assessment and Prophylaxis

Patients who must undergo surgery with general anesthesia sometimes experience nausea and vomiting. This is a potential side effect of general anesthesia and is termed post-operative nausea and vomiting, or PONV. The screening process prior to surgery usually includes questions regarding previous problems with PONV; however, this only applies to patients who have had previous experiences with surgery and general anesthesia. Relying on a patients' history of PONV alone to predict this unwanted side effect limits the providers' ability to assess and prophylactically treat PONV. Assessing for risk of PONV using a pre-operative risk assessment tool can help to identify those who are at increased risk and potentially prevent PONV. Incorporating a preoperative risk screening tool as well as a prophylactic protocol based on risk would give providers a consistent process for screening patients without relying on a

history of PONV. This process would ensure patients are treated with appropriate prophylaxis to reduce incidence of PONV allowing for all patients to be screened rather than just in those who have had previous surgery. PONV has many potential complications for patients, staff, and the surgical facility. Even though PONV may be a side effect of anesthesia it may create an overall negative experience for patients, which has the potential to affect the facility's patient satisfaction ratings.

Rationale for the Project

The incidence of PONV in surgical patients may be as high as 80% in those who are at high risk, with a general incidence rate of 30% for all surgeries (Gan et al., 2014). PONV may potentially lead to many unwanted physical and psychological complications for patients after surgery. For some patients, PONV may only cause a small delay in discharge time; however, for others, it could lead to life-threatening complications such as pulmonary aspiration, dehydration, increased intercranial/intraocular pressures, and wound dehiscence (Squire & Spencer, 2018). These Having surgery can be a source of stress for patients, however some patients fear PONV more than the pain from surgery (Hambridge, 2013). Psychological complications from PONV may include anxiety, distress, shame, embarrassment, and potentially fear of further surgeries.

Physical and psychological complications from PONV may create an overall negative experience for patients, which has the potential to affect the facility's overall patient satisfaction. In addition to the physical and psychological complications for patients, PONV has the potential to increase costs associated with surgery for the patient and the facility. Complications requiring an overnight stay or a transfer to the hospital from the ambulatory center will increase costs for patients, as well as the facility due to potential overtime for staff.

From their review of literature, Squire and Spencer (2018) concluded that many factors may potentially cause patients to be at increased risk for PONV, including type of anesthetic used, type and length of surgical, history of motion sickness/PONV, gender, smoking status, dehydration, and gastric distention. They explained that prophylactic treatment of PONV should be dependent on patients' risk; however, most patients who undergo surgery are generally treated from PONV prophylactically.

Literature Synthesis

Databases were searched to find studies related to PONV, PONV risk assessment and prophylaxis treatment of PONV. Of the studies found information was gathered related to risk assessment tools used, and prophylaxis treatment guidelines. Risk assessment tools use evidence-based risk factors to determine the patient's simplified risk score (SRS). The risk assessment tools use factors such as female gender, history of PONV, history of motion sickness, non-smoker, and postoperative opioid administration to calculate the SRS. The patients' risk for PONV is based on the number of risk factors present, therefore the higher the number of risk factors the more likely the patient is to experience PONV (Hooper, 2015). Reduction in baseline risk factors that can be altered is recommended by The Society for Ambulatory Anesthesia (SAMBA). Risk factors that may be altered include avoidance of general anesthesia by using regional anesthesia, preferential use of propofol infusions, avoidance of nitrous oxide, avoidance of volatile anesthetics, minimization of peri-operative opioids, and adequate hydration (Gan et al., 2014). The ability to identify patients who are at risk for PONV is helpful however, for this tool to benefit the patient, and affect the incidence of PONV a prophylactic protocol is necessary (Kappen et al.,2014). Five out of six studies recommend screening patients pre-operatively with some form of SRS, and four out of six studies show a significant reduction in PONV with use of

the SRS. Five out of six studies show that adding a prophylaxis protocol for providers to follow based on the patients' risk score showed a significant increase in administration of prophylactic antiemetics in high-risk patients. These studies suggest assessing risk for PONV preoperatively using a simplified risk score, along with a directive antiemetic prophylaxis protocol administered by the anesthesia providers has the potential to significantly affect the incidence of PONV in ambulatory surgical patients, as well as ensure prophylaxis treatment is initiated when patients are found to be high risk for PONV (Kappen et al., 2015; Gan et al., 2014; Pym et al., 2018; Smith et al., 2016; Tabrizi et al., 2018; Thomas et al., 2019).

Project Stakeholders

The addition of a pre-operative risk assessment for PONV would potentially benefit the anesthesiologist, surgeons, and post anesthesia care unit (PACU) nurses. This group of doctors and nurses would be the largest of the stakeholders for the proposed change. Data for incidence of PONV at the center would be essential to obtain prior to the start of the project to help with the education and rational of the project. The administrator, clinical director, and medical director will be an important part of obtaining permission for completing the project. The medical director in this case is an anesthesiologist and may potentially be a key stakeholder for implementation. For this project, a directive prophylaxis protocol is needed and would have to be written and approved by the administration team based on evidence from literature on prophylaxis. Training and education would be needed for pre-operative nurses on the risk assessment tool, as well as anesthesiologist for the directive prophylaxis protocol. The PACU nurses would see the most benefit from the reduction in PONV and would-be great leaders for this change.

Implementation Plan

Postoperative nausea and vomiting (PONV) risk assessment should begin as the patient is prepared for surgery. Patients will be screened for PONV using the Apfel risk assessment tool to determine level of risk. The Apfel risk assessment is comprised of four questions: 1. Is the patient of female gender? 2. Is the patient a non-smoker? 3. Does the patient have a history of PONV/motion sickness? 4. Will the patient be receiving post-operative opioids? (Gan et al., 2014). Each question with and answer of "yes", will be equal to 1 point, with a possible total of 4 points and about 80% risk of PONV. This risk assessment will be completed and documented during the first point of contact with the patient by phone when the pre-operative nurse calls to gather pertinent health and mediation history from the patient. If the patient is unable to be reached prior to the arrival at the center, the pre-operative nurse who prepares the patient for surgery shall obtain the risk assessment. The risk assessment will be documented on a separate form that will be part of the anesthesia hand off report. After a risk score has been calculated for the patient, the nurse will then highlight the corresponding recommended intervention on the prophylaxis portion of the risk assessment form. Here there will be a directive protocol for prophylaxis interventions based on the patients' risk score. This form will be placed with anesthesia paperwork and the risk score and corresponding recommended prophylaxis will be relayed during verbal report from the pre-operative nurse to the anesthesia provider. The anesthesia provider and the pre-operative nurse shall both sign the form acknowledging the information was relayed. If the provider chooses not to follow the directed prophylaxis, they should complete, or circle the reason for choosing not to follow the recommendation.

The form will become part of the patients record and will be used to document the patient's status postoperatively. The recovery nurse will document the presence of PONV in the recovery area and any interventions during the recovery period related to PONV. The recovery nurse will document delays in care due to PONV and complications related to PONV. This information will be used to determine the incidence of PONV after implementation of the risk assessment score and directive prophylaxis. To determine if using a risk assessment and directive prophylaxis reduces the incidence of PONV data must be collected prior to implementation. The postoperative nurses will audit charts using an audit form developed to determine the incidence of PONV by determining the current incidence of PONV and collecting data for 30 days prior to the implementation of the project.

Timetable/Flowchart

The project will be presented to the administration team at Baylor Surgicare Dallas where it will need be approved for implementation prior to collecting data. Once approval is obtained, staff from the post-anesthesia care unit will be introduced to the topic and a team will be formed. This is an important step to ensure the project is successful. Once a team is in place data collection will begin to find the current incidence of PONV at the facility. The goal is to collect at least 30-45 days of data to get a baseline incidence rate. If it is possible to go back in the records and collect data from previous patients this would be ideal to gain a larger pre-implementation incidence rate of PONV. During the data collection by the project team, education of the staff about PONV and the rational for the project would begin. Education for all nurses would be completed by a member of the project team. The anesthesia providers would be given information about the project and the coming risk assessment tool and directive

prophylaxis as part of the education roll out. Once staff have received education the SRS and prophylaxis protocol will be implemented in the pre-operative area, and the anesthesia providers will have access to the directive prophylaxis protocol by email as well as the details of the project. The goal is to collect data for 1 month and then revisit with the team and discuss the implementation process to ensure barriers or process issues are addressed. At the 1-month mark results of the project would determine if changes need to be made to the process. Ideally the project would last for at least 3 months to see if the process was working to reduce the incidence of PONV. Assessment of data collected on incidence of PONV before and after the project was implemented will be reviewed. The data will need to show a change in the incidence of PONV, as well as the increase in use of the directive prophylaxis protocol based on risk. Data will be gathered from the project, as well as discussions with the team for an overall evaluation of how well the plan was implemented. Since the change project is unable to be implemented staff will be educated about PONV. The intent is to increase awareness of PONV potential complications, known risk factors, and identification of patients who would potentially benefit from prophylaxis.

Project Phases	**Timeline**
Approval from administration team	By January 1, 2021
Meeting with staff to form project team	January 4
Begin PONV incidence data collection	January 6
Meet with team to write SRS, Directive prophylaxis/approval/ data collection tool	January 6-11
Education for Staff on Pre-op assessment/prophylaxis	January 12
Implement SRS/Prophylaxis directive	February 15
Team meeting discuss implementation process/barriers	February 22
Final team meeting/ data collection ends	March 26
Data analysis/discuss issues with change implementation/refine process	March 26- April 2
Complete project	April 26

Data Collection Methods

The incidence of PONV in ambulatory surgical patients at Baylor Scott and White Surgicare Dallas would be measured prior to beginning the project. This data will then be compared to the data collected after the implementation of a risk assessment tool to determine the patient's risk for PONV, as well as a directive prophylaxis protocol to be used by the anesthesia providers. Risk assessment tools use evidence-based risk factors to determine the patient's simplified risk score (SRS). The risk assessment tools use factors such as female gender, history of PONV, history of motion sickness, non-smoker, and postoperative opioid administration to calculate the SRS. The patients' risk for PONV is based on the number of risk factors present, therefore the higher the number of risk factors the more likely the patient is to experience PONV (Hooper, 2015). The ability to identify patients who are at risk for PONV is helpful however, for this tool to benefit the patient, and affect the incidence of PONV a prophylactic protocol is necessary (Kappen et al.,2014). Once both tools are implemented the incidence rates of PONV in the ambulatory patients would again be measured to determine if there was any change in the incidence rates of PONV with use of the tools.

Within the data collected the use of the directive prophylaxis protocol would also be key to determine if the recommendations based on the patient's risk score were followed through with prophylaxis. This would help to determine if the protocols created for prophylaxis are effective against PONV, and ensure they are being utilized with high-risk patients. A team would also be created to debrief with anesthesia providers using the directive prophylaxis to gather feedback about the protocol and determine if there need to be changes made based on use and effect on PONV incidence. Once the data is collected and analyzed to see effect on incidence of PONV the project will then need to be reviewed for potential changes with the key stakeholders.

The data will need to show a change in the incidence of PONV, as well as the use of the directive prophylaxis protocol based on risk. Data will be gathered from the project, as well as discussions with the team for an overall evaluation of how well the plan was implemented. If the change project is unable to be implemented staff will be educated about PONV. The intent would be to increase awareness of PONV potential complications, known risk factors, and identification of patients who would potentially benefit from prophylaxis.

Cost/Benefit Discussion

The costs associated with this plan should be minimal, at most it would be an increase use of antiemetic medications, which could potentially be offset by decreased complications/recovery time. The benefit of reducing incidence of PONV would be to decrease the amount of overtime for the recovery department. When patients experience PONV recovery time is increased, and this has a potential to increase workload for the recovery nurses. With more time spent caring for patients who are nauseated or vomiting, this can take time away from other patients as well as increase the time it takes to discharge other patients the nurse is caring for. If PONV incidence is reduced the workflow for nurses can be maintained which will ensure that patients discharge time is not delayed and staffing is appropriately maintained for the day.

Discussion of Results

PONV will continue to be a problem in surgical patients. Ambulatory centers such as Baylor Surgicare could benefit from ensuring all steps are taken to reduce the incidence of PONV. At this time, the project was not able to be implemented however, I do think it brought awareness to the issue and has potential for implementation in the future. This time has been a struggle for staff and the center while trying to recover from the time lost during the furlough of

staff and the center being closed for operation for over a month during the pandemic. The center is also in the middle of a transition from operating out of two separate facilities and now has combined both centers of employees and procedures to one building. This has been a time of challenge for the staff and administration and unfortunately not an ideal time for an implementation project. When the time is appropriate, and data collection of the incidence of PONV can be obtained, it is my belief findings will be significant enough to warrant an exploration of current practices. At that time the evidence of PONV risk assessments can be added to the pre-operative process and a prophylactic protocol can be developed and implemented, and I feel the findings will support a need for practice change.

Conclusions/Recommendations

Patients who experience PONV have the potential to experience life-threatening physical and psychological complications. PONV may also create an increase in the costs of care for patients as well as facilities by prolonging recovery time. Understanding that PONV is not only a nuisance for patients but can even lead to life threatening complications such as aspiration and wound dehiscence, it becomes a very hard topic to ignore. Using a risk assessment tool to identify patients at risk for PONV along with the use of a directive prophylactic treatment protocol has the potential to reduce the incidence of PONV. Evidence is clear patients do not want to experience PONV as well as the surgeons, anesthesiologist, and any nurses responsible for care want to do what is possible to prevent it from occurring. Following evidence-based practice for prevention of PONV may help providers to identify those who are at risk and decrease the chances of occurrence in some cases. Currently in the ambulatory surgery center there are no specific guidelines or directives that dictate what prophylaxis medications a patient may get, and there is no specific tool or risk assessment used to identify patients who are at risk

for PONV. All methods used to identify and assess need for prophylaxis and even what type of prophylaxis is left up to the anesthesiologist at this time. Following systematic process using evidence-based practice to identify risks and treat with the appropriate prophylaxis has the potential to reduce the incidence of PONV according to Gan et al., 2014. With this the conclusion of the data collected it seems PONV incidence rates should be explored as well as a process implemented to ensure patients are screened for potential risk and treated accordingly.

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Appendix A: Evaluation Table

PICOT Question: In ambulatory surgical patients receiving general anesthesia (P) how does utilizing a pre-operative risk assessment tool for post-operative nausea and vomiting along with a directive prophylaxis protocol (I) compared to no risk assessment tool or protocol (C) affect the incidence of post-operative nausea and vomiting (O) in the first twenty-four hours after surgery (T)?
PICOT Question Type (Circle): Intervention Etiology Diagnosis or Diagnostic Test Prognosis/Prediction Meaning

Caveats

1) The **only studies** you should put in these tables are the ones that **you know answer your question** after you have done rapid critical appraisal (i.e., the keeper studies)
2) Include APA reference
3) Use abbreviations & create **a legend** for readers & yourself
4) Keep your descriptions brief – there should be **NO complete sentences**
5) This evaluation is for the purpose of knowing your studies to synthesize.

Place your APA Reference here (Use correct APA reference format including the hanging indentation):

Appendix A: Continued

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Appendix A: Continued

Citation: (i.e., author(s), date of publication, & title)	Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence (i.e., level of evidence + quality [study strengths and weaknesses])
Author, Year, Title	**Theoretical basis for study Qualitative Tradition**		**Number, Characteristics, Attrition rate & why?**	**Independent variables (e.g., IV1 = IV2 =)** **Dependent variables (e.g., DV =)**	**What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])**	**What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)**	**Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)**	• **Strengths and limitations of the study** • **Risk or harm if study intervention or findings implemented** • **Feasibility of use in your practice** • **Remember: level of evidence (See Melnyk & Finout-Overholt, pp. 32-33) + quality of evidence = strength of evidence & confidence to act** • **Use the USPSTF grading schema http://www.ahrq.gov/clinic/3rduspstf/ratings.htm**
Pym, et al. (2018). The Effect of a Multifaceted Postoperative Nausea and Vomiting Reduction Strategy on Prophylaxis Administration Amongst Higher-Risk Adult Surgical Patients	None stated	Quantitative; Pre-/post-intervention cohort study	*N*=1102 Mean age 53 60% Male 40% Female Mean age 52 60% male 40%female Attrition rate-none	**IV:** use of prophylactic antiemetics for patients at moderate or high risk of PONV DV: Use of PONV prophylaxis guidelines	Evidence based locally developed PONV guideline; PONV risk classification	X^2	Consistent administration of guideline prophylaxis (p=0.004) post Intervention (p=0.001)-post Intervention Reduction of PACU length of stay In the high-risk group - postintervention (p=0.032)	Limitations -PONV rates were only collected during PACU stay no follow up after PACU discharge which could possibly have missed some delayed PONV -no assessment done to show that the providers reviewed the data prior to intervention Strengths -Increase In provider administration of antiemetics In high risk patients -decreased pacu length of stay due to decreased PONV with Implementation Feasible In practice with Improved Implementation technique Low risk of harm Level of evidence: 4 USPSTF: Grade B Level of certainty: low

Appendix A: Continued

Kappen, et al. (2015). Impact of adding therapeutic recommendations to risk assessments from a prediction model for postoperative nausea and vomiting	None Stated	Quantitative; prospective before and after cohort study	University Medical Center Utrecht, Netherlands (*N*= 1480) Care as usual (n=1022) Intervention group (n= 458) 100% Female Mean age: Care as usual=52 Intervention group=54 Attrition: none	**IV1=** use of DDSP for AP **IV2=** administration of risk dependent PONV prophylaxis **DV**= incidence of PONV,	The implementation prediction model for PONV, unsure of reliability developed at a university hospital in the Netherlands, externally validated	OR/CI R^2/CI	PONV Incidence during Intervention period compared to care-as-usual (OR: 0.60, 95% CI: 0.43-0.83) Administration of additional antiemetics as directed 0.49 (95% CI: 0.41-0.58)	Limitations -small sample size -decisions to give medications based on the recommended model may not have been superior to the care-as -usual phase -adherence to the therapeutic recommendations was not 100% -feasible for use In practice Low risk of harm Level of evidence: 4 USPSTF: Grade B Level of certainty: low

Appendix A: Continued

Smith, et al. (2016). Improving the quality of post-anesthesia care: An evidence based initiative to decrease the incidence of postoperative nausea and vomiting in the post-anesthesia care unit. *Perioperative Care and Operating Room Management(4)* 12-16.	None Stated	Quantitative; Quality improvement, pre- and post-intervention	*N*=4907 historical group *n* =3768 Implementation group *n* = 1139 adult elective surgery patients with GA, admitted to PACU York, PA, USA Attrition: none	IV= preoperative PONV risk screening and targeted prophylaxis DV= Incidence of postoperative nausea and vomiting	Apfel simplified risk score 0-4	X^2 OR/CI	Incidence of PONV significantly lower in the post-implementation sample (p=0.000054) Both genders had decreased Incidence PONV males: (X^2= 4.52, p = 0.03) females: (X^2= 14.4, p = 0.00014) Incidence of PONV implementation group: 0.13 (0.10 to 0.16) Implementation sample: 0.44 (0.22 to 0.8880)	Limitations -Design of the study- difficult to extract data from health record if not noted or addressed. Only interpretation of patient's health record since some criteria was not specifically addressed. -limitation on time frame PONV present since only monitored in pacu and discharge, not on inpatients. -historical sample was unable to obtain some information that is needed to complete the risk assessment like motion sickness. - Historical sample only able to gather PONV incidence based on medications given, not an interaction or question of presence of PONV Low risk of harm Level of evidence: 6 USPSTF: Grade B Level of certainty : low

Appendix A: Continued

Tabrizi, et al. (2019). Implementation of postoperative nausea and vomiting guidelines for female adult patients undergoing anesthesia during gynecologic and breast surgery in an ambulatory setting. *Journal of PeriAnesthesia Nursing.* Advance online publication. http://doi.org10.1016/j.jopan.2018.10.006	None Stated	Quantitative; Pre/post implementation quality improvement project	*N= 294* Female mean age 45, GYN/breast surgery with general or MAC anesthesia preimplement*n* = 147 postimplement *n* =147 major multicampus teaching hospital in northeastern U.S. Attrition: none	IV= implementation of evidence based PONV guideline DV1= Anesthesia compliance with documentation of Apfel risk assessment score DV2= Incidence of PONV in female patients undergoing GYN or breast surgery in an ambulatory setting	Convenience sample of retrospective chart reviews from electronic health record. PONV guidelines created using institutional guidelines, literature review, input from staff Apfel risk score: Post-op opioids, non-smoker; female ; history of PONV/MS	X^2	Incidence of PONV significantly decreased int the posimplementation period *p= .009* Anesthesia providers charting the correct Apfel score significant increase *p*= 0.019 Significant reduction in incidence of PONV with general anesthesia 21% to 10%	statistically significant evidence strengths-able to successfully implement risk stratification and targeted prophylaxis that was easily adopted by staff and providers Limitations-manual chart review/data collection, small sample size, only specific surgery type, limited staff education Low risk of harm Level of evidence: 6 USPSTF: Grade B Level of certainty: low

Appendix A: Continued

Thomas et al., (2019). Preoperative risk assessment to guide prophylaxis and reduce the incidence of postoperative nausea and vomiting. *Journal of PeriAnesthesia Nursing, 34* (1), 74-85. http://doi.org10.1016/j.jopan.2018.02.007	None stated	Quality improvement project; retrospective pre/post implementation quality improvement project	*N*=316 Female mean age range 40-42 , gynecologic surgery, *N*= 316, preimplemenation *n*= 164 , postimplementation *n*=152 Community hospital in the U.S. Attrition: none	IV: Use of PONV prophylaxis protocol DV: prophylaxis and incidence of PONV	Data was collected using retrospective chart reviews. PONV risk assessment tool to guide prophylaxis based on risk using six predictors of PONV: general anesthesia, female, <50years of age, nonsmoking status, history of PONV or motion sickness, and anticipated postoperative opioid administration	*M* *t* X^2	Increase in the total number of prophylactic antiemetics administered in the moderate-risk and high-risk categories from preimplementation 3.64 to postimplementation 4.07 (*t* = 3.96; *df* = 298.9; *P* < .001) Significant increase in postimplementation for antiemetics administered Incidence of PONV decreased in the postimplemenation period Reduction 79% preimplementation to 29% postimplemenation	Strengths: Risk assessment tool identified moderate to high risk patients and helped to increase prophylaxis Limitations: small sample size, limited to gynecologic surgery, and female only patients. Female gender is an independent risk factor for PONV. Compliance from providers who are responsible for administering prophylaxis Risk: None stated Feasibility: use to assess risk for PONV in surgical patients. Level of evidence: 6 USPSTF: Grade B Level of certainty: low

Appendix A: Continued

Gan et al., (2014) Consensus guidelines for the management of postoperative nausea and vomiting. *Anesthesia & Analgesia, 118(1)*, 85-113. http://doi.org10.1213/ANE.0000000000000002	None stated	Qualitative Systematic literature review	*N*= 2604 *n*= 564 risk assessment *n*= 549 risk reduction *n*=171 PONV protocols *n*= 433 prophylaxis *n*=567 treatment effectiveness *n*= 320 nonpharmacological/alternative therapy	IV: use of risk assessment tool IV: Use of PONV prophylaxis protocol DV: prophylaxis protocol use and assessment of risk	Literature was searched using 6 different topics: Algorithms, prophylaxis treatment effectiveness, nonpharmacological or alternative therapy, risk assessment, risk reduction	*t*	Identification of risk factors that increase risk of PONV; <50y/o, type of procedure, opioid administration, female gender, history of motion sickness, duration of anesthesia, use of volatile anesthetics, and nitrous oxide. Reducing risk factors to reduce incidence of PONV Administration of 1-2 prophylactic interventions in moderate risk patients Administration of prophylactic therapy with >=2 in high risk patients	Strengths: Limitations: inadequate literature. Unable to assess if relationship between interventions and outcomes. Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Gecit, S., & Ozbayir, T. (2020). Evaluation of preoperative risk assessment and postoperative nausea and vomiting: Importance for nurses. *Journal of PeriAnesthesia Nursing*, *35*(6), 625-629. https://doi.org/10.1016/j.jopan.2020.04.006	None stated	Qualitative Descriptive Study	*N*= 242 *n*= 137 men *n*= 105 women	IV: Use of Apfel and Koivuranta risk scoring systemin surgical patients DV: Early detection and prevention of PONV	Surgical patients who had surgery were evaluated through forms from medical records with demographic information and risk scores for ponv.	X^2	Apfel and Koivuranta both showed significant difference between use of the scoring systems and PONV	Strengths: Limitations: Small sample size Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Apfel, C. C., Heidrich, F. M., Jukar-Rao, S., Jalota, L., Hornuss, C., Whelan, R. P., Zhang, K., & Cakmakkaya, O. S. (2012). Evidence-based analysis of risk factors for postoperative nausea and vomiting. *British Journal of Anaesthesia*, *109*(5), 742-753. https://doi.org/10.1093/bja/aes276	None stated	Qualitative	*N*= 22	IV: individual predictors for risk of PONV DV: Overall accurate points for each individual predictor	Literature was searched using 3 different databases. Reviewed systematically for individual predictor accurate point prediction of PONV	I^2	Risk factors: Patient =46 Anesthesia= 58 Surgery= 70	Strengths: Limitations: none stated Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Smith, C. A ., & Ruth-Sahd, L. (2016). Reducing the incidence of postoperative nausea and vomiting begins with risk screening: An evaluation of the evidence. *Journal of PeriAnesthesia Nursing*, *31* (2), 158-171. https://doi.org/10.1016/j.jopan.2015.03.011	None stated	Qualitative	*N*= 37	IV: identify PONV risk factors in patients DV: reduction in incidence of PONV	Literature was searched using 4 different databases.	OR	Volatile anesthetics = 1.82 Age= 0.88 Female gender= 2.57	Strengths: Limitations: English language only Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 3 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Wu, Y. H., Sun, H. S., Wang, S. T., & Tseng, C. A. (2015). Applicability of risk scores for postoperative nausea and vomiting in a Taiwanese population undergoing general anaesthesia. *Anaesthesia and Intensive Care*, *43*(4), 473-478. https://doi.org/10.1177/0310057x1504300409	None stated	Qualitative	*N*= 992 Female-579 Male-413	IV: Scoring system for PONV risk DV: Development of a new scoring system using Taiwanese data	Observational data collected from 1000 bed tertiary hospital for patients receiving general anesthesia	*t*	Female p= <0.001 History of motion sickness/ponv p= 0.004	Strengths: Limitations: only enrolled Taiwanese patients from one tertiary hospital in Taiwan. Patients were scheduled for major surgery, may not apply to younger population patients were scheduled for longer surgeries and endotracheal intubation. Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Sawatzky, J. V., Rivet, M., Ariano, R. E., Hiebert, B., & Arora, R. C. (2014). Post-operative nausea and vomiting in the cardiac surgery population: Who is at risk? *Heart & Lung*, *43*(6), 550-554. https://doi.org/10.1016/j.hrtlng.2014.07.002	None stated	Qualitative	*N*= 150	IV: Scoring system for PONV risk DV: Development of a new scoring system for cardiac surgery patients	Cardiac patients undergoing CABG, isolated valve, or combined procedure in tertiary center in Canada.	OR	HX of PONV= 3.54 Female =4.11 Non-smoker =3.31 Extubated on admission to CSICU= 3.57 Intra operative steroid use= 3.23	Strengths: Limitations: retrospective design small sample size Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Chau, D., Reddy, A., Breheny, P., Young, A., Ashford, E., Song, M., Zhang, C., Taylor, T., Younes, A., & Vazifedan, T. (2017). Revisiting the applicability of adult early post-operative nausea and vomiting risk factors for the paediatric patient: A prospective study using cotinine levels in children undergoing adenotonsillectomies. *Indian Journal of Anaesthesia*, *61*(12), 964. https://doi.org/10.4103/ija.ija_303_17	None stated	Qualitative	*N*= 200	IV: Adult PONV risk factors can be applied to pediatric patients DV: PONV risk factors for pediatric patients	Patients who were scheduled for adenotonsillectomies at a outpatient surgical facility	OR	Family HX of PONV = *P* < 0.01 Hx of motion sickness *P = 0.02*	Strengths: Limitations: use of dexamethasone, limited to one type of procedure, and protocolized anesthesia techniques Risk: None stated Feasibility: use for risk assessment and treatment prophylaxis Level of evidence: 1 USPSTF: Grade B Level of certainty: moderate

Appendix A: Continued

Legend:
PONV- Post operative nausea and vomiting

PACU- Post anesthesia care unit

MS- Motion sickness

GA- General anesthesia

M- mean

X^{2-} chi square test

t- *t*-test

OR- Odds ratio

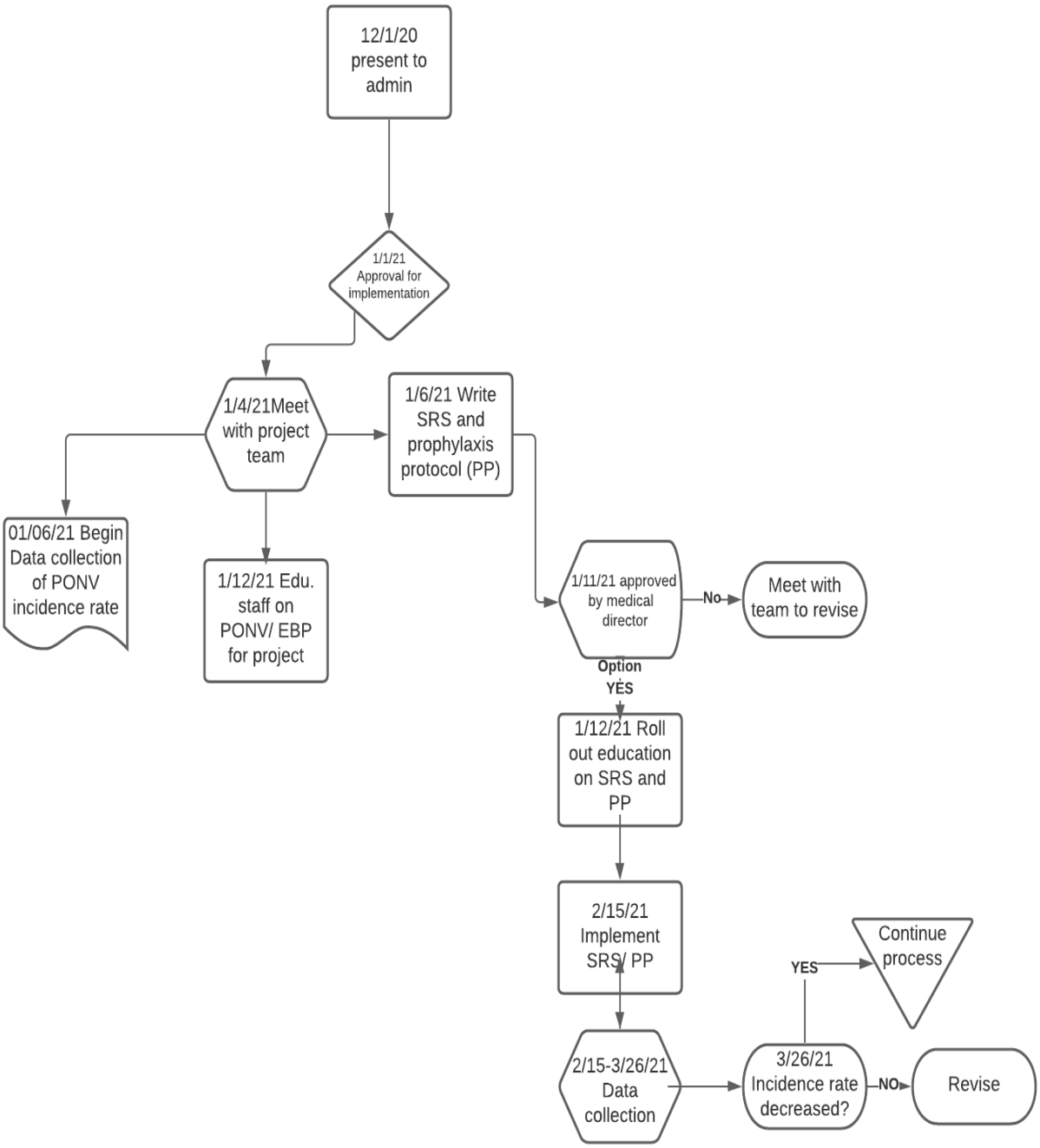
CI- confidence interval

R^{2-} regression analysis

DDSP for AP- directive decision support tool for antiemetic prophylaxis

***Prompts for each column – **please do not repeat the headings, just provide the data**

Appendix B: Flowchart



Appendix C: Apfel risk assessment tool Directive prophylaxis protocol

PONV prophylaxis guidelines

Determine the number of risk factors for PONV using risk score from Apfel.

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV/Motion sickness	1
Post-operative opioids	1
Risk Score Total	0-4

Prophylaxis bases on risk score total _____

Risk Score	Prevalence of PONV	Prophylaxis: # of antiemetics	Examples
0	9%	0-1	Ondansetron 4mg
1	20%	1	Ondansetron 4mg ± Dexamethasone 4mg
2	39%	2	Ondansetron 4mg + Dexamethasone 4mg + Propofol infusion
3	60%	3	Ondansetron 4mg + Dexamethasone 4mg + Propofol ± Scopolamine patch
4	78%	4	Ondansetron 4mg + Dexamethasone 4mg + Propofol infusion + Scopolamine patch

**Drug Combinations should be with drugs that have different mechanisms of action.